Oncologic Imaging

Oncodiagnosis Panel: Hodgkin Lymphoma: Current Controversies

Sunday, Nov. 29 10:45AM - 12:15PM Location: E353C

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Stephanie A. Terezakis, MD, Baltimore, MD (*Moderator*) Speaker, Elekta AB
Karen M. Winkfield, MD, PhD, Boston, MA, (kwinkfield@partners.org) (*Presenter*) Consultant, Novartis AG
Satish P. Shanbhag, MBBS, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose
Steve Cho, MD, Madison, WI, (scho@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the role of computed tomography (CT) and positron emission tomography (PET)/CT in the management of patients with Hodgkin and non-Hodgkin lymphoma. 2) To review the new Lugano Classification:Recommendations for Initial Evaluation, Staging, and Response Assessment of Hodgkin and Non-Hodgkin Lymphoma. 3) To assess the limitations and potential of PET/CT and PET/MR in assessing lymphoma evaluation and treatment response.

ABSTRACT

FDG PET/CT and contrast-enhanced CT both play an important role in lymphoma, for initial evaluation, staging and assessing response to therapy. In this session we will review the current and evolving role of imaging in lymphoma and demonstrate how it guides therapy in this patient population. The limitations and future developments of PET imaging in the context of PET/CT and PET/MRI will be addressed and discussed.

URL

ISP: Gastrointestinal (HCC)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E450B

CT **GI** **MR** **OI** **BQ**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shahid M. Hussain, MD, PhD, Omaha, NE (*Moderator*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Moderator*) Research support, Siemens AG; Research support, Bayer AG; Research support, Guerbet SA; Research support, General Electric Company; Consultant, Bristol-Myers Squibb Company

Sub-Events

SSA08-01 Gastrointestinal Keynote Speaker: Update on HCC Screening with Imaging

Sunday, Nov. 29 10:45AM - 10:55AM Location: E450B

Participants
Shahid M. Hussain, MD, PhD, Omaha, NE (*Presenter*) Nothing to Disclose

SSA08-02 Performances of Imaging for the Diagnosis of Small HCC Following the Recommendations of the European and American Association for the Study of the Liver

Sunday, Nov. 29 10:55AM - 11:05AM Location: E450B

Participants
Christophe Aube, MD, PhD, Angers, France (*Presenter*) Speaker, Bayer AG Support, General Electric Company
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Julie Lonjon, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Olivier Seror, Bondy, France (*Abstract Co-Author*) Consultant, Angiodynamics, Inc; Consultant, Olympus Corporation; Consultant, Bayer AG
Ivan Bricault, PhD, Grenoble, France (*Abstract Co-Author*) Medical Advisory Board, IMACTIS
Agnes Rode, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Cassinotto, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Frederic Oberti, MD, PhD, Angers, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate, in a large population of patients with chronic liver disease, the performances of the different imaging techniques (contrast enhanced ultrasound (CEUS), CT scanner and MRI) alone and in combinations for the characterisation of hepatic nodules smaller than 3cm. This study was supported by a national institutional grant (PHRC 2008)

METHOD AND MATERIALS

From April 2010 to April 2013, 442 patients with a chronic liver disease have been prospectively included in 16 centres. They had 1 to 3 nodules 10 to 30 mm explored by CEUS, CT scanner and a MRI within a month. The examination was regarded as positive if the nodule displayed the typical landmark of HCC as defined by the European and American Association for the Study of the Liver (EASL and AASLD) recommendations. A composite gold standard was constructed with histology, imaging and follow up. We determined sensitivity and specificity for a given exam alone and for various combinations of exams as single tests. Results were given regarding the size of the nodules: 10-20mm and 20-30 mm.

RESULTS

382/442 patients with 551 nodules have been finally kept for the statistical analysis. They were 315 (82.46%) males; the mean age was 62.06 +/- 9.73 years. The causes of the chronic liver disease were mainly alcohol (58.12%), C virus (31.41%) and metabolic syndrome (19.11%). The mean size of the nodules was 18.15 +/- 5.74mm.For the 10 - 20mm nodules (n=347) sensibility for the diagnosis of HCC was 70.2% for MR, 67.6% for CT scanner and 39.9% for the CEUS; and the specificity was respectively 83.1%, 76.6% and 93.5%. For the 20 - 30mm nodules (n=204) sensibility for the diagnosis of HCC was 70.5% for MR, 67.5% for CT scanner and 52.4% for the CEUS; and the specificity was respectively 97.3%, 97.3% and 100%.For the 10 - 20mm nodules the sensibility and specificity were respectively 54.8% and 100% for the association of CT + MR; 27.7% and 100% for CT + CEUS; and 28.7% and 99.4% for MR and CEUS

CONCLUSION

This study validates the use of sequencial application of CT and MRI as recommended in the recent update of EASL and AASLD guidelines, in case of small HCC and in a large population. It shows the potential interest of CEUS for its high specificity.This study is part of the CHIC group.

CLINICAL RELEVANCE/APPLICATION

Recent updates of EASL and AASLD recommendations for the non invasive diagnosis of HCC are validated for the small HCC in a large population.

SSA08-03 **Non-invasive Diagnostic Criteria of Hepatocellular Carcinoma: Comparison of Diagnostic Accuracy of Updated LI-RADS with Clinical Practice Guidelines of OPTN-UNOS, AASLD, NCCN, EASL-EORTC, and KLCSG-NCC**

Sunday, Nov. 29 11:05AM - 11:15AM Location: E450B

Participants
Burcu Akpinar, MD, Aurora, CO (*Presenter*) Nothing to Disclose
Samuel Chang, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Kaplan, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively compare the diagnostic accuracy of different noninvasive diagnostic criteria of hepatocellular carcinoma (HCC) by LI-RADS, OPTN-UNOS, AASLD, NCCN, EASL-EORTC, KLCSG-NCC

METHOD AND MATERIALS

We reviewed the medical records of 2,210 patients who had undergone biopsy, resection, or explantation of liver from January 2011 to November 2013 in our institution. Ninety three patients (M:F=69:24; mean age: 54.8, range 30-77) with chronic hepatitis B and/or cirrhosis for any etiology who had focal hepatic lesions ≥ 5 mm reported on dynamic contrast enhanced CT or MR were included. The focal hepatic lesions treated prior to imaging were excluded. A total of 144 lesions were finally included in our study with 73 lesions ≥ 2 cm, 55 lesions between 1-2 cm, and 16 lesions < 1 cm. The focal hepatic lesions were retrospectively evaluated on CT or MR by use of different noninvasive diagnostic criteria of HCC including LI-RADS (2014), OPTN-UNOS, AASLD, NCCN, EASL-EORTC, and KLCSG-NCC. Using the pathology reports as a gold standard, sensitivity, specificity, and accuracy of the diagnostic criteria were analyzed.

RESULTS

The sensitivity was highest and equal with AASLD, NCCN, EASL-EORTC and KLCSG-NCC criteria (84.4%), followed by LI-RADS (77.9%) and OPTN-UNOS criteria (75.3%). The specificity was highest with OPTN-UNOS criteria (92.5%), followed by LI-RADS (90.0%), AASLD, NCCN, EASL-EORTC and KLCSG-NCC (82.1%). The accuracies were 83.3%, equal for all noninvasive diagnostic criteria.

CONCLUSION

AASLD, NCCN, EASL-EORTC and KLCSG-NCC had the highest sensitivity whereas OPTN-UNOS had the highest specificity among all six guidelines. LI-RADS could not provide higher specificity than OPTN-UNOS criteria or high sensitivity than AASLD or EASL criteria.

CLINICAL RELEVANCE/APPLICATION

Though LI-RADS 2014 is widely used by radiologists, it provides lower specificity than OPTN-UNOS criteria as well as lower sensitivity than AASLD or EASL criteria for noninvasive diagnosis of HCC.

SSA08-04 **Prognostic Stratification of Patients with Hepatocellular Carcinoma Undergoing Curative Resection: Comparison of Preoperative MRI Staging and Postoperative American Joint Committee on Cancer Staging Systems**

Sunday, Nov. 29 11:15AM - 11:25AM Location: E450B

Participants
Chae Jung Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chansik An, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeun Yoon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Young Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To devise a preoperative staging system for hepatocellular carcinoma (HCC) undergoing resection using magnetic resonance imaging (MRI) findings, and to compare its prognostic ability with that of the American Joint Committee on Cancer (AJCC) staging.

METHOD AND MATERIALS

A total of 175 consecutive patients with HCC who underwent curative hepatic resection after preoperative MRI between January 2000 and December 2007 were analyzed. We devised an MRI staging system based on the number of nodules, a size criterion of 2 cm, gross vascular invasion, and two MRI features (rim enhancement and peritumoral parenchymal enhancement in the arterial phase) which were reported to be associated with worse prognosis after curative resection of HCC. In the devised MRI staging, instead of microvascular invasion which is used by the AJCC staging system, a size criterion of 2 cm was used to differentiate tumor stages 1 and 2. Each tumor stage was further divided into two substages; if both of the MRI features were absent, a patient was staged as T1a, 2a, or 3a, but staged as T1b, 2b, or 3b if any of these were present. Disease-free survival of both staging systems was analyzed using the Kaplan-Meier method with log-rank testing.

RESULTS

Both MRI and AJCC staging systems were excellent for predicting disease-free survival across different tumor stages 1, 2 and 3. Of 175 patients, 29 (16.6%), 6 (3.4%), 77 (44%), 51(29%), 6 (3.5%), and 6 (3.5%) were staged as T1a, T1b, T2a, T2b, T3a, and T3b by the preoperative MRI staging system, respectively. Disease-free survival was significantly different between T1 and T2a (median, 1925 days vs. 1668 days; P=0.048), between T2a and T2b (median, 1668 days vs. 799 days; P=0.0021), and between T2b and T3 (median survival, 799 days vs. 141 days; P=0.0015). However, no significant difference was found in disease-free survival between T1a and T1b, and between T3a and T3b.

CONCLUSION

Preoperative MRI staging system may be comparable to the postoperative AJCC staging system in predicting prognosis following

curative resection of HCC. Furthermore, tumor stage 2 of the MRI staging system may be further divided into T2a and T2b.

CLINICAL RELEVANCE/APPLICATION

These advantages (preoperative staging and further stratification of T2 into T2a/b) can make the devised MRI staging useful in deciding on treatment plans of patients with HCC.

SSA08-05   Utilising the Full Potential of MRI in the Diagnosis of HCC - Time for a Game Changer?

Sunday, Nov. 29 11:25AM - 11:35AM Location: E450B

Participants
Kelvin Cortis, MD, FRCR, Msida, Malta (*Presenter*) Nothing to Disclose
Rosa Liotta, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Miraglia, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Settimo Caruso, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabio Tuzzolino, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Luca, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The current cornerstone of HCC diagnosis is the wash-in/wash-out enhancement pattern. It is known that HCC might exhibit other MRI findings. Our aim was to retrospectively review the MRIs of histologically proven HCCs on liver explants, and to identify the best combination of sequences useful in HCC diagnosis.

METHOD AND MATERIALS

97 consecutive patients who underwent liver transplantation between 2004 and 2012 and Gd-BOPTA-MRI within 3 months of surgery were enrolled. A hepatobiliary histopathologist and two radiologists blinded to the radiological/histopathological findings performed a nodule by nodule analysis. The signal intensity of all nodules was assessed on the following axial sequences: T1 in/opposed phase, 3D fat suppressed (FS) T1 (pre-contrast, arterial, portal, equilibrium, and hepatobiliary phases), T2, T2 FS, and diffusion (B=800). Arterial enhancement was graded as none, mild, moderate, or intense.A multiple logistic regression analysis was performed following pathological/radiological correlation, and the Odds Ratio (OR) was calculated for every parameter analysed and adjusted for nodule size.

RESULTS

Imaging was performed 41.7±25.4 days pre-transplantation. 291 lesions were identified on histopathology, of which 193 were HCCs, 68 regenerative nodules, 8 low-grade dysplastic nodules (DN), 19 high-grade DNs, 2 cholangiocarcinomas, and 1 necrotic nodule. 48 HCCs (24.9%) were not detectable on imaging (24.9%), leaving a total of 145 HCCs ($\leq$ 10 mm n=25;11-19 mm n=58;$\geq$ 20 mm n=62).As expected, intense (OR 10.9, p<0.000) or moderate (OR 2.2, p=0.003) arterial enhancement and hypointensity on the portal venous (OR 14.3, p<0.000) or equilibrium (OR 15.9, p<0.000) phases were found to predict HCC.In addition, nodules showing hypointensity on the hepatobiliary phase and T2 hyperintensity were also highly likely to represent HCC. In the former, an OR of 10.2 was observed (p<0.000). The OR was 14.3 in non-FS T2 weighted sequences, and 10.2 in FS T2 weighted sequences (p<0.000).

CONCLUSION

In patients with a high risk of HCC, nodules lacking the typical hemodynamic findings are most likely HCC if they exhibit T2 hyperintensity and/or hypointensity on the hepatobiliary phase with an OR of 14.3 and 10.2, respectively (p<0.000).

CLINICAL RELEVANCE/APPLICATION

MRIs targeted at diagnosing HCC should include T2 weighted sequences with and without FS and Gd-BOPTA/Gd-EOB-enhanced hepatobiliary phases alongside standard sequences.

SSA08-06   A Tumor Suppression Factor HNF4α (Hepatocyte Nuclear Factor) Expression Correlates with Gadoxetic Acid Enhanced MRI Fndings in Hepatocellular Carcinoma

Sunday, Nov. 29 11:35AM - 11:45AM Location: E450B

Participants
Azusa Kitao, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Osamu Matsui, MD, Kanazawa, Japan (*Abstract Co-Author*) Research Consultant, Kowa Company, Ltd Research Consultant, Otsuka Holdings Co, Ltd Research Consultant, Eisai Co, Ltd Speakers Bureau, Bayer AG Speakers Bureau, Eisai Co, Ltd
Norihide Yoneda, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuto Kozaka, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshifumi Gabata, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kotaro Yoshida, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Dai Inoue, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Minami, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Wataru Koda, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Junichiro Sanada, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatocyte nuclear factor (HNF) 4A is one of transcription factors with tumor suppression effect, and besides, regulates expression of many molecules including organic anion transporting polypeptide (OATP) 1B3 (uptake transporter of gadoxetic acid) in hepatocellular carcinoma (HCC) (Yamashita T, Hepatology 2014). The purpose of this study is to clarify the correlation between HNF4A expression, pathological findings and imaging findings on gadoxetic acid enhanced MRI.

METHOD AND MATERIALS

The subjects are 138 surgically resected HCCs. We semiquantitatively evaluated the immunohistochemical HNF4A and OATP1B3 expression of HCC into four grades: grade 0: no expression, grade 1: weak expression, grade 2: moderate expression and grade 3:

intensive expression. We compared HNF4A grade of HCCs with OATP1B3 grade, enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI and histological tumor differentiation grade (well, moderately and poorly differentiated HCC).

RESULTS

HNF4A grade in HCC showed a significant positive correlation with OATP1B3 grade (P=0.003, r=0.46). There was also a significant positive correlation between HNF4A grade and enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI (P<0.0001, r=0.49). Especially, intensive HNF4A expression was observed in atypical HCC showing high enhancement ratio and increased OATP1B3 expression. HNF4A grade was decreased according to the decline of differentiation grade of HCC (P=0.0007, r=0.29).

CONCLUSION

The expression of HNF4A in HCC correlated with both of OATP1B3 expression and enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI. In addition, HNF4A expression was decreased during multistep hepatocarcinogenesis. Gadoxetic acid enhanced MRI is useful to evaluate the expression of HNF4A in HCC.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic acid enhanced MRI has a potential to reflect the expression of many genes and molecules regulated by HNF4A as imaging biomarkers (radiogenomics), which will be important for future personalized medicine.

SSA08-07 Presence of Hypovascular and Hypointense Nodules on Preoperative Gadoxetic Acid-enhanced MR Imaging: An Important Risk Factor for Recurrence after Liver Resection for Hypervascular Hepatocellular Carcinoma

Sunday, Nov. 29 11:45AM - 11:55AM Location: E450B

Participants
Katsuhiro Sano, MD, PhD, Chuo, Japan (*Presenter*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Shimizu, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Kofu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Matsuda, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideki Fujii, MD, Tamaho, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The hepatocyte phase (HP) of gadoxetic acid-enhanced magnetic resonance imaging (EOB-MRI) can reveal numerous hypovascular and hypointense nodules with malignant potential, which may progress to conventional hypervascular hepatocellular carcinoma (HCC). We retrospectively evaluated the prognostic factors for patients with hypervascular HCC after liver resection, including the presence of hypovascular hypointense nodules on HP of EOB-MRI (hypo-nodule).

METHOD AND MATERIALS

In total, 114 consecutive patients who had undergone surgical resection and were pathologically diagnosed with moderately differentiated HCC were included. For the analysis of risk factors for recurrence and a poor survival rate after liver resection, univariate and multivariate Cox regression analyses were performed for the following factors: age, tumor size, tumor number, vascular invasion, TNM stage, albumin level, prothrombin ratio, Child-Pugh class, alpha-fetoprotein level, protein induced by vitamin K absence/antagonist-II (PIVKA-II), liver cirrhosis, past history of HCC, and presence of hypo-nodules on HP of preoperative EOB-MRI. We compared the 5-year recurrence-free and overall survival rates between patients with and without hypo-nodules on HP of EOB-MRI.

RESULTS

Univariate and multivariate analyses revealed the presence of hypo-nodules as the only significant risk factor for recurrence after liver resection (risk ratio, 2.1 and 2.1; p-value, 0.014 and 0.020) and albumin level as the only significant risk factor for a poor survival rate (risk ratio, 10.3 and 6.1; p-value, <0.001 and 0.019).The 5-year recurrence-free rate was significantly lower for patients with hypo-nodules (13.1%) than for those without (48.8%; p = 0.008); similar results were observed for the 5-year survival rate (66.1% vs. 83.4%), although the difference was not significant (p = 0.222).

CONCLUSION

The presence of hypo-nodules on HP of preoperative EOB-MRI is an important risk factor for recurrence after liver resection for hypervascular HCC.

CLINICAL RELEVANCE/APPLICATION

The presence of hypovascular and hypointense nodules on hepatocyte phase of preoperative gadoxetic acid-enhanced MR imaging is an important risk factor for recurrence after liver resection for hypervascular hepatocellular carcinoma.

SSA08-08 Hepatocellular Carcinoma without Gadoxetic Acid Uptake on Preoperative MR Imaging: An Important Prognostic Risk Factor after Liver Resection

Sunday, Nov. 29 11:55AM - 12:05PM Location: E450B

Participants
Tatsuya Shimizu, MD, Yamanashi, Japan (*Presenter*) Nothing to Disclose
Katsuhiro Sano, MD, PhD, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Kofu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose

Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Matsuda, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideki Fujii, MD, Tamaho, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatocellular carcinomas (HCCs) commonly demonstrate hypointensity compared with the surrounding liver parenchyma on the hepatocyte phase (HP) of gadoxetic acid-enhanced MR imaging (EOB-MRI). However, some hypervascular HCCs with gadoxetic acid (EOB) uptake demonstrate iso- or hyperintensity on HP. Such lesions are known to be biologically less aggressive. A previous study showed a lower recurrence rate for hyperintense HCC than for hypointense HCC.In this study, we retrospectively evaluated the overall survival rate for patients with hyperintense and hypointense HCC on EOB-MRI.

METHOD AND MATERIALS

In total, 114 consecutive patients with moderately differentiated HCC that was surgically resected from January 2008 to December 2013 were included in this study. According to their signal intensity on HP of EOB-MRI, the 114 patients were classified as EOB uptake (+) HCC (n = 23) and EOB uptake (-) HCC (n = 91). Risk factors for recurrence and a poor survival rate after liver resection were analyzed by univariate and multivariate Cox regression analyses of the following factors: age, tumor size, tumor number, vascular invasion, TNM stage, albumin level, prothrombin ratio, Child-Pugh class, alpha-fetoprotein level, protein induced by vitamin K absence/antagonist-II (PIVKA-II), liver cirrhosis, past history of HCC, and EOB uptake on HP of preoperative EOB-MRI. Then, we calculated the overall survival and recurrence-free rates for both groups using Kaplan-Meier survival curves. The log-rank and Wilcoxon tests were used to analyze significant differences.

RESULTS

The absence of EOB uptake was found to be a significant risk factor for a poor survival rate after liver resection (risk ratio, 5.4; p < 0.05). The EOB uptake (+) group showed a higher overall survival rate compared with the EOB uptake (-) group (5-year survival rate, 100% and 73.3%; p < 0.05). However, the recurrence-free rate was not significantly different (p = 0.70).

CONCLUSION

The absence of EOB uptake was a significant risk factor for a poor survival rate after liver resection. The overall survival rate was higher for patients with EOB uptake than for those without.

CLINICAL RELEVANCE/APPLICATION

In patients with moderately-differentiated hepatocellular carcinoma, the absence of gadoxetic acid uptake is a significant risk factor for a poor survival rate after liver resection. The overall survival rate is higher for patients with gadoxetic acid uptake than for those without.

SSA08-09 Dual Energy Spectral CT Imaging for the Evaluation of Small Hepatocellular Carcinoma Microvascular Invasion

Sunday, Nov. 29 12:05PM - 12:15PM Location: E450B

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Lei Yuxin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Ma Chunling, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Tian Xin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate small hepatocellular carcinoma microvascular invasion using dual energy spectral CT imaging.

METHOD AND MATERIALS

This study was approved by our ethics committee. We retrospectively analyzed the images of 50 patients with 56 small hepatocellular carcinoma who underwent preoperative contrast enhanced dual-phase spectral CT scans before surgical resection. Tumors were divided into two groups based on the pathological findings for analysis: with (n=37) and without (n=19) microvascular invasion. Iodine concentration (IC) for tumors was measured in arterial phase (AP) and venous phase (VP) on the iodine-based material decomposition images to calculate IC reduction rate (ICrr) between AP and VP. IC values were further normalized to that of aorta to obtain normalized IC (NIC). Tumor CT attenuation number was measured on the monochromatic image sets to generate spectral HU curve and to calculate a slope (k) for the curve: (CT(40keV)-CT(90keV))/50. Values of the 2 pathological groups were compared and ROC study was performed to assess the differential diagnosis performance.

RESULTS

The IC, NIC, ICrr and slope (k) values in AP for tumors with microvascular invasion(Fig 2A-2C) were significantly higher than those without microvascular invasion(Fig 1A-1C) (2.40±0.80mg/ml vs. 1.68±0.47mg/ml for IC; 0.22±0.06 vs. 0.16±0.05 for NIC; 0.27±0.16 vs. 0.01±0.25 for ICrr; and 3.28±1.08 vs. 2.27±0.63 for slope, all p<0.05)(Table 1). Using the normalized iodine concentration value of 0.18 in AP as a threshold, one could obtain an area-under-curve of 0.82 for ROC study with sensitivity of 82.4% and specificity of 70.0% for differentiating small hepatocellular carcinoma with and without microvascular invasion. These values were significantly higher than the sensitivity of 64.7% and specificity of 69.2% with conventional CT numbers at 70keV(Table 2).

CONCLUSION

Using quantitative parameters obtained in spectral CT in the arterial phase provides new method with high accuracy to evaluate small hepatocellular carcinoma microvascular invasion.

CLINICAL RELEVANCE/APPLICATION

Quantitative iodine concentration measurement in spectral CT may be used to provide a new method to evaluate small

hepatocellular carcinoma microvascular invasion.

Interventional Oncology Series: Percutaneous Management of Renal Tumors: Updates and Ongoing Controversies in 2015

Sunday, Nov. 29 1:30PM - 6:00PM Location: S405AB

`GU` `IR` `OI` `RO`

AMA PRA Category 1 Credits ™: 4.25
ARRT Category A+ Credits: 5.00

`FDA` Discussions may include off-label uses.

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review management options for small renal masses as well as indications for each. 2) To review the data supporting the energy based thermal ablation modalities for ablation of renal masses. 3) To describe the role and limitations of biopsy of renal masses. 4) To review the management of benign solid renal masses. 5) To describe the evidence for ablation of T1b renal masses.

Sub-Events

VSIO11-01 Updates in the Management of Small (T1a) Renal Masses: Resect, Ablate, or Follow?

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-02 Small Renal Mass (T1a): The Case for Ablation in 2015

Sunday, Nov. 29 1:30PM - 1:50PM Location: S405AB

Participants
Jeremy C. Durack, MD, New York, NY (*Presenter*) Scientific Advisory Board, Adient Medical Inc Investor, Adient Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-03 Small Renal Mass (T1a): The Case for Resection in 2015

Sunday, Nov. 29 1:50PM - 2:10PM Location: S405AB

Participants
Adam S. Feldman, MD, Boston, MA (*Presenter*) Consultant, Olympus Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-04 Small Renal Mass (T1a): Both Cases for Intervention are Weak. Active Surveillance Will Do Just as Well

Sunday, Nov. 29 2:10PM - 2:30PM Location: S405AB

Participants
Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (*Presenter*) Author, Wolters Kluwer nv

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-05 Age Impacts Choice of Partial Nephrectomy vs. Percutaneous Ablation for Stage T1a Renal Cell Carcinoma: a Surveillance, Epidemiology and End Results (SEER)-Medicare Population Study

Sunday, Nov. 29 2:30PM - 2:40PM Location: S405AB

Participants
Minzhi Xing, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Nima Kokabi, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Di Zhang, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate survival outcomes in patients with stage 1a renal cell carcinoma (RCC) undergoing open or laparoscopic partial nephrectomy (PN) vs. percutaneous cryoablation (CRA) or radiofrequency ablation (RFA) in a large-scale population study.

METHOD AND MATERIALS

The most recently updated SEER-Medicare linked database was queried for patients with T1aN0M0 RCC (<4cm, ICD-O-3 C64.9)

The most recently updated SEER-Medicare linked database was queried for patients with T1aN0M0 RCC (≤4cm, ICD-O-3 C64.9) diagnosed between 2000 and 2011 and followed to 2012. Patients who underwent therapy were selected from Medicare via CPT carrier claim codes (percutaneous RFA 50592; percutaneous CRA 50593; open PN 50240; laparoscopic PN 50543). Mean overall survival (OS) from therapy was compared between patients who underwent percutaneous ablation vs. partial nephrectomy, with subgroup survival analysis of individual therapies. Kaplan-Meier estimation and Cox proportional hazard models were used for survival analyses and to assess independent prognostic factors for OS.

RESULTS

A total of 5,983 T1a RCC patients underwent percutaneous ablation or PN within the study period, median age 72.0 yrs, 61.0% male. Of these, 3150 received open PN, 1785 received laparoscopic PN, 419 received CRA and 629 received RFA. Of these, 47.9% of patients undergoing PN were >72 yrs, vs. 67.1% of patients in the ablation group. Mean age of patients receiving ablation was significantly higher than that of the PN group, 80.1 vs. 70.6 yrs, p<0.001. Other factors including gender, ethnicity, mean index tumor size and tumor grade were not significantly different between comparison groups. Patients who underwent PN had significantly higher mean OS compared to the ablation group, 128.7 vs. 75.5 months, p<.001. On Cox regression analysis, younger age was the only independent prognostic factor for survival, HR 0.91 (0.87-0.93, p<0.001).

CONCLUSION

In T1aN0M0 RCC, patients undergoing ablation were significantly older compared to PN patients. Age was found to be an independent prognostic factor for survival from treatment.

CLINICAL RELEVANCE/APPLICATION

In T1aN0M0 RCC, age was found to be an independent prognostic factor for survival from treatment and may impact choice of therapy.

VSIO11-06 Ablation for Renal Cell Carcinoma: Radiofrequency, Cryoblation, or Microwave?

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-07 Small Renal Mass (T1a): The Case for RFA in 2015

Sunday, Nov. 29 2:40PM - 3:00PM Location: S405AB

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Debra A. Gervais, MD - 2012 Honored Educator

VSIO11-08 US-guided Percutaneus Radiofrequency Ablation of Renal Cell Carcinoma: Experience from Treating 120 Renal Masses Over 7 Years

Sunday, Nov. 29 3:00PM - 3:10PM Location: S405AB

Participants
Adriana C. Montealegre Angarita, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier Serres Creixams, PhD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Enrique Trilla, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Milton R. Villa III, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Juan Halaburda Berni, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Esteban Ramirez Pinto, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier G. Azogue JR, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluate the efficacy and safet of ultrasound (US) guided percutaneous radiofrequency ablation (RFA) for small renal masses. Describe the complications of RFA guided by US. Evaluate the technique in their initial ablative capacity and rate of tumor recurrence at one year minimum follow up. Illustrate postablation findings of residual or recurrent renal tumor by using Contrast-enhanced US (CEUS) Evaluate the effect of renal function in patients undergoing RFA guided by US

METHOD AND MATERIALS

Over a 7 year 105 patients with 120 renal masses (tumor size averaged 2.7 cm) were reviewed treated with US-guided percutaneous RFA. Biopsy was performed at the same moment of the procedure from 2009. Cool-tip RFA system was percutaneously inserted under ultrasound guidance. RF was emitted at 100-120 W for 12 minutes to attain temperatures sufficient to ensure tumor kill. The treatment response and technical success were defined by absence of contrast enhancement within the tumor on contrast enhanced CT and CEUS. The patients were followed up with CEUS and computed tomography at 3.6 months and every 6 months thereafter. Multivariate analysis was performed to determine variables associated with procedural outcome.

RESULTS

Follow-up ranged from 24 months to 84 months.The initial treatment success rate was 95.8%.Five of the remaining tumors were successfully re-treated.Four tumors had recurrence (defined as the occurrence of contrast enhancing tumor 12 months after complete ablation) three of whom required a second ablation and one nephrectomy.The overall technical success rate was 99%. Complications were seven self-limited included hematomas subcapsular or perirenal. In all 104 (99%) patients have preservation of renal function,only one patient developed significant renal function deterioration associated with perirenal hematoma. There were no bowel complications despite the fact that 6 of the tumors were within 1 cm of bowel. Protective strategies progressed from reliance on electrode positioning to hydro dissection.

CONCLUSION

Our experience to date suggests that US-guided RFA of small renal tumors is a safe and effective, minimally invasive technique in selected patients.

CLINICAL RELEVANCE/APPLICATION

US-guided RFA of renal tumors can provide benefits compared to other techniques: Intraprocedural monitoring affords visualization of the forming hot ball, helps detect proximity to surrounding structures and does not use ionizing radiation.

VSIO11-09   Small Renal Mass (T1a): The Case for Cryoblation

Sunday, Nov. 29 3:10PM - 3:30PM Location: S405AB

Participants
Peter J. Littrup, MD, Providence, RI (*Presenter*) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo Health Solutions Inc; Consultant, Delphinus Medical Technologies, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cryoablation of smaller renal cancers (i.e., T1a, or <4 cm) is an out-patient treatment that is safe, effective and flexibility for nearly any renal location. Major cryoablation benefits include its excellent visualization of ablation zone extent, low procedure pain and flexible protection of tumor ablation sites near calyces, bowel and ureter. CT-guidance is the cryoablation guidance modality of choice due to circumferential visualization of low density ice and ready availability. US-guidance can augment renal cryoablation, especially for smaller visible masses and/or placement of interstitial metallic markers during biopsy for selected cases requiring better eventual CT localization. MR-guidance has little clinical benefit or cost-efficacy. For safety, cases will be considered for avoidance of direct calyceal puncture, selection of hydrodissection or balloon interposition for bowel protection, and protection of the uretero-pelvic junction by stent placement. Imaging outcomes of complications and their avoidance will be shown. For optimal efficacy, tumor size in relation to number and size of cryoprobes emphasize the "1-2 Rule" of at least 1 cryoprobe per cm of tumor diameter and no further than 1 cm from tumor margin, as well as cryoprobe spacing of <2cm. Thorough extent of visible cryoablation margins beyond all apparent tumor margins produces very low local recurrence rates for tumors in nearly any renal location, resulting in excellent cost-efficacy by minimizing the need for re-treatments.

VSIO11-10   Adjunctive Techniques to Improve Image-Guided Percutaneous Cyroablation of Renal Masses in Difficult Anatomic Locations: Quantifying Procedural Success and Long-term Outcomes

Sunday, Nov. 29 3:30PM - 3:40PM Location: S405AB

Participants
Ahmed Fadl, MD, Mineola, NY (*Presenter*) Nothing to Disclose
Andrew Ho, Bayside, NY (*Abstract Co-Author*) Nothing to Disclose
Samia Sayegh, DO, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
April Griffith, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Siavash Behbahani, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (*Abstract Co-Author*) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc

PURPOSE

When performing renal mass cryoablation in difficult anatomic locations, adjunctive techniques such as retrograde pyeloperfusion, hydrodissection, and angioplasty balloon interposition can improve safety and technical success rates. Prior studies have reported the technical success of these techniques, but correlation with longer-term outcomes has not been reported in this specific patient population. This study quantifies the success of these techniques, and correlates with long-term cross-sectional imaging outcomes.

METHOD AND MATERIALS

Retrospective analysis of percutaneous renal mass cryoablation was performed from September 2011 through October 2014 at a single, tertiary care institution. Cases using adjunctive techniques were analyzed. The diagnostic cross sectional imaging, procedural images and report, and follow-up multi-phasic cross-sectional imaging were reviewed by one radiology resident and one interventional radiology attending. The type of adjunctive technique used, reason for such utilization, and procedural outcome of the technique were recorded. Specifically, in cases of hydrodissection or balloon angioplasty interposition, measurements of the displacement distance were made. Minor and major complications were recorded, per Society of Interventional Radiology criteria. Longer-term outcomes were evaluated by review of follow-up cross-sectional imaging.

RESULTS

Out of 53 cryoablations during the study period, 9 utilized adjunctive techniques, including hydrodissection (n=8), retrograde pyeloperfusion (n=1), and angioplasty balloon interposition (n=1). Median greatest tumor dimension was 1.9cm (range 1.3-3.5cm). Prior to adjunctive technique, median tumor proximity to closest organ was 0.4cm (range 0.1-1.3cm). After technique was used, median distance to closest organ was 2.8cm (range 0.3-3.3cm). One hydrodissection was unsuccessful, thus angioplasty balloon interposition was then performed. All cases had appropriate ablation zones and protection of adjacent critical structures. No minor or major complications were reported. No patients had evidence of residual or recurrent tumor on follow-up imaging, ranging from 3 to 30 months.

CONCLUSION

Adjunctive techniques to allow cryoablation of renal masses in difficult anatomic locations have excellent technical success rates and long-term outcomes.

CLINICAL RELEVANCE/APPLICATION

Improving outcomes of difficult renal mass cryoablations.

VSIO11-11 Small Renal Mass (T1a): The Case for Microwave

Sunday, Nov. 29 3:40PM - 4:00PM Location: S405AB

Participants
Fred T. Lee JR, MD, Madison, WI (*Presenter*) Stockholder, NeuWave Medical, Inc; Patent holder, NeuWave Medical, Inc; Board of Directors, NeuWave Medical, Inc ; Patent holder, Medtronic, Inc; Inventor, Medtronic, Inc; Royalties, Medtronic, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-12 Long-term Clinical Outcomes Following Radiofrequency and Microwave Ablation of Renal Cell Carcinoma at a Single Large VA Medical Center

Sunday, Nov. 29 4:00PM - 4:10PM Location: S405AB

Participants
Salim E. Abboud, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Tanay Y. Patel, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Stephanie Soriano, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Nannette Alvarado, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Preet S. Kang, MD, Pepper Pike, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Earlier detection and a desire to preserve renal function and decrease surgical morbidity in the treatment renal cell carcinoma (RCC) has prompted increased use of percutaneous thermal ablation treatments such as radiofrequency ablation (RFA) and more recently microwave ablation (MWA). MWA has the potential to provide more complete ablation compared to RFA in part due to more uniform and higher intra-tumoral temperatures, but only a few small studies have examined the short-and long-term outcomes of MWA for RCC. This retrospective review assesses the experience and technical short- and long-term success rates of using RFA and MWA for RCC at a large VA medical center.

METHOD AND MATERIALS

Patient and tumor characteristics (tumor size, nearness to collecting system, anterior/posterior location, location relative to polar line, and endophytic/exophytic predominance) were tabulated using descriptive statistics. Group comparisons were performed by using univariate logistic regression analysis to determine factors impacting primary efficacy, secondary efficacy, and technique effectiveness. Kaplan-Meier local tumor progression-free survival following ablation was calculated.

RESULTS

71 patients with 78 renal lesions underwent ablation. Mean, primary, and secondary mean follow-up were 35.1, 33.5, and 31.3 months. Total, primary, and secondary technique effectiveness rates were 86%, 82%, and 4%, respectively. Primary efficacy and total technique effectiveness were associated with size, with p values of 0.02 and 0.001. There was no significant difference in survival curves between MWA and RFA treated patients. MWA and RFA groups were not significantly different in terms of age, BMI, or tumor size. Complications occurred in 11.5% of patients, none resulting in death. More than 90% patients were done as outpatients (sent home day of procedure) with moderate sedation. No cases used intubations or general anesthesia.

CONCLUSION

RFA and MWA both represent effective treatment modalities for RCC. Longer follow-up time and larger tumor size may be associated with the somewhat lower effectiveness rates; the comparable efficacy/complication rates compared to prior ablation studies demonstrate the feasibility of performing ablations on an outpatient basis.

CLINICAL RELEVANCE/APPLICATION

Image guided percutaneous ablation is an effective and cost-effective treatment modality for RCC in patients that are not surgical candidates.

VSIO11-13 To Biopsy or Not Biopsy the Small Renal Mass before Ablation? That Is the Question

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Characterization of small renal masses has proven challenging. However, with appropriate CT and MR protocols, the majority of these lesions can now be characterized pre procedurally, enabling a confident diagnosis. In this lecture, we will describe renal mass characterization protocols and describe the common imaging signatures of RCC subtypes and their common mimics including lipid poor AML and oncocytoma. This may eliminate need for preprocedural biopsy.

VSIO11-14 Biopsy or No Biopsy Before Ablation? Biopsy Every Renal Mass before Percutaneous Ablation

Participants
William W. Mayo-Smith, MD, Boston, MA (*Presenter*) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-15 Biopsy or No Biopsy before Ablation? Don't Trouble Yourself or the Patient with the Renal Mass Biopsy - Imaging Diagnosis Will Do Just as Well in 2015

Sunday, Nov. 29 4:50PM - 5:10PM Location: S405AB

Participants
Steven S. Raman, MD, Santa Monica, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-16 Thermal Ablation of a Confluent Lesion in the Porcine Kidney with Magnetic Resonance Guided High Intensity Focused Ultrasound (MR-HIFU)

Sunday, Nov. 29 5:10PM - 5:20PM Location: S405AB

Participants
Johanna M. van Breugel, MSc, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Martijn de Greef, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Joost W Wijlemans, MD,PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gerald Schubert, PhD, Vantaa, Finland (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Chrit T. Moonen, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Maurice V. Bosch, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario G Ries, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate if MR-HIFU can provide for a reliable confluent volumetric lesion in the renal cortex in a clinically relevant time-frame in a porcine study.

METHOD AND MATERIALS

Nine anesthetized pigs were placed on a clinical Philips Sonalleve MR-HIFU therapy system integrated with a 1.5T Achieva MRI. Both acoustic energy delivery and MR-thermometry were respiratory gated and active surface cooling was employed to prevent near-field damage. A honeycomb pattern of at least seven ablation cells (9-25s, 450W acoustic power, 4x4x10 mm3 per cell) were positioned in the cortex of the kidney. The therapeutic endpoint was evaluated by a non-perfused volume (NPV) measurement using DCE-MRI. Subsequently, the animal was euthanized and the extent of induced necrosis was examined using a cellular viability staining (NADH).

RESULTS

Confluent volumes on NPV-imaging (up ~3 mL) and NADH staining (up to ~4mL) were obtained and temperatures exceeding 60°C were reached in 6 pigs. I.e. heating of the false rib, poor respiratory correction, and a large incidence angle caused poor kidney heating in 3 pigs.

CONCLUSION

These first results indicate that current clinical MR-HIFU equipment might be suitable for non-invasive therapy of renal masses. Positioning of the sonications and the subject based on anatomical scans is very important, as well as adequate motion compensation. Future work will include a first clinical study on renal cell carcinomas.

CLINICAL RELEVANCE/APPLICATION

There is an increasing interest in non-invasive kidney sparing therapy for renal cancer, since ~1.6% of men and women will be diagnosed with kidney and renal pelvis cancer during their lifetime, in 25% of all abdominal imaging sessions a renal lesion is found, partial nephrectomy - standard care for tumors <4cm - has a 15% complication rate, and the population is aging and known with comorbidities and poor physical condition. Therefore, several patient studies investigated the feasibility of HIFU for the thermal ablation of renal masses. Mainly a hand-held extracorporeal ultrasound device with US B-mode imaging for guidance or a laparoscopic approach was used. Disadvantages are i.e. the lack of respiratory motion compensation, no real-time visualization of energy deposition, and the complexity of the probe positioning. Alternatively, feasibility of MR-HIFU interventions on the kidney with respect to motion compensated real-time thermometry and acoustic energy delivery was established, recently.

VSIO11-17 Outside the Box: Is Ablation Effective for Masses other than T1a RCC

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-18 Percutantous Ablation for T1b Tumors

Sunday, Nov. 29 5:20PM - 5:40PM Location: S405AB

Participants
Thomas D. Atwell, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO11-19 Percutantous Ablation for Angiomyolipomas

Sunday, Nov. 29 5:40PM - 6:00PM Location: S405AB

Participants
Fred T. Lee JR, MD, Madison, WI (*Presenter*) Stockholder, NeuWave Medical, Inc; Patent holder, NeuWave Medical, Inc; Board of Directors, NeuWave Medical, Inc ; Patent holder, Medtronic, Inc; Inventor, Medtronic, Inc; Royalties, Medtronic, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC111

Head and Neck Cancer PET Interpretation with Case Examples (An Interactive Session)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S505AB

| HN | NR | CT | NM | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC111A Practical Approach for Interpreting Head and Neck PET/CT

Participants
Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (*Presenter*) Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES

1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To learn common pathways of tumor spread in head and neck. 3) To review illustrative cases and pitfalls of interpretation.

ABSTRACT

RC111B PET/CT for Head and Neck Cancer: Clinical Applications and Case Studies

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review head and neck anatomy and physiologic sites of FDG uptake. 2) Review the impact of FDG-PET/CT on the management of patients with head and neck malignancies.

ABSTRACT

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

Honored Educators

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC111C The Head and Neck Surgeon's Perspective: What I Need to Know

Participants
Nishant Agrawal, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the indications of PET/CT in head and neck cancer. 2) Review the impact of PET/CT on staging in head and neck cancer. 3) Review the role of PET/CT in the evaluation of the unknown primary. 4) Review the role of post-treatment PET/CT.

Imaging Cancer Treatment Complications

Sunday, Nov. 29 2:00PM - 3:30PM Location: N229

| CT | NM | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC118A   Identifying and Distinguishing Treatment Complications on FDG PET/CT

Participants
Gary A. Ulaner, MD, PhD, New York, NY, (ulanerg@mskcc.org) (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Identify iatrogenic causes of FDG-avidity on FDG PET/CT and distinguish them from FDG-avid malignancy. Iatrogenic causes of FDG-avidity include changes caused by surgery (inflammation at sites of incision, pleurodesis inflammation, transposition of ovaries/testes), radiation (pneumonitis, esophagitis, hepatitis), and drugs (bleomycin pneumonitis, bisphosphonate osteonecrosis, ipilimumab enterocolitis). Familiarity with usual and unusual causes of iatrogenic FDG-avidity will improve accuracy of FDG PET/CT reporting.

ABSTRACT

Fluorine 18 fluorodeoxyglucose (FDG) positron emission tomography / computed tomography (PET/CT) is increasingly used in the initial staging, evaluation of treatment response and surveillance of many malignancies. Uptake of FDG is substantially increased in most malignancies compared with its uptake in normal tissues, and FDG-avidity often leads to cancer detection earlier than abnormalities on anatomic imaging. However, FDG is not a cancer-specific agent, and FDG-avidity can be seen in many benign processes. It can be particularly challenging to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy. FDG-avid lesions caused by surgery and procedures includes inflammation at sites of incision or dissection, inflammation from vascular compromise or surgical retraction, surgical transposition of structures with physiologic FDG-avidity (such as ovaries or testes), and pleurodesis inflammation. Radiation may induce FDG-avid pneumonitis, esophagitis, or hepatitis, as well as osteoradionecrosis or fractures. FDG-avid chemotherapy complications include pneumonitis, osteonecrosis, enterocolitis, and pancreatitis. Granulocyte Colony Stimulating Factor for treatment of bone marrow suppression after chemotherapy induces temporary increases of FDG-avidity in the bone marrow and spleen. In this review we illustrate common and unusual iatrogenic causes of FDG-avidity that can confound FDG PET/CT interpretation. Familiarity with these cases will improve accuracy of FDG PET/CT interpretation.

RC118B   Imaging Musculoskeletal Complications

Participants
Brooke R. Beckett, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the osseous and soft tissue complications of tumor treatment, specifically those caused by radiation, chemotherapy, and surgery. These include radiation osteitis, osteonecrosis, insufficiency fractures, secondary malignancy, myositis and myonecrosis, and muscle denervation changes.

ABSTRACT

Musculoskeletal complications of tumor treatment are relatively common, often symptomatic, and therefore, an important cause of morbidity in the posttreatment cancer patient. Radiation causes local marrow changes such as osteitis, osteonecrosis and osteopenia, predisposing to insufficiency fractures. It may also cause local muscle damage, most commonly myositis, but occasionally myonecrosis. A rare but especially dreaded complication of radiation is secondary bone or soft tissue sarcoma, which will also be described. Chemotherapy, particularly protocols that include high doses of steroids, predisposes to osteonecrosis. And finally, surgical resection of extremity tumors, either primary or metastatic, may lead to muscle denervation changes. The bones and soft tissues should be carefully reviewed on all surveillance imaging, be it radiographs, CT or MRI, to exclude the presence of these often treatable complications.

RC118C   GI Complications

Participants
Priya R. Bhosale, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the complications caused by chemotherapy and radiation specifically those that occur in the GI tract including the liver and the pancreas. These include perforations, abscess formation, radiation enteritis, insufficiency fractures and secondary malignancy.

ABSTRACT

Several complications can occur in the GI tract following surgery. Similarly chemotherapy can cause a myriad of complications such as perforation, abscesses and enteritis. Radiation therapy can result in radiation enteritis and occurrence of radiation induced

cancer

RC118D   **Pulmonary Complications**

Participants
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize complications in the postoperative thoracic patient in both immediate and late periods. In the immediate period this will include lobar collapse, hemorrhage, pulmonary edema, pneumonia, as well as rarer complications such as bronchopleural fistula, chylothorax and lung torsion. In the later period it is important to follow these patients and to recognize and distinguishing recurrent tumor from treatment changes and new primary tumors.

ABSTRACT

Hot Topic Session: PET/MR and Hyperpolarized MR for GU Imaging

Monday, Nov. 30 7:15AM - 8:15AM Location: E450B

GU **MR** **NM** **OI**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Zhen J. Wang, MD, Hillsborough, CA, (jane.wang@ucsf.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with current PET-MR imaging strategies. 2) To learn the current and future applications of PET-MR in genitourinary oncology including gynecological cancers and prostate cancer. 3) To understand the principles of hyperpolarized carbon-13 MR metabolic imaging 4) To learn the clinical utility of hyperpolarized carbon-13 MR for measuring prostate cancer aggressiveness and response to therapy

ABSTRACT

URL

Sub-Events

SPSH20A   PET/MRI of Gynecological Malignancies

Participants
Raj M. Paspulati, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) PET-MRI protocol and workflow for Gynecological cancer. 2) Role of PET-MRI in Gynecological cancer staging, treatment planning and follow up for treatment response. 3) PET-MR Imaging pit falls and limitations.

SPSH20B   Imaging of Prostate Cancer: Potential of PET/MRI with Tracers beyond FDG

Participants
Matthias Roethke, MD, Heidelberg, Germany (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Handout:Matthias Roethke

http://abstract.rsna.org/uploads/2015/15006404/Roethke Prostate RSNA handout.pdf

SPSH20C   Hyperpolarized 13C MR Clinical Trials of Prostate Cancer

Participants
John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Genitourinary Series: Prostate MR 2015: Current Role in Staging and Surveillance and Intervention

Monday, Nov. 30 8:30AM - 12:00PM Location: N227

GU **MR** **OI**

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand why prostate cancer is currently under- and over-diagnosed. 2) To understand the role of multiparametric prostate MRI in guiding biopsy of the prostate. 3) To understand the role in the diagnosis, surveillance and recurrence of cancer. 4) To review current progress in the focal treatment of prostate cancer.

ABSTRACT

The paradox of prostate cancer is that it is currently being overdiagnosed and underdiagnosed. PSA and blind biopsy has resulted in the overtreatment of men with low risk disease and the undertreatment of men with intermediate high risk tumors that evade blind biopsy. Multiparametric MRI is a major breakthrough in the diagnosis of prostate cancer. Moreover it can be used to monitor patients for active surveillance and guide treatment. New standards for reporting of prostate MRI have been recently development. This course will not only review these important developments but will provide new research results to participants.

Sub-Events

RC207-01   Intro to Prostate Cancer

Monday, Nov. 30 8:30AM - 8:55AM Location: N227

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the limitations of PSA screening and random prostate biopsy. 2) To introduce the concepts of novel screening tests and genomic analysis of prostate biopsies. 3) To review the importance of MRI in improving tumor localization, guiding biopsy, monitoring active surveillance and focally ablating prostate cancer.

ABSTRACT

See overview abstract

ABSTRACT

The diagnosis of prostate cancer is evolving quickly. There is increasing recognition that the combination of routine PSA screening and random prostate biopsy overdiagnoses low grade disease and underdiagnoses high grade disease. Autopsy studies show that the normal prostate harbors many low grade and microscopic cancers that never becomes clinically apparent. On the other hand, random biopsies undersample the anterior prostate gland. More accurate screening tests (e.g. PCA-3) are under development for determining which men warrant biopsy. Genomic testing of prostate biopsy samples is also becoming more common and it is thought to improve the prediction of tumor aggressiveness. The increased use of genomics to guide therapy clearly requires that the biopsy sample be representative of the tumor. MR guided biopsies, whether performed in gantry or using MR-US fusion, will improve the quality of the prostate biopsy specimen enabling more accurate genomic testing. Armed with more accurate and reliable tissue diagnosis, more rational decisions regarding active surveillance and/or focal therapy can be made. This course will review advances in MR guided diagnosis, biopsy and therapy of prostate cancer.

RC207-02   Detection and Characterization of Prostate Cancer with Multiparametric MRI (mpMRI): Do Learning and Experience Matter for Diagnostic Accuracy?

Monday, Nov. 30 8:55AM - 9:05AM Location: N227

Participants
Rajan T. Gupta, MD, Durham, NC (*Presenter*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation
Daniele Marin, MD, Cary, NC (*Abstract Co-Author*) Nothing to Disclose
Bhavik N. Patel, MD,MBA, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kirema Garcia-Reyes, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Polascik, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate effect of dedicated reader education on accuracy/Gleason score estimation of index and anterior prostate cancer (PCa) diagnosis with mpMRI in attending radiologists compared to abdominal imaging fellows.

METHOD AND MATERIALS

4 blinded attending abdominal imagers with 2-16 years of experience evaluated 31 prostate mpMRIs in this IRB-approved, HIPAA-compliant, retrospective study for index lesion and anterior PCa detection (including Gleason score estimation). Following dedicated education program, readers reinterpreted cases after a 2-4 month memory extinction period, blinded to initial reads. Reference standard was established combining whole mount histopathology with mpMRI findings by a board-certified radiologist with 5 years of prostate mpMRI experience. Multivariate analysis was performed to assess the effects of learning and reader experience. Results for attending radiologists were then compared with prior reader study results in radiology fellows (using the same set of cases).

RESULTS

Index cancer detection (attending vs. fellow): pre-education accuracy 64.5% vs. 74.2%; post-education accuracy 71.8% vs. 87.7% (p=0.12 vs. p=0.003). Gleason score estimation (index): pre-education accuracy 46.8% vs. 54.8%; post-education accuracy 57.3% vs. 73.5% (p=0.04 vs. p=0.0005). Anterior PCa detection: pre-education accuracy 46.4% vs. 54.3%; post-education accuracy 75% vs. 94.3% (p=0.02 vs. p=0.001). Gleason score estimation (anterior): pre-education accuracy 42.9% vs. 45.7%; post-education accuracy 67.9% vs. 80% (p=0.03 vs. p=0.002). These effects were all attributable to learning and not to reader experience based on multivariate analysis.

CONCLUSION

Accuracy of anterior PCa detection and Gleason score estimation for both index and anterior cancers significantly increased following dedicated reader education for both attendings and fellows. In addition, accuracy for index cancers was statistically significantly improved for fellows post-education. The degree of statistically significant improvement was higher for fellows vs. attendings overall.

CLINICAL RELEVANCE/APPLICATION

Performance in detection and characterization of PCa on mpMRI can be improved with dedicated reader education, however, it may be that the earlier the educational intervention is done, the more significant the improvement.

RC207-04   Abbreviated Prostate MRI (AP-MRI)

Monday, Nov. 30 9:15AM - 9:25AM Location: N227

Participants
Robin Bruhn, Aachen, Germany (*Presenter*) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It has recently been shown that an Abbreviated MRI Protocol is suitable for breast cancer screening. Aim of this study was to investigate whether an Abbreviated Prostate MRI protocol (AP-MRI), consisting of 2 pulse sequences only (high resolution T2-TSE and DWI in a single plane), acquired without endorectal coil, is sufficient to diagnose prostate cancer (PCa) in men presenting with elevated PSA-levels.

METHOD AND MATERIALS

Ongoing prospective reader study on 222 men (mean age 53.6 years) with median PSA of 7.1 who underwent multiparametric 3.0T-MRI with multi-element surface coil. The AP-MRI took a table time of just under 10 min. The full diagnostic protocol (FDP) took 30 min and included the pulse sequences of the AP-MRI (0.4 mm in-plane axial T2-TSE and DWI with 4 b-values up to 1400 s/mm²), plus additional T2-TSE planes, coronal T1-TSE, and DCE. All MRI studies were read prospectively by two GU-radiologists in consensus according to PIRADS 2.0. Readers first read the AP-MR images and made their diagnoses. Then, they read the FDP. Results of MR-guided biopsy, TRUS/saturation biopsy, and/or final surgical pathology, or MRI and PSA follow up of at least 24 months served as SOR.

RESULTS

PCa was finally diagnosed in 85/222 men (38.3%), with median size 12 mm, classified as Gleason-6 in 25 patients, Gln-7 in 31, Gln ≥ 8 in 29. Diagnostic indices of the AP-MRI vs. the FDP were: Sensitivity: 93% (79/85) vs. 94% (80/85); Specificity: 89% (122/137) vs. 87% (120/137); PPV: 84% (79/94) vs. 82% (80/97), NPV: 95% (122/128) vs. 96% (120/125). The single cancer that went undetected by AP-MRI was a Gln-6-cancer diagnosed by DCE. A total five additional cancers (Gln-6 in 3, and Gln-7 in 2 patients) went undetected by both, AP-MRI and FDP, and were detected by TRUS biopsy. NPV for biologically relevant prostate cancer (> Gln-6) was 98.8% (95%CI: 95.7%-99.9%) for both, AP-MRI and FDP.

CONCLUSION

Abbreviated prostate MRI allows diagnosis of biologically relevant PCa in under 10 minutes magnet time, without endorectal coil and without contrast agent, and offers a diagnostic accuracy that is equivalent to that of a full state-of-the-art multi-parametric prostate MRI protocol.

CLINICAL RELEVANCE/APPLICATION

Abbreviated prostate MRI, if confirmed by further studies, may open the door for systematic MRI screening for prostate cancer.

RC207-05   The Natural History of Low-grade Prostate Cancer: Lessons from an Active Surveillance Cohort

Monday, Nov. 30 9:25AM - 9:35AM Location: N227

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Neophytos Petrides, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Caroline M. Moore, London, United Kingdom (*Abstract Co-Author*) Speakers Bureau, Myriad Genetics, Inc; Research Grant,

GlaxoSmithKline plc; Consultant, STEBA Biotech NV
Mark Emberton, London, United Kingdom (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc; Consultant, sanofi-aventis Group; Consultant, Glide Pharmaceutical Technologies Limited; Consultant, SonaCare Medical, LLC
Clare M. Allen, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alex P. Kirkham, BMBCh, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the natural history of low-grade prostate cancer by mpMRI changes in patients under active surveillance (AS).

METHOD AND MATERIALS

This study had an authorization from our institutional ethics review board. From our database on patients with prostate cancer, a total of 86 were enrolled in an AS program and had their first mpMRI in 2012 or before. The two reading radiologists, in consensus, knew tumor location and PSA but were blinded to both patient demographics and date of scan. The scans were reported randomly (reducing any bias assuming an increase in size with time). For each visible lesion we measured volume on the sequence best showing the tumor (the same for all scans), as well as attributing a score based on the European Society of Uroradiology -ESUR- 2012 guidelines.

RESULTS

1. 66/86 patients had Gleason 3+3 and 20/86 Gleason 3+4 tumor. Median maximum cancer core lengths were 1 and 3.5 mm, respectively.2. 38/86 patients did not have a visible lesion on the initial MRI (< 3, ESUR criteria). Of these patients, none had developed at a median of 3.56 years of follow up.3. 40/86 patients had a lesion scoring 3/5 or more (ESUR criteria) on more than 2 scans, enabling an estimation of annual growth rate. 25 had Gleason 3+3, and 15 Gleason 3+4. Median monthly increase in volume was 0.4% for Gleason 3+3 and 1.2% for 3+4 (p=0.049, Mann-Whitney test). No significant difference in the median monthly PSA increase between these groups (0.9 vs 0.6%, p=0.42) was observed.4. In 38/40 patients having 2 scans separated by a median of 1.19 years, 9/38 showed a decrease in lesion size between 5 and 50 %.

CONCLUSION

In a group of men on AS, we never observed development of a convincing lesion in those negative on the first scan. Conversely, it was possible to measure a growth rate in visible tumors, and it was significantly different for Gleason 3+3 and 3+4. Finally, there is considerable inter-scan variability in volume: this must be taken into account when attrbuting a significant increase to a small lesion.

CLINICAL RELEVANCE/APPLICATION

The significant difference in rate of increase between small tumors of different grades under AS suggests that it is possible to monitor their size on MRI.

RC207-06   Multi-parametric MRI (including PIRADS)

Monday, Nov. 30 9:35AM - 10:00AM Location: N227

Participants
Clare M. Tempany-Afdhal, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The state of the art mpMR protocols/sequences for prostate cancer imaging. 2) How to acquire and interpret high quality images. 3) What ACR-Pi-Rads is and how it can be implemented in clinical practice. 4) Current and future role of Prostate MR and ACR- PiRads.

ABSTRACT

The current state of the art approaches to prostate cancer Multi-parametric MR(mpMR) Prostate imaging will be presented. MRI techniques at 1.5T and 3.0T and pulse seqeunce optimization for a state of the art mpMRI exam will be reviewed. The roles of each seqeunce will be illustrated with clinical case examples to outline technical aspects and interpretative approaches. As the examinations have become complex and the clinical demands are increasing there isa need for standarization of our techniques and interpretative reporting. Thus in keeping with Bi-Rads and Li-Rads, we are developing Pi-Rads. The current ACR-PiRads will be reviewed - goals, methods and clinical applications will be presented and future vision for the role of prostate MR and ACR-PiRADS will be presented

RC207-07   Active Surveillance with MRI

Monday, Nov. 30 10:05AM - 10:30AM Location: N227

Participants
Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) What is active surveillance and how it is done. 2) Who is a candidate for active surveillance. 3) The role of mpMRI in risk stratification for active surveillance. 4) The relevance of mpMRI in addition to clinical parameters in disease management.

ABSTRACT

ABSTRACT

Active Surveillance with MRI Active surveillance is increasingly acknowledged as a preferred strategy for most men with low-risk disease. This lecture will discuss low risk prostate cancer and how it is managed clinically. Role of mpMRI will be reviewed with clinical case examples to show selection, follow- up or possible removal of patients from active surveillance protocols.

Honored Educators

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educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Sadhna Verma, MD - 2013 Honored Educator

RC207-08   Longitudinal Follow-up Study of Prebiopsy Multiparametric MRI with Cancer- Negative Findings in Patients with Suspicious Prostate Cancer: A Single Institution Experience

Monday, Nov. 30 10:30AM - 10:40AM Location: N227

Participants
Jun Gon Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Few follow-up studies of prebiopsy prostate multiparametric MRI (mpMRI) with cancer-negative findings have been reported. The aim of this study was to investigate the chance and characteristics of missing cancers on prebiopsy mpMRI with cancer-negative findings based on Prostate Imaging Reporting and Data System (PI-RADS) in patients with suspicious prostate cancer (PCa).

METHOD AND MATERIALS

584 consecutive patients (mean, 62.7 years; range, 30-86 years) with suspicious PCa who performed initial (n= 391) or repeated prostate biopsies (n= 193) were enrolled in this retrospective study. All patients underwent prebiopsy 3-T mpMRI including T2-weighted, diffusion-weighted and dynamic contrast-enhanced imaging. Random systemic core biopsies and MR-targeted core biopsies in cases of cancer-positive MRI findings were performed, while cases with cancer-negative MRI findings underwent random systemic core biopsies during subsequent follow-up. Biopsy-based definition of clinically significant cancer (CSC) was Gleason ≥ 3 + 4 or Gleason 6 with maximal cancer core length (MCL) ≥ 4 mm. The likelihood of PCa on mpMRI was evaluated based on PI-RADS version 2: score 4 or 5 was considered cancer positive.

RESULTS

Pathologically the cancers were found in 25% (146/584). The cancer-positive MRI findings were found in 17% (99/584) patients and of these, 85.9% (85/99) had pathologically cancer cores. Of 485 patients with cancer-negative MRI findings, a total of 61 (12.5%) had cancer cores [Gleason 6 (n= 42), 3 + 4 (n= 14), 4 + 3 (n= 2), 8 (n= 2), and 9 (n= 1)]: biopsy-naive patients (n= 38) and patients with negative previous biopsy (n= 23). The mean MCL was 3.4 mm (range, 1-12.6 mm). The CSCs were found in 47.5% (29/61). Accordingly cancer-negative MRI findings missed 6% (29/485) CSCs: 4.1% (20/485) in biopsy-naive patients and 1.9% (9/485) in patients with negative previous biopsy.

CONCLUSION

Prebiopsy 3-T mpMRI with cancer-negative findings misses approximately 12.5% PCa including 6% CSCs in a cohort of biopsy-naive patients and patients with negative previous biopsy.

CLINICAL RELEVANCE/APPLICATION

In a cohort of biopsy-naive patients or patients with negative previous biopsy, 3-T multiparametric MRI can improve the detection of clinically significant prostate cancers, which can help to select optimal treatment strategies.

RC207-09   Magnetic Resonance/Ultrasound (MR/US) Fusion Biopsy in Clinical Practice: Is Systematic Biopsy still Needed to Detect Clinically Significant Prostate Cancers?

Monday, Nov. 30 10:40AM - 10:50AM Location: N227

Participants
Andrei S. Purysko, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Stephenson, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Erick M. Remer, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Brian R. Herts, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG
Erika Schneider, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, General Electric Company Stockholder, Pfizer Inc Stockholder, NitroSci Pharmaceuticals, LLC
Jennifer Bullen, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Cristina Magi-Galluzzi, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Eric Klein, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the detection rates of clinically significant (CS) prostate cancer (PCa), herein defined as a tumor with Gleason score >= 3 + 4, by MR/US fusion biopsy and systematic extended-sextant TRUS (S-TRUS) biopsy.

METHOD AND MATERIALS

IIRB-approved, HIPAA compliant retrospective study included 256 men (mean age: 62.3 yrs.) with either suspected PCa (n = 187) or enrolled on active surveillance (n = 69). All patients underwent multiparametric MRI (mpMRI) of the prostate on a 3.0 T magnet without endorectal coil as part of clinical care prior to biopsy, with T2, high B-value diffusion, and dynamic contrast enhancing imaging. Patients with potential tumor by mpMRI (n= 193) underwent MR/US fusion biopsy followed by 12-core systematic biopsy (SB) in the same procedure and performed by the same urologist who was aware of the location of the targets; those with negative mpMRI underwent SB only (n = 63). The results of both biopsy techniques alone and combined were evaluated.

RESULTS

The overall detection rate of PCa in this population was 51.2% (131/256), and CS PCa was detected in 26.6% (68/256) of the men. In those with positive mpMRI, there was no significant difference in the number of men with CS PCa detected by either biopsy technique (MR/US fusion biopsy: 46 men [23.8%]; SB: 48 men [24.9%]), and both techniques combined detected more men with CS PCA (66 men [34.2%]). CS PCa was detected exclusively by MR/US fusion biopsy in 18 men (9.3%), and by SB in 20 men (10.4%). In most men with CS PCa exclusively detected by SB, the sextants involved were the same (n = 14) or the immediately adjacent ipsilateral sextant (n = 3) where the MRI target was described; in only 3 men (1.5%) the targets were located in a distant sextant from the site involved by CS PCa. PCa was detected in 28.6% (18/63) of the men with negative mpMRI, but only 2 cases (3.2%) were CS PCa.

CONCLUSION

More CS PCa was detected when MR/US fusion biopsy was combined with SB, with greater contribution from biopsies of the same or immediately adjacent sextants of the MRI targets.

CLINICAL RELEVANCE/APPLICATION

In clinical practice, MR/US fusion biopsy should be performed in conjunction with systematic biopsy of the same and immediately adjacent sextants of MRI-targets to ensure the detection of CS PCa detected by mpMRI.

RC207-10   MR and MR-US Guided Biopsy

Monday, Nov. 30 10:50AM - 11:15AM Location: N227

Participants
Daniel J. Margolis, MD, Los Angeles, CA, (daniel.margolis@ucla.edu) (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) List the indications for in-bore MR-guided and MR/US fusion-guided prostate biopsy. 2) Optimize the protocol and image post-processing of prostate MRI for lesion detection, selection, and delineation. 3) Understand the differences between in-bore MR-guided and MR/US fusion-guided prostate biopsy. 4) Describe the advantages and disadvantages of the different kinds of MR/US fusion-guided prostate biopsy. 5) Communicate with referrers to ensure all information is processed correctly for the biopsy session.

ABSTRACT

Interest in, and growth of, prostate MRI has been largely driven by increasing use of this technology for lesion detection rather than treatment planning. This shift in focus is accompanied by changes in the MRI protocol, and how this information is used. A growing number of opportunities for targeted biopsy, both in-bore direct MRI-guided and MRI-ultrasound image fusion targeting, is accompanied by nearly as many different approaches. Each has advantages and disadvantages, some obvious, and some surprising. Awareness of these issues and how to master them is crucial for providing optimal patient care. These issues range from the hardware and software necessary to plan and perform the biopsy, to the intricacies of information and data communication, to referral and follow-up. A comprehensive, service-line approach ensures patients are followed appropriately at all stages of this process.

ABSTRACT

Multiparametric MRI has transformed from a tool primarily used for staging of known cancer into one for detection, localization, and sampling of suspected cancer. This has allowed for streamlining and simplifying the protocol use for imaging the prostate, which presents its own challenges, including managing decreased signal-to-noise ratios and interfacing with image-guided targeted biopsy software and hardware. The various platforms available for image-fusion targeted biopsy include in-bore MRI-directed, "cognitive-" or "mental-fusion" MRI-ultrasound targeted biopsy, software image fusion, articulated arm, and electromagnetic tracking. Attendees will learn how to incorporate image-guided targeted biopsy into their practice, how to interface with clinical collaborators and referrers, and how image-guided targeted biopsy improves confidence in managing men with suspected or known prostate cancer.

URL

http://1drv.ms/1kzFy7W

RC207-11   12 Months Follow-Up Results of MRI-Guided Transurethral Ultrasound Ablation for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:15AM - 11:25AM Location: N227

Participants
Maya B. Mueller-Wolf, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Sascha Pahernik, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Hadaschik, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Timur Kuru, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ionel V. Popeneciu, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Michele Billia, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
James D. Relle, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Jason M. Hafron, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
Mathieu Burtnyk, DIPLPHYS, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Roethke, MD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

MRI-guided transurethral ultrasound ablation (MR-TULSA) is a novel minimally-invasive technology to treat organ-confined prostate cancer (PCa), aiming to provide local disease control with a low side-effect profile. Directional plane-wave high-intensity ultrasound generates a continuous volume of thermal coagulation to the prostate using real-time MR-thermometry control. A prospective, multi-institutional Phase I clinical study investigated safety, feasibility, and assessed efficacy of MR-TULSA treatment for PCa.

METHOD AND MATERIALS

30 patients with biopsy-proven, low-risk prostate cancer were enrolled: age>=65y, T1c/T2a, PSA<=10ng/ml, Gleason<=3+3 (3+4 in Canada only). Under general anaesthesia, the ultrasound device (TULSA-PRO, Profound Medical Inc., Canada) was positioned in the prostatic urethra with guidance from a 3T MRI (Siemens, Germany). Treatment planning was performed under MRI visualization with therapeutic intent of whole-gland ablation. Treatment was delivered under continuous MRI thermometry feedback control.

RESULTS

MR-TULSA was well-tolerated by all patients without intraoperative complications. Median (5th-9th percentile) treatment time and prostate volume were 36 (24-54) min and 44 (30-89) ml, respectively. Maximum temperature measured during treatment depicted a continuous region of heating shaped accurately to the prostate to within 0.1 ± 1.3 mm. CE-MRI confirmed the resulting conformal non-perfused volume, and correlated well with the ablative temperatures on MR-thermometry. Successful treatment was further indicated by a median PSA decrease from 5.8 (2.8-8.9) ng/ml to 0.8 (0.1-3.2) ng/ml after one month remaining stable at 0.8 (0.1-3.7) ng/ml to 12 month. MRI and biopsy findings at 12 month show diminutive prostate volumes, averaging 51% fibrosis (n=29). Positive biopsies (55% of patients) demonstrate 61% reduction in total cancer length.

CONCLUSION

MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. Primary outcomes show that MR-TULSA is safe and precise for prostate ablation. Phase I data are sufficiently compelling to study MR-TULSA in a larger efficacy trial.

CLINICAL RELEVANCE/APPLICATION

Whole-gland ablation can be safely and accurately achieved using MR-TULSA, which represents a minimally-invasive treatment option for organ-confined prostate cancer.

RC207-12   A Pilot Study to Evaluate Outpatient, Transrectal, Magnetic Resonance-guided Laser Focal Therapy for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:25AM - 11:35AM Location: N227

Participants
Bernadette M. Greenwood, BS, RT, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
John F. Feller, MD, Indian Wells, CA (*Presenter*) Consultant, Koninklijke Philips NV Consultant, Visualase, Inc
Stuart T. May Sr, MD, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Roger McNichols, PhD, Houston, TX (*Abstract Co-Author*) Employee, BioTex, Inc
Wes Jones, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Axel Winkel, DiplEng, Schwerin, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

In the United States alone, new prostate cancer cases for 2014 were estimated at 233,000 and deaths at 29,480. Focal therapies for low risk and intermediate risk localized prostate cancer are increasingly being explored. Our objective is to investigate the safety and feasibility of using outpatient MR- (magnetic resonance) guided laser focal therapy for MR-visible prostate cancer utilizing a transrectal approach for laser applicator placement and therapy delivery.

METHOD AND MATERIALS

All MR-guided therapy was delivered using a 1.5T Philips Achieva XR system (Philips Healthcare, Best, The Netherlands) for both image acquisition and real-time thermometry. Follow-up multiparametric MRI's (mpMRI) were performed on the same scanner as were all follow-up MR-guided prostate biopsies. DynaCAD and DynaLOC (Invivo, Orlando, FL, USA) software were used for image analysis and interventional planning. Laser therapy was delivered using a Visualase (BioTex, Houston, TX, USA) 15W 980 nm laser applicator introduced transrectally using the DynaTRIM (Invivo, Orlando, FL, USA)

RESULTS

34 men were treated. 45 cancer foci were treated. Total procedure time was between 1.5 and 4 hours. MRI volume of coagulation necrosis ranged from 1.2-5.0cc. No serious adverse events or morbidity were reported. 7 treatment regions were positive at 6 month biopsy, consistent with residual/recurrent cancer (23% of subjects, 15% of treated regions). 4 regions were retreated with laser focal therapy. We observed a 35% decrease in mean PSA 1 year post-therapy and no statistically significant change is IPSS and SHIM scores at 6 months post-treatment. 4 patients went on to whole gland therapy: 3 incidence cancer patients (2 Gleason Score 4+4=8, 1 Gleason Score 4+3=7 multi-focal) elected radical prostatectomy (RP). No additional technical difficulty with dissection was reported by the surgeon performing RP. 1 Gleason 3+3=6 elected proton beam therapy (PBT) before undergoing 6 month follow-up and biopsy. Incidence cancer rate was 10%.

CONCLUSION

Our data indicate that outpatient transrectally delivered MR-guided laser focal therapy for localized prostate cancer is both safe and feasible.

CLINICAL RELEVANCE/APPLICATION

In the current climate of cost-reduction and emphasis on minimally-invasive treatment of cancer, focal treatment of prostace cancer with a precisely delivered energy source under MRI-guidance may have favorable results for cost control and quality of life.

RC207-13   Focal Therapies

Monday, Nov. 30 11:35AM - 12:00PM Location: N227

Participants
Aytekin Oto, MD, Chicago, IL, (oto@uchicago.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; ; ;

LEARNING OBJECTIVES

1) Emerging paradigm of focal therapy for early stage low risk prostate cancer. 2) Current status of different focal therapy methods

including laser ablation, high intensity focused US, electroporation and cryotherapy. 3) Challenges in patient monitoring following focal therapy. 4) Future developments in focal therapy of prostate cancer and the importance of radiologist's involvement.

ABSTRACT

TITLE: Image guided focal therapy of prostate cancer Focal therapy of low risk early stage prostate cancer is increasingly important as a minimally invasive option for many patients. The rationale, patient selection criteria and challenges for image-guided focal prostate cancer therapy will be discussed. The essential technical details, advantages and disadvantages of clinically available focal therapy methods will be reviewed. Post-therapy patient monitoring options will be presented. Future developments in the area of focal therapy of prostate cancer and opportunities for involvement of radiologists in focal therapy will be explored.

Honored Educators

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Aytekin Oto, MD - 2013 Honored Educator

Nuclear Medicine Series: Assessment of Cancer Treatment Response: Updates

Monday, Nov. 30 8:30AM - 12:00PM Location: S505AB

`BQ` `NM` `OI`

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Moderator*) Nothing to Disclose
Haesun Choi, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC211-01 Imaging Response - Earning Biomarker Status

Monday, Nov. 30 8:30AM - 9:15AM Location: S505AB

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare and contrast prognostic, predictive, and pharmacodynamic biomarkers. 2) Understand the difference between integrated and integral biomarkers in clinical trials. 3) Discuss advantages and limitations of imaging biomarkers.

ABSTRACT

Serum, pathological, and imaging biomarkers are becoming increasingly important to define potential biological targets, select which patients may benefit from a particular targeted agent, and to follow patients during and following therapy. Traditionally, imaging has not been formally recognized as a biomarker, and standardization of quantitative imaging techniques remains a major challenge. However, functional and quantitative imaging techniques are now being used routinely to evaluate early response to therapy. Unlike conventional cytotoxic chemotherapy, targeted therapy can be cytostatic and selects only susceptible populations of cells. Imaging response criteria is therefore often different from standard anatomic (RECIST, WHO) criteria, and the response may be heterogeneous. In the future, both serum and imaging biomarkers will have an increasingly important role in managing patients undergoing conventional and targeted therapy.

RC211-02 Can Interim [18F]-FDG-PET or Diffusion-weighted MRI Predict End-of-Treatment Outcome in MALT Lymphoma after Immunotherapy? A Prospective Study in 15 Patients

Monday, Nov. 30 9:15AM - 9:25AM Location: S505AB

Participants
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Kurt Kletter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Pones, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether, in in patients with MALT lymphoma, quantitative changes of glycolytic activity on interim [18F]-FDG-PET, or quantitative changes of cell density on interim diffusion-weighted MRI (DWI), relative to pre-therapeutic scans, can predict the end-of-treatment (EOT) outcome after immunotherapy.

METHOD AND MATERIALS

Our prospective IRB-approved study included patients with untreated, histologically proven, FDG-avid MALT lymphoma that underwent whole-body [18F]-FDG-PET/CT and DWI at three time-points: before treatment (baseline); after three cycles (interim); and after six cycles of rituximab-based immunotherapy (EOT). The up to three largest nodal or extranodal lymphoma lesions that were visible on both [18F]-FDG-PET and DWI were defined as target lesions at baseline. Maximum and mean SUVs (SUVmax, SUVmean), and minimum and mean apparent diffusion coefficients (ADCmin, ADCmean) were measured, and their rates of change between baseline and interim examinations (ΔSUVmax, ΔSUVmean, ΔADCmin, and ΔADCmean) were compared, using ANOVAs, between the four EOT outcomes: complete remission (CR), partial remission (PR), stable disease (SD), or progressive disease (PD). The relationship between ΔSUVs and ΔADCs was also assessed by Pearson correlation coefficients (r).

RESULTS

Fifteen patients with 25 lesions were included. Lesion-based post-hoc tests showed significant differences between CR and PR for ΔSUVmax (P<0.001), ΔSUVmean (P<0.001), and ΔADCmin (P=0.044); and between CR and SD for ΔSUVmax (P<0.001), ΔSUVmean (P<0.001), ΔADCmin (P=0.021), and ΔADCmean (P=0.022); but not between CR and PR for ΔADCmean (P=0.012); and also not between PR and SD for ΔSUVmax (P=0.98), ΔSUVmean (P=0.96), ΔADCmin (P=0.85), or ΔADCmean (P=0.99). No lesion showed PD at EOT. A substantial and significant, negative correlation between ΔSUVmax and ΔADCmin (r=-0.71, P<0.001), and ΔSUVmean and ΔADCmean (r=-0.70, P<0.001), was observed.

CONCLUSION

Both quantitative interim [18F]-FDG-PET measures and interim DWI measures may be able to predict lesion-based complete response to immunotherapy at end-of-treatment in MALT lymphoma.

CLINICAL RELEVANCE/APPLICATION

[18F]-FDG-PET and DWI may be useful for early treatment outcome prediction in patients with MALT lymphoma undergoing rituximab-based immunotherapy.

RC211-03   Whole-Body FDG-PET/MRI vs. Whole-Body MRI with DWI vs. Integrated FDG-PET/CT with Brain CE-MRI: Capability for Recurrence Assessment in Patients with Postoperative Non-Small Cell Lung Cancer

Monday, Nov. 30 9:25AM - 9:35AM Location: S505AB

Participants

Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Hitoshi Yamagata, PhD, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To compare the diagnostic performance for postoperative lung cancer recurrence assessment among whole-body FDG-PET/MRI, MRI with diffusion weighted imaging (DWI) and integrated FDG-PET/CT with brain contrast-enhanced (CE-) MRI in non-small lung cancer (NSCLC) patients.

METHOD AND MATERIALS

96 consecutive postoperative NSCLC patients (52 men, 44 women; mean age 72 years) prospectively underwent whole-body MRI with and without DWI at 3T MRI system, integrated PET/CTs and conventional radiological examinations as well as follow-up examinations. When recurrence was suspected in each NSCLC patients, pathological examination was performed. Then, all patients were divided into recurrence (n=17) and non-recurrence (n=79) groups based on pathological and follow-up examinations. All co-registered PET/MRIs were generated by means of our proprietary software. Then, probability postoperative recurrence in each patient was visually assessed on all methods by means of 5-point visual scoring system. To compare diagnostic performance among all methods, receiver operating characteristic analyses were performed. Finally, diagnostic accuracy of each factor and clinical stage was statistically compared each other by using McNemar's test.

RESULTS

Area under the curves (Azs) of whole-body PET/MRI (Az=0.99) and MRI with DWI (Az=0.99) were significantly larger than that of PET/CT (Az=0.92, p<0.05) and conventional examination (Az=0.91, p<0.05). When applied feasible threshold values, specificities (SPs) and accuracies (ACs) of PET/MRI (SP: 96.2 [76/79] %, and AC: 96.8 [93/96] %) and MRI with DWI (SP: 100 [79/79] %, and AC: 96.8 [93/96] %) were significantly higher than those of PET/CT with CE-brain MRI (SP: 81.0 [64/79] %, p<0.05; AC: 84.4 [81/96] %, p<0.05) and conventional radiological examination (SP: 79.7 [63/79] %, p<0.05; AC: 83.3 [80/96] %, p<0.05).

CONCLUSION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

RC211-04   Lung Cancer: PET/CT Interpretation (Hopkins Criteria) for Therapy Assessment and Survival Outcome Prediction

Monday, Nov. 30 9:35AM - 9:45AM Location: S505AB

Participants

Rick Wray, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Sheikhbahaei, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

The aim of the study was to test a simple, reproducible, qualitative, therapy response interpretation method (Hopkins Criteria) that can be implemented on the post treatment 18F-FDG PET/CT study and to evaluate its impact on prognosis in patients with lung cancer.

METHOD AND MATERIALS

This was a retrospective study of 204 biopsy-proven lung cancer patients, who underwent a post treatment PET/CT study after completion of primary treatment from 2003 to 2012. The median follow-up was 12.1 months. The PET/CT studies were interpreted using a qualitative 5-point scoring system - Hopkins Criteria. The primary outcome was overall survival (OS), which was analyzed by Kaplan-Meier plots with a Mantel-Cox long-rank test.

RESULTS

Of the 204 patients, 88 were women and 116 were men. A total of 140 (68.6%) patients died during the follow-up period. There were 123 (61.3%) with a positive Hopkins Criteria score for residual disease and 81 (39.7%) patients with a negative score. The median survival time for patients with a positive score was 29.6 months in comparison to 51.2 months in those with a negative score (p<0.001). There was a significant difference in the OS between patients with a positive score versus those with a negative score (HR 2.01; 95%CI: 1.42-2.84; Logrank P<0.001). The Kaplan-Meier analysis also showed a significant difference in OS between patients with a positive and negative score who were treated with surgery (HR 4.72; 95%CI: 1.84-12.08; Logrank P<0.001) and those treated with chemoradiation alone (HR 1.62; 95%CI: 1.11-2.37; Logrank P=0.012). There was also a significant difference in the OS between patients with scores 1 and 2 versus score 3 versus score 4 and 5 (Logrank P<0.0001).

CONCLUSION

The 5-point qualitative therapy response Hopkins Criteria provides valuable prognostic information in patients with lung carcinoma.

CLINICAL RELEVANCE/APPLICATION

The 5-point qualitative therapy response Hopkins Criteria can predict survival outcome in post therapy patients with lung carcinoma and is recommended for surveillance in this population.

RC211-05 Response Assessment Recommendations in Solid Tumors: RECIST vs PERCIST

Monday, Nov. 30 9:45AM - 10:30AM Location: S505AB

Participants
Heather Jacene, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To compare anatomic and metabolic imaging for response assessment. 2) To discuss limitations of current widely used criteria for assessing response. 3) To discuss the benefits and limitations of metabolic imaging for response assessment.

ABSTRACT

RC211-06 Challenges of Solid Tumor Measurements and Techniques to Address This

Monday, Nov. 30 10:45AM - 11:30AM Location: S505AB

Participants
Haesun Choi, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The currently available response evaluation criteria of solid tumors and its limitations. 2) New concept of response evaluation of solid tumors. 3) Future of response evaluation of solid tumors.

ABSTRACT

RC211-07 Is There an Influence of the PERCIST Analysis Approach Used with FDG PET/CT for Evaluation of Tumor Response on Outcome Prediction in Stage IV Breast Cancer Patients?

Monday, Nov. 30 11:30AM - 11:40AM Location: S505AB

Participants
Katja Pinker, MD, New York, NY (*Presenter*) Nothing to Disclose
Christopher C. Riedl, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Leonard Ong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gary A. Ulaner, MD, PhD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd
Maura Dickler, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Wolfgang A. Weber, MD, New York, NY (*Abstract Co-Author*) Consultant, Endocyte, Inc

PURPOSE

PET Response Criteria in Solid Tumors (PERCIST) 1.0, is a framework for the evaluation of tumor response to therapy by FDG PET/CT. PERCIST recommends measuring changes in tumor FDG uptake of 1-5 lesions as measured by SUVpeak normalized for body weight. The purpose of this study was to compare analysis of 1 lesion (PERCIST_1) to analysis of up to 5 lesions (PERCIST_5) and to changes of tumor/liver ratio (TLR) of one lesion for prediction of progression-free (PFS) and disease-specific survival (DSS) in stage IV breast cancer patients under systemic therapy.

METHOD AND MATERIALS

This HPAA compliant IRB approved retrospective study included 65 patients with stage IV breast cancer who received 1st or 2nd line systemic therapy in clinical trials and had a FDG PET/CT at baseline and within 3 months after therapy initiation. Treatment response according to PERCIST_1, PERCIST_5 and TLR was correlated with PFS and DSS using Kaplan-Meier analysis/log-rank tests.

RESULTS

Response classifications using PERCIST_1, PERCIST_5 and tumor/liver ratio analysis are summarized in Table 1. All three approaches resulted in highly significant (p<0.01) differences between responders (CR+PR) and nonresponders (SD+PD) for both PFS and DSS (Figure 1). When comparing the PFS and DSS of responders there were no significant differences for PERCIST_1 vs PERCIST_5 (p=0.74), PERCIST_1 vs TLR (p=0.88) and PERCIST_5 vs TLR (p=0.64). There were also no significant differences of PFS in the group of nonresponders: (PERCIST_1 vs PERCIST_5, p=0.3; PERCIST_1 vs TLR, p=0.54; and PERCIST_5 vs TLR, p=0.62).

CONCLUSION

In metastatic breast cancer a metabolic response according to PERCIST 1, 5 and TLR is highly significantly correlated with PFS and

In metastatic breast cancer a metabolic response according to PERCIST 1, 5 and TLR is highly significantly correlated with PFS and DSS. The exact definition of a metabolic response does not have a major impact on the prognostic value of response assessment.

CLINICAL RELEVANCE/APPLICATION

Response assessment by FDG PET/CT appears to be a robust approach for monitoring tumor response to therapy in patients with metastatic breast cancer.

RC211-08 Assessment of Early Response to Treatment Using FDG PET/CT in Patients with Advanced Melanoma Receiving Immune Checkpoint Inhibitors

Monday, Nov. 30 11:40AM - 11:50AM Location: S505AB

Participants
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Evan J. Lipson, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Hyung-Jun Im, MD,PhD, Madison, WI (*Presenter*) Nothing to Disclose
Esther Mena, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Steven P. Rowe, MD, PhD , Parkville, MD (*Abstract Co-Author*) Nothing to Disclose
Drew M. Pardoll, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Suzanne Topalian, MD, Baltimore, MD (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company Research Grant, Bristol-Myers Squibb Company
Richard L. Wahl, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Nihon Medi-Physics Co, Ltd;

PURPOSE

Immune checkpoint inhibitors (ICI) have demonstrated antitumor activity and prolonged survival in patients with advanced melanoma. Evaluation of response to early treatment response with these agents using standard CT imaging can be challenging. A recent report of FDG-PET/CT after two cycles of ICI has been reported to be highly predictive of the final outcome. We evaluated the use of FDG-PET/CT scans as early predictors of response to therapy in patients with melanoma receiving ICI.

METHOD AND MATERIALS

Twenty patients with advanced melanoma treated with ICI therapy underwent FDG PET/CT prior to initiation of therapy (day -28 to 0; SCAN1), at day 23-28 (SCAN2) and at 16 weeks (SCAN3). FDG-PET scans were evaluated for changes in maximum standardized uptake value (SUVmax), peak SUV (SUVpeak), metabolic tumor volume (MTV), and total lesion glycolysis (TLG). CT images were used to evaluate response according to RECIST 1.1 and immune-related response criteria (irRC). Receiver-operating characteristic (ROC) analysis for prediction of tumor response used area under curve (AUC) to compare baseline SCAN1 and the percent change in PET and CT parameters between SCAN1 and SCAN2. These values were also compared to the standard RECIST 1.1 response at SCAN3.

RESULTS

Twenty evaluable patients who had completed SCAN1 and SCAN2 and had a documented radiologic and/or clinical outcome were evaluated. By RECIST 1.1 criteria 2 had partial responses (PR) and 2 complete responses (CR) at 16 weeks. One patient had stable disease >6 months and 15 had progressive disease (PD). SUVmax and SUVpeak at SCAN1 and SUVmax and SUVpeak percent change from SCAN1 to SCAN2 were not strongly predictive of tumor response, with AUC of 0.480, 0.547, 0.680, and 0.680, respectively. CT-based irRC and RECIST 1.1 were also not strongly predictive of tumor response with AUC of 0.760 and 0.787, respectively. Analyses of PET based MTV and TLG parameters are in progress.

CONCLUSION

Standard parameters of PET and CT response at baseline and early in the course of ICI therapy were not strongly predictive for response to ICI treatment in patients with advanced melanoma. These findings require further validation in a larger cohort of patients.

CLINICAL RELEVANCE/APPLICATION

Standard PET and CT parameters of early tumor response to ICI therapy are not sufficient for predicting response to therapy, and therefore development of improved imaging metrics and methods are needed.

Honored Educators

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Richard L. Wahl, MD - 2013 Honored Educator

RC211-09 Analysis of PET/CT Patterns of Response to Ipilimumab in Patients with Metastatic Melanoma

Monday, Nov. 30 11:50AM - 12:00PM Location: S505AB

Participants
Brandon A. Howard, MD, Durham, NC (*Presenter*) Nothing to Disclose
Bhavana Singh, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
April Salama, Durham, NC (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company; Advisory Board Member, Bristol-Myers Squibb Company; Institutional Research Grant, Bristol-Myers Squibb Company; Institutional Research Grant, Merck & Co, Inc
Brent Hanks, MD,PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Abstract Co-Author*) Research support, Siemens AG; Research support, Bayer AG; Research support, Guerbet SA; Research support, General Electric Company; Consultant, Bristol-Myers Squibb Company
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Andrew R. Barina, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Melanoma is a serious public health problem with rising incidence worldwide. Although surgery is efficacious for early stage disease, prognosis is poor for metastatic melanoma, with median survival of less than 1 year. Previous therapies, such as interleukin-2 and chemoradiation, have had minimal impact on survival. Ipilimumab (Ipi; Bristol- Meyers Squibb, Princeton, NJ), a human monoclonal antibody against the cytotoxic T-lymphocyte associated antigen 4 (CTLA-4), was recently introduced and demonstrates improved survival in metastatic melanoma. CTLA-4 is a negative regulator of T cell activation and is exploited by melanoma cells to evade T cell immune- mediated destruction. CTLA-4 blockade by Ipi enhances host anti-tumor response. F-18 fluorodeoxyglucose PET-CT is routinely used in melanoma, however is subject to false positives when inflammatory or immune mediated processes are involved. It has recently been reported that in the setting of Ipi therapy, certain findings such as colitis, lymphadenopathy, inflammatory fat stranding may portend a favorable prognosis. We aim to further characterize the spectrum of PET/CT findings relevant to response to ipilimumab in our population.

METHOD AND MATERIALS

Patients who underwent FDG PET-CT from 2005 through Sept. 2014, and received at least one cycle of Ipi were retrospectively reviewed. PET/CT results, including unusual findings (i.e. those neither clearly malignant or benign on imaging) were recorded and correlated with clinicopathologic records and subsequent imaging.

RESULTS

103 patients met criteria for the study. Indeterminate findings on PET-CT included FDG-avid lymphadenopathy, diffuse thyroid uptake, subcutaneous nodularity, gallbladder uptake, and intracardiac uptake. A mixed pattern of response was often reported.

CONCLUSION

The most common PET/CT findings in metastatic melanoma patients on ipilimumab were FDG- avid lymphadenopathy, thyroid uptake, and subcutaneous nodularity, which did not correlate with an adverse outcome. A mixed response was often noted. Further analysis of clinical outcome data and clinical benefit analysis will be performed, including Kaplan-Meier analysis, to determine whether these correlated with improved outcomes.

CLINICAL RELEVANCE/APPLICATION

Characteristic patterns on PET/CT may imply a favorable outcome to treatment with ipilimumab in melanoma. Care must be taken not to interpret FDG uptake in lymph nodes, thyroid, and subcutaneous fat as progression.

Quantitative CT and MR Perfusion Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: S504CD

`CT` `GI` `MR` `OI` `BQ`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Moderator*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To understand unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 4) To describe the potential clinical applications, with a focus on hepatic and extrahepatic applications and clinical trials. 5) To discuss several recent challenging issues regarding CT perfusion. 6) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to perfoming studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology.These presentations will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on hepatic and extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

Sub-Events

RC217A   CT Perfusion in Oncology: Hepatic Imaging

Participants
Se Hyung Kim, Seoul, Korea, Republic Of (*Presenter*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd

LEARNING OBJECTIVES

1) To understand basic principles, acquisition protocol, and pharmacokinetic models of CT perfusion. 2) To learn unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 3) To describe the potential clinical applications, with a focus on hepatic applications. 4) To discuss several recent challenging issues regarding CT perfusion.

ABSTRACT

RC217B   CT Perfusion in Oncology: Extrahepatic Imaging

Participants
Vicky J. Goh, MBBCh, London, United Kingdom (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To describe the potential clinical applications, with a focus on extrahepatic applications and clinical trials. 4) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to perfoming studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. This presentation will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

RC217C   Quantitative MR Perfusion Imaging of the Brain

Participants

Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Presenter*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) Understand the difference between quantitative and qualitative perfusion measurements. 2) Distinguish several approaches for obtaining quantitative perfusion maps in the brain. 3) Appreciate the strengths and weaknesses between the two major techniques, arterial spin labeling and bolus contrast dynamic susceptibility imaging.

Have RADS Gone Wild? Remaining Challenges of Standardized Reporting and Data Systems

Monday, Nov. 30 8:30AM - 10:00AM Location: N229

| OI | IN | SQ |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC218A   BI-RADS: Why Bother?

Participants
Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale behind the development of BI-RADS. 2) Comprehend the application of BI-RADS in clinical practice. 3) Recognize the contribution of BI-RADS in improving patient outcomes.

RC218B   LI-RADS: Pros, Cons and Solutions

Participants
Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

LEARNING OBJECTIVES

1) To review the advantages, challenges, solutions, and future directions for standardized reporting of liver imaging examinations using LI-RADS.

RC218C   PI-RADS: What Is the Supporting Evidence?

Participants
Hebert Alberto Vargas, MD, New York, NY, (vargasah@mskcc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the rationale for PI-RADS. 2) Highlight the updates included in PIRADS v2. 3) Discuss the evidence basis for PI-RADS and present the literature highlighting its strengths and limitations.

ABSTRACT

The Prostate Imaging Reporting and Data System (PIRADS), published in 2012, was one of the first well-orchestrated efforts focused on "integration, reporting and communication of multi-parametric prostate MRI". The guideline was updated in 2015 (PIRADS v2) to address some of the limitations of the original version. This session will cover the highlights of PIRADS v2 and discuss the published evidence supporting or questioning the recommendations included in this guideline.

Rectal Carcinoma: Pre and Post Treatment Evaluation with MRI (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: E353B

`GI` `MR` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC229A   Rectal Carcinoma: Setting the Stage, What the Clinician Needs to Know

Participants
Gina Brown, MD, MBBS, Sutton, United Kingdom, (gina.brown@rmh.nhs.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the prognostic relevance of MRI in planning surgical treatment options. 2) MRI assessment for oncologic treatment decisions. 3) Future developments in treatment strategies based on MRI assessment and restaging after chemoradiotherapy.

Handout:Gina Brown

http://abstract.rsna.org/uploads/2015/15002789/RSNA2015_GinaBrownHandout.pdf

RC229B   Pre Treatment Staging Standardized Reporting: Have you Checked the 'DISTANCE?'

Participants
Caroline Reinhold, MD, MSc, Montreal, QC, (caroline.reinhold@mcgill.ca) (*Presenter*) Consultant, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) To propose a MR imaging protocol for staging newly diagnosed rectal carcinoma.2) To understand the anatomy of the rectum and mesorectum as pertains to MRI staging.2) To propose a step-by-step approach for standardized MRI staging of pre-treatment rectal carcinoma using the mnemonic "DISTANCE".

ABSTRACT

In the Western Hemisphere, colorectal cancer is the third most common cancer in men after prostate and lung, and the second most common in women after breast cancer. One-third of colorectal cancers occur in the rectum. Survival rates for rectal cancer have improved in the past decade due to the combined effects of better staging, improved preoperative treatment strategies and total mesorectal excision (TME) surgery. Several studies have been published showing the ability of MRI to accurately stage rectal cancer and predict a negative circumferential resection margin. Moreover, advances in preoperative therapies require accurate preoperative MRI staging to select those patients who may benefit from chemoradiation prior to surgery. To accurately stratify patients according to the risk of local and distant failure, imaging takes on the same importance as tumor type and genetic susceptibility. However, rectal cancer evaluation by MRI continues to pose a challenge in non experts' hands. This presentation will present a mnemonic: "DISTANCE" to enable a systematic and standardized approach to the interpretation of MR imaging in newly diagnosed rectal cancers, thereby enabling all the clinically relevant features to be adequately assessed: DIS: for Distance from the Inferior part of the tumor to the transitional Skin, T: for T staging, A: for Anal complex, N: for Nodal staging, C: for Circumferential Resection Margin, E: for Extramural vascular invasion.

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Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

RC229C   Post Treatment Evaluation: What Criteria and Imaging Protocol Should I Use?

Participants
Stephanie Nougaret, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight current management of rectal cancer including sphincter- and organ-sparing treatment options 2) To describe how pretreatment multi-parametric rectal MRI may serve as a predictive biomarker of subsequent tumor response to chemoradiation (CRT) 3) To propose a step-by-step approach for accurate interpretation of rectal MRI following CRT and to illustrate how the information gleaned from post CRT multi-parametric rectal MRI may influence treatment decisions.

ABSTRACT

Recent changes in the management of patients with locally advanced rectal cancer highlight the need for accurate assessment of tumor response to chemoradiation (CRT). In the past, CRT was followed by surgical resection in nearly all patients, irrespective of response to CRT. However, new data suggest that surgery may not be necessary in patients with complete response. MR imaging

has become an essential tool to enable the oncology team to make appropriate treatment decisions. MRI has so far relied on changes in morphology as a measurement for response. However, this evaluation is hampered by the difficulties in differentiating residual tumor from radiation-induced fibrosis. Recent studies have suggested that adding diffusion-weighted imaging (DWI) to conventional MRI can aid this differentiation and thus improve the prediction of response after neoadjuvant therapy.Thus, the learning objectives for this lecture are as follows:1) To learn about the value of multi-parametric rectal MRI prior to and following CRT for the prediction and subsequent assessment of response to CRT. To understand how rectal MR imaging finding are essential to making patient-centered treatment decisions.2) To become familiar with "DISTANCE" mnemonic and diagnostic clues which provide a systematic approach to the interpretation of rectal MRI images in patients with rectal cancer prior to treatment and following CRT.

Honored Educators

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Stephanie Nougaret, MD - 2013 Honored Educator

Common Dilemmas in Lung Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: E450B

CH **CT** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC251A   An Algorithm for Lung Nodule Interpretation

Participants
Christian J. Herold, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how different clinical scenarios influence the management of patients with pulmonary nodules. 2) To apply state-of-the-art features, methods and guidelines for the work-up of pulmonary nodules. 3) To develop an algorithm for the management of pulmonary nodules for various risk groups.

RC251B   Current Concepts in Lung Cancer Staging: What the Clinician Wants to Know

Participants
Brett W. Carter, MD, Houston, TX, (bcarter2@mdanderson.org) (*Presenter*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;

LEARNING OBJECTIVES

1) Outline the staging system used for lung cancer. 2) Illustrate specific TNM descriptors through representative examples on imaging studies. 3) Synthesize TNM descriptors into stages and evaluate the impact on patient management. 4) Review limitations of the current system and assess the potential influence on image interpretation.

ABSTRACT

Lung cancer is the most common cause of cancer-related death in men and women in the United States. The seventh edition of the TNM staging system for lung cancer was published in 2009 by the International Union Against Cancer and the American Joint Committee on Cancer and was based on findings from the International Staging Project of the International Association for the Study of Lung Cancer (IASLC). In addition to the inclusion of small cell lung cancer and bronchopulmonary carcinoid, key revisions were made to the tumor (T) and metastasis (M) descriptors based on differential 5-year survival. As accurate staging of lung cancer is crucial to formulating treatment plans and optimizing survival, radiologists should be familiar with the current TNM staging system and understand the strengths of weaknesses of the various thoracic imaging techniques used to diagnose and stage the disease.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Brett W. Carter, MD - 2015 Honored Educator

RC251C   A Simple Approach to Interstitial Lung Disease

Participants
Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify key findings of lung fibrosis and small airways disease. 2) List 4 telltale findings of specific subtypes of interstitial lung disease. 3) Apply a simple methods for reliable characterization of the majority of cases of interstitial lung disease.

BOOST: Head and Neck-Integrated Science and Practice (ISP) Session

Monday, Nov. 30 10:30AM - 12:00PM Location: S103CD

HN **OI** **RO**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
John C. Grecula, MD, Columbus, OH (*Moderator*) Research Grant, Teva Pharmaceutical Industries Ltd; Research Grant, Soligenix, Inc;
Sung Kim, MD, New Brunswick, NJ (*Moderator*) Nothing to Disclose

Sub-Events

MSRO25-01 Invited Speaker:

Monday, Nov. 30 10:30AM - 10:40AM Location: S103CD

Participants
Bahman Emami, MD, Maywood, IL (*Presenter*) Nothing to Disclose

MSRO25-02 Impact of Patient and Tumor Characteristics on Time from Diagnosis to Treatment in Patients Undergoing Radiation Therapy for Head and Neck Cancer

Monday, Nov. 30 10:40AM - 10:50AM Location: S103CD

Participants
Muhammad M. Qureshi, MBBS,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bhartesh A. Shah, BA, Edison, NJ (*Abstract Co-Author*) Nothing to Disclose
Minh T. Truong, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Apar Gupta, Boston, MA (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Treatment delay is a significant impediment to effective cancer management and could potentially impact disease progression and survival, especially in Head and Neck Cancer (HNC) patients who are often diagnosed with locally advanced stage disease. The purpose of this study was to determine the impact of patient and tumor characteristics on time-to-treatment (TTT) from diagnosis in HNC patients treated with curative intent radiation therapy (RT).Materials/Methods: From August 2004 to May 2011, 131 non-metastatic and non-recurrent biopsy proven HNC patients completed definitive RT at an urban academic safety net hospital. Patient and tumor factors examined included: race/ethnicity (Black, White, Hispanic, Other), English proficiency (English proficient, EP, Limited English proficient, LEP), marital status (Married, Non-married), insurance coverage (Private/Medicare, Medicaid/Free care), age at diagnosis (years) (median, =50) and AJCC stage (stage I-III versus stage IV). TTT was calculated from date of biopsy to date of first treatment received (surgery, induction chemotherapy/IC, radiotherapy alone/RT or concurrent radiotherapy/CCRT). Analysis of Variance was performed using SAS version 9.1 to determine the drivers of TTT. Data were analyzed using a 0.05 level of significance. Results: The median TTT was 41 days (range 6-249 days). Surgery, IC, RT or CCRT was the first treatment received in 45 (34.4%), 22 (16.8%), 13 (9.9%) and 51 (38.9%) patients, respectively. TTT did not differ by first treatment received (time to surgery 48 days, time to IC 47 days, time to RT 40 days and time to CCRT 51 days), P=0.802. No statistically significant differences in TTT were noted for gender (P=0.637), race/ethnicity (P=0.996), marital status (P=0.737), insurance coverage (P=0.836), age at diagnosis (P=0.571), and AJCC stage (P=0.889). TTT among EP and LEP patients was 46 and 57 days, respectively (P=0.197).Conclusion: Limited English proficient patients had longer TTT compared to EP, although this result failed to reach statistical significance. Other patient and tumor factors were not found to be predictive of TTT.

MSRO25-03 Prediction of Weight Loss in Irradiated Head and Neck Cancer Patients Based on the Clinical and Dosimetric Big Data

Monday, Nov. 30 10:50AM - 11:00AM Location: S103CD

Participants
Minoru Nakatsugawa, PhD, Baltimore, MD (*Presenter*) Employee, Toshiba Corporation; Research support, Toshiba Corporation;
Zhi Cheng, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Scott Robertson, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Kosuke Sakaue, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Shinya Sugiyama, Otawara, Tochigi, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Ana P. Kiess, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Mysha Allen, RN,BSN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Afonso, RN,BSN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Choflet, MS,RN, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
John Wong, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Elekta AB; Research Grant, Xstrahl Ltd; Research Grant, Toshiba Corporation; Co-founder, JPLC Associates LLC; Royalty, Elekta AB; Consultant, Xstrahl Ltd
Todd R. McNutt, PhD, Baltimore, MD (*Abstract Co-Author*) Research collaboration, Koninklijke Philips NV; Research collaboration, Toshiba Corporation; Research collaboration, Elekta AB
Harry Quon, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The quality of life (QOL) of irradiated head and neck cancer (HNC) patients is significantly limited by toxicities leading to weight loss. The ability to predict and reduce toxicities by applying a learning health system (LHS) model is thus an important goal. The

aim of this study is to determine the predictors for weight loss based on the outcomes of similar patients previously treated with radiation therapy (RT) to develop a real-time clinical decision-support system.

METHOD AND MATERIALS

From a database of systematically captured prospective data elements, NCI-CTCAEv4.0 toxicity assessments and all aspects of RT planning, 326 HNC patients with longitudinal records from 2007 to 2014 were identified. The records consisted of 2,985 variables, including planned dose-volume histogram at 1% volume increments (2,020 variables), distance between planning target volume (PTV) and organs at risk, diagnostic ICD-9 code, QOL and toxicities during treatment. Weight loss of 5kg or more at 3 months post-RT was predicted by the Classification and Regression Trees algorithm. Two different prediction models at the time of RT planning and at the end of treatment were developed.

RESULTS

Weight loss predictors during treatment were 1) patient reported outcome of oral intake, 2) ICD-9 code, N stage, 3) nausea, esophagitis/pharyngitis, skin toxicity, pain intensity, 4) dose to larynx, parotid, cricopharyngeal muscle and 5) minimum distance between low dose PTV and larynx. The weight loss prediction at RT planning was also developed excluding assessment variables during treatment. The sensitivity of the model at treatment / RT planning was 0.988 / 0.860 and the positive predictive value (PPV) was 0.467 / 0.451 respectively.

CONCLUSION

The informatics framework combined with data mining tools can facilitate large-scale analysis predicting for weight loss and is encouraging for the development of a LHS model to reduce the risk of toxicities. The two prediction models at RT planning / treatment show the potential for a real-time decision-support based on the incremental data collection in each patient's RT course. Given the importance of diagnostic modality, we believe that incorporation of imaging features is an important next step to improve PPV.

CLINICAL RELEVANCE/APPLICATION

The weight loss prediction model at RT planning / treatment can support decisions regarding treatment planning and toxicity management during treatment.

MSRO25-04 Short Treatment Time and Excellent Treatment Outcome in Accelerated Hyperfractionated Radiation Therapy for T1 Glottic Cancer

Monday, Nov. 30 11:00AM - 11:10AM Location: S103CD

Participants
Yukihisa Tamaki, Izumo, Japan (*Presenter*) Nothing to Disclose
Yoko Hieda, MD, PhD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Rika Yoshida, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshizako, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Kitagaki, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Taisuke Inomata, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Accelerated hyperfractionated radiotherapy was performed as treatment for patients with T1 glottic cancer, and its utility was evaluated based on treatment outcomes and adverse effects.Materials/Methods: Subjects were 58 men (median age, 70 years) who underwent radiotherapy at a University Hospital between January 2000 and November 2013. Tumor classification was Tis (6.9%) in 4 patients, T1a (65.5%) in 38, and T1b (27.6%) in 16. Histological examination revealed squamous cell carcinoma in the majority of cases (55 patients, 94.8%). Travel time from home to hospital was 2 h for 25 patients (43.1%). Laser vaporization was performed prior to radiotherapy in 38 patients (65.5%), and 19 patients (32.8%) received concurrent chemotherapy with an agent such as S-1. Patients were irradiated twice daily (morning and evening) using an irradiation container. Most patients received a dose of 1.5 Gy/fraction up to a total of 60 Gy.Results: The median overall treatment time was 30 days (range, 26–45 days), with a median observation period of 59.6 months. After completion of radiotherapy, a complete response was observed in all patients. The overall 5-year and 7-year survival rates were 97.2% and 86.1%, respectively, and the 5-year and 7-year disease-free survival rates were 93.2% and 82.2%, respectively. The 5-year and 7-year local control rates were both 97.8%. Seven patients died either of other cancer (3/7) or disease (4/7), with no death due to glottic cancer or treatment-related causes. Although grade 3 pharyngeal mucositis was observed in 2 (3.4%) patients, there were no other grade 3 or higher acute adverse events. As late toxicity, grade 2 laryngeal edema and grade 1 laryngeal hemorrhage were observed in 1 patient each, but no serious events such as laryngeal necrosis or laryngeal stenosis were observed.Conclusion: The outcome of accelerated hyperfractionated radiotherapy for T1 glottic cancer was excellent, and the adverse events were acceptable. The present treatment method will substantially reduce the treatment duration among patients who need to stay at nearby hotels while undergoing treatment at hospitals in rural areas.

MSRO25-05 Are Contouring Time and Multimodality Imaging Prognostic Factors for Radiation Therapy of Head and Neck Cancer?

Monday, Nov. 30 11:10AM - 11:20AM Location: S103CD

Participants
Michael W. Schmuecking, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
O Elicin, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Bernd Klaeser, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Alan Dal Pra, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Dario Terribilini, PhD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Beat Bojaxhiu, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Natalie D. Klass, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Roland Bigler, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Yannick Eller, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Marco Malthaner, PhD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
S Fankhauser, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Jan Tille, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Nando Mertineit, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
A Geretschlaeger, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the DEGRO-Quiro Trials correlation of clinical outcome with contouring time in the planning process of radiation therapy and the amount of multimodality imaging has not been analyzed. To evaluate if contouring time and multimodality imaging are prognostic factors for radiation therapy of advanced head and neck cancer 207 patients were analyzed retrospectively between 2001 and 2012.

METHOD AND MATERIALS

Before 2007 radiation treatment planning CT was done without contrast enhancement, MR imaging and 18F-FDG PET/CT as additional imaging modalities were used only occasionally. From 2007 contrast enhanced planning CT in addition to multimodality imaging consisting of MR imaging (including DWI and ADC) and 18F-FDG PET/CT was used routinely for every head and neck cancer patient. Additionally, in unclear or equivocal imaging findings of lymph nodes a re-report was performed with a higher sensivity at the expense of specificity to minimize geographical miss in the contouring procedure for radiation treatment and to maximize the binary decision for each lymph node (malignant vs benign). The re-reports were done in conjunction with radiooncologists, nuclear physicians and radiologists. The mean contouring time was 60 min before 2007 and 150 min after 2007 (including the time of a re-report). Clinical outcome (local, regional and locoregional control) of advanced oropharyngeal, laryngeal and hypopharyngeal cancers with lymph node metastases was assessed in two groups (group I: 2001-2007 vs group II: 2008-2012).

RESULTS

Group I: n=113, group II: n=94. Regional recurrence was significantly reduced in group II (log-rank-test p = 0.03. regional control after 1, 2 and 3 years was 88%, 79% and 76%, respectively as compared to 95%, 92% and 88%, retrospectively. Locoregional control for 207 patients shows no difference in survival (p = 0.08), inclusion of 340 patients leads to a p-value p < 0.05.

CONCLUSION

Imaging findings of multimodality imaging and a critical re-report of these imaging findings in conjunction with a longer contouring time may have an impact on clinical outcome of advanced head and neck cancers. However, this overtime is not reimbursed.

CLINICAL RELEVANCE/APPLICATION

A close collaboration of radiooncologists, nuclear physicians and radiologists in the radiation treatment planning process may have a benefit for patients with advanced head and neck cancer.

MSRO25-06 Lessons from a Standardized Program Using PET-CT to Avoid Neck Dissection after Primary Radiation Therapy for N2 Squamous Cell Carcinoma of the Oropharynx: Beware the Late Recurrence and Salvage Is Unlikely

Monday, Nov. 30 11:20AM - 11:30AM Location: S103CD

Participants
Kathryn E. Hitchcock, MD, PhD, Gainesville, FL (*Presenter*) Nothing to Disclose
Robert J. Amdur, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
William M. Mendenhall, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
John Werning, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Walter E. Drane, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose
Anthony A. Mancuso, MD, Gainesville, FL (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To report the results of a standardized program using positron emission tomography (PET)-computed tomography (CT) approximately 12 weeks after primary radiotherapy to determine the need for a planned neck dissection in patients with radiographic N2 squamous cell carcinoma (SCC) of the oropharynx.Materials/Methods: Fifty consecutive patients with T1-4 and hemineck radiographic stage N2A-B SCC of the oropharynx for whom the only indication for planned neck dissection was a positive PET-CT performed ~12 weeks after completing primary treatment with radiotherapy. Endpoints to determine the value of 12-week PET-CT in identifying residual neck disease were pathologic status of planned neck dissection specimens and neck recurrence at any time during the follow-up period.Results: All patients at risk for neck recurrence at last follow-up had =1 year of follow-up after PET-CT (median, 2.0 years). Results of PET-CT to identify residual neck disease were as follows:Sensitivity and positive predictive value: 0% (zero true positive)Specificity: 89% (4 False Negatives), and negative predictive value: 91%Potential neck recurrence from using this 12-week PET-CT program: 2%(Three of 4 neck recurrences would not have been prevented by historic approaches.)Time between negative PET-CT and detection of neck recurrence was 0.8, 0.9, 2.4, and 2.7 years. Rate of successful (>1 year) salvage of neck recurrence: 25% (1/4).Conclusion: PET-CT approximately 12 weeks after radiotherapy for oropharyngeal cancer is an excellent way to identify patients who do not need neck dissection, but low-risk is not no-risk. Approximately half of neck recurrences present over 2 years after negative PET-CT and the chance of successful salvage is low. Accurate results for this kind of program will require long-term follow-up and support a policy of frequent neck imaging for years in patients with N2 orpharyngeal cancer who do not undergo neck dissection after primary treatment with radiotherapy.

MSRO25-07 Megavoltage Radiation Therapy of Skin Malignancies of the Nose Using Custom Nasal Paraffin Bolus

Monday, Nov. 30 11:30AM - 11:40AM Location: S103CD

Participants
Randy Wei, MD, Orange, CA (*Presenter*) Nothing to Disclose
Anna-Marie Hosking, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Juying Zhang, PhD, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose
Samar Azawi, MD, Long Beach, CA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To treat surface malignancies, bolus materials are used to enhance the dose delivered at the surface and

to reduce hot and cold spots due to sharp surface irregularities and oblique incident angles. Radiation treatment of skin malignancies on the nose is challenging due to the irregular surface anatomy of the nose to which homogenous dose must be delivered. Materials/Methods: Superflab is a commonly used bolus material that is non-conformal for irregular surface contours of the nose making it difficult to reproducibly apply and maintain. Additionally, air gaps from non-conformal bolus will result in dose inhomogeneity. We present our experiences and outcomes using custom-made paraffin bolus to conform to the shape of the nose for the treatment of basal cell cancer (BCC) or squamous cell cancer (SCC). A mold of the patient's nose was created and a negative impression was made in a paraffin rectangle block. Minimum thickness was 1.5 cm laterally and 1 cm anterior-posteriorly. Thin coating of petroleum jelly was applied within bolus to reduce air gaps. Nine patients were treated to 60 Gy at 2 Gy per with parallel opposing 6x MV photon beams using three-dimensional conformal treatment planning. Six patients had BCC and three patients had SCC. Six patients had two or more distinct sites of disease. Results show that 100% prescription isodose line conforms to the planned target volume and dose to critical structures are well below tolerance limits. Daily kilovoltage orthogonal and weekly cone beam CT show close patient and wax bolus contact and reproducibility. Six thermoluminescent dosimetry (TLD) chips (LiF) were used to measure doses deposited and matched the planned dosimetry for each patient. TLD measurements showed a 2.6% average difference between planned dose and delivered dose.Results: Of the 9 patients treated with this method, maximum hot spot was 102.7% (101.1%-104%) for all 9 plans. Mean follow-up time was 25 months (10 – 58 months). Of the 9 treated, two patients developed new lesions on the nose and one patient had recurrent disease at the columella. Acute side effects were erythema and congested nose. None of the patients developed RTOG Grade 3 skin toxicity immediately following radiation treatment. Followup visits reported no telangiectasia and good cosmetic outcomes. Conclusion: This study demonstrates a practical approach to radiotherapy of the nose which minimizes air gaps and daily setup variability, while achieving dose homogeneity with minimal hotspots.

MSRO25-08 Superior Carotid Artery Sparing by Proton Radiation Therapy Compared to IMRT/VMAT for Reirradiation of Locally Recurrent Cancers of the Base of Tongue

Monday, Nov. 30 11:40AM - 11:50AM Location: S103CD

Participants
Upendra Parvathaneni, MBBS,FRANZCR, Seattle, WA (*Presenter*) Nothing to Disclose
Yolanda D. Tseng, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Quang Dang, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
George E. Laramore, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Kent McCune, CMD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jay J. Liao, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Salvage treatment options for isolated in-field local recurrences in the base of tongue (BOT) after previous radiotherapy (RT) are limited. Total glossectomy is extremely morbid and re irradiation (reRT) is often preferred in an attempt to preserve function. However, the close anatomical proximity of the carotid arteries to the BOT makes it difficult to avoid this structure with photon based conformal planning such as IMRT or VMAT. Adding radiation dose to a previously irradiated carotid artery may increase the risk of a carotid blow out, which is a fatal complication. Although a clear dose threshold for this complication has not been established, a treatment plan that delivers the least dose to the carotid would be preferred. We hypothesized that compared with photon based planning (IMRT/VMAT), proton radiotherapy (PRT) may decrease the dose to the carotids as there is no exit dose distal to the target, thereby limiting cumulative dose to surrounding organs at risk (OARs). We compared the dose to carotid arteries and other OARs with IMRT/VMAT versus PRT for two patients who had reRT for locally recurrent cancers of the tongue base.Materials/Methods: Comparative plans with photons using an IMRT or VMAT technique and PRT with uniform scanning or pencil beam scanning technique were generated for two patients on Eclipse and RayStation planning systems. Both patients had BOT recurrences that were located centrally within the high dose region of previous RT fields. They also received elective nodal RT for their initial BOT cancers and hence their carotid arteries were irradiated. The patients developed local recurrences after one and 3 years following initial RT. The BOT recurrences were treated to a dose of 66-72 Gy. Elective nodal RT was not given with reRT. Target cover and OAR doses, including dose to the carotid artery were evaluated by standard dose volume histograms. Results: In both patients, the proton plans spared the surrounding OARs including carotid arteries better than IMRT or VMAT photon plans. For patient 1, mean dose to both carotids was lower with protons (right, 3.0 vs 28.0 Gy; left, 4.8 vs 15.7 Gy). Dose to the spinal cord (max, 0 vs 14.9 Gy) was also lower with protons versus photons. Similarly, in patient 2, the proton plan had a lower mean dose to both carotids (right, 5.9 vs 15.9 Gy; left, 0.7 vs 8.1 Gy) and parotids (right, 1.6 vs 19.0 Gy; left, 0 vs 10.7 Gy). Both techniques provided adequate target coverage.Conclusion: Compared with conformal photon techniques such as IMRT/VMAT, proton radiotherapy reduces dose to previously irradiated carotid arteries and other surrounding OARs during treatment of recurrent cancers of the base of tongue. In the re irradiation setting, this advantage may translate to a reduced risk of a fatal carotid blow out. This case study suggests that proton therapy should be considered for reirradiation of locally recurrent tongue base cancers.

MSRO25-09 Hyperbaric Oxygen Therapy for Radiation Induced Toxicity: A Retrospective Review from a Single-Institution

Monday, Nov. 30 11:50AM - 12:00PM Location: S103CD

Participants
Leah Katz, MD, MPH, New York, NY (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Adverse radiation (RT) side effects pose an important barrier to progress in the field of radiation oncology. While hyperbaric oxygen therapy (HBOT) is recognized as an effective treatment for RT side effects, in particular for osteoradionecrosis (ORN;) many radiation oncologists fail to refer patients.We evaluated NYU's HBOT experience over the past three years to assess its safety and efficacy in treating various RT toxicities. It is our hope that clinicians consider HBOT more frequently and develop a prophylactic referral pattern.Materials/Methods: A retrospective 3-year (2013-2015) chart review of a prospectively maintained database was performed. Thirty-three patients were evaluated with a median age of 62 (range 37-80,) 16 F, 17 M.Sites of initial therapeutic RT included truncal and extremity soft tissue sarcoma (12 %,) squamous cell and adenocarcinoma, anorectum (9 %,) adenocystic vulvar cancer (3%,) adenocarcinoma, prostate (12%,) squamous cell carcinoma, head and neck (12%,) adenocarcinoma, breast (6%,) and squamous cell carcinoma, cervix (9%.) RT induced toxicities were non-healing soft tissue wounds (39%,), mandibular ORN (37%.), radiation cystitis (15%,) and rectal bladder fistula (3%). The median time from end of radiation therapy to HBOT initiation was 7 years, and median follow-up was 8 months. Patients were treated with a median of 35 HBOT treatments (range 5-90.) All patients were treated at the NYU Hyperbaric Center with no adverse

effects. Results: Each RT injury category was evaluated. Symptoms associated with RT soft tissue injury included chronic wound infection, vaginal bleeding/pain, rectal pain, dyspareunia, and perineal pain. 38% of patients had complete resolution of symptoms after HBOT alone, 31% underwent adjuvant flap closure with complete wound healing, and 31% experienced no wound healing.For radiation cystitis, 60% had complete symptom resolution within a one month period after HBOT. A single patient treated for a rectal bladder fistula enjoyed complete resolution of the fistula with cessation of rectal urine drainage within one month after HBOT.Patients with ORN of the mandible with BRONJ stage I experienced complete resolution of intraoral deficits. Patients with BRONJ stage 2 experienced complete resolution of infection after HBOT with adjuvant debridement. Patients with BRONJ stage 3 experienced complete fracture healing after HBO with adjuvant mandibulectomy.Conclusion: The NYU experience demonstrates both safety and efficacy in ameliorating symptoms and improving patient quality of life with various types of RT morbidity. Our data encourages early referral to HBOT in an effort to save patients time, medical costs, energy, and psychological stress associated with ineffective medical measures. This study encourages further research with longer follow-up to better define the benefit and durability of HBOT.

Molecular Imaging Symposium: Oncologic MI Applications

Monday, Nov. 30 1:30PM - 3:00PM Location: S405AB

`GU` `MI` `MR` `OI` `RO`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

`FDA`   Discussions may include off-label uses.

Participants

Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand the role of molecular imaging in cancer therapy. 2) To understand the impact that new molecular imaging agents could have on drug development. 3) To understand the barriers facing the development of new molecular imaging agents.

ABSTRACT

Molecular Imaging is expanding in many new directions. Most research is being performed for PET and SPECT agents. However, optical and MRI agents are also being developed. Molecular Imaging can play a role in accelerating the development and approval of new cancer therapeutics by quantifying the impact drugs have in early Phase studies and by selecting the most appropriate patients for trials. Molecular Imaging agents can be useful in determining the utility and mechanism of actions of drugs that are already approved and may provide insights to oncologists regarding the best treatment combinations for individual patients. Molecular Imaging methods have already expanded our knowledge of cancer behavior and this will ultimately lead to new forms of the therapy that will one day cure this dreaded disease.

Sub-Events

MSMI23A   Overview of MI in Oncology

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the broad spectrum of activities in molecular imaging including PET, SPECT, optical and MRI. 2) To understand the potential impact of Molecular Imaging on cancer treatment.

ABSTRACT

Molecular Imaging is expanding at a rapid rate. This overview will provide a panoramic view of the field of Molecular Imaging and major trends that are emerging among the different modalities, PET, SPECT, optical, ultrasound and MRI that constitute molecular imaging.

MSMI23B   Hyperpolarized MRI of Prostate Cancer

Participants
Daniel B. Vigneron, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI23C   Radiogenomics

Participants
Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind radgiogenomics and to highlight areas of clinical application and future development.

ABSTRACT

MSMI23D   Somatastatin Receptor Imaging

Participants
Ronald C. Walker, MD, Nashville, TN, (ronald.walker@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the advantages of 68Ga somatostatin PET/CT over 111In-DTPA octreotide. 2) Determine patient likely to benefit

1) Describe the advantages of 68Ga-somatostatin PET/CT over 111In-DTPA-octreotide Jimaging. 2) Detect patients likely to benefit from peptide receptor radiotherapy (PRRT).

ABSTRACT

68Ga-labeled somatostatin analogs (DOTATATE, DOTATOC and DOTANOC) PET/CT imaging provides higher resolution scans than 111In-DTPA-octreotide with less radiation, comparable cost, and imaging completion within 2 hours vs. 2-3 days. 68Ga-somatostatin analogs have a higher impact on care than 111In-DTPA-octreotide, including superior ability to identify patients likely to benefit from PRRT. This activity will provide results from the literature and the author's experience to illustrate the advantages of 68Ga-based PET/CT imaging of neuroendocrine tumors.

Active Handout:Ronald Clark Walker

http://abstract.rsna.org/uploads/2015/15003715/MSMI23D.pdf

MSMI23E   Multimodal MI in Oncology

Participants
Umar Mahmood, MD, PhD, Charlestown, MA (*Presenter*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand strengths of various imaging modalities for specific target/disease assessment.

ABSTRACT

Each imaging modality has a set of characteristics that helps define optimal use. These constraints include sensitivity, depth of imaging, integration time for signal, and radiation dose, among other factors. Understanding when each modality can be used and when combining the relative strengths of differerent modalities can be synergistic allows greater molecular information to be acquired.

Interventional Oncology Series: Hepatocellular Carcinoma

Monday, Nov. 30 1:30PM - 6:00PM Location: S406B

`GI` `IR` `OI` `RO`

AMA PRA Category 1 Credits ™: 4.25
ARRT Category A+ Credits: 5.00

`FDA` Discussions may include off-label uses.

Participants
Riccardo A. Lencioni, MD, Pisa, Italy (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the indications for image-guided ablation and transcatheter-based therapies for patients with HCC. 2) To understand the potential limitations, pitfalls, side effects and toxicities associated with ablative and transcatheter therapies for patients with HCC. 3) To know the results, imaging responses and survival benefit of various ablative and transcatheter therapies. 4) To know the future ablative and transcatheter therapies and understand their potential. 5) To learn the various combination therapies available and undergoing clinical evaluation for HCC.

ABSTRACT

Sub-Events

VSIO21-01 Epidemiology, Staging, and Medical Therapy

Monday, Nov. 30 1:30PM - 1:50PM Location: S406B

Participants
Ghassan K. Abou-Alfa, MD, New York, NY (*Presenter*) Research Grant, Abbott Laboratories; Research Grant, Amgen Inc; Research Grant, AstraZeneca PLC; Research Grant, Bayer AG; Research Grant, Eli Lilly and Company; Research Grant, Exelixis, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Immunomedics, Inc; Research Grant, Incyte Corporation; Research Grant, Momenta Pharmaceuticals; Research Grant, Myriad Genetics, Inc; Research Grant, Novartis AG; Research Grant, OncoMed Pharmaceuticals, Inc; Research Grant, Polaris Group; Research Grant, Vicus Therapeutics, LLC; Consultant, Aduro BioTech, Inc; Consultant, Astellas Group; Consultant, Onxeo SA; Consultant, Boston Scientific Corporation; Consultant, Boston Therapeutics, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, CASI Pharmaceuticals Inc; Consultant, Celgene Corporation; Consultant, Cipla Ltd; Consultant, Eli Lilly and Company; Consultant, Gilead Sciences, Inc; Consultant, IntegraGen SA; Consultant, AstraZeneca PLC; Consultant, Merrimack Pharmaceuticals, Inc; Consultant, Momenta Pharmaceuticals; Consultant, Novartis AG; Consultant, Onxeo SA; Consultant, AbbVie Inc; Consultant, sanofi-aventis Group; Consultant, Silenseed Ltd; Consultant, SillaJen, Inc; Consultant, Vicus Therapeutics, LLC

LEARNING OBJECTIVES

1) Recognize the increasing incidence of HCC in the Western Hemisphere. 2) Learn about scoring the cirrhosis and staging the cancer. 3) Identify sorafenib as the standard care treatment for advanced HCC.

VSIO21-02 Critical Evaluation and Validation of the 9-Stage Hong Kong Liver Cancer Staging System in North American Hepatocellular Carcinoma Patients Who Underwent TACE

Monday, Nov. 30 1:50PM - 2:00PM Location: S406B

Participants
Jae Ho Sohn, MD,MS, New Haven, CT (*Presenter*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Florian N. Fleckenstein, MS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
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Ruediger E. Schernthaner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Li Zhao, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE

The new Hong Kong Liver Cancer (HKLC) staging offers 9-stage and 5-stage classification for survival and treatment allocation for hepatocellular carcinoma (HCC), thought to be superior to the Barcelona Clinic Liver Cancer (BCLC) staging. A known limitation of the HKLC staging is the need for validation in non-HBV patient cohort. The purpose of this study is to compare the 9-stage HKLC against BCLC staging in a North American cohort and then identify any needs for improvement.

METHOD AND MATERIALS

968 HCC patients at a single institution who underwent TACE were retrospectively reviewed. 890 had sufficiently complete record to calculate the 9-stage HKLC and BCLC stages. Overall survival (OS) from date of first TACE to death or last note date was recorded. The performances of the HKLC and BCLC systems were compared through homogeneity, survival discrimination, monotonicity of gradients, and reduction in error of survival prediction. The staging systems were evaluated through Kaplan-Meier

(KM) estimate, Cox model's likelihood ratio (LHR), linear trend (LT), Harrell's C, Akaike's information criterion (AIC), and % error reduction in survival.

RESULTS

The HCC etiologies in this cohort included 132 (14.8%) hepatitis B, 427 (48.0%) hepatitis C, 254 (28.5%) alcoholic, 60 (7.8%) NASH, and 60 (6.7%) no identifiable cause (some patients with overlapping etiologies). Median OS in months for HKLC were I (62.6), IIa (35.8), IIb (24.3), IIIa(12.3), IIIb (10.9), IVa (11.0), IVb (4.3), Va (10.5), and Vb (2.7), notable for similarity in OS among a few stages. Median OS for BCLC were A (51.6), B (24.3), C (12.2), and D (4.3). The 9-stage HKLC performed better on all statistical measures. Better homogeneity was found for HKLC (LHR: 249) than BCLC (LHR: 119). Superior survival discrimination was shown for HKLC (C=0.72, AIC=6200) than BCLC (C=0.64, AIC=6320). Monotonicity was better in HKLC (LT: 261) than in BCLC (LT: 111). Reduction in error of prediction for HKLC was 15.9% while BCLC was 11.8%.

CONCLUSION

The 9-stage HKLC staging system outperformed the BCLC staging system as a prognostic classification system on overall statistical measures, but similarity in survival for stages IIIa/b, IVa, and Va should be further explored and addressed.

CLINICAL RELEVANCE/APPLICATION

The HKLC staging system may become the next HCC staging system of choice after addressing some of the identified issues and completing further validations.

VSIO21-03   TACE Techniques, Indications, and Results: Western Perspective

Monday, Nov. 30 2:00PM - 2:20PM Location: S406B

Participants
Jean-Francois H. Geschwind, MD, Westport, CT (*Presenter*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

LEARNING OBJECTIVES

1) To understand the indications for TACE and describe the various technical issues and clinical results of TACE.

VSIO21-04   Does DEB-TACE Enhance the Local Effect of IRE? Imaging and Histopathological Evaluation in a Porcine Model

Monday, Nov. 30 2:20PM - 2:30PM Location: S406B

Participants
Peter Isfort, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Philip Rauen, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hong-Sik Na, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nobutake Ito, MD, Yokohama, Japan (*Abstract Co-Author*) Nothing to Disclose
Christoph Wilkmann, DIPLENG, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Irreversible electroporation (IRE) is associated with a hypervascular penumbra of vital temporarily damaged tissue due to reversible electroporation. Transarterial treatment of this penumbra could increase local efficacy of IRE. We conducted an in-vivo trial on swine to compare the ablation volumes of an IRE/DEB-TACE combination vs. IRE-only.

METHOD AND MATERIALS

Nine swine underwent IRE in one liver lobe and DEB-TACE immediately followed by IRE in a different liver lobe. For DEB-TACE, 100-300 µm beads (DC-Beads®) were loaded with 50mg doxorubicin. For IRE, the NanoKnife® was used with two IRE electrodes according to the vendor's recommended protocol. After one day (n=3), three days (n=3) and seven days (n=3) animals were sacrificed, and ablation volumes were evaluated histopathologically. Imaging follow-up was performed using contrast-enhanced CT and MRI. Lesion volumes were measured one day (n=9), three days (n=6) and 7 days (n=3) after the procedure.

RESULTS

Mean histopathological ablation volume of IRE/DEB-TACE combination lesions after one, three and seven days were 15.7 ± 11.1 ml, 11.8 ± 9.3 ml and 4.2 ± 1.4 ml. Mean histopathological ablation volumes of IRE-only lesions after one, three and seven days were 7.2 ± 4.5 ml, 4.0 ± 1.0 ml and 1.7 ± 1.5 ml. In intra-individual comparison the ablation volumes of the IRE/DEB-TACE combination group were on average 199.6 %, 163.4% and 98.5% larger than IRE-only lesions after one, three and seven days.

CONCLUSION

Combination of IRE followed by DEB-TACE resulted in larger ablation volumes compared to IRE alone suggesting that local efficacy of IRE can be enhanced by post-IRE DEB-TACE.

CLINICAL RELEVANCE/APPLICATION

Results suggest that local efficacy of IRE can be enhanced when additional DEB-TACE is performed in the target liver segment after ablation.

VSIO21-05   TACE Techniques, Indications, and Results: Eastern Perspective

Monday, Nov. 30 2:30PM - 2:50PM Location: S406B

Participants

Yasuaki Arai, Tokyo, Japan (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the various techniques and approaches used in TACE treatment. 2) To understand the indications and results of TACE in the treatment of HCC. 3) To discuss differences and similiarities between Eastern and Western approaches in TACE.

VSIO21-06 Anti-tumor Effects of TAE Administered in Combination with Sorafenib in a Rabbit VX2 Liver Tumor Model

Monday, Nov. 30 2:50PM - 3:00PM Location: S406B

Participants
Yuki Tomozawa, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichi Ohta, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shobu Watanabe, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Ayumi N. Seko, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A number of studies have been reported that a combination of Sorafenib with TACE has been a more effective treatment than Sorafenib or TACE alone in addition to being tolerable. Using a VX2 liver tumor model, we investigated the most suitable timing parameters when using Sorafenib to enhance the anti-tumor effects of TAE.

METHOD AND MATERIALS

20 Japanese white rabbits were randomly assigned to four equal groups two weeks after of VX2 tumor transplantation to the liver. We then performed the combination treatment with Sorafenib and TAE on the four groups in the according ways; Group 1(TAE prior to administration of Sorafenib), Group 2(TAE on the second day after administration of Sorafenib), Group 3(TAE on the fourth day after administration of Sorafenib) and Group 4(TAE after the end of administrating Sorafenib). Sorafenib (40mg/day) was orally administrated for consecutive 7 days starting on the day two week after tumor implantation. The anti-tumor effects were assessed by comparing the pre- and post-treatment tumour volumes measured on a contrast-enhanced CT scans and by immuno-histochemical analysis of the number of intra-tumoral vessels two weeks after the treatment.

RESULTS

Among the four groups, the tumor growth rate tended to be lower in Group 1 and Group 2 than in Group 3 and Group 4. The difference between Group 1 and Group 3 was significant. The number of CD31-positive intra-tumor vessels in specimens tended to be higher in Group 3 than in the other groups, although there was no significant difference.

CONCLUSION

We suggest that the ideal time of TAE is prior to or early after commencement of administration Sorafenib.

CLINICAL RELEVANCE/APPLICATION

To date, limited data has focused on the timing parameters when Sorafenib is combined with TACE.

VSIO21-07 Y90 Radioembolization: What We Know, and What We Need to Know

Monday, Nov. 30 3:00PM - 3:20PM Location: S406B

Participants
Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd; Research Grant, BTG International Ltd; ;

LEARNING OBJECTIVES

1) To describe techniques and approaches used for Y90 treatment of liver cancers. 2) To understand the available data for Y90 in the treatment of primary and metastatic liver tumors. 3) To discuss current gaps in knowledge and ongoing clinical studies.

VSIO21-08 Predicting the Hepato-pulmonary Shunt Fraction Using 3D Quantification of Tumor Enhancement on Contrast-enhanced CT Imaging in Patients with Hepatocellular Carcinoma before Y90 Radioembolization

Monday, Nov. 30 3:20PM - 3:30PM Location: S406B

Participants
Julius Chapiro, MD, Berlin, Germany (*Presenter*) Nothing to Disclose
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Dirk Schnapauff, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, Toshiba Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, Elbit Imaging Ltd; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group; Research Grant, B. Braun Melsungen AG; Research Grant, KRAUTH medical KG; Research Grant, Boston Scientific Corporation; Equipment support, Elbit Imaging Ltd; Investigator, CMC Contrast AB

Bernhard Gebauer, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex Medical Ltd; Research Grant, C. R. Bard, Inc; Research Consultant, PAREXEL International Corporation;
Federico Collettini, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study explored the ability of 3D quantitative CT image analysis to predict the hepato-pulmonary shunt fraction (HPSF) in patients with hepatocellular carcinoma (HCC) before Yttrium90 (Y90) radioembolization.

METHOD AND MATERIALS

This IRB-approved, retrospective analysis included a total of 26 patients with HCC, who underwent an evaluation study to calculate the HPSF from SPECT/CT after infusion of Tc-99m macroaggregated albumin into the proper hepatic artery. All patients underwent tri-phasic contrast-enhanced CT imaging within six weeks before the evaluation study. A semi-automatic, segmentation-based 3D quantification of the total tumor volume (TTV) was used to calculate the enhancing tumor volume (ETV), measured in cm3 and as a relative ratio (%; TTV/ETV). TTV as well as ETV were correlated with the HPSF for each patient. Statistical analysis included the One-way ANOVA test and linear regression analysis to calculate the R2 values.

RESULTS

N=24 (92%) patients had preserved liver function (Child-Pugh A) and N=2 (8%) had Child-Pugh B. The mean HPSF was 13.5% (Range, 2.9-32.8; SD, 7.4) and the mean TTV was 569cm3 (Range, 18-2998; SD, 584). The mean absolute ETV was 120cm3 (Range, 7-431; SD, 116) and the mean relative ETV was 28% (Range, 6-60; SD, 19). A low correlation between TTV and the HPSF was observed (R2=0.29) and relative ETV (%) showed no correlation with the HPSF (R2<0.1). However, some correlation between the absolute ETV (cm3) and the HPSF was observed (R2=0.59). More importantly, patients with HPSF≤10% showed significantly lower mean ETVs as compared to patients with a HPSF≥10% (53cm3; Range, 7-96; SD, 21 vs. 187cm3, Range, 104-431; SD, 87, p<0.0001). No patient with HPSF≤10% exceeded the ETV of 100cm3. No statistically significant differences were observed for TTV and relative ETV (%).

CONCLUSION

The quantification of the absolute ETV (cm3) using semi-automatic 3D tools allows for an estimation of the HPSF in patients with HCC before Y90 Radioembolization. TTV and relative ETV (%) did not appear as reliable predictors of the HPSF.

CLINICAL RELEVANCE/APPLICATION

These preliminary results may introduce absolute ETV (cm3) as a new imaging biomarker for HPSF, potentially allowing to narrow down the selection of patients who will undergo shunt evaluation studies prior to Y90 radioembolization.

VSIO21-09 **Response Assessment and the Concept of Treatment Failure**

Monday, Nov. 30 3:30PM - 3:50PM Location: S406B

Participants
Riccardo A. Lencioni, MD, Pisa, Italy (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the imaging criteria used for response assessment in patients with HCC. 2) To understand the limitations and the pitfalls associated with conventional response evaluation models. 3) To know the basic concepts of modified RECIST (mRECIST) criteria and how response predicts survival. 4) To understand the concept of treatment failure in patients undergoing loco-regional therapies. 5) To learn the novel volumetric response criteria currently undergoing clinical evaluation.

ABSTRACT

VSIO21-10 **Which Response Criteria can Predict Early Tumor Progression in Hepatocellular Carcinoma Patients Treated with Conventional TACE: RECIST, mRECIST, EASL or qEASL?**

Monday, Nov. 30 3:50PM - 4:00PM Location: S406B

Participants
Yan Zhao, MS, Baltimore, MD (*Presenter*) Nothing to Disclose
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Wei Bai, Xian, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

In this preliminary study, we compared the ability of RECIST, modified RECIST (mRECIST), EASL and quantitative EASL [(qEASL), a volumetric enhancement criterion] to assess early tumor progression after transarterial chemoembolization (TACE) in hepatocellular carcinoma (HCC) patients.

METHOD AND MATERIALS

A total of 53 consecutive patients (77.4% men; mean age, 51 years) with intermediate-stage HCC were included. All patients underwent conventional TACE and contrast-enhanced computed tomography (CT) scan at baseline and 1 month after TACE. Tumor response was determined by RECIST, mRECIST, EASL, and qEASL on CT. qEASL classifies progression as ≥73% increase in

enhancing tumor volume. The Kaplan-Meier method with the log-rank test was used to compare median overall survival (OS) between progression and non-progression.

RESULTS

Median follow-up period was 15.4 months (range 1.2-54.1).The mean value of enhancing tumor volume (qEASL) at baseline and post-treatment were 214± 263.5 cm3 and 58.5 ± 21.9 cm3, respectively. RECIST, mRECIST and EASL, identified progression in 2 (4%), 1(2%) and 2 (4%) patients at 1 month after TACE treatment. Notably, qEASL had a higher sensitivity for early tumor progression and it identified 9 (17%) patients with progression. Too few patients showed progression to perform survival analysis for the RECIST, mRECIST, and EASL. However, the patients who experienced progression according to qEASL demonstrated a significantly shorter median OS than those with non-progression [6.5 months (95%CI 4.2-8.8) vs. 21.1 months (95%CI 14.1-28.1), P<0.001].

CONCLUSION

qEASL is a more sensitive biomarker for tumor progression and survival than RECIST, mRECIST and EASL one month after TACE in hepatocellular carcinoma patients.

CLINICAL RELEVANCE/APPLICATION

Defining early tumor progression may help guide the decisions of further treatment. qEASL gave a better discrimination for early progression than other 1D or 2D criteria

VSIO21-11   Panel Discussion: Management of Intermediate-Advanced HCC in 2015

Monday, Nov. 30 4:00PM - 4:20PM Location: S406B

Participants

VSIO21-12   The Effect of Sociodemographic Determinants of Receipt of Cancer Directed Therapy on Survival and Therapeutic Efficacy in AJCC Stage I and II Unresectable Hepatocellular Carcinoma: A SEER-Medicare Population Study

Monday, Nov. 30 4:30PM - 4:40PM Location: S406B

Participants
Nima Kokabi, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Minzhi Xing, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Richard Duszak JR, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Kimberly E. Applegate, MD, MS, Zionsville, IN (*Abstract Co-Author*) Nothing to Disclose
Juan C. Camacho, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David H. Howard, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the socio-demographic determinants of receipt of HCC-directed locoregional therapies (LRT's) and comparative effectiveness of different therapies in American Joint Commission on Cancer (AJCC) Stage I and II unresectable hepatocellular carcinoma (HCC) using Surveillance Epidemiology and End Results (SEER) registries linked to Medicare database.

METHOD AND MATERIALS

Patients diagnosed with HCC during 2000 to 2010 were identified with unresectability defined using "no cancer-directed surgery recommended" and no HCC directed surgical claim. Patients were stratified by AJCC staging and the following therapies: ablation, trans-arterial chemoembolization (TACE), Yttrium-90 (Y90) radioembolization, sorafenib, systemic chemotherapy (CTX), external beam radiation (EBRT) or no cancer directed therapy (NCDT). Sociodemographic predictors of receipt of LRT's (i.e. TACE and Y-90) were evaluated by chi-square. Overall survival (OS) was estimated using Kaplan-Meier analysis.

RESULTS

Total of 9,169 patients with unresectable HCC were identified with the followings staging composition: I (25%), II (10%), III (13%), IV (17%), and unstaged (35%). All therapies demonstrated OS benefit compared to no therapy with the following median OS (months): ablation (30.8), Y90 (15.6), TACE (15.5), EBRT (7.6), Sorafenib (5.6), CTX (5.10), NCDT (3.7; p<0.001). One year survival rate of stage I and II patients treated with TACE was 67% and 53% vs. 27% and 14% for NCDT respectively (p<0.001). Overall, 38% of patients received any cancer directed therapy including TACE (18%), EBRT (8%), sorafenib (4%), ablation (3%), and Y-90 (2%) and CTX (1%). Specifically, 56% and 65% of stage I and II patients had NCDT respectively. There was no OS difference between TACE and Y90 group (p=0.31). There was a significantly prolonged OS in LRT group vs. EBRT/CTX groups (p<0.001) and the LRT vs. NCDT group (p<0.001). The receipt of LRT significantly correlated with being married and of Asian decent, living on the pacific coast and in urban areas, being insured with higher income and education levels (p's <0.05).

CONCLUSION

Favorable sociodemopgraphic factors were determinant of receipt of HCC directed LRT's. Less than 50% of of Stage I and II patients received LRT's. LRT's in Stage I and II significantly prolonged survivals over CTX/EBRT/NCDT.

CLINICAL RELEVANCE/APPLICATION

There is a national underutilization of effective HCC directed LRT's in patients with unresctable HCC.

VSIO21-13   Image-guided Ablation: Does Novel Technology Mean Better Outcomes?

Monday, Nov. 30 4:40PM - 5:00PM Location: S406B

Participants
Stephen B. Solomon, MD, New York, NY (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To describe techniques and approaches used for image-guided ablation. 2) To understand the available data for novel thermal and non-thermal technologies. 3) To discuss strategies to improve clinical outcomes.

VSIO21-14 Hepatocellular Ccrcinomas Treated with Percutaneous Ablation Using a High-power Microwave System with a Single Antenna: 5 Years' Experience

Monday, Nov. 30 5:00PM - 5:10PM Location: S406B

Participants
Giovanni Mauri, MD, San Donato Milanese, Italy (*Presenter*) Consultant, Esaote SpA
Luca Cova, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose
Tiziana Ierace, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose
S. Nahum Goldberg, MD, Ein Kerem, Israel (*Abstract Co-Author*) Consultant, AngioDynamics, Inc; Research support, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc;
Luigi Solbiati, MD, Busto Arsizio, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To report our 5 year experience treating hepatocellular carcinoma (HCC) using a third-generation high-power microwave system and a single antenna.

METHOD AND MATERIALS

From 2009, 223 HCCs (mean 2.2 cm, size range 0.7-5.5 cm) in 109 patients (mean age 67.7 ± 6.2 years) underwent US-guided ablation using a high-power (140 Watt, 2.45 GHz) microwave system (AMICA-Probe: Hospital Service, Aprilia, Italy) with a single insertion of an internally-cooled antenna. Power and time of energy application ranged between 45-100 Watts and 4-10 min, respectively. Follow-up from a minimum of 1 year to 6 years (mean: 2.2yr) was performed with contrast-enhanced CT at 4-6 months intervals. Results were classified according to index tumor size (<=2cm; 2.1-3 cm; > 3 cm). Chi Square test was used for comparison.

RESULTS

Immediate complete ablation (i.e. technical success) was achieved in 221/223 (99.1%) HCCs. Local tumor progression within 1 year from ablation occurred in 23/223 (10.3%) HCCs: 4/103 (3.9%) <= 2cm; 8/68 (11.8%) sized 2.1-3 cm; and 11/52 (21.2%) > 3 cm (p = 0.003). In 9/23 (39.1%) HCCs, local progression underwent successful re-treatment. Major complications occurred in 6/151 (4.0%) ablation sessions and only 2 required surgical repair. No deaths related to ablation were seen. In 29/109 (26.6%) patients, new HCCs were detected on follow-up.

CONCLUSION

With an affordable and efficient high-power microwave system, local control of HCCs can be safely achieved in the vast majority of cases with the simplest and fastest technique, i.e. single insertion of single antenna.

CLINICAL RELEVANCE/APPLICATION

Percutaneous ablation with a high-power, affordable microwave system allows successfully treatment for a large majority of HCCs using a simple technique of single insertion of a single antenna with a short energy deposition time.

VSIO21-15 TACE Segmentectomy for Small, Solitary HCC: Just for the Unfit for Resection and Ablation?

Monday, Nov. 30 5:10PM - 5:30PM Location: S406B

Participants
Jin Wook Chung, MD, Seoul, Korea, Republic Of (*Presenter*) Research Grant, BTG International Ltd

LEARNING OBJECTIVES

1) Describe the current role of TACE for small solitary HCC in the routine daily practice. 2) Explain the technical aspects of subsegmental or ultraselective TACE. 3) Estimate curative potential of subsegmental TACE for small solitary HCC. 4) Appraise the role of subsegmental TACE for small solitary HCC.

VSIO21-16 A Prospective Study of the Safety and Efficacy of Small Caliber Drug-Eluting Beads in TACE for the Treatment of Hepatocellular Carcinoma

Monday, Nov. 30 5:30PM - 5:40PM Location: S406B

Participants
Sonia P. Sahu, New Haven, CT (*Presenter*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ruediger E. Schernthaner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD,MS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE

There has been a growing interest in smaller caliber beads which can penetrate deeper into tumors for transarterial chemoembolization (TACE). This prospective clinical trial examined the safety and efficacy of TACE using 70-150 μm doxorubicin-eluting beads (LC BeadM1,BTG, UK) in patients with hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This single-center prospective study was HIPPA compliant and IRB approved. Patients with HCC who were locoregional therapy naïve, Eastern Cooperative Oncology Group performance status 0-2, Barcelona Clinic Liver Cancer stage A-C, and Child-Pugh A-B were eligible. Adverse events were graded by severity and in relationship to TACE using CTCAE V4.03. Tumor response at 1 month follow-up was assessed by modified RECIST (mRECIST), European Association for the Study of the Liver (EASL), and volumetric tumor enhancement [quantitative EASL (qEASL)] on T1-weighted contrast-enhanced MR. qEASL response was defined as ≥65% decrease in volumetric tumor enhancement.

RESULTS

24 patients (men: 21, median age: 62 years) with a mean tumor size of 4.28 cm (range: 1.2 - 21.2) were enrolled and successfully treated with TACE. 2 serious adverse events unrelated to TACE occurred in 2 patients [upper GI bleed (n=1) and cardiac arrest (n=1)]. Possible to definitive device related toxicities were seen in 10 patients and were all grade 1-2 in severity [hypoalbuminemia (n=3), pain (n=3), elevated AP (n=2), headache (n=2), fatigue (n=2), leukopenia (n=1), anemia (n=1), anorexia (n=1), elevated AST (n=1), fever (n=1), flu-like symptoms (n=1), hyperbilirubinemia (n=1), weight loss (n=1)]. One month tumor response was assessed in 21 patients [died before follow-up (n=1), pending follow-up (n=2)]. 10 (45.5%) patients were classified as responders regardless of the criteria utilized.

CONCLUSION

TACE with 70-150 µm doxorubicin-eluting beads was well tolerated and had good tumor response after 1 month in patients with HCC.

CLINICAL RELEVANCE/APPLICATION

Smaller caliber 70-150 µm doxorubicin-eluting beads are a safe and promising alternative to the conventional sized 100-500 µm beads in TACE for patients with hepatocellular carcinoma

VSIO21-17 HCC Tumor Board

Monday, Nov. 30 5:40PM - 6:00PM Location: S406B

Participants

Special Interest Session: Radiology and Radiation Oncology: A Partnership Made in Heaven

Monday, Nov. 30 4:30PM - 6:00PM Location: E351

IR **OI** **RO**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sarah S. Donaldson, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose
Peter R. Mueller, MD, Boston, MA (*Moderator*) Consultant, Cook Group Incorporated

LEARNING OBJECTIVES

1) To understand the role of interventional radiologists in the care of patients with cancer. 2) To understand the increasing role of imaging in radiation oncology. 3) To learn which aspects of oncology must be taught to interventional radiologists in order to enable them to care for cancer patients appropriately. 4) To understand the overlap between radiation oncology and interventional oncology, and how these disciplines can become stronger by collaborating with each other.

Sub-Events

SPSI21A   **Interventional Oncology: The Fourth Pillar of Cancer Care**

Participants
Andreas Adam, MD, London, United Kingdom, (andy.adam@kcl.ac.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21B   **It Takes More than Technology to Be an Oncologist: What Interventional Radiologists Can Learn from Radiation Oncology**

Participants
Lizbeth Kenny, MD, FRANZCR, Herston, Australia (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21C   **Image Targeted Oncology: The Birth of a New Specialty**

Participants
Anthony L. Zietman, MD, Boston, MA (*Presenter*) Editor, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

Case-based Review of Nuclear Medicine: PET/CT Workshop-Head and Neck Cancers (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S406A

HN **NR** **CT** **NM** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Participants will use FDG-PET/CT more effectively in their clinical practice through better understanding of the anatomy, clinical scenarios, and differential diagnoses relevant to the diagnostic imaging of head and neck cancers.

RC318

Interactive Quiz Cases in Neuro-oncologic Imaging (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E352

NR **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC318A   Spine

Participants
James C. Anderson, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review imaging of tumors of the spine. 2) Identify aspects of spinal tumors that affect staging, treatment and management 3)Highlight roles of various imaging modalities.

ABSTRACT

Review imaging of tumors of the spine Review aspects of spinal tumors that affect staging, treatment and management Review roles of various imaging modalities

RC318B   Head and Neck/ENT

Participants
Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review common head and neck tumors. 2) Identify pertinent imaging findings that show how imaging affects staging. 3) Highlight specific imaging findings that will affect staging, treatment and management.

ABSTRACT

Review common tumors of the head and neck Review imaging findings in head and neck malignancies that specifically change staging Review the value of imaging in directly affecting managemement and treatment

RC318C   Brain

Participants
Megan K. Strother, MD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify basic anatomic, pathologic, and physiologic principles as they apply to neuro-oncologic imaging of the brain.

ABSTRACT

Five interactive neuro-oncologic cases will be presented in an interactive format. Participants will review basic knowledge and skills that are relevant to the clinical practice of neuroradiology, while evaluating the results of the latest research in neuro-oncologic imaging.

RC351

Pelvic MRI in Oncology: Pearls for Practice

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E350

GU **MR** **OI** **RO**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC351A   Practical Approach to Understanding Gene Mutations with Interpretation of Imaging in Gynecologic Malignancy

Participants
Priya R. Bhosale, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the gentic mutations present in Endomtrial and Ovarian Cancer. 2) Pathogenesis of Ovarian Cancer. 3) Implications on image interpretation.

ABSTRACT

Endometrial cancer is teh most common female gynecologic malignancy.Epithelial ovarian cancer is the most common cause of gynecological cancer death in the United States. More recently epithelial ovarian tumors have been broadly classified into two distinct groups. The type I tumors have low grade serous, clear cell, endometrioid, and mucinous histological features. Typically, these tumors are slow growing and confined to the ovary, and are less sensitive to standard chemotherapy. BRAF and KRAS somatic mutations are relatively common in these tumors, which may have important therapeutic implications. Type II tumors are high grade serous cancers of the ovary, peritoneum, and fallopian tube. These tumors are clinically aggressive and are often widely metastatic at the time of presentation. We will discuss the gene mutations associated with different endometrial and epithelial ovarian cancer, pathogenesis, implications on therapy and imaging.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Priya R. Bhosale, MD - 2012 Honored Educator

RC351B   Pearls and Pitfalls in Prostate MRI

Participants
Aradhana M. Venkatesan, MD, Houston, TX, (avenkatesan@mdanderson.org) (*Presenter*) Institutional research agreement, Koninklijke Philips NV

LEARNING OBJECTIVES

1) List the elements of common prostate MRI acquisition protocols, defining the roles for each pulse sequence in prostate cancer detection. 2) List imaging findings critical to accurate prostate cancer detection and staging. 3) Identify imaging pitfalls in the detection and staging of prostate cancer. 4) Describe common MRI findings of treated prostate cancer. 4) List the elements of the Prostate Imaging-Reporting and Data System (PI-RADS) structured reporting scheme. 5) List the updated changes reflected in the most recent PI-RADSv2 structured reporting scheme.

ABSTRACT

Prostate cancer is one of the most frequently diagnosed cancers in the male population. It is the second most common type of cancer detected in American men and their second leading cause of cancer death. The proposed refresher course will provide an overview of MRI for prostate cancer imaging, including a discussion of salient imaging findings on multi-parametric MRI, pitfalls in imaging interpretation, and an overview of existing standardized reporting templates for prostate MR interpretation.

RC351C   How to Perform and Interpret MRI of the Bladder and Urethra: Anatomy, Technique, and Applications

Participants
Mukesh G. Harisinghani, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) MR techniques to image the bladder and urethra will be discussed. 2) Pointers for optimal MR evaluation will be discussed. 3) Pointers for accurate diagnosis on MRI will be discussed.

ABSTRACT

The propsed course will be provide an overview of applying MR for imaging the bladder and uretheral region

Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Thorax (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S406A

CH CT NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Katherine A. Zukotynski, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply basic anatomic, pathologic, and physiologic principles to the interpretation of PET/CT with emphasis on cancers of the thorax. 2) Identify artifacts that can influence interpretation of PET/CT studies and analyze factors that can improve image quality while minimizing patient risk. 3) Demonstrate understanding of issues on current and future practice patterns.

ABSTRACT

Essentials of GI Imaging

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S100AB

`GI` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

MSES32A   Imaging Esophageal Cancer

Participants
Peter L. Davis, MD, Pittsburgh, PA, (davispl@upmc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss how esophageal cancer treatment and prognosis is initially determined by stage of the cancer. 2) Understand the present TMN staging system for esophageal cancer. 3) Know how imaging techniques such as endoscopic ultrasound, computed tomography and PET/CT are used to determine the stage and, therefore, the treatment of esophageal cancer.

ABSTRACT

The treatment of esophageal cancer is initially determined by its pretreatment stage. The American Joint Committee on Cancer and the Union for International Cancer Control have recently revised the TNM (primary Tumor, lymph Node involvement, distant Metastasis) staging of esophageal cancer to reflect evidence-based findings supporting different treatments at different stages. The primary tumor stage is dependent on the depth of invasion of the esophageal wall. The T stage will determine if the tumor is resectable. The depth of tumor invasion is best determined by endoscopic ultrasound. CT may help tumor staging by identifying invasion of adjacent structures. Since there is an extensive submucosal lymphatic network that enables early lymph node spread, local-regional lymph node involvement is an important prognostic factor. Although esophageal cancers with lymph node involvement may be treated with just surgical resection, clinical trials have shown increased survival with the addition of neoadjuvant chemoradiotherapy or chemotherapy. Lymph node involvement is also best detected by endoscopic ultrasound, but may be supplemented by PET/CT and CT. Metastatic esophageal cancer has a very poor survival rate that is not significantly improved with surgical resections. Therefore, only chemotherapy is commonly used to treat patients with metastatic disease. PET/CT appears to be best for detecting and precisely locating metastatic disease, but may be supplemented by high quality CT.This lecture will review the recent staging changes. The appropriate use and imaging findings of endoscopic ultrasound, computed tomography, and PET/CT to determine the proper stage will be shown.

MSES32B   Imaging of Colorectal Cancer

Participants
Seong Ho Park, MD, Seoul, Korea, Republic Of, (parksh.radiology@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the role of radiological imaging in the management of colorectal cancer patients. 2) Apply state-of-the-art imaging techniques to evaluate colorectal cancer patients. 3) Explain the typical and atypical imaging findings of colorectal cancer lesions and differentiate them from treatment-related findings.

ABSTRACT

Not applicable

Handout:Seong Ho Park

http://abstract.rsna.org/uploads/2015/15001853/RSNA2015-MSES32B-Imaging of CRC-Park.pdf

MSES32C   Liver Lesions in Cancer Patients

Participants
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Grant, Guerbet SA; Support, Siemens AG; Support, Koninklijke Philips NV ; Grant, Bayer AG; Consultant, Bayer AG; Grant, General Electric Company; Support General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Dong-Seo Medical Industrial Col, Ltd

LEARNING OBJECTIVES

1) Describe common incidental lesions in the liver at various stages of a cancer patient's journey. 2) To recognize the role of MRI in comparison with CT in characterization of incidental liver lesion in cancer patients, and explain how technical advances in MR can help address challenges in characterization of those incidental lesions. 3) To illustrate the diagnostic assessment of morphologic features of incidental liver lesions in cancer patients and review

BOOST: Breast-Integrated Science and Practice (ISP) Session

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S103AB

BR **OI** **RO**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose
Katherine L. Griem, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

MSRO32-01 Invited Speaker:

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S103AB

Participants
William Small JR, MD, Maywood, IL (*Presenter*) Speakers Bureau, Carl Zeiss AG

MSRO32-02 Potencial Benefits of Neoadjuvant Radiation Therapy in Overall Survival of Advanced Breast Cancer Patients

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S103AB

Participants
Lilian Faroni, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Daniel Przybysz, MD, RIO DE JANEIRO, Brazil (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To analyze 66 patients with inoperable breast cancer who failed to neoadjuvant chemotherapy and were rescued with radiotherapy prior to surgery.Materials/Methods: From a total of 10.199 registered breast cancer patients, 3.365 new cases of advanced disease were treated and their charts revised. 1.641 patients received neoadjuvant chemotherapy (NeoCh) and 229 failed it. In 66 cases, they received neoadjuvant radiotherapy (NeoRT). Endpoints were resectability and response rate. Chi-square test was used for comparison among groups. NeoRT was delivered in a conventional course of 50 Gy @ 25 fractions or 40 Gy @ 16 fractions to breast, supraclavicular fossae and axila, with tangential and non-pair irregular opposed fields, and 6 MV photons energy. If inoperable, they received a 10 Gy boost on the breast area. Surgery was intended to be done four weeks after RT.Results: From a total of 66 patients analyzed, the median age was 55 years, and 97% of patients were staged as IIIB. Invasive ductal carcinoma was the most frequent hystopathological diagnose. Regarding NeoCh, 43 (65.15%) received FAC; 16 (24.2%) FAC plus Docetaxel and 6 (10%) CMF. Tamoxifen was used in 8 (12%) cases. After NeoCh, 34 (52%) showed stable disease (SD); 24 (36%), progression disease (PD) and 8 (12%), partial response (PR). After NeoRT, 33 (50%) showed SD; 24 (36%), PR and 4 (6%) had clinical complete response (CR). 5 cases (8%) showed PD. 32 patients (48.5%) were eligible to mastectomy. In pathological study, 4 (12,5%) had pathological CR and 20 (61%) showed PR, with a response rate of 73,5% and median volume of surgical specimen of 2,68 cm3. Axillary dissection was performed in all patients, and the mean number excised and positive nodes were respectively 11 (5-22) and 2 (0-18). In the hypofractionated group (13 cases), 4 (31%) patients were considered operable. In the conventional group (49 cases), 28 (57%) had their tumor respected. 4 patients received an additional whole breast boost of 10 Gy @ 5 fractions . Median time of RT was, respectively, 26 and 37 days in the hypofractionated and in the conventional group (including boosted patients). Patients who remained inoperable after RT, showed 91% of distant metastasis. With a median follow up of 84 months, 7 operated patients (21.8%) are alive without evidence of disease and no patients at the inoperable group; last follow-up: Dec/2014. Regarding operated and non-operated patients, 3 years OS, were respectively 75% and 50% (p Conclusion: NeoRT in patients with poor response to NeoCh, who remained inoperable, is a feasible treatment approach. It has allowed almost half of them to become eligible to surgery, with significant benefit on OS when compared to those that remained inoperable. Although, further studies should be done before this protocol becomes standard of are for advanced breast cancer patients.

MSRO32-03 Intraoperative Radiation Therapy as a Boost After Neoadjuvant Chemotherapy: DFS after a Median Follow-up of 4 Years

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S103AB

Participants
Hans-Christian Kolberg, Bottrop, Germany (*Presenter*) Advisory Boards, Novartis AG; Advisory Boards, GlaxoSmithKline plc; Advisory Boards, Carl Zeiss AG; Advisory Boards, Genomic Health, Inc; Advisory Boards, LIV Pharma GmbH; Speaker, Novartis AG; Speaker, GlaxoSmithKline plc; Speaker, Carl Zeiss AG; Speaker, F. Hoffmann-La Roche Ltd; Speaker, Teva Pharmaceutical Industries Ltd; Speaker, Theraclion; Speaker, Genomic Health, Inc; Speaker, Amgen Inc;
Gyorgy Lovey, Bottrop, Germany (*Abstract Co-Author*) Nothing to Disclose
Leyla Akpolat-Basci, Bottrop, Germany (*Abstract Co-Author*) Nothing to Disclose
Miltiades Stephanou, Bottrop, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Untch, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The expected local recurrence rate in 5 year follow-up after breast conserving therapy and whole breast irradiation is 7,6%. Adding a boost of the index region results in a reduced recurrence rate of 4,3%. The boost irradiation as an intraoperative procedure showed a further decrease of local recurrence rates down to 1,75% . We adapted this approach to patients after neoadjuvant chemotherapy (NACT) and are reporting the DFS after a median of 4 years of follow up. To our knowledge this is the first time that data concerning intraoperative radiotherapy with a 50 kV X-ray source after neoadjuvant chemotherapy are presented.Materials/Methods: Between April 2010 and November 2011 we treated 61 patients after NACT (+/-

Trastuzumab according to HER2-status) with an intraoperative boost of 20 Gy with a 50 kV X-ray source followed by an external radiation with 50 Gy. The patient characteristics were as follows and represent the high risk cohort typical for a cohort of patients treated with NACT: median age 54,9 years, 24 pts premenopausal / 37 pts postmenopausal, 31 pts G2 / 30 pts G3, 39 pts ER positive / 22 pts ER negative, 29 pts PR positive / 32 pts PR negative, 24 pts HER2 positive / 37 pts HER2 negative, 36 pts T1 / 24 pts T2 / 1 pt T3, 28 pts node negative / 33 pts node positive. 19 patients reached a pCR. 17 patients needed more than one operation. No patient was lost to follow up and at the time of data closure the median follow up was 49,56 months.Results: At a median follow up of 49,55 months the DFS was 86,89%, the DDFS 93,44%. 18 of the 19 patients were disease free in the group of patients who reached a pCR (DFS 94,74%). In the group of 42 patients who had residual tumor after NACT, 35 were disease free (DFS 83,33%).Conclusion: A DFS of 86,89% compares favorably to the DFS expected for patients after NACT. The higher DFS in the pCR-group was expected due to the fact that a pCR after NACT +/- Trastuzumab is predictive for DFS. Still the DFS in the non pCR-group compares favorably to the known data for patients not reaching a pCR. Our data are the first on IORT as a boost after neoadjuvant chemotherapy and show a favorable outcome of the patients in this high risk group. They strongly encourage the design of prospective trials in this indication.

MSRO32-04 Preliminary Results of a Phase I Trial Evaluating Nipple Sparing Mastectomy with Immediate Reconstruction Followed by Prophylactic Nipple Areola Complex Irradiation in Early-Stage Breast Cancer: Patient Reported Satisfaction and Cosmesis Outcomes

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S103AB

Participants
Cristiane Takita, MD, Miami, FL (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Breast conserving therapy has become the standard option for patients with early stage breast cancer. Still, there are some patients in need for mastectomy due to multicentric disease or diffuse microcalcifications. If mastectomy is to be performed, keeping the nipple areola complex (NAC) is still controversial. Studies have shown that preservation of the NAC provided higher patient's satisfaction and less psychological impact after mastectomy. Previous studies have used nipple sparing approach using intraoperative radiation (RT) to the NAC. This study is to report preliminary data of a prospective phase I trial using nipple sparing mastectomy with immediate reconstruction, followed by prophylactic NAC RT at weeks 5 to 8 postoperative.Materials/Methods: From 2009 to 2014, 10 patients with 11 breast cancers primary (one patient had bilateral disease) were enrolled in the study. The first 6 patients were treated to the NAC using 25 Gy in 10 fractions, BID, 6 hours apart, over 5 consecutive days, using electrons (dose level II; dose escalation/de-escalation design). The next 3 patients received dose level III, 30 Gy in 10 fractions, using same regimen. Radiation was delivered 5 to 8 weeks postoperative. Patient's cosmesis was assessed by the patient and physicians during 1, 3, 6, and 12 months after completion of protocol therapy. Patient's satisfaction was also evaluated at same interval.Results: Nine out of ten patients were able to complete treatment per protocol. At the last follow up, patient's evaluation of cosmesis was excellent in 78% (7/9), good in 11% (1/9), and poor in 11% (1/9). Overall patient satisfaction with nipple sparing protocol was Good/Excellent in all patients during the time interval of evaluations. Physician's evaluation of NAC cosmesis was excellent in 34% (3/9), good 66% (6/9). In regard toxicity, only one patient developed grade 3 infection and loss of NAC postoperative; this patient did not receive NAC RT. Of the 9 evaluable patients in the protocol, there was no NAC loss or need for treatment interruption. There was no grade 4, 5 toxicity in patients treated with NAC RT. The most common toxicity was acute radiation dermatitis and NAC pain, mostly grade 2, which completely resolved in subsequent follow up.Conclusion: The preliminary results of this nipple sparing protocol for early stage breast cancer showed a high level of patient's satisfaction and self-reported good/excellent cosmesis in the majority of patients treated. Toxicity appeared to be acceptable so far, mostly related to acute radiation dermatitis, grade 2. There was no NAC loss with the use of prophylactic NAC RT. Final results will be presented at completion of the trial.

MSRO32-06 Dose to Organs in the Supraclavicular Region When Covering the Internal Mammary Nodes (IMN) in Breast Cancer Patients: A Comparison of VMAT Versus 3-D and VMAT

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S103AB

Participants
Vishruta A. Dumane, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Richard L. Bakst, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sheryl Green, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): VMAT has been reported to offer improved dosimetric sparing of the ipsilateral lung, total lung and heart compared to 3D conformal planning while covering IMNs. However OARs in the supraclavicular region often receive higher doses compared to 3D conformal planning. We aim to compare VMAT versus a combination of 3D and VMAT to improve sparing of OARs in this region without compromising target coverage or the dosimetric advantage that is already offered on using VMAT alone.Materials/Methods: 10 patients previously treated with VMAT at our institution were re-planned with 3D conformal planning in the supraclavicular region and VMAT inferiorly to the chestwall. VMAT planning consisted of 2 complementary arcs within a 230° arc range with 6 MV. The supraclavicular region was planned either with a single off-cord AP field or with off-cord AP/PA and field in field employing 6 MV and/or 16 MV depending on the depth of nodal coverage. Coverage criteria were PTV D95 = 50 Gy, V95 = 98% and PTV D05 = 115%. Doses to the esophagus, trachea, larynx, brachial plexus, thyroid and cord were noted in addition to the heart, lungs and contralateral breast.Results: Combining 3D with VMAT significantly reduced the maximum dose to the esophagus, trachea and spinal cord by 15 Gy, 11 Gy and 12 Gy and also significantly reduced mean dose to the thyroid, larynx and trachea by 15 Gy, 12 Gy and 18 Gy respectively (Table 1). No significant differences were seen in the mean dose to the heart, ipsilateral lung, total lung and contralateral breast or in the maximum dose to the brachial plexus. A statistically significant increase in the V20 Gy to the ipsilateral lung and total lung was observed but was = 2%.Conclusion: 3D conformal planning in the supraclavicular region while restricting VMAT to the chestwall helps reduce dose to additional OARs without compromising doses to the heart, lungs and contralateral breast when VMAT alone is used.

OAR	VMAT	3D + VMAT
Esophagus Max (Gy)	45.65* (SE 2.32)	30.8* (SE 4.54)
Esophagus Mean (Gy)	9.16* (SE 0.64)	6.54* (SE 0.54)
Trachea Max (Gy)	43.97* (SE 1.51)	33.24* (SE 5.44)
Trachea Mean (Gy)	26.53* (SE 1.65)	8.52* (SE 1.38)
Cord Max (Gy)	28.25* (SE 1.64)	15.93* (SE 3.46)
Thyroid Mean (Gy)	29.61* (SE 2.91)	14.36* (SE 3.25)
Larynx Mean (Gy)	14.24* (SE 2.15)	2.26* (SE 0.64)
Brachial Plexus Max (Gy)	56.03 (SE 1.2)	55.95 (SE 1.83)
Heart Mean (Gy)	5.54 (SE 0.71)	5.49 (SE 0.7)
Ipsilateral Lung Mean (Gy)	15.31 (SE 0.27)	16.01 (SE 0.24)
Ipsilateral Lung V20Gy (%)	24.69* (SE 0.72)	26.85* (SE 0.62)
Total Lung Mean (Gy)	9.78 (SE 0.24)	9.97 (SE 0.23)
Total Lung V20Gy (%)	13.04* (SE 0.61)	14.06* (SE 0.49)
Contralateral Lung Mean (Gy)	3.6* (SE 0.37)	3.23* (SE 0.32)
Contralateral Breast Mean (Gy)	4.13 (SE 0.2)	4.05 (SE 0.23)

SE= standard error *p <0.05

MSRO32-07   SBRT for Secondary Lung and Liver Lesions in 35 Breast Cancer Oligometastatic Patients

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S103AB

Participants
Slavisa Tubin, Empoli, Italy (*Presenter*) Nothing to Disclose
Franco Casamassima, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudia Menichelli, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Grespi, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Fanelli, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriella Pastore, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Cecilia Arrichiello, Empoli, Italy (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): This retrospective study explores the impact of SBRT as an aggressive local treatment on the disease evolution and survival of patients with oligometastatic breast cancer treated for lung and liver metastases.Materials/Methods: 24 lung lesions in 11 patients and 39 liver lesions in 24 patients (total of 63 lesions) were irradiated using SBRT between Feb.'07-Nov.'14. All 35 patients treated (KPS =70) were oligometastatic which according to our criteria implied the presence of = 5 in lung- or in liver-only metastases, or = 3 if presented in > 1 site. 7 patients (20%) were with single metastases while 28 (80%) with multiple. 11 patients were irradiated for lung lesions while 24 for liver lesions. Histology was ductal ADK in 81% of patients, lobular in 10%, mixed in 2% and other histologies or no data in 7%. The median diameter of the lung lesions was 1 cm (range 0.5-5) and of the liver metastases 3.5 cm (range 1-9.1). Planning Target Volume was created by adding a 3 mm margin to the Gross Tumor Volume. SBRT was delivered with VMAT by 6 MV LINAC and planned by TPS with Montecarlo algorithm. All lesions were treated in Breath-hold with different dose levels depending on tumor site and size. Almost all lung lesions (83.3%) were irradiated with 26 Gy in a single fraction prescribed to the 70% isodose (BED10 to isocenter = 175). Liver lesions were treated mainly (72%) with 37.5 Gy in 3 fractions prescribed to the 67% isodose (BED10 to isocenter = 161). Set-up and isocenter were assessed by CBCT. All patients treated for liver lesions underwent Gold fiducials insertion 1 week before CT simulation. The response was evaluated after 60 days by CT and PET, and every 3 months subsequently. Toxicity was assessed by CTCAE score.Results: Considering all treated lesions, both lung and liver, only 5 (7.9%) "in field" recurrences were observed, all occurred in liver during the first year from SBRT so the local control rate at 1 year was 92.1%; Dividing irradiated lesions by anatomic site 1 year local control rate for lung lesions was 100% while for liver-group 87.2%. At 1 and 2 years Overall Survival (OS) rates were 86% and 69% (91% and 70% in lung-group vs. 83% and 50% in liver-group), and Progression Free Survival rates were 37% and 20%, respectively (median F.U. 19.9 months, range 2,2-60). No predictive factors of local failure were found. No toxicity > G2 (4 patients) was recorded.Conclusion: SBRT for Lung and Liver metastases in Breast oligometastatic patients is a safe and well tolerated treatment. High local control rate (only 5 recurrences in field) confirms the ablative role of SBRT using high BED doses (> 100). The low number of relapses does not allow statistical analysis on predictive factors of local failure but high local control rate in the subset of patients with primary breast cancer indicates an trend for better local control respect to other primitive tumors (92.1% at 1 year that appears stable over the time).

MSRO32-08   Salvage Radiation Therapy for 2nd Oligo-Recurrence in Patients With Breast Cancer

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S103AB

Participants
Mari Miyata, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Ohguri, Kitakyushu, Japan (*Presenter*) Nothing to Disclose
Katsuya Yahara, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): A new concept of "oligo-recurrence (OR)" indicates one to several distant metastases/recurrences in one or several organs which can be treated with local therapy, while the primary site of the cancer was once controlled. A previous study demonstrated that first failure detected as the state of OR (e.g. isolated loco-regional recurrence (LRR) or isolated pulmonary metastasis) could be salvaged by local therapy. However, a subset of once salvaged patients with OR could have a second failure which is also detected as the state of OR. We have often experienced this situation in patients with breast cancer and have defined that as "2nd OR." The purpose of this study was to assess the efficacy and toxicity of salvage radiotherapy (RT) for the 2nd OR of breast cancer.Materials/Methods: All the 23 patients satisfied the following requirements of our definition for 2nd OR: (i) disease-free status after initial therapy for clinically localized breast cancer had been once confirmed; (ii) first failure was detected as OR (1st OR), and disease control of the 1st OR after salvage local therapy was confirmed, while simultaneously there were no other distant metastases/recurrences; (iii) second failure was also detected as OR (2nd OR) which was treated with salvage RT. The sites of the 2nd OR were LRR in 9 patients and distant metastasis in 14 patients. The total radiation dose of the salvage RT ranged from 40–76 Gy (median, 60 Gy), the daily dose was 2.0–3.0 Gy (median, 2.0 Gy). Efficacy and toxicity of the salvage RT for the 2nd OR were retrospectively evaluated, and the predictors of a long-term survival were analyzed.Results: Twenty-one (91%) patients had an objective response. The median overall survival and progression-free survival times were 40 and 20 months after salvage RT for the 2nd OR, respectively. The three-year local (in-field) control rates were 84%. The toxicities were mild; acute toxicities = Grade 3 were seen in one patient with Grade 3 dermatitis, and no late toxicity = Grade 2 was observed, except for one patient who had a Grade 3 lymphatic edema of the arm. The first sites of disease progression after the salvage RT for the 2nd OR were out-field alone in 11 patients (48%) and both in-field and out-field in 4 patients (17%); none of the patients had first sites in local (in-field) alone. The univariate analyses indicated that age (Conclusion: Salvage RT for the 2nd OR was able to achieve a better local control rate and longer progression-free survival time without inducing severe toxicity, and therefore may be a potentially effective modality for inducing long-term survival in select patients.

MSRO32-09   Cost-Effectiveness of Pertuzumab in HER2-positive Metastatic Breast Cancer

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S103AB

Participants
Yushen Qian, MD, Stanford, CA (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The Clinical Evaluation of Pertuzumab and Trastuzumab (CLEOPATRA) study showed a benefit in overall

survival with the addition of pertuzumab (P) to docetaxel (T) and trastuzumab (H) (THP) compared to TH as first-line treatment for patients with HER2-positive metastatic breast cancer. With median follow-up of 50 months, median overall survival for the THP and TH groups were 56.5 and 40.8 months, respectively [Swain, NEJM 2015]. Based on these results, we performed a cost-effectiveness analysis to determine the impact of pertuzumab on the treatment of HER2-positive metastatic breast cancer.Materials/Methods: Cost-effectiveness was evaluated from a societal perspective. A four-state Markov model was constructed to evaluate the cost-effectiveness of TH with or without P. Health states included: stable disease, progression of disease, hospice, and death. The model was run over 10 years with cycle length of 1 week. Transition probabilities were based on the results of the CLEOPATRA study. Costs were based upon 2014 Medicare reimbursement rates and manufacturers' Average Sales Price. Interventions were evaluated with a willingness-to-pay threshold (WTP) of $100,000 per quality-adjusted life years (QALY) gained. One-way and multi-way sensitivity analyses were performed to explore the effects of specific assumptions.Results: Our modeled overall survival and progression-free survival intervals compared well with the results of the CLEOPATRA study. Modeled median survival was 171 weeks (39.5 months) and 253 weeks (58.3 months) for TH and THP group, respectively. The addition of P resulted in an additional 0.73 QALY at an increased cost of $426,039 compared with TH, resulting in an incremental cost-effectiveness ratio (ICER) of $582,141 per QALY. Two-way sensitivity analysis showed that in the scenario where baseline costs (including cost of trastuzumab) were half of predicted, THP would not become cost-effective until discounted by 96% of the current Medicare Average Sales Price.Conclusion: The addition of pertuzumab to docetaxel and trastuzumab in metastatic HER2(+) breast is unlikely to be cost-effective at a WTP threshold of $100,000 per QALY gained. This finding is attributed to 1) the expense of pertuzumab, and 2) that patients treated with pertuzumab have prolonged progression-free survival, and, therefore, accrue higher costs for prolonged treatment with both pertuzumab and trastuzumab. Additional results from the adjuvant trials of pertuzumab will be important to characterize the overall cost-benefit of this agent in both metastatic and early stage HER2-positive breast cancer.

BOOST: CNS-Integrated Science and Practice (ISP) Session

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S103CD

| NR | OI | RO |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jun Deng, PhD, New Haven, CT (*Moderator*) Nothing to Disclose
Edward Melian, MD, Maywood, IL (*Moderator*) Nothing to Disclose

Sub-Events

MSRO35-01 Invited Speaker: Single Fraction or Multisession SBRT for Spinal Metastases?

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S103CD

Participants
Simon S. Lo, MD, Cleveland, OH (*Presenter*) Research support, Elekta AB;

MSRO35-02 Impact of Posterior Fossa Boost Volume on Tumor Recurrence and Incidental Hippocampal Dose in Medulloblastoma

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S103CD

Participants
Palak Kundu, Stanford, CA (*Presenter*) Nothing to Disclose
Ben Durkee, MD, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Rie von Eyben, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sarah S. Donaldson, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Iris C. Gibbs, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Radiation boost is critical for local control in MB, yet targeting the whole posterior fossa is associated with neurocognitive morbidity. The incidental hippocampal dose may account for these effects. Despite traditional tumor bed vs. posterior fossa categorization, the relative irradiated volume of posterior fossa may vary significantly. We model boost volume more rigorously as a continuous variable to investigate associations with hippocampal dose and recurrence rates.Materials/Methods: Bilateral hippocampi and posterior fossa were contoured on T1 axial images for 25 medulloblastoma patients [3-21 years; 5 female; 15 average risk (7 18Gy, 8 23.4Gy), 10 high risk (36Gy)]. There were 9 total recurrences: 5 exoprimary (3 high risk 36Gy, 2 average risk 18Gy), 2 primary (2 average risk: 1 18Gy, 1 23.4Gy), 2 both (2 high risk 36Gy). Minimum dose received by 100% of each hippocampus (D100%) and percent volume of posterior fossa receiving 100% of boost dose (V100%) were extracted from dose-volume histograms. Analysis of covariance was used to investigate the effect of V100% as a continuous variable while controlling for total craniospinal dose categorically (Low Dose 18-23.4Gy, High Dose 36Gy). Ordinal logistic regression was used to estimate probability of overall, primary and exoprimary recurrences.Results: Right and left total incidental hippocampal BED were both greater for the high dose group by 13.9Gy (p=0.00040) and 14.0Gy (p=0.00010) respectively. Right and left D100% significantly varied with V100% by 0.18Gy (p=0.022) and 0.15Gy (p=.032) per percent volume respectively. Probability of any recurrences (p=0.079) and exoprimary recurrences (p=0.098) exhibited negative trends with V100%. Primary recurrences were not associated with V100%, and dose group was not significant.Conclusion: Incidental hippocampal doses are positively associated with boost volumes and may account for neurocognitive decline in medulloblastoma patients. Posterior fossa V100% can be a useful metric to more accurately describe boost volumes given the hetereogeneity within risk groups, and new hippocampal sparing techniques may allow for greater posterior fossa coverage. Aggressive posterior fossa management may further augment metastatic compartment therapies.

MSRO35-03 Predictive Factors of Brain Metastasis in Non-Small Cell Lung Cancer Patients: Implications for Patient Selection for Prophylactic Cranial Irradiation

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S103CD

Participants
Santosh Nori, New York, NY (*Presenter*) Nothing to Disclose
Anthony Pham, MD, San Jose, CA (*Abstract Co-Author*) Nothing to Disclose
Paul Christos, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Himanshu Nagar, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gabriella Wernicke, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Dattatreyudu Nori, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Bhupesh Parashar, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The medical community has suspected a correlation between Non-Small Cell Lung Cancer and brain metastasis for quite some time. Identifying reliable predicting characteristics of brain metastasis in NSCLC patients can allow for effective treatment with Prophylactic Cranial Irradiation (PCI) to minimize the risk of metastasis. We sought to identify predictive factors for patients with NSCLC to develop brain metastasis.Materials/Methods: MOSAIQ databases were queried for patients that received radiotherapy treatment at the institution. Details of patients that received radiotherapy to the brain were collected for further data collection using the EPIC database. Pathology records of these patients were examined for presence of certain biomarkers (TTF-1, CK7, CK20, Synaptophysin, p63, and CK 5/6) and histology (adenocarcinoma or SCLC, with neuroendocrine differentiation). Radiological reports were examined for tumor site(s), tumor size information, nodal involvement, and number of nodules present. Information on age, sex, and tumor stage were also collected. Results: A total of 193 patients were identified and included in this analysis. Among these, 67 patients developed brain metastasis and 126 patients did not. A univariate analysis of

data determined that tumor stages 3 and 4 (pA multivariable logistic regression model of data determined higher stage (stages 3 or 4: p=0.004, Adjusted OR=3.612) and tumor size (Above 3 cm: pAdditionally, the presence of CK7 and Synaptophysin showed a trend and non-significant increased risk of brain metastasis (OR=2.22 and 2.90, p=0.06 and 0.40, respectively).Conclusion: Identifying the presence of predictive characteristics in NSCLC patients can help patient survival through the administration of prophylactic cranial irradiation. In this study, we showed that NSCLC of stages 3 or 4, with tumors greater than 3 cm in at least one dimension, or more than two nodes or nodules involved are predictive of brain metastasis. Presence of CK7 may also be a reliable predictor of brain metastasis. This evidence can be helpful to doctors in evaluating whether or not patients should receive PCI.

MSRO35-04 Roles of Tumor Size and Histology in Outcomes Following Resection and Stereotactic Radiosurgery for Brain Metastases

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S103CD

Awards
Trainee Research Prize - Medical Student

Participants
Chase Escott, Lebanon, NH (*Presenter*) Nothing to Disclose
Linton T. Evans, MD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Zhongze Li, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Nathan Simmons, MD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
David W. Roberts, MD, Lebanon, NH (*Abstract Co-Author*) Scientific Advisory Board, Carthera AB; Scientific Advisory Board, IMRIS Inc; Scientific Advisory Board, Alcyone Lifesciences, Inc; Equipment support, Medtronic, Inc; Research support, Medtronic, Inc; Equipment support, Carl Zeiss AG; Research support, Carl Zeiss AG;
Andrew Zureick, BA, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Alan C. Hartford, MD, PhD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Stereotactic radiosurgery (SRS) following resection of a brain metastasis improves disease control at the surgical site. Our prior published work demonstrated a relationship between size of the resected tumor and risk of local recurrence (LR). In this analysis we expanded our database to examine the role of tumor histology among factors that may predict recurrence and overall survival (OS).

METHOD AND MATERIALS

We retrospectively reviewed all patients treated through Jan 2013 who underwent SRS to the surgical bed, deferring whole brain radiation therapy (WBRT). Multiple factors - including histology, tumor size, planning target volume (PTV), dose, meningeal contact (SUP), development of leptomeningeal disease (LMD), gross total resection (GTR), number of metastases (MET#), and the RTOG's histology-specific Graded Prognostic Assessment (GPA) - were analyzed for time to local recurrence at the tumor bed (LR), to distant recurrence within the brain (DR), to intracranial recurrence (ICR), to salvage WBRT, and for OS.

RESULTS

122 lesions in 118 patients were treated with resection and SRS between February 2002 and January 2013. With median follow-up 18.3 months, local control rates at the resection cavity were 91.2% at 1-year, 83.4% at 2-years. Overall survival (OS) rates at 1-year and 2-years were 51.2% and 24.4%, respectively. On univariate analysis tumors > 3.0 cm, compared to smaller tumors, had a marginally significant higher risk of local recurrence (28.6% versus 9.6% at 2-years, p=.057) and a significantly higher rate of WBRT (66.2% versus 35.6% at 2-years, p<.05). Multivariate Cox regressions showed pre-op size to be significant for risk of LR in patients with non-lung tumors (p<.05), but not significant for patients with NSCLC metastases. In multivariate analysis of the entire dataset, only GPA was significantly associated (p<.0001) with OS, while size, PTV, GTR, histology, SUP, dose, LMD, and MET# were not -- arguing for successful salvage of recurrences.

CONCLUSION

SRS without WBRT is efficacious in controlling disease recurrence following resection of brain metastases. This study supports tumor size and histology as important factors prognostic for disease control in this group of patients.

CLINICAL RELEVANCE/APPLICATION

Pre-operative tumor size and tumor histology are important progrostic factors for efficacy of stereotactic radiosurgery following resection for brain metastases.

MSRO35-05 Gamma Knife Radiosurgery for Intracranial Grade 2 Meningiomas

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S103CD

Participants
Tamer Refaat Abdelrhman, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Michelle S. Gentile, MD, PhD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Orin Bloch I, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Maryanne Marymont, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
James P. Chandler, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
John A. Kalapurakal, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Irene Helenowksi, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There has been few reports addressing the treatment outcomes of Gamma knife radiosurgery (GKRS) for grade 2 meningioams. This study aims to report clinical outcomes after GKRS for intracranial grade 2 meningiomas.

METHOD AND MATERIALS

In this IRB approved study, we reviewed the records of all patients with histopathologically confirmed meningiomas treated with GKRS between 1998 and 2014. The median GKRS dose was 15 Gy (range 11-20) prescribed to the 50% isodose line.

RESULTS

A total of 209 meningiomas were treated consecutively and postoperatively with GKRS; of them 96 were histopathologically confirmed grade 2 meningiomas and were included in this study. Median age was 61 years, 57.3 % were females and 42.7% were males. Tumor sites included anterior (11.5%), middle (11.5%), and posterior (18.7%) cranial fossae, convexity (32.3%), parasagittal (12.5%), temporal (10.4%), and others (3.1%). Mean tumor size was 3.3 cm3 (median 2.2 cm3). Among 41 (48.8%) symptomatic patients, most common symptoms were headache (21.9%), visual impairment (14.6%), hearing deficit (5.2%) and motor deficits (9.4%). After a mean follow up of 40 months (range 3 - 174), the local control rate was 70 % of all treated meningiomas. The median time to recurrence was 89 months (range 47 - 168 months). Of symptomatic patients, 54%, 39%, and 7% reported improved, stable, or worse initial symptoms, respectively. The 3, and 5-year actuarial local control rates were 69.9%, and 55.6%, respectively. The 3, and 5-years overall survival were 80.7%, and 65.6%, respectively. Multivariate analysis including tumor size, site, status (residual versus recurrent), dose, age, sex, race, previous irradiation, previous surgery, time since surgery, will bepresented during the meeting in order to identify most contributing factors for local failure and provide recommendations for optimal treatment. The most common acute toxicities after GKRS were headache (1.1%), sensory loss (1.1%), visual impairment (1.1 %), and dementia (3.4%). Chronic toxicities included, headache (1.1%), and visual impairment (2.2%). There were no radiation necrosis or second malignant tumors noted in our series.

CONCLUSION

This report, one of the largest GKRS series for grade 2 meningiomas, demonstrates that GKRS is a safe and effective treatment modality for grade 2 meningiomas with durable tumor control and minimal toxicity.

CLINICAL RELEVANCE/APPLICATION

GKRS is a safe and effective treatment modality for grade 2 meningiomas patients.

MSRO35-07 Stereotactic Radiosurgery for Treatment of Brain Metastastes from Colorectal Cancer: A Single-Institution Experience

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S103CD

Participants
Michael A. Cummings, MD, MS, Rochester, NY (*Presenter*) Nothing to Disclose
Kevin Walter, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Kenneth Usuki, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Paul G. Okunieff, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Alan W. Katz, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Michael T. Milano, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To review outcomes of patients with colorectal adenocarcinoma who underwent stereotactic radiosurgery for brain metastasisMaterials/Methods: A retrospective review of patients with biopsy proven colorectal adenocarcinoma treated with stereotactic radiosurgery for brain metastases from 2001-2013 was conducted under an IRB approved protocol. End points were radiologic response, neurologic symptom response, overall survival, and treatment related complications. Radiographic response to treatment was defined as stable or shrinking lesion size (accounting for expect post-radiation changes) on follow-up imaging, which was MRI in all except 1 patient. Neurologic symptom response was defined as improved or stable deficits on follow up exam with decreasing steroid dosage and no interval novel-to-patient systemic therapy.Results: Twenty-three patients received single fraction SRS using either a frame based (2002-2010) or frameless (2011-2013) technique. Mean follow up was 5.4 months (range 1 to 13) which was dictated by overall survival. A total of 46 lesions were treated. The mean lesion size on MRI was 17 mm in greatest dimension (range 2 – 35 mm) with mean PTV size of 3.4 cm3 (0.02 to 14.94 cm3). The median number of lesions treated in a single course was 2 (range 1 to 5). Median prescribed dose to isocenter was 16.5 Gy (12.5 to 20) with median minimal PTV dose of 14 Gy (10 to 19.6). Eight lesions were recurrent after previous resection. Six lesions were treated with SRS and then required retreatment with SRS. Eleven patients had previous WBRT with median dose of 30 Gy. Radiographically 72% of lesions were stable or decreasing in size using last available assessment with mean interval of 4.1 months (1 to 19.2). Mean overall survival was 6 months. Two patients died within 1 month of treatment from causes other than disease (MI, MVA). Sixteen courses of treatment coincided with presentation of neurologic symptoms, with previous WBRT in 14. Seven of these sixteen patients had improvement in their presenting deficit, first noted on assessment at median interval of 2 months after SRS (range 1.3 to 6 mos). Two patients remained steroid dependent, both on substantially decreased doses. None of the patients with neurologic response had recurrence of their presenting neurologic symptom prior to death. No patients required hospitalization for adverse effects of treatment. Two patients proceeded to resection post SRS for progressive lesion. Two patients who did not have WBRT had progression of CNS disease outside the treatment volumes.Conclusion: Stereotactic radiosurgery was well tolerated with excellent radiographic response and no major reported adverse events. In this review 44% of patients with neurologic symptoms prior to SRS had clinical improvement with length and time course not attributable to steroid therapy.

MSRO35-08 Long-term Follow-up of Intensive Chemotherapy Followed by Reduced Dose and Field Irradiation for Intracranial Germ Cell Tumors

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S103CD

Participants
Akinori Takada, MD, Tsu, Japan (*Presenter*) Nothing to Disclose
Noriko Ii, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshio Matsubara, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Komada, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd
Yoshihito Nomoto, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidemi Toyoda, MD,PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Takao Deguchi, MD,PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yutaka Toyomasu, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The purpose of this study is to report the treatment outcomes of intensive chemotherapy followed by reduced dose and field irradiation for the treatment of intracranial germ cell tumors (GCTs).Materials/Methods: 22 patients (18 males and 4 females) with intracranial GCTs were treated at our facility between 1991 and 2012. They were classified three groups based on serological and histological findings. Five patients (23%) with pure germinoma were treated with conventional-dose chemotherapy (ifosphamide-cisplatin-etoposide) followed by 24 Gy ventricular field irradiation as good prognosis group, and 14 patients (64%) germinoma with syncytiotrophoblastic giant cells and 3 patients (14%) with nongerminomatous GCTs were treated with high-dose chemotherapy (HDC) with stem-cell support followed by 24-50.4 Gy reduced field irradiation as intermediate and poor prognosis group, respectively. The Median age was 14 years and primary sites were at pineal region for 11(50%) patients, suprasellar region for 4(18%) patients and others for 7(32%) patients. Disseminated tumors were present in 4 patients. Ten patients (45%) were diagnosed with hydrocephalus before treatment. Four patients who relapsed after initial chemotherapy were included in this study.Results: The medium follow-up duration was 113 months, 10-year overall survival rate and progressive-free survival rate was 80.1% and 69.8%, respectively. Regarding late adverse effect, pituitary dysfunction (short stature, insufficiency of secondary sexual feature, hypothyroidism); 8 patients (36%), hearing impairment; 5 patients (23%), intelligence diminution; 6 patients (27%), convulsion•electroencephalogram abnormality; 5 patients (23%), treatment induced secondary neoplasm; 2 patients (9.1%), motility disorder; 2 patients (9.1%), azoospermia; 1 patient (4.5%) and treatment-related death (brain hemorrhage); 1 patient (4.5%) appeared. In addition, 5 (23%) patients needed intervention of a psychiatrist due to school refusal, anxiety disorder, eating disorder and self-injury behavior etc. In contrast, patients who received irradiation less than 30 Gy tended to have no late adverse effect.Conclusion: Intensive chemotherapy followed by reduced dose and field irradiation resulted in preferable outcomes. Based on our results, further study will be required from the perspective of radiation dose and field, especially for patients classified as intermediate and poor prognosis group.

MSRO35-09 Incidence, Treatment, and Survival Patterns for Sacral Chordoma in the United States, 1973-2011

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S103CD

Participants
Esther Yu, MD, Boston, MA (*Presenter*) Nothing to Disclose

PURPOSE

Purpose/Objective(s): Sacral chordomas represent approximately a third of all chordomas, a rare neoplasm of notochordal remnants. Current NCCN guidelines recommend surgical resection with or without adjuvant radiotherapy, or definitive radiation for unresectable cases. Recent advances in radiation for chordomas include conformal photon and proton beam radiation. We investigated the incidence, treatment, and survival outcomes for sacral chordomas to observe any trends in response to improvements in surgical and radiation techniques over a near 40 year time period.

METHOD AND MATERIALS

Materials/Methods: 345 microscopically confirmed cases of sacral chordoma were identified between 1974 and 2011 from the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute. Incidence and survival rates were adjusted for age. Cases were divided into three cohorts by calendar year, 1974-1989, 1990-1999, and 2000-2011, as well as into two groups by age less than or equal to 65 versus greater than 65 to investigate trends over time and by age via Chi-square analysis. Kaplan-Meier analyses were performed to determine effects of treatment on survival.

RESULTS

Results: Median age at diagnosis was 64. The age-adjusted incidence rate of sacral chordomas was .03 per 100,000. 5-year relative survival for the entire cohort was 60%. Overall survival correlated significantly with treatment modality, with 44% surviving at 5 years with no treatment, 52% with radiation alone, 82% surgery alone, and 78% surgery and radiation (pTable 1. Trends of Radiation, Surgery, and Survival by Time.1974-1989(N=68)1990-1999(N=78)2000-2011(N=199)P-valuePatients Receiving Radiation1 53%40%33%.03Patients Receiving Surgery165%74%70%.555-year Overall Survival (%)63%59%63%2.991Treatments were not mutually exclusive.2Calculated from 94 cases between 2000-2006 with median follow-up 84 months.

CONCLUSION

Conclusion: Surgery remains an important component in the treatment of sacral chordomas in current practice. Fewer patients were treated with radiation more recently despite advances in photon and proton beam radiation. Overall survival remains unchanged. Additional analyses of margin status, radiation modality, and local control in current practice are warranted.

ABSTRACT

Conclusion: Surgery remains an important component in the treatment of sacral chordomas in current practice. Fewer patients were treated with radiation more recently despite advances in photon and proton beam radiation. Overall survival remains unchanged. Additional analyses of margin status, radiation modality, and local control in current practice are warranted.

ISP: Chest (Dual Energy CT of the Chest)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S404CD

`CH` `CT` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

`FDA` Discussions may include off-label uses.

Participants
Mannudeep K. Kalra, MD, Boston, MA (*Moderator*) Nothing to Disclose
Jonathan H. Chung, MD, Denver, CO (*Moderator*) Research Grant, Siemens AG; Royalties, Reed Elsevier

Sub-Events

SSG03-01   Chest Keynote Speaker: Dual Energy of the Chest

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S404CD

Participants
Myrna C. Godoy, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

SSG03-02   Are There Radiomic Features Associated with EGFR Mutation Status in Peripheral Lung Adenocarcinomas

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S404CD

Participants
Ying Liu, Tianjin, China (*Presenter*) Nothing to Disclose
Jongphil Kim, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Shichang Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Qian Li, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Fangyuan Qu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yoganand Balagurunathan, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Alberto L. Garcia, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively evaluate the capability of computed-tomography (CT) radiomic features in predicting EGFR mutation status in surgically resected peripheral lung adenocarcinomas in Asian cohort patients.

METHOD AND MATERIALS

This study was approved by the institutional review board, with waiver of informed consent. 298 patients (167 for training and 131 for validation) with surgically resected peripheral lung adenocarcinomas were enrolled in this study. The EGFR mutations at exons 18 - 21 were determined by amplification refractory mutation system-PCR. We used Definiens Developer XD© (Munich, Germany) as the image analysis platform to perform tumor segmentation and feature extraction.

RESULTS

Mutant EGFR was significant associated with neversmoker status (p=0.041), lepidic predominant adenocarcinomas subtype (p=0.030), and low or intermediate pathologic grade (p=0.041) in peripheral lung adenocarcinomas. Eight radiomic features were significantly associated with the presence of EGFR mutation, including three size base features, four tumor location based features, and one runlength and coocurrence based feature. The results of a multivariable model showed that the most important predictors of harboring EGFR mutation in Asian patients with peripheral lung adenocarcinoma were histologic subtype (OR 1.99, 95% CI 0.97-4.06), smoking status (OR 0.55, 95% CI 0.29-1.03), and one radiomic feature describing tumor location (OR 0.01, 95% CI <0.001-1.10). The AUC value calculated from the predictive logistic model was 0.650 (95% CI: 0.567 - 0.734), and the AUC value computed by cross-validation method was 0.569 (95% CI: 0.480 - 0.659). The AUC value of this predictive model on the independent validation dataset was 0.696 (95% CI: 0.605 - 0.787).

CONCLUSION

CT based radiomic features of peripheral lung adenocarcinomas can capture useful information regarding tumor phenotype, and the current model we built could be highly useful to predict the presence of EGFR mutations in peripheral lung adenocarcinoma in Asian patients when mutational profiling is not available or possible.

CLINICAL RELEVANCE/APPLICATION

The significant association between radiomic features and EGFR mutation status for patients with peripheral lung adenocarcinomas would serve as image biomarker to allow identification of patients with high incidence of harboring EGFR mutations.

SSG03-03   Correlations of Iodine Uptake and Perfusion Parameters in Lung Cancer with Dual-Energy CT and First-pass Dual-input Perfusion CT

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S404CD

Participants
Xiaoliang Chen, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hongliang Sun, MD, Beijing, China (*Presenter*) Nothing to Disclose

Wu Wang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Shaoyuan Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the potential relationship between iodine uptake levels estimated from single source dual-energy CT (DE-CT) and perfusion parameters with dual-input perfusion CT in lung cancer.

METHOD AND MATERIALS

This study was an institutional review board-approved study, and written informed consent was obtained from all patients. Twenty patients with lung cancers (including 12 of adenocarcinoma, 6 of squamous carcinoma and 2 of small cell lung cancer) underwent whole volume perfusion CT and single source DE-CT with 320-row CT in one examination(30S perfusion then DE-CT). The dual-input maximum slope CT perfusion (DI-CT) analysis was employed. Then, the single source DE-CT was applied, and iodine uptake were estimated by the difference (λ) and the slope (λHU) between the CT numbers of net enhancement in 40KeV and 70KeV monochromatic images. For the perfusion CT, the pulmonary trunk and the ascending aorta were selected as the input arteries for the pulmonary circulation and the aortic circulation respectively. Pulmonary flow (PF), aortic flow (AF), and a perfusion index (PI, =PF/ (PF + AF) were calculated using the maximum slope method. The DI-CT and DE-CT parameters were analyzed by Pearson/Spearman correlation analysis, respectively.

RESULTS

There are significant correlations between λ, λHU and AF, PF. Correlation coefficient between λ and AF, PF are 0.615 (P <0.01) and 0.526 (P<0.05), respectively. Correlation coefficient between λHU and AF, PF are 0.575 (P <0.01) and 0.538 (P<0.05), respectively. There is a positive correlation between the DI-CT and DE-CT parameters.

CONCLUSION

Both the single source DE-CT and dual-input CT perfusion analysis method can be used to estimate lung cancer perfusion. This study demonstrates that the iodine uptake of lung cancer estimated from DE-CT is significant correlated with the pulmonary flow and aortic flow supplying the tumors.

CLINICAL RELEVANCE/APPLICATION

The iodine uptake of lung cancer estimated from single source DE-CT may assess tumor perfusion in consistent with the whole volume perfusion CT. It has potential value to reflect tumor pathophysiology and treatment response.

SSG03-04   Effect of Energy Level on Texture Analysis in Simultaneously Acquired Dual-Energy Chest CT

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S404CD

Participants
James Sorensen, MBBCh, Houston, TX (*Presenter*) Nothing to Disclose
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Unnati Shah, BDS,MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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Myrna C. Godoy, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Cihan Duran, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To characterize the effect of dual-energy CT (DECT) energy levels on some commonly used texture analysis features, and on the ability of these features to differentiate between tissue types.

METHOD AND MATERIALS

18 consecutive patients underwent chest DECT for investigation of lung nodules. All images were acquired on Siemens Somatom Definition Flash scanners. Various image acquisition and post processed data sets were evaluated, including 70keV monochromatic, 100 and 140 kVp, and a mixed 100/140 kVp (0.6 weighting factor). In each patient, a series of cylindrical ROIs were drawn in 5 different healthy tissues (bone, muscle, lung, fat, and liver), as well as an ROI delineating the lung lesion under investigation. Histogram, GreyLevel Cooccurence Matrix, and RunLength Matrix -based texture features were then calculated in each ROI from each CT image set.The diagnostic accuracy of the features acquired from each reconstruction was then tested by using them in a machine-learning classifier to identify the tissue type present in each ROI. The diagnostic accuracy of the predictions derived from each reconstruction was then noted.

RESULTS

All textural features were found to vary considerably with the CT energy level.In nearly all tissues, and for all feature classes, the change in feature values with different image data sets followed a simple linear regression, with r^2 values typically > 0.9. The exceptions to this were fat, which had a slightly weaker positive relation for most features, and skeletal muscle, in which feature values of all classes were found to change unpredictably with energy. In general, GLCM features were the most predictable in response to changes in kilovoltage (with r^2 usually >0.95), while RLM were the least (r^2>0.8).The ability of this group of features to identify tissue types varied only slightly across the evaluated CT datasets, ranging from 77%% with mixed 100/140kVp, to 84% at 100kVp.

CONCLUSION

Textural features were accurately able to differentiate between tissue types on DECT, and this accuracy was independent of energy level. All textural features showed variation according to the energy level used, and for most tissue types this followed a simple linear relation.

CLINICAL RELEVANCE/APPLICATION

By using a simple correction factor, textural feature values in most tissues can be directly compared between CT scans acquired with different energy levels and reconstruction datasets.

SSG03-05 Lesion Differentiation with Material Decomposition Images Acquired from Dual Energy CT of the Chest

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S404CD

Participants
Alexi Otrakji, MD, Boston, MA (*Presenter*) Nothing to Disclose
Azadeh Tabari, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess imaging characteristics of pulmonary abnormalities seen on material decomposition images of dual energy CT of the chest.

METHOD AND MATERIALS

In an IRB approved retrospective study, 83 patients (mean age:61±14 years, M:F 45:38, mean weight 77±18 kg) underwent dual-energy chest CT on dual source multidetector CT (Siemens Definition Flash) or a single source 64-row multidetector CT (GE 750HD Discovery). Virtual monochromatic (60 keV) images were reviewed for presence of pulmonary embolism, as well as presence, shape, size, location, and attenuation characteristics of pulmonary abnormalities. Pulmonary blood volume (PBV) images were assessed for presence and size of blood volume abnormalities in the area of pulmonary abnormalities seen on other images. Data were analyzed using Wilcoxon Signed Rank test.

RESULTS

In pulmonary embolism with infarction, the size of decreased perfusion on PBV images was greater or equal to the size of pulmonary opacities on 60 keV images (size mismatch between attenuation and decomposition images in 10/83 patients). Decreased PBV ("perfusion defect") was also seen in 6/83 patients with non-occlusive pulmonary embolism without definite pulmonary infarction. The "stripe sign" described in perfusion nuclear scans was negative in all patients with infarctions and perfusion defects. In patients with atelectasis, pneumonia or emphysema the size of perfusion abnormalities on PBV was smaller or equal to the size of pulmonary opacity or lucency seen on 60 keV images (no size mismatch). Areas of heterogeneously increased perfusion on PBV with associated "Swiss cheese" appearance was seen in 17/83 patients with pneumonia. PBV abnormality in 34/83 patients with atelectasis is characterized by homogeneously increased perfusion on PBV. Perfusion abnormality in 15/83 patients with lucent lesions (emphysema, air trapping, cysts) is characterized by homogeneous hypo-perfusion on PBV images.

CONCLUSION

Size matching of area of abnormalities seen on attenuation and on PBV images help differentiate pulmonary opacities from pulmonary infarcts, pneumonia and atelectasis. Lessons from nuclear medicine (V:Q) can help the chest radiologists interpret DECT.

CLINICAL RELEVANCE/APPLICATION

Simultaneous interpretation of virtual monochromatic and PBV images can increase the diagnostic confidence of differentiating between the lung lesions.

SSG03-06 Reproducibility and Consistency of Dual Energy Computed Tomography (DECT) Pulmonary Blood Volume (PBV) Measurements in Repeated Examinations

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S404CD

Participants
Sam Dumonteil, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose
Jaymin H. Patel, MBBS, BSC, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Charlie Sayer, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Research Consultant, Siemens AG Research Consultant, General Electric Company

PURPOSE

To evaluate the reproducibility of DECT in the measurement of PBV in patients with and without pulmonary embolism (PE).

METHOD AND MATERIALS

133 patients were identified from a 3yr retrospective review of all patients undergoing more than one DECT for suspected PE

133 patients were identified from a 3yr retrospective review of all patients undergoing more than one DECT for suspected PE (100/Sn140kVp, refmAs 150/128, 100 mls 5ml/s iohexol 300mgI/ml, Definition FLASH, Siemens). Excluding patients with known pulmonary hypertension or technical failures 61 patients (mean age 62, 27 male) had a pair of normal examinations (N-N). 47 patients (mean age 60, 18 male) had one normal and one PE positive examination (N-PE). Mean interval was 6.5 months.On a both lung, individual lung or 6 standardized volumetric region basis automated PBV measurements (SyngoVia) were compared from the first to the second study by paired t-test. N-N paired PBV measurements were tested for reproducibility using Intraclass Correlation (ICC) before and after correction for central pulmonary arterial enhancement. The variance of the standard 6 regions was compared by paired t-test across time in both groups.

RESULTS

For N-N pairs all regional PBV measures showed no significant difference between the two scans: Both Lungs (25 v 26), Right Lung (25 v 25), Left Lung (25 v 26), 6 Regions (22 v 22, 26 v 26, 28 v 28, 24 v 23, 26 v 27, 27 v 28), all p>0.05.ICC concordance in all regions was moderate to substantial (Mean 0.66, 0.57-0.73) improving further when corrected for central pulmonary enhancement (Mean 0.75, 0.65-0.82).For the N-PE pairs all regional PBV measures showed significant reduction on the PE positive study: Both Lungs (31 v 25), Right Lung (31 v 25), Left Lung (31 v 27), 6 Regions (28 v 21, 31 v 25, 33 v 28, 28 v 23, 32 v 27, 34 v 29), all p<0.01.In the N-PE group the PE positive study demonstrated significantly increased variance of the 6 standard region PBVs compared to the normal study (554 v 1062, p=0.04), whereas comparable variance comparison in the N-N pairs was not statistically different.

CONCLUSION

In patients undergoing repeated DECT, PBV measures are reproducible with a high degree of concordance within individual patients when normal, but with significant reduction and variability in all lung regions when PE is present.

CLINICAL RELEVANCE/APPLICATION

The reproducibility of DECT PBV measures in normality and their predictable absolute value reduction and increased variance in PE raises the possibility of using such measures to assess treatment response.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

SSG03-07   Iodine-density Analysis Using Enhanced ssDECT Imaging in Differentiating Benign and Malignant Serous Cavity Effusion

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S404CD

Participants
Ye Ju, Dalian, China (*Presenter*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Yijun Liu, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Shifeng Tian, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Lingxin Kong, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the value of quantitatively iodine concentration measurement of enhanced ssDECT imaging in the differential diagnosis of malignant and benign serous cavity effusion.

METHOD AND MATERIALS

Approval for this retrospective HIPAA -compliant study was obtained from the institutional review board, and informed consent was waived. From August 2012 to February 2015, totally 51 patients, including 17 cases of benign serous effusion and 34 cases of malignant serous effusion proven by histopathological diagnosis or laboratorial examination, underwent plain and three-phase enhanced ssDECT imaging through fast kVp-switching technique. The iodine-based material density images were reconstructed. The iodine concentration (M-IE) in the effusion was measured at plain and three-phase enhanced iodine-based material density images, and the iodine concentration (M-IA) in the artery was also measured. The normalized iodine concentration (NIC= M-IE /M-IA) was calculated. The difference of normalized iodine concentration (D-I) was also calculated. The difference of these parameters was evaluated statistically by Mann-Whitney Test.

RESULTS

1)The NIC of benign group in the three-phase enhanced images all lower than those of malignant group (26.13 vs. 36.76, 25.87 vs. 36.90, 23.87 vs. 38.00, respectively) with statistical difference(P=0.03, P=0.02, P=0.00).2)D-I between arterial phase and plain scan of benign group (21.96) was lower than that of malignant group(39.05) with statistical difference(P=0.00). The D-I between venous phase and plain scan of benign group (20.91) was also lower than that of malignant group (39.62) with statistical difference (P=0.00). The D-I between delayed phase and plain scan of benign group (19.48) was also lower than that of malignant group (40.40) with statistical difference(p=0.00).

CONCLUSION

The malignant and benign effusion shows different NIC and D-I in the iodine-density images of enhanced ssDECT imaging.

CLINICAL RELEVANCE/APPLICATION

The iodine-density images of enhanced ssDECT scanning provides a sensitive approach for identifying benign and malignant serous cavity effusion.

SSG03-08   Xenon Ventilation CTs Using Dual-Energy CT and Subtraction CT Methods versus Krypton Ventilation

SPECT/CT: Capability for Regional Ventilation and Pulmonary Functional Loss Assessments in Smokers

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S404CD

Participants
Daisuke Takenaka, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
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Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To compare the capability for regional ventilation and pulmonary functional loss assessments among xenon ventilation CT (Xe-CT) obtained by dual-energy CT (DECT) and subtraction CT (Sub-CT) methods, and krypton ventilation SPECT/CT in smokers.

METHOD AND MATERIALS

Eleven consecutive smokers (7 male and 4 female, mean age: 69 years) prospectively underwent low-dose unenhanced and xenon-enhanced CT as well as xenon-CT by DECT at 320-detector row CT. In addition, all smokers were also performed SPECT/ CT and pulmonary function test. In each smoker, unenhanced and xenon-enhanced CT data were subtracted by commercially available software to generate Xe-CT as Sub-CT method. To evaluate the capability of regional ventilation difference on each method, regional ventilation was assessed by consensus of board certified chest radiologists according to previously reported 3-point scoring system on a per segment basis. To determine the functional lung volume on each method, functional lung volume in each subject was calculated based on visual scores according to past literatures. To evaluate qualitative capability for regional ventilation assessment, the inter-method agreements were determined by kappa statistics. To determine quantitative capability for regional ventilation and pulmonary functional loss assessments among three methods, functional lung volume was correlated each other by Pearson's correlation. Finally, functional lung volume on each method was also correlated with FEV1%.

RESULTS

Inter-method agreements were as follows: DECT vs. Sub-CT, $\kappa=0.90$, DECT vs. SPECT/CT, $\kappa=0.82$, Sub-CT vs. SPECT/CT, $\kappa=0.79$. On correlation of functional lung volume among three methods, there were excellent correlations among three methods (DECT vs. Sub-CT: r=0.99, p<0.0001; DECT vs. SPECT/CT: r=0.96, p<0.0001; Sub-CT vs. SPECT/CT; r=0.96, p<0.0001). In addition, FEV1% had excellent correlations with all methods (DECT: r=0.93, p<0.0001; Sub-CT: r=0.93, p<0.0001; SPECT/CT; r=0.88, p<0.0001).

CONCLUSION

Xenon CT can be obtained by DECT and subtraction CT methods, and have similar potentials to evaluate regional ventilation and pulmonary functional loss as well as krypton ventilation SPECT/CT.

CLINICAL RELEVANCE/APPLICATION

Xenon CT can be obtained by DECT and subtraction CT methods, and have similar potentials to evaluate regional ventilation and pulmonary functional loss as well as krypton ventilation SPECT/CT.

SSG03-09   Dual-Point Contrast-Enhanced Dual-Energy CT vs. FDG-PET/CT: Capability for Distinguishing Malignant from Benign Pulmonary Nodules

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S404CD

Participants
Sachiko Miura, MD, Kashihara, Japan (*Presenter*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Takeshi Kawaguchi, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Tojo, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Kimihiko Kichikawa, MD, Kashihara, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To directly and prospectively compare the capability of dual-point contrast-enhanced (CE-) dual-energy CT (DECT) for distinguishing malignant from benign pulmonary nodules as compared with FDG-PET/CT.

METHOD AND MATERIALS

Fifteen consecutive patients who had 19 lung nodules totally (10 men, 5 women, mean age: 70.5 years) underwent dual-point CE-DECT and FDG-PET/CT, and pathological and/or follow-up examinations. According to the pathological and follow-up examinations, all nodules were divided into two groups as follows: malignant (n=15) and benign (n=4) nodules. From dual-point CE-DECT data obtained at 80 and 140kV, we generated virtual non-contrast (VNC) images and iodine maps at early and late phases. To determine the capability of dual-point CE-DECT for nodule evaluation in each patient, ROIs were placed over all nodules for measuring values on all generated images at the two phases and difference of values between early and late phases on VNC image (ΔVNC). On FDG-PET/CT in all patients, SUVmax was also assessed by ROI measurement placed over each nodule. To evaluate differences of all CE-

DECT indices and SUVmax between malignant and benign nodule groups, Student's t-test was performed. For distinguishing malignant from benign nodules, ROC-based positive test was performed to determine feasible threshold values of the indices as having significant differences between the two groups. Finally, sensitivity (SE), specificity (SP) and accuracy (AC) were compared each other by means of McNemar's test.

RESULTS

On comparison between the two groups, there were significant differences between malignant and benign groups on ΔVNC (malignant vs. benign: 0.67±4.2HU vs. 10.8±7.6HU, p=0.002) and SUVmax (malignant vs. benign: 6.7±4.6 vs. 1.5±0.58, p=0.0007). When applied feasible threshold values, diagnostic performance of ΔVNC (SE: 100 [15/15] %, SP: 50 [2/4] %, AC: 89.5 [17/19] %) was slightly better than that of SUVmax (SE: 86.7 [13/15] %, SP: 50 [2/4] %, AC: 78.9 [15/19] %), although there were no significant differences (p>0.05).

CONCLUSION

Dual-point CE-DECT is considered at least as valuable as FDG-PET/CT for distinguishing malignant from benign nodules.

CLINICAL RELEVANCE/APPLICATION

When applied dual-point CE-DECT technique, CE-DECT is considered at least as valuable as FDG-PET/CT for distinguishing malignant from benign nodules in routine clinical practice.

Gastrointestinal (Liver Masses)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: E350

GI **CT** **MR** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Ernst J. Rummeny, MD, Munich, Germany (*Moderator*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSG04-01   Predictive Value of MRI Combined with MR Cholangiography in the Preoperative Assessment of Perihilar Cholangiocarcinoma

Tuesday, Dec. 1 10:30AM - 10:40AM Location: E350

Participants
Claudio Sallemi, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Francesca Ratti, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Aldrighetti, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of contrast enhanced MR images with MR cholangiography (MRC) in the preoperative evaluation of perihilar cholangiocarcinoma.

METHOD AND MATERIALS

twenty-five patients that underwent MRI/MRC and surgical treatment were included. Two radiologists evaluated the biliary MR images, including 3D-MRC and gadolinium-enhanced dynamic images, regarding the tumor resectability (including longitudinal tumor extent, vascular involvement of the bile duct cancer, and lymph node metastasis) and the surgical radicality, intended as tumor-free\tumor-involved margins (R0\R1) of biliary ducts and portal vein. The results of preoperative and retrospective (blinded) assessment of diagnostic data were compared with the surgical and pathology findings used as the reference standards.

RESULTS

The prospective assessment of the resection to be performed was correct in 80% of cases. For determining the assessment of tumor margins (R0\R1) of biliary ducts and portal vein, the overall accuracy was, respectively, 84% and 88% for each reviewer. The area under the receiver operating characteristic curve (Az) of the 2 reviewers for evaluation of tumor margins (R0\R1) was 0.83 and 0.78 for biliary ducts, and 0.68 and 0.97 for portal vein. In the assessment of lymph node metastasis, the overall accuracy was 0.75 for each reviewer.

CONCLUSION

MR imaging combined with MRC showed excellent diagnostic capability for assessing the tumor resectability of bile duct cancer, although it generally underestimated the tumor involvement of lymph nodes, and predicted with good diagnostic accuracy surgical radicality.

CLINICAL RELEVANCE/APPLICATION

MRI combined with MRC can predict in advance R0\R1 resection in perihilar cholangiocarcinoma . In case of R1, it can lead to a focused neo adjuvant therapy or change of the treatment strategy.

SSG04-02   Correlation between Standardized Uptake Value and Apparent Diffusion Coefficient in Focal FDG-PET Positive Hepatic Metastasis

Tuesday, Dec. 1 10:40AM - 10:50AM Location: E350

Participants
Vaseemali J. Mulla, MBBS, DMRD, Gokak, India (*Presenter*) Nothing to Disclose
Vishal Agrawal, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Kapil K. Shirodkar, DMRD, MBBS, Mapusa, India (*Abstract Co-Author*) Nothing to Disclose
Govindarajan J. Mallarajapatna, MBBS, MD, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Aruna R. Patil, MD, FRCR, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

1)To evaluate a potential correlation of the maximum standard uptake value (SUVmax) and the minimum apparent diffusion coefficient (ADCmin) in FDG-PET positive hepatic metastasis2) To study the role of Diffusion Weighted MR Imaging in patients with FDG-PET positive hepatic metastasis

METHOD AND MATERIALS

Twenty patients with a known and histopathologically proven extrahepatic primary lesion, who were referred for FDG PET and found

to have FDG avid hepatic lesion were enrolled. Regions of interest were drawn on the PET images and SUV mean was calculated. Patients with a SUVmean more than 4 were further imaged with MRI within 30-60 min of acquisition of PET images. Diffusion-weighted imaging was performed with free breathing and with b values of 0, 500, and 800. ADC map was generated using the above raw diffusion data. Regions of interest were manually drawn along the contours of neoplastic lesions, which were identified on PET and diffusion-weighted images. Maximum SUV (SUVmax) and mean SUV (SUVmean) were recorded from PET-CT fusion images using fusion viewer (Philips medical systems).Minimum ADC (ADCmin), and mean (ADCmean) were recorded on MRI workstation for each FDG-avid lesion. Pearson correlation coefficient was used to assess the following relations: SUVmax versus ADCmin and SUVmean versus ADCmean. A total of 33 lesions were studied.

RESULTS

Thirty three lesions were evaluated in a total of 20 patients. The mean SUVmax was 13.5 with standard deviation of 5.1; SUVmean, 8.3 with standard deviation of 3.1; mean ADCmin, 491 with standard deviation of 235; and mean ADCmean, 809 with standard deviation of 263. Pearson correlation coefficient of 0.026 was found between SUVmean and ADCmean. Pearson correlation coefficient of 0.002 was found between SUVmax and ADCmin.

CONCLUSION

There was no correlation between SUVmax and ADCmin or SUVmean and ADCmean. Focal hepatic lesions visualized on PET/CT were visualized clearly with a high contrast in the background of reduced signal from normal liver on b 0,500 and 800 maps of DWI

CLINICAL RELEVANCE/APPLICATION

Liver metastases are the most frequently encountered malignant liver lesions. DWI is a non-contrast technique that is easy to perform, fast, has the potential to provide tissue characterization, and gives qualitative and quantitative information that can be helpful for tumor assessment. DWI gives visually comparable imaging which can be approximated to PET CT

SSG04-03   Improving Detection of Vascular Structure and Intratumoral Hemorrhage in Primary Hepatic Carcinoma with a Multi-breath-hold Susceptibility-weighted Imaging Technique

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E350

Participants
Ling Zhang, MD, Nanning, China (*Presenter*) Nothing to Disclose
Zhongkui Huang, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Yongming Dai, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Wenmei Li, Nanning, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose is to evaluate the role of abdominal susceptibility-weighted imaging (SWI) in the detection of vascular structure and intratumoral hemorrhage of primary hepatic carcinoma.

METHOD AND MATERIALS

Nineteen patients with pathologically identified primary hepatic carcinoma were imaged at 3T (MAGNETOM Verio, A Tim System, Siemens, Germany) using a standard body matrix-coil. Imaging included precontrast transverse T1-weighted GRE (fiip angle 70°,TR/TE 140/2.46 msec), transverse T2-weighted fat-suppressed 2D turbo-spin-echo (TSE, fiip angle 122°, TR/TE 3700/84 msec, ETL 9) and transverse abdominal 2D SWI (fiip 20°, TR/TE 150/2.5 msec). For all sequences, the following parameters were used: field of view (FOV) 380×285 mm2; matrix 320-384×250, slice thickness 5 mm with a gap of 1 mm. Two to three 15-20 second breath-hold acquisitions were acquired to cover the liver. Two radiologists prospectively analyzed all magnetic resonance imaging (MRI) studies. Vascular structure and hemorrhage detected by each imaging technique were evaluated for comparison.

RESULTS

Nineteen lesions were found in nineteen patients. 2D SWI showed the evidence of hemorrhage in 12 of all 19 cases. SWI displayed vasculature of tumors in 11 cases. Only 5 cases found vasculature in conventional sequences. On 2D SWI, the hemorrhage or vasculature in the lesions manifested dot-like, streak, circular areas with hypointensity signal. In the evaluation of blood products, SWI is superior to the conventional T1WI and T2WI for visualizing the intra vascular structure and hemorrhage (X2= 4.17, P < 0.05). There was close correlation between pathological results and SWI in depicting internal architecture of lesions.

CONCLUSION

SWI surpassed conventional MRI sequences in discovering vascular structure in tumor and intratumoral hemorrhage. SWI offers a new way to show the internal structures of primary hepatic carcinoma. It is more useful than conventional MRI in showing blood products and details of tumor related veins.

CLINICAL RELEVANCE/APPLICATION

SWI offers a new way to show the internal structures of primary hepatic carcinoma. It is more useful than conventional MRI in showing blood products and details of tumor related veins.

SSG04-04   Subtraction Images of Gadoxetic Acid-enhanced MR: The Impact on Image Interpretation of Focal Hepatic Lesions in Patients at Risk for HCC

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E350

Participants
Sang Hyun Choi, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of subtraction images of gadoxetic acid-enhance on image interpretation of hepatic lesions in patients at risk for hepatocellular carcinomas (HCC)

METHOD AND MATERIALS

We retrospectively identified 228 patients (181 men, 47 women; mean age, 55.2 years) with chronic viral hepatitis or liver cirrhosis who underwent gadoxetic acid-enhanced liver MR for the evaluation of focal hepatic lesions and then hepatic resection. The patients were confirmed to have 243 focal hepatic lesions including 227 HCCs, and 16 cholangiocarcinomas. We compared the detection rate of arterial hypervascularity on subtraction images and that on visual assessment of arterial phase images. Subgroup analysis was performed according to the pathology and the size of the lesions (≤ 3 cm vs. > 3 cm). We assessed the impact of subtraction images in diagnosing HCC according to the American Association for the Study of Liver Diseases (AASLD) guidelines in comparison with that of visual assessment.

RESULTS

Subtraction images (92.6%, 225/243) detected arterial hypervascularity of all the focal hepatic lesions more sensitively than visual assessment (85.6%, 208/243; P = .001). On the subgroup analysis according to the pathology, the same trend was also observed in HCC (96.0% vs. 90.3%, P = .011), and in cholangiocarcinomas (43.8% vs. 18.8%, P = .125). In the 113 lesions ≤ 3 cm, subtraction images (91.2%, 103/113) depicted arterial hypervascularity significantly better than visual assessment (81.4%, 92/113; P = .013), while they did not significantly differ in detecting arterial hypervascularity in the 130 large lesions (> 3 cm, P = .109). When we included arterial hypervascularity detected on subtraction images, it increased the sensitivity from 86.3% to 92.5% in diagnosing HCCs with the increased false positive rate from 0.8% to 2.5%.

CONCLUSION

Subtraction images can enhance the sensitivity of the non-invasive diagnosis of HCC by detecting arterial hypervascularity more sensitively especially in small focal hepatic lesions, with minimal increase in a false positive rate.

CLINICAL RELEVANCE/APPLICATION

Subtraction images may be considered as an option to enhance the diagnostic performance of the noninvasive diagnosis for HCC.

SSG04-05   Is Contrast-Enhanced Ultrasound Comparable to MRI with Liver-Specific Contrast Agent for Diagnosis of Focal Nodular Hyperplasia and Hepatocellular Adenoma?

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E350

Participants
Krishan Ramsaransing, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Roy S. Dwarkasing, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Francois Willemssen, MD, Hoogstraten, Belgium (*Presenter*) Nothing to Disclose
Marianne De Vries, MD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of contrast-enhanced ultrasonography (CEUS) with MRI with gadobenate dimeglumine (CEMRI) for the diagnosis of focal nodular hyperplasia (FNH) and hepatocellular adenoma (HCA) in a tertiary referral center for hepatobiliary diseases.

METHOD AND MATERIALS

One hundred-nineteen patients (111 female and 8 male, mean age 39 years) referred to a tertiary center for hepatobiliairy diseases were included. Patients had undergone standard diagnostic work-up with CEUS and CEMRI for the diagnosis of FNH or HCA. Final diagnosis was considered correct when outcome of CEUS and CEMRI were concordant. Histopathologic assessment (PA) followed in case of discrepancy between outcome of CEUS and CEMRI. CEMRI was considered as the reference method for final diagnosis when lesion biopsy for PA was considered undesirable or contra-indicated. Agreement between CEUS and CEMRI was calculated with Cohen's kappa and sensitivity, specificity, predictive values and likelihood ratios were calculated for CEUS and CEMRI.

RESULTS

Outcomes of CEUS and CEMRI were concordant in the majority of patients (n=80, 67%) (p<0.001) with an unweighted kappa of 0.34 (95% CI 0.20-0.49). In case of discrepancy between CEUS and CEMRI (n=39, 33%), PA followed in fourteen cases (12% of total), where CEMRI was correct in thirteen cases (93%) and CEUS in one case (7%) (p=0.002). In the remaining twenty-five cases (21% of total), CEMRI was considered as reference for final diagnosis. For HCA, sensitivity was 64% (95% CI 48% - 78%) with CEUS and 100% (95% CI 92% - 100 %) with CEMRI. For FNH, sensitivity was 67% (95% CI 55% - 77%) with CEUS, and 99% (95% CI 93% - 100%) with CEMRI.

CONCLUSION

In our study, agreement between CEUS and CEMRI was fair and the diagnostic performance of CEUS was inferior to CEMRI for diagnosis of FNH and HCA, especially with emphasis on PA proven cases.

CLINICAL RELEVANCE/APPLICATION

In case of discordance between CEUS and CEMRI, it may be justifiable to be prudent with liver biopsy and prefer CEMRI-outcome as final diagnosis, especially when the diagnosis on CEMRI is firm.

SSG04-06   Hypoenhancement on Delayed Phase Contrast-enhanced MRI is a More Sensitive Sign of Malignancy in Colorectal Cancer Patients with Intravascular Contrast Agent, Gadofosveset, Than with Extracellular Contrast Agent, Gadobutrol

Tuesday, Dec. 1 11:20AM - 11:30AM Location: E350

Participants

Helen Cheung, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Natalie Coburn, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Chirag Patel, MBBS, MRCP, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Paul Karanicolas, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Consultant, Bayer AG
Laurent Milot, MD, MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Calvin Law, MD, FRCPC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hypoenhancement on delayed phase contrast-enhanced MRI using extracellular contrast agents, such as gadobutrol, is often used as a sign to diagnose colorectal liver metastases. Some studies have suggested that MRI with intravascular contrast agent, gadofosveset, may be useful in diagnosing focal liver lesions. The goal of this study is to determine the diagnostic accuracy of this sign using gadofosveset versus gadobutrol.

METHOD AND MATERIALS

This is an interim analysis on an institutional REB-approved, prospective study. Patients with known colorectal cancer referred for a clinical gadobutrol-enhanced MRI at our institution met inclusion criteria for our study. Patients with known contraindication to MRI or MR contrast agents were excluded. Patients received both gadobutrol- and gadofosveset-enhanced liver MRI's, performed within 4 weeks of each other. Lesion-liver contrast-to-noise ratios (CNR) of all solid focal liver lesions (cysts were excluded) were measured on 10-minute delayed phase imaging for both contrast agents. Lesions with CNR<0 were considered hypoenhancing and lesions with CNR≥0 were considered hyperenhancing. We calculated the sensitivity, specificity, and likelihood ratio's of the ability of hypoenhancement to predict malignancy. Weighting was performed to account for the effects of clustering. The generalized estimating equation (GEE) was used to determine the effect of the contrast agent on the ability of the sign to predict malignancy.

RESULTS

There were a total of 265 lesions from 14 patients. The weighted sensitivity and specificity of gadofosveset was 89.2% (SD: 25.0%) and 81.3% (SD: 37.2%) respectively, which corresponds to positive and negative likelihood ratio's of 4.76 and 0.13, respectively. The weighted sensitivity and specificity of gadobutrol 41.6% (SD: 40.9%) and 98.1% (5.6%), which corresponds to positive and negative likelihood ratios of 22.5 and 0.59. In the GEE model, hypoenhancement on delayed phase significantly predicted malignancy (p=0.005) as did the interaction of hypoenhancement and contrast agent (p=0.006).

CONCLUSION

Hypoenhancement on delayed phase contrast-enhanced MRI with gadofosveset is a more sensitive sign of malignancy in colorectal cancer patients than with gadobutrol.

CLINICAL RELEVANCE/APPLICATION

Delayed phase gadofosveset-enhanced MRI may be a helpful problem-solving tool for excluding malignancy in colorectal cancer patients.

SSG04-07   Accuracy of the Extended Washout of Gadoxetic-Acid for Distinguishing Hypervascular Hepatic Metastases from Hemangiomas on MRI

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E350

Participants
Sheela Agarwal, MD, MS, Boston, MA (*Presenter*) Subsequent to the conduct of this research, speaker has become an employee of Bayer HC.
Cinthia Cruz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Grajo, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sanjay Saini, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Peter F. Hahn, MD, PhD, Belmont, MA (*Abstract Co-Author*) Stockholder, Abbott Laboratories Stockholder, Medtronic, Inc Stockholder, CVS Caremark Corporation Stockholder, Kimberly-Clark Corporation Stockholder, Landauer, Inc

PURPOSE

The extended washout sign, slow de-enhancement of liver lesions in early hepatobiliary phase, has been proposed to help distinguish hemangiomas from conventional metastases. The intent of this study was to test this sign for hypervascular metastases.

METHOD AND MATERIALS

This IRB approved retrospective study performed quantitative and qualitative image analysis of 24 patients with proven neuroendocrine liver metastases, together with data on 45 hemangioma patients and 39 with hypovascular metastases already reported. Gadoxetic-acid MR imaging was obtained during arterial and portal-venous phase, and delays of 3, 8, and 20 minutes. During each phase, signal intensities were measured for the lesion, liver, and aorta, and were normalized by paraspinal musculature. Quantitatively, extended washout was defined as a 10% change in signal intensity from 8 to 20 minutes. Statistical analysis was performed using paired Student's t-test. Qualitative analysis was performed by one reader, who assessed the appearance of all lesions on T2-weighted images alone, dynamic images alone, and combined early (8 min) and late (20 min) hepatobiliary phases. Extended washout was defined as a perceptible change in signal from 8 to 20 minutes.

RESULTS

On quantitative analysis, 84% (n=38) of hemangiomas demonstrated a positive extended washout sign while only 8% (n=2) of hypervascular metastases, and 4% (n=7) of hypovascular metastases did. Hemangiomas demonstrated a mean change in signal intensity of 18.4% as compared to 5.5% for hypervascular metastases (p<0.05). Qualitatively, 78% of hemangiomas demonstrated a perceptible change is signal from 8 to 20 minutes, but only 4.1% of metastases did. 67% of hemangiomas demonstrated peripheral nodular enhancement during dynamic phases and 87% demonstrated classic T2 hyperintensity. Arterial enhancement of the metastases was appreciated with gadoxeticacid in 83% of the cases. When extended washout was used in combination with T2 hyperintensity, specificity increased to 98%, with a sensitivity of 96%.

CONCLUSION

The extended washout sign on gadoxetic acid-enhanced MRI can be applied to hypervascular as well as to non-hypervascular liver metastases to help in distinguishing them from hemangiomas.

CLINICAL RELEVANCE/APPLICATION

Extended washout sign, particularly when used in conjunction with T2 signal intensity, can be used to increase accuracy of differentiating hemangiomas from metastases on gadoxetate-enhanced MRI.

SSG04-09 Fully Integrated PET/MRI for the Colorectal Cancer Liver Metastases: Diagnostic Performance and Prognostic Value

Tuesday, Dec. 1 11:50AM - 12:00PM Location: E350

Participants
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Guerbet SA; Support, Siemens AG; Support, Koninklijke Philips NV ; Grant, Bayer AG; Consultant, Bayer AG; Grant, General Electric Company; Support General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Dong-Seo Medical Industrial Col, Ltd
Ijin Joo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo Yun Hur, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance and prognostic value of fully integrated PET/MRI in patients with colorectal cancer liver metastases (CRLMs)

METHOD AND MATERIALS

between January 2013 and June 2014, 55 patients with 98 CRLMs who underwent fully integrated PET/MRI and MDCT were included in this study. Among these CRLMs, 66 CRLMs in 34 patients were diagnosed by histopathology after hepatic resection, and 32 CRMLs in 21 patients were diagnosed by follow-up imaging. Among the 34 patients who underwent hepatic resection for CRLMs, 17 patients received neoadjuvant chemotherapy (NAC) and then followed by surgery. Two board-certificated radiologists independently and randomly assessed both MDCT and fully integrated PET/MRI for detection of CRLMs. In order to compare the diagnostic performance of PET/MRI for detecting CRLMs to MDCT, jackknife alternative free-response receiver-operating characteristic (JAFROC) and generalized estimating equations (GEE) were used. For the evaluation of prognostic value of PET, we analyzed recurrence-free survival in17 patients who underwent NAC and followed by hepatic resection for CRLMs.

RESULTS

reader average figure-of-merit of PET/MRI was significantly higher than that of MDCT for detecting CRLMs (0.842 for MDCT vs. 0.932 for PET/MRI, P=0.004). Sensitivity per tumor as well as per patients of PET/MRI was also significantly higher than those of MDCT in both two readers. Especially, PET/MRI showed significantly higher sensitivities for CRLMs ≤1cm and CRLMs treated by NAC in both tow readers. According to the PET imaging findings of PET/MRI, six of 17 patients who underwent NAC were classified as having iso-metabolic CRLMs on PET, while 11 patients as having hyper-metabolic CRLMs. 1-year recurrence-free survival rate was 80.0% in 6 patients with iso-metabolic CRLMs, compared to 15.2% in 11 patients with hyper-metabolic CRLMs: this difference was statistically significant (P=0.034).

CONCLUSION

fully integrated PET/MRI can provide significantly higher diagnostic performance for detecting CRLMs compared to MDCT, especially for small CRLMs and CRLMs treated by NAC. PET imaging findings of PET/MRI after NAC was a significant affecting factor for recurrence-free survival after hepatic resection.

CLINICAL RELEVANCE/APPLICATION

fully integrated PET/MRI can be helpful for patients with CRLMs.

ISP: Genitourinary (Imaging Gynecological Malignancy)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: N229

| GU | MR | OI | BQ |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Susanna I. Lee, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Moderator*) Nothing to Disclose

Sub-Events

SSG06-01   Genitourinary Keynote Speaker: Gynecologic Cancer Imaging-Present and Future

Tuesday, Dec. 1 10:30AM - 10:40AM Location: N229

Participants
Susanna I. Lee, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

ABSTRACT

The past decade has seen the development of MRI and FDG PET-CT, both of which now play central and complementary roles in treatment planning and followup of women with uterine, ovarian and vulvar cancer. Ongoing investigations of novel techniques such as diffusion and perfusion imaging, and of PET tracers capable of targeting hypoxia and hormone receptors, will push cancer radiology firmly into the realm of the molecular, quantitative and predictive in the coming decade. PET-MRI, capable of concurrent multi-modality functional imaging, will likely prove to be a mainstay in personalized gynecologic cancer care.

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Susanna I. Lee, MD, PhD - 2013 Honored Educator

SSG06-02   High Grade Serous Ovarian Cancer: BRCA Mutation Status and CT Imaging Phenotypes

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N229

Participants
Stephanie Nougaret, MD, New York, NY (*Presenter*) Nothing to Disclose
Yuliya Lakhman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maura Micco, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Melvin D'Anastasi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sarah A. Johnson, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Krishna Juluru, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Noah Kauff, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the associations between BRCA mutation status and preoperative CT imaging phenotypes in women with high-grade serous ovarian cancer (HGSOC).

METHOD AND MATERIALS

115 patients with HGSOC (76 BRCA mutation-positive and 39 BRCA mutation-negative) and CT scans prior to the primary cytoreductive surgery were included in this retrospective HIPAA-compliant study. Two radiologists (R1 and R2) independently reviewed all CT scans and R1 determined total measurable peritoneal tumor volume (TPTV) for each patient. Associations between BRCA mutation status, CT imaging features, and TPTV were analyzed using Fisher exact test and Mann Whitney test. Inter-reader agreement was assessed with the Cohen's kappa. Kaplan-Meier and Cox proportional hazards regression survival analyses were performed.

RESULTS

BRCA mutation-positive HGSOC had less frequent peritoneal disease, mesenteric infiltration, and lymphadenopathy at CT (p = 0.0002, < 0.0001-0.03, 0.03 for both readers, respectively). Furthermore, the pattern of peritoneal implants was correlated with the BRCA mutation status: nodular pattern was more common in BRCA-associated tumors whereas infiltrative pattern was more frequent in sporadic tumors (p = 0.0009 and p = 0.0005 for R1 and R2, respectively). BRCA mutation-positive HGSOC had higher mean TPTV (125 cm3 ± 171) than sporadic tumors (56 cm3 ± 95) (p<0.001). Irrespective of BRCA mutation status, mesenteric involvement by tumor was associated with shorter progression-free survival (p <0.0001 for both readers) and overall survival (p<0.0002 and p<0.0001 for R1 and R2, respectively).

CONCLUSION

BRCA mutation status in HGSOC was linked to the distinct CT imaging phenotypes. Mesenteric disease at CT was an independent

predictor of reduced survival in both BRCA mutation-positive and sporadic tumors.

CLINICAL RELEVANCE/APPLICATION

BRCA-associated HGSOC have characteristic prognostically significant morphology on CT.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Stephanie Nougaret, MD - 2013 Honored Educator
Evis Sala, MD, PhD - 2013 Honored Educator

SSG06-03   Advanced Cervical Cancer: Quantitative Assessment of Early Response to Neoadjuvant Chemotherapy with Intravoxel Incoherent Motion Diffusion-weighted Magnetic Resonance Imaging

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N229

Participants
Yanchun Wang, Wuhan, China (*Presenter*) Nothing to Disclose
Dao Y. Hu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the utility of intravoxel incoherent motion (IVIM) diffusion-weighted magnetic resonance imaging (MRI) for predicting and monitoring the response of cervical cancer to neoadjuvant chemotherapy (NACT).

METHOD AND MATERIALS

This prospective study was approved by an institutional review board, and informed consent was obtained from all patients. A total of 42 patients with primary cervical cancer were recruited into this study. IVIM diffusion-weighted MRI was performed on all patients at three time points (prior to NACT, 3 weeks after the first NACT, and 3 weeks after the second NACT).The response to treatment was determined according to the Responded Evaluation Criteria in Solid Tumors (RECIST) three weeks after the second NACT treatment, and the subjects were categorized into responders and non-responders. The standard ADC, true diffusion coefficient (D), perfusion-related pseudo-diffusion coefficient (D*), and perfusion fraction (f) values were determined.

RESULTS

Patients were divided into responders (n=24) and non-responders (n=18) according to the RECIST guidelines. Before treatment, the D and standard ADC values were significantly higher in responders than in non-responders (both p<0.01). No significant differences were observed in D* and f . Analysis of the receiver operating characteristic (ROC) curves indicated that the threshold of D<0.93×10-3mm2/s and the standard ADC<1.11×10-3mm2/s could be used to differentiate responders from non-responders, yielding area under curve (AUC) values of 0.804 and 0.768, respectively. Three weeks after both the first and second NACT treatments, the D and standard ADC values in the responders were still significantly higher than those in the non-responders.D* and f values still showed no significant differences.The ROC curve analysis indicated that the AUC values for D and standard ADC were 0.823 and 0.763 for the second time point and 0.787 and 0.794 for the last time point.

CONCLUSION

IVIM may be useful for predicting and monitoring the efficacy of NACT in cervical cancer. D and standard ADC values could represent reliable early predictors of the NACT response prior to treatment. Furthermore, these parameters can be used to monitor NACT responses during and after therapy.

CLINICAL RELEVANCE/APPLICATION

These results should be useful for both patients and clinical doctors. Patients who are unsuitable for NACT could be given radiation or surgical treatment in a more timely manner.

SSG06-04   Prognostic Value of Diffusion-weighted MRI and PET/CT During Concurrent Chemoradiotherapy in Uterine Cervical Cancer

Tuesday, Dec. 1 11:00AM - 11:10AM Location: N229

Participants
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prognostic value of diffusion-weighted MRI (DWI) and PET/CT during concurrent chemoradiotherapy (CCRT) of cervical cancer for predicting disease progression.

METHOD AND MATERIALS

This retrospective study included 67 consecutive patients (median age, 55 years; range, 28-78 years) who received CCRT for locally advanced cervical cancer. All patients underwent both 3T-DWI and PET/CT before and during (at 4 weeks) treatment. The mean apparent diffusion coefficient (ADC) and maximum standardized uptake value (SUVmax) were measured on the tumors and the percentage changes of each parameter between the two time points (ΔADC and ΔSUVmax) were calculated. In the prediction of disease progression, the diagnostic performance of tumor ΔADC and ΔSUVmax was evaluated using the time-dependent receiver operating characteristics (ROC) curve analysis. The relationship between disease progression and clinical and imaging parameters was investigated using univariate and multivariate Cox regression analyses.

RESULTS

During a mean follow-up of 2.7 years, disease progression was identified in 16 patients (23.9%): local recurrence (n= 7), distant metastasis (n= 8) and both local recurrence and distance metastasis (n= 1). During treatment, the mean ADC and SUVmax significantly increased and decreased, respectively (both P < 0.001). The mean ΔADC and ΔSUVmax were 42.6 ± 17% and 67.6 ± 16.5%, respectively. In the prediction of disease progression, the integrated area under the curve of ΔADC (0.791) and ΔSUVmax (0.781) were not significantly different (P = 0.88) and the optimal cut-offs of ΔADC and ΔSUVmax were 35.1% and 60.7%, respectively. On multivariate Cox regression analysis, the ΔADC (< 35.1%) and ΔSUVmax (< 60.7%) were the only independent predictors of disease progression after treatment (hazard ratio, 4.1 and 4.5; P , 0.04 and 0.03, respectively).

CONCLUSION

The percentage changes of DWI and PET/CT parameters during CCRT offer similar prognostic value for the prediction of post-treatment disease progression in patients with cervical cancer.

CLINICAL RELEVANCE/APPLICATION

DWI, as a noninvasive tool, can be used in the prediction of therapeutic outcomes following concurrent chemoradiotherapy in patients with cervical cancer, instead of PET/CT with the risk of ionizing radiation exposure.

SSG06-05 Application of Non-Gaussian Water Diffusional Kurtosis Imaging in the Assessment of Uterine Tumors: A Preliminary Study

Tuesday, Dec. 1 11:10AM - 11:20AM Location: N229

Participants
Aliou A. Dia, MD, Suita, Japan (*Presenter*) Nothing to Disclose
Masatoshi Hori, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
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Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Okuaki, RT, Chuo-Ku, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

To retrospectively evaluate the feasibility and the value of diffusional kurtosis imaging (DKI) in the assessment of uterine tumors compared with that of conventional diffusion weighted imaging (DWI) and with pathological findings as gold-standard.

METHOD AND MATERIALS

Sixty-one women (mean age: 54.85 years ±14.09, range 26-89 years) with histopathologically proven uterine cancers (51 cervical cancers and 10 corpus cancers) underwent 3-T MR imaging using DKI with high b values (b=700, 1000, 1700 and 2500 s/mm2) and DWI (b=0 s/mm2, b=700 s/mm2). Thirteen of the 61 patients (21.3 %) had coexisting leiomyomas.ROI-based measurements of diffusivity (D), kurtosis (K) and ADC of the uterine cancers, leiomyomas, healthy myometrium and endometrium were performed.The areas under the ROC curve (AUC) in differentiating malignant from benign lesions were also compared.

RESULTS

Mean D of uterine cancers (0.879 mm/s2 ± 0.30) was significantly lower than that of the leiomyomas (1.174 mm/s2±0.43) (P=0.006), the healthy myometrium (1.178 mm/s2± 0.27) (P=0.000) and the healthy endometrium (1.308 mm/s2±0.5) (P=0.013). Mean K of uterine cancers (0.754 mm/s2± 0.22) was moderately higher than that of leiomyomas (0.686 mm/s2± 0.24), the healthy myometrium (0.708 mm/s2± 0.19) and the healthy endometrium (0.568mm/s2± 0.25).No significant difference was found between the mean K of the uterine cancers, the leiomyomas, the healthy myometrium and endometrium (P=0.33, 0.27 and 0.23).There was no significant difference in AUC between D and ADC.

CONCLUSION

D is not superior or inferior to the conventional ADC in the differentiation between benign and malignant uterine lesions. The K that is related to the microstructural complexity was higher in uterine cancers than that of leiomyomas but without any significant difference, opposite to K values in white matter tissue of the brain, in breast or prostate cancers where the mean K of malignant lesions was significantly higher than of the benign lesions.

CLINICAL RELEVANCE/APPLICATION

The D, in non-Gaussian DKI, is equal to the conventional ADC in differentiating benign from malignant uterine lesions. The K of uterine malignant tumors was not significantly higher than that of the benign lesions, unlike in breast or prostate cancers.

SSG06-06 Clinical Value of Proton (1H-) Magnetic Resonance Spectroscopy (MRS) Using Body-phased Array Coil at 3.0 T in Pretreatment Assessment for Cervical Cancer Patients

Tuesday, Dec. 1 11:20AM - 11:30AM Location: N229

Participants
Gigin Lin, MD, Guishan, Taiwan (*Presenter*) Nothing to Disclose
Yu-Ting Huang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Koon-Kwan Ng, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Chun Lin, MSC, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Tzu-Chen Yen, MD, PHD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Hung-Hsueh Chou, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Angel Chao, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chiun-Chieh Wang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chyong-Huey Lai, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Pen-An Liao, MD, Taipei City, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the clinical value of proton (1H-) magnetic resonance spectroscopy (MRS) using body-phased array coil at 3.0 T, in pretreatment assessment for cervical cancer patients.

METHOD AND MATERIALS

We prospectively enrolled 52 histology proven cervical cancer patients (age 27-80 years) and 30 age-matched surgical candidates for benign uterine myoma without evidence of cervical cancer. Pretreatment MR study plus MRS and diffusion weighted imaging (DWI) sequences were carried out at a 3.0 T system using body-phased array coil for the pelvis. PRESS localized 1H-MRS was applied to cervical tumor or normal tissue, with resonances analyzed by using the LC-Model algorithm. Cramer-Rao lower bound (CRLB) threshold of 20% was used as quality control. We compared resonances based on: (1) tumor vs normal cervical tissue, (2) histopathology type (squamous vs adenocarcinoma) (3) T stage = IIb (4) nodal metastasis (5) distant metastasis using Mann-Whitney test.

RESULTS

Cervical tumor showed a lower 1.3-ppm lipid level (0.30 vs 1.01μM, P < .05), as compared with normal cervical tissue. Squamous cell carcinoma demonstrated lower levels in 1.3-ppm lipid (0.17μM vs 0.59μM, P < .05) and 0.9-ppm lipid (0.04μM vs 0.16μM, P < .05), as compared with adenocarcinoma. Tumor with T stage >= IIb had lower levels in 1.3-ppm lipid (0.15μM vs 0.53μM, P < .05), 0.9-ppm lipid (0.04μM vs 0.15μM, P < .05) and total choline (0.04μM vs 0.16μM, P < .05). Tumors with nodal metastasis contained lower levels of 1.3-ppm lipid (0.16μM vs 0.44μM, P < .05) and glutamine (0.01μM vs 0.02μM, P < .005), whereas tumors with distant metastasis contained a lower level of 1.3-ppm lipid (0.12μM vs 0.50μM, P < .05). However, resonances from cervical tumor were independent to maximal tumor size or ADC value on MRI.

CONCLUSION

1H-MRS using body-phased array coil at 3.0 T in cervical cancer patients is useful in differentiating tumor, histopathology type, T stage >= IIb, nodal or distant metastasis, and is independent to maximal tumor size or ADC value on MRI.

CLINICAL RELEVANCE/APPLICATION

1H-MRS using body-phased array coil at 3.0 T added additional dimensions for pretreatment assessment in cervical cancer patients.

SSG06-07   Impact of Multiparametric MRI (mMRI) on the Therapeutic Management of Suspicious Adnexal Masses Detected by Transvaginal Ultrasound (TVUS)

Tuesday, Dec. 1 11:30AM - 11:40AM Location: N229

Participants
Simone Schrading, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Sabine M. Detering, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk Bauerschlag, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Incidental adnexal masses at TVUS are common and diagnostically challenging. The primary goal of imaging is accurate tissue characterization to guide further management, i.e. the choice between plain follow-up vs laparoscopic surgery vs. open surgery. Aim of this study was to evaluate the diagnostic utility of mMRI for further management stratification in patients with such adnexal masses

METHOD AND MATERIALS

Prospective IRB-approved trial on 126 women (mean age 54.6 years) with inconclusive adnexal masses at TVUS. All women underwent conventional work up, including pelvic examination, TVUS, and CA-125 levels. In addition, all women underwent mMRI at 3T with high resolution T2-TSE in three planes, DWI (max. b-800) and DCE. Likelihood of malignancy and appropriate management (i.e. follow-up vs. laparoscopic vs. open surgery) was first determined based on results of conventional methods, and then, independently, based on mMRI. Then, all methods were reviewed in synopsis. Final surgical pathology served as standard-of-reference or clinical and imaging follow-up of at least 24 months

RESULTS

In 65% (82/126) of patients the adnexal mass finally classified as benign, in 29% (36/126) as malignant and in 6% (8/126) as borderline. The diagnostic indices for TVUS+CA-125 alone vs. MRI alone vs. all methods combined were as follows: Sensitivity: 86% (31/36) vs. 97% (35/36) vs. 100% (36/36); Specificity: 32% (29/90) vs. 83% (75/90) vs. 80% (68/90); PPV: 34% (31/91) vs. 70% (35/50) vs. 74% (40/54), NPV: 65% (29/44) vs. 98% (75/76) vs. 100% (72/72). After mMRI, the therapeutic management was changed in 41/126 (34%) of patients. In 30 patients in whom surgery had been recommended based on conventional assessment, mMRI correctly diagnosed typical benign findings; these patients underwent follow-up instead of surgery. None of these women developed malignancy during follow-up. In another 11 patients, mMRI results correctly suggested malignancy such that open surgery was performed instead of laparoscopic surgery

CONCLUSION

Compared with conventional assessment (pelvic exam, TVUS, CA-125), mMRI correctly changed the management in one-third of women with incidental adnexal masses. It helps avoid unnecessary surgery, or unnecessary surgical steps (conversion from laparoscopic to open surgery)

CLINICAL RELEVANCE/APPLICATION

Pelvic mMRI helps to significantly improve clinical management of asymptomatic women with incidental adnexal masses identified on TVUS

SSG06-08   Preoperative Tumor Texture Analysis from MRI Predicts Deep Myometrial Invasion and High Risk Histology in Endometrial Carcinomas

Tuesday, Dec. 1 11:40AM - 11:50AM Location: N229

Participants

Sigmund Ytre-Hauge, MD, Bergen, Norway (*Presenter*) Nothing to Disclose
Erik Hanson, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Arvid Lundervold, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Jone Trovik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Helga Salvesen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingfrid S. Haldorsen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor heterogeneity is a key feature of malignant disease. Heterogeneity in MR images can be quantified by texture analysis. We aimed to explore whether high risk histological features are reflected in texture parameters derived from preoperative MRI in endometrial carcinomas.

METHOD AND MATERIALS

Preoperative pelvic contrast-enhanced MRI (1.5T) including diffusion-weighted imaging (DWI) was prospectively performed in 99 patients with histologically confirmed endometrial carcinomas. Tumor region of interest (ROI) was manually drawn encircling the uterine tumor on axial T1-weighted contrast-enhanced (CE) series on the slice displaying the largest cross-section tumor area. Histogram based texture features (standard deviation, skewness and kurtosis) were calculated from these tumor ROIs. Texture parameters were analyzed in relation to established histological subtype and grade, surgicopathological staging parameters (deep myometrial and cervical stroma invasion and lymph node metastases) and MRI based tumor volume and tumor apparent diffusion coefficient (ADC) value using Mann-Whitney U test, Jonckheere-Terpsta trend test and Pearson's bivariate correlation test.

RESULTS

Large standard deviation (SD) in the tumor ROIs was significantly associated with presence of deep myometrial invasion (p=0.009). Lower values for skewness were observed in the tumor ROIs from endometrioid high grade tumors (p=0.012) and from non-endometrioid tumors (by definition always high grade lesions, p=0.020). Kurtosis was positively correlated to tumor volume (r= 0.27; p=0.006) and negatively correlated to tumor ADC value (r=-0.28; p=0.006).

CONCLUSION

MRI derived tumor texture features reflecting tumor heterogeneity are significantly related to high risk histology and predict deep myometrial invasion in endometrial carcinomas. Thus, tumor texture features based on MRI represent promising biomarkers to aid preoperative tumor characterization for risk stratified surgical treatment.

CLINICAL RELEVANCE/APPLICATION

Tumor texture features derived from MRI reflect high risk endometrial carcinoma and may aid preoperative risk classification for stratified surgery.

SSG06-09 Endometrial Cancer MR Staging Accuracy in a Large Multi-site UK Cancer Network Over Three Years: Can the Reported Single Centre Staging Accuracies be Met in Clinical Practice?

Tuesday, Dec. 1 11:50AM - 12:00PM Location: N229

Participants
Neil Soneji, BSC, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Annarita Ferri, MD, Chieti, Italy (*Presenter*) Nothing to Disclose
Victoria Stewart, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Roberto Dina, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nishat Bharwani, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the radiological staging accuracy of endometrial cancer (EC) from images acquired from multiple MR scanners across a 10 centre UK cancer network over three years.

METHOD AND MATERIALS

Retrospective study of 382 consecutive patients with EC imaged in 9 external hospitals and 3 internal hospital sites discussed at our tertiary gyne-oncology centre between October 2011-October 2014. All patients with tertiary centre reports for both final histology and MRI were included (n=270). The radiological stage provided at MDT discussion was compared to the 'gold standard' histological report. Parameters assessed included depth of myometrial invasion, cervical and nodal stage. The use of DWI or DCE and the site for incorrect staging were recorded. MedCalc statistical software version 15.2.2 was used.

RESULTS

242 of 270 MRI reports (90%) included a final FIGO stage; of these 147 scans were performed internally and 95 at an external hospital. Accuracy of the reported depth of invasion was 72.7% for all cases (72.8% for internal and 72.6% for external scans). Sensitivity, specificity, positive and negative predictive values & accuracy with DWI (n=204) were 67%, 77%, 64%, 79%, 73% and without DWI (n=38) were 75%, 69%, 53%, 86%, 71% (p>.05). Accuracy with DCE (n=109) was 72% and without (n=130) was 73%. For cervical stromal invasion, sensitivity, specificity, PPV, NPV and accuracy for all scans were 59%, 94%, 64%, 93% and 89%. As a percentage of all causes of staging error, depth of invasion accounted for 41-52%, cervix stromal invasion 20-32% and nodal stage 8-16% depending on whether the patient was scanned internally or externally, or whether DWI or DCE were included (p>.05).

CONCLUSION

Staging accuracy in a large multi-site cancer network over three years does not meet the reported staging accuracies in meta-analyses of smaller single centre published research (pooled sensitivity/specificity of 86-90%). DWI and DCE did not affect staging accuracy, although only a small number of cases did not have these. The underlying causes for the reduction in sensitivity and specificity need to be evaluated in order to translate the highest achievable MR staging accuracy to long term routine practice.

CLINICAL RELEVANCE/APPLICATION

Accuracy of MR staging of endometrial cancer in a multi-site cancer network over three years does not reach single centre study results. The causes for staging inaccuracies need to be understood.

Chest (Lung Malignancy/COPD)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S404CD

CH **CT** **OI**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, Guerbet SA;
Mark S. Parker, MD, Mechanicsvlle, VA (*Moderator*) Nothing to Disclose

Sub-Events

SSJ05-01 Quantitative CT Imaging Features Improve Prediction of EGFR Mutation Status in Lung Adenocarcinomas

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S404CD

Participants
Ying Liu, Tianjin, China (*Presenter*) Nothing to Disclose
Jongphil Kim, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Fangyuan Qu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Shichang Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Hua Wang, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yoganand Balagurunathan, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively identify the relationship between epidermal growth factor receptor (EGFR) mutation status, predominant histologic subtype, and computed tomographic (CT) characteristics in surgically resected lung adenocarcinomas in an Asian cohort patients.

METHOD AND MATERIALS

This study was approved by the institutional review board, with waiver of informed consent. Findings of preoperative chest CT were retrospectively evaluated in 385 surgically resected lung adenocarcinomas. 30 CT descriptors that characterized tumor location, size, shape, margin, density, enhancement, internal, external, and associated findings were assessed. EGFR mutations at exons 18 - 21 were determined by using a polymerase chain reaction (PCR)-based assay. Univariable and multivariable analyses were performed for this study. The area under ROC curve (AUC) was computed using the leave-one-out cross-validation method.

RESULTS

EGFR mutations were found in 168/385 patients (43.6%). Mutations were found more frequently among female, never smokers, and with lepidic predominant adenocarcinomas, intermediate pathologic grade, among tumors of smaller size, with spiculation, GGO or mixed GGO, air bronchogram, cavitation, vascular convergence, thickened adjacent bronchovascular bundles, and pleural retraction, and also among tumors without pleural attachment, well-defined margin, marked heterogeneous enhancement, severe peripheral emphysema, severe peripheral fibrosis, or lymphadenopathy (P < 0.05). The most important and significantly independent predictors of harboring EGFR activating mutation for the model with both clinical variables and CT features were never smokers, tumors of smaller size, with cavitation, homogeneous enhancement, and pleural retraction when adjusting for gender, pathologic grade, and thickened adjacent bronchovascular bundles. ROC curve analysis showed that clinical predictors combined with CT features (AUC = 0.76) were superior to clinical predictors alone (AUC = 0.61).

CONCLUSION

Quantitative CT imaging features of lung adenocarcinomas in combination with clinical predictors can predict EGFR mutation status better than clinical predictors alone.

CLINICAL RELEVANCE/APPLICATION

Selecting patients with high potential for EGFR mutations by combining imaging-based predictors with known clinical variable may result in a population with a greater sensitivity to EGFR-TKI treatment.

SSJ05-02 18F-FDG Uptake as a Prognostic Factor for Tumor Recurrence in Patients with Pathologic Stage I Lung Adenocarcinomas

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S404CD

Participants
Ying Liu, MD, Beijing, China (*Presenter*) Nothing to Disclose
Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the 18F-FDG uptake features and the correlation between 18F-FDG uptake and tumor recurrence in patients with pathologic stage 1lung adenocarcinomas.

METHOD AND MATERIALS

One hundred and seventeen patients with stage 1 lung adenocarcinomas proved by surgery were studied retrospectively. Eighty-

four patients had a subsequent follow-up. The tumors' SUVmax in different groups of size, density, tumor differentiation degree and T staging were analyzed by Kruskal-Wallis test. The correlations between the SUVmax and clinicopathologic factors were analyzed using Spearman rank correlation. The disease-free survival (DFS) periods in different clinicopathologic groups were estimated using the Kaplan-Meier method and Log-rank test.

RESULTS

The SUVmax of pathologic stage 1lung adenocarcinomas were significantly different in different groups of size, density, tumor differentiation degree and T staging, respectively($P<0.01$). The SUVmax was positively correlated with the size of the adenocarcinomas($P<0.01$), and were both negatively correlated with the density and tumor differentiation degree($P<0.01$).But there was no correlation with the tumors'T staging($P>0.05$). The patients with an SUVmax of <2.5 had a much better DFS period than those with an SUVmax of ≥2.5($P<0.05$). The DFS periods showed no statistical differences in other clinicopathologic groups($P>0.05$). But tumor with a poorly differentiated degree was associated with reduced DFS period compared with those with well differentiated degree($P<0.05$).

CONCLUSION

18F-FDG uptake is correlated with the tumor differentiation degree, and has a prognostic value for predicting the tumor recurrence in the patients with pathologic stage 1 lung cancer. The patients with an SUVmax of <2.5 have a much better DFS periods than those with an SUVmax of ≥2.5.

CLINICAL RELEVANCE/APPLICATION

The level of metabolic activity observed with 18F-FDG uptake correlates with the probability of tumor recurrence in the patients with pathologic stage 1 lung cancer.

SSJ05-03   Evaluation of Texture Analysis Parameters in EGFR or ALK-Positive Advanced Non-Small Cell Lung Cancer (NSCLC)

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S404CD

Participants
Caroline Caramella, MD, Villejuif, France (*Presenter*) Nothing to Disclose
Maria Virginia Bluthgen, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Silvia Rosselini, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Charlotte Leduc, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Francesco Facchinetti, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Eva Haspinger, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Charles Ferte, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Stefan Michiels, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Clarisse Dromain, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Charles Soria, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Benjamin Besse, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The quantitative assessment of heterogeneity in tumor images through Texture Analysis is an emerging tool that can potentially provide a non-invasive prognostic biomarker. We investigated if Texture Analysis parameters derived from contrast-enhanced CT (CTTA) were associated with EGFR/ALK status and have a prognostic value in NSCLC patients treated with tyrosine-kinase inhibitors.

METHOD AND MATERIALS

The CT images of advanced NSCLC patients with EGFR mutation or ALK translocation treated with tyrosine-kinase inhibitors were retrospectively reviewed. CTTA using the filtration-histogram method was applied to the region of interest (ROI) in the primary tumor of the enhanced-CT by two independent operators to examine the inter-individual reproducibility. A wilcoxon test was used to correlate CTTA and EGFR / ALK status and a Cox model to evaluate the prognostic value of CTTA for overall survival. A p-value cutoff of 0.01 was used to adjust for multiple testing.

RESULTS

CTTA parameters were evaluated in CT scan from 68 patients recruited in 2 centers between 2008 and 2013, of them, 80.9% (n=55) were EGFR mutated and 19.1 % (n=13) ALK+ NSCLC. The CTTA measures were highly reproducible between the 2 operators as indicated by Bland-Altman plots and correlation values. The skewness of the distribution was significantly different between EGFR mutated and ALK+ tumors for coarse texture with spatial filter value 3.3 (p= 0.002), filter value 2.8 (p=0.001) and medium texture with spatial filter value 2.2 (p=0.004). The median follow-up time was 35 months; 39 deaths occurred. The A unit increase in skewness in coarse texture (2.8 spatial filter) was significantly associated with better survival with an univariate cox analysis (HR: 0.36 [0.2-0.69] p=0.002). A multivariate analysis adjusted by prognostic factors (PS, lymphocyte count, hepatic and adrenal metastasis) indicate a similar trend for better survival (HR: 0.40 [0.2-0.8] p=0.01).

CONCLUSION

CTTA parameters were reproducible between the 2 operators. The skewness was significantly different between EGFR mutated and ALK rearranged advanced NSCLC and may have a prognostic value.

CLINICAL RELEVANCE/APPLICATION

Texture analysis of CT images is a simple tool that has proven inter-individual reproducibility and that might have a potential to provide prognostic and molecular indicators to help clinicians in their treatment strategy

SSJ05-04   Dynamic CE-Perfusion Area-Detector CT vs. FDG-PET/CT: Capability for N-Stage Assessment in Non-Small Cell Lung Cancer Patients

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S404CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
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Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Noriyuki Negi, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Tohru Murakami, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To prospectively and directly compare the capability for N-stage assessment between dynamic contrast-enhanced (CE-) perfusion area-detector CT (ADCT) and FDG-PET/CT in non-small cell lung cancer (NSCLC) patients.

METHOD AND MATERIALS

44 consecutive pathologically diagnosed NSCLC patients (26 males, 18 females; mean age 67 years) who were candidates for surgical treatment underwent dynamic CE-perfusion ADCT that were performed at two or three different positions as single examination, PET/CT, surgical treatment and pathological examination. From all perfusion ADCT data in each subject, whole chest perfusion map was computationally generated based on dual- and single-input maximum slope and Patlak plot methods by means of previously reported software. For quantitative diagnosis of metastatic lymph node and N-stage, perfusion parameters and SUVmax at each lymph node were evaluated by ROI measurement. Then, Student's t-test was performed to determine the difference between metastatic and non-metastatic lymph nodes. To determine the diagnostic capability and feasible threshold value on a per node basis analysis, ROC analyses were performed among all indexes as having significant difference between two groups. Finally, sensitivity, specificity and accuracy for diagnosis of metastatic lymph node and N-stage were compared by means of McNemar's test.

RESULTS

Systemic arterial perfusion from dual-input maximum slope method and SUVmax had significant difference between metastatic and non-metastatic lymph nodes (p<0.05). Although there was no significant difference of area under the curve between systemic arterial perfusion and SUVmax on a per node basis analysis (p>0.05), specificity (SP: 92.1%) and accuracy (AC: 92.8%) of former were significantly higher than those of latter (SP: 88.3%, p=0.004; AC: 88.3%, p=0.005). In addition, when assessed N-stage in all patients, accuracy of systemic arterial perfusion (75%) was also significantly higher than that of SUVmax (55.8%, p=0.008).

CONCLUSION

Dynamic CE-perfusion ADCT has better potential for N-stage assessment than PET/CT in NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Dynamic CE-perfusion ADCT has better potential for N-stage assessment than PET/CT in NSCLC patients.

SSJ05-05   CT-based Quantification of 3rd Generation Bronchial Luminal Collapsibility in Patients with Chronic Obstructive Lung Disease (COLD) and Correlations with Corresponding Lung Volume Changes

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S404CD

Participants
Christopher Kloth, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfgang M. Thaiss, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Hendrik Ditt, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Juergen Hetzel, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Marius Horger, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the degree of bronchial lumen collapsibility in 3rd generation bronchi in COPD grade IV (GOLD) patients by using quantitative chest-CT (virtual bronchoscopy) in correlation with corresponding changes of lung volumes between end-inspiration and end-expiration.

METHOD AND MATERIALS

29 patients (male=14; median age=63.36y; range 48-76y) with grade IV COPD underwent chest-CT at our institution from January 2010 to November 2014. Two thin-slice (0.6mm) non-enhanced image data sets were acquired both at end-inspiration and end-expiration using helical technique (120 kV,100-150 mAs). The software automatically identified the bronchial tree for quantitative bronchial lumen assessment (crossectional area) both at end-inspiration and end-expiration.Each bronchial lumen was measured at 0.5 cm after the offspring of a 3rd generation bronchus. Subsequently, the edges of the bronchial lumen were corrected hand drawn with using a hand free polygonal ROI. Lung lobes were semi-automatically segmented and the volumes of segmented lobes and the percentage of their volumes below the threshold -950 HU (LAV - 950HU) were calculated. We evaluated the impact of lobar compressibility (Vexp. vs. Vinsp. or residual volume) on bronchial collapsibility

RESULTS

Mean total lung volume decreased by 17.8% in expiration (6877 ± 1641 mL in inspiration and 5495 ± 1160 mL in expiration). Mean expiratory bronchial collapse was 15%. The degree of bronchial lumen collapsibility correlated well with the magnitude of volume reduction of the corresponding lobes (Spearman's r = 0.7, p = 0.001). Importantly, this correlation holds also true for the individual lobes. Considering also the emphysema phenotype, collapsibility and volume reduction were stronger for homogenous compared to heterogeneous emphysematous lobes (diameter reduction 13.1% vs 25.1%; volume reduction 14.2% vs 19.4%, respectively).

CONCLUSION

With about 15%, collapsibility of 3rd generation bronchi in COPD patients was significantly lower than that in the trachea and the main bronchi compared to earlier published data. Bronchial wall consistency (cartilage rings vs. cartilage + mebranous wall) seem to be the reason for these differences. The collapsibility correlated well with the reduction in lung volume.

CLINICAL RELEVANCE/APPLICATION

The degree and the sites of increased bronchial lumen collapsibility have severe clinical consequences for understanding and planning novel endobronchial therapies.

SSJ05-06   Sensitivity of Airway Wall Thickness Measurements: Influence of Small Airways

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S404CD

Participants
Jean-Paul Charbonnier, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Laurens Hogeweg, MSC, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jan-Martin Kuhnigk, PhD, MS, Bremen, Germany (*Abstract Co-Author*) Stockholder, MeVis Medical Solutions AG
David A. Lynch, MBBCh, Denver, CO (*Abstract Co-Author*) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;
Eva M. Van Rikxoort, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Stock holder, Thirona BV Co-founder, Thirona BV

PURPOSE

Changes in the morphology of the airways contributes to lung function impairment in chronic obstructive pulmonary disease (COPD). Measurements of airway morphology might be influenced by the quality of the airway segmentation. In this study we investigate the stability of a commonly used airway measurement (Pi10) from CT scans for varying segmentation depths of the airways.

METHOD AND MATERIALS

Inspiratory low-dose thoracic CT scans of 267 subjects, well distributed over GOLD stages, were selected for this study. Airways were automatically extracted by a state-of-the-art segmentation method and manually corrected to ensure a leakage free segmentation. Airway wall thickness quantification was performed in orthogonal cross-sections every 1mm throughout the entire airway tree using an intensity-integration technique which accounts for partial volume effects. Using regression on all cross-sectional measurements, airway morphology was expressed as the square root of wall area at airways with a perimeter of 10mm (Pi10). To determine the sensitivity of the Pi10 measurement to the length of the segmented airway tree, sensitivity analysis was performed on Pi10 by leaving-out wall measurements of the smallest airways and recalculating the Pi10. For each subject, Pi10 regression analysis was repeated excluding airways with a lumen perimeter below 6mm, 8mm or 10mm. The recalculated Pi10 measurements were compared to the baseline Pi10.

RESULTS

The segmented airway trees consisted for 55% of airways with lumen diameters below 10mm, 19% below 8mm, and 1% below 6mm.The average baseline Pi10 of all subjects was 2.43 +/- 0.56 (range [1.40, 4.36]), which corresponds to an average airway wall thickness (for an airway with a lumen perimeter of 10mm) of 0.52mm +/- 0.21mm. By excluding airways with a lumen perimeter below 6, 8 or 10mm from the regression analysis, absolute changes in Pi10 were 0.003 +/- 0.004 (0.11%), 0.035 +/- 0.023 (1.46%), and 0.107 +/- 0.087 (4.6%), respectively, corresponding to changes in airway wall thickness (at 10mm lumen perimeter) of 0.001, 0.013, and 0.039mm.

CONCLUSION

The commonly used Pi10 measurement to express airway morphology from a CT scan is insensitive to the exclusion of smaller airways in the computation.

CLINICAL RELEVANCE/APPLICATION

When expressing airway morhplgy as Pi10, there is no need to (manually) adjust automatic airway segmentation methods to include smaller airways in order to obtain an accurate Pi10 measurement.

Case-based Review of Nuclear Medicine: PET/CT Workshop-Lymphoma/Melanoma/Sarcoma (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 3:30PM - 5:00PM Location: S406A

CT **NM** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss imaging presentation and special considerations when interpreting FDG PET/CT studies for lymphoma, melanoma and sarcoma. 2) Formulate a systematic approach to interpreting PET/CT studies for this patient population. 3) Discuss pertinent correlative findings on CT for each diagnosis on a case by case basis.

ABSTRACT

Update on Radionuclide Therapies

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S504CD

IR **NM** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC411A   New Guidelines for I-131 Therapy of Thyroid Cancer

Participants
Don C. Yoo, MD, Providence, RI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe why thyroid cancer is increasing. 2) Review guidelines for the use of I-131 in the treatment of thyroid cancer. 3) Review the controversies in thyroid cancer treatment.

ABSTRACT

The purpose of this educational activity is to review the reasons why the incidence of thyroid cancer has risen so rapidly over the last 40 years and discuss the role of radioiodine ablation in patients with thyroid cancer. Issues that will be discussed include controversies in the extent of thyroid surgery and the appropriate use of radioiodine ablation in patients with thyroid cancer which is controversial in low risk and intermediate risk patients. The incidence of thyroid cancer in the United States has almost tripled since the early 1970s with unchanged mortality principally due to overdiagnosis. The extent of surgery performed for thyroid cancer is controversial especially in small cancers but only patients with complete thyroidectomy are candidates for radioiodine ablation. Recently lower doses of I-131 have been shown to be effective for radioiodine ablation of remnant thyroid tissue after thyroidectomy. High risk patients will benefit from radioiodine ablation with decreased recurrence and improved mortality. Radioiodine ablation in low risk patients is very controversial and has not been shown to improve mortality.

RC411B   Ra-223 Therapy for Bone Metastases

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Radium-223 is a recently approved therapy for patients with metastatic prostate cancer to bone. The use of radium-223 is increasing worldwide, and new applications are being evaluated. The objectives of this presentation are: 1) Review the chemistry and mechanism of action of Ra-223. 2) Understand the approved indications for Ra-223. 3) Illustrate the techniques and procedures for radium administration using a case-based approach.

ABSTRACT

Radium-223 is an alpha-emitting radiopharmaceutical approved for use in men with castration-resistant prostate carcinoma. THe use of radium in a clinical setting will be discussed, including the rationale, patient eligibility, administration, and follow-up, as well as radiation safety precautions and handling. Illustrative cases will be presented.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC411C   Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants
Charles Y. Kim, MD, Durham, NC, (charles.kim@duke.edu) (*Presenter*) Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, Cryolife, Inc

LEARNING OBJECTIVES

1) Review range of malignancies treated with Y90 microsphere infusion. 2) Discuss the types of Y90 therapy and dosimetric considerations. 3) Describe the procedures and technical steps involved in Y90 therapy. 4) Recognize pertinent scintigraphic findings associated with Y90 therapy.

ABSTRACT

Intra-arterial Yttrium-90 (Y90) therapy is an important treatment modality for a variety of hepatic tumors. While numerous types of embolotherapies are employed by interventional radiologists for treatment of cancer, Y90 therapy is unique in its multimodality and multi-procedural nature. Not only does this treatment effect rely on deposited ionizing radiation therapy, but scintigraphic imaging is also an integral component of treatment. Two types of Y90 therapies are available, made by two different manufacturers. The

differences between the two types are subtle, but there are differences in administration and manufacturer-recommended dosimetric calculation. These various differences will be highlighted. Y90 therapy is comprised of several steps and is frequently subclassified into a "planning" phase and "treatment" phase. In the planning phase, detailed angiographic imaging is performed to delineate arterial anatomy , determine tumoral distributions, and redistribute vascular flow if indicated. Scintigraphic imaging is an integral component of this planning phase, in order to help identify angiographically occult arterial anomalies, confirm appropriate infusion site, and to quantify the hepatopulmonary shunt fraction. From this information, as well as other factors, the appropriate treatment doses can be determined. In the treatment phase(s), the Y90 dose is administered to the appropriate portions of the liver with subsequent scintigraphic imaging for confirmation.

Imaging of Tumor Syndromes (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S103CD

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC418A   Von Hippel Lindau and Other Hereditary Renal Cancer Syndromes

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To identify the key genetic aspects of von Hippel Lindau (VHL) disease and their relevance to treatment. 2) To distinguish radiologic features of VHL from other hereditary renal cancers. 3) To explain the implications of hereditary renal cancers for sporadic renal cancers.

ABSTRACT

Hereditary renal cancers include clear cell carcinomas associated with von Hippel Lindau Disease (VHL), chromophobe carcinomas associated with Birt Hogg Dube, papillary carcinomas associated with hereditary papillary cancer syndrome and type II papillary carcinomas associated with Hereditary Leiomyoma-Renal Carcinoma (HLRC) syndrome. Additional rare syndromes exist. This talk will focus on the distinguishing features of each entity from a radiologic perspective but also will describe the lexicon underlying the description of the genetics of these entities. This should enable the participant to understand the 'language' of genetics when describing hereditary entities in general, including terms such as tumor suppressor gene, oncogene, hypoxia inducible factor and metabolomics. The participant should come away with a fuller understanding of these hereditary entities and their implications for more common, sporadically occurring renal cancers.

RC418B   Neurocutaneous Syndromes

Participants
Petra Vajtai, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify the key distinguishing radiologic features of each of the most common phakomatoses: neurofibromatosis types I and II, tuberous sclerosis, and Sturge-Weber syndrome. 2) To provide guidance on the appropriate use of surveillance imaging in affected individuals.

ABSTRACT

The phakomatoses are a group of hereditary neuroectodermal diseases, each characterized by its unique cutaneous a well as radiologic manifestations. The most common phakomatoses are neurofibromatosis (types I and II,) tuberous sclerosis, and Sturge-Weber syndrome, whose respective characteristic neuroradiological finding is the neurogenic tumor, the tuber and angiomatosis. The talk should enable the participant to distinguish the addressed phakomatoses based on radiologic characteristics, to describe the presentation, diagnosis and prognosis of each, and to provide guidance on the appropriate use of surveillance imaging in affected individuals.

RC418C   Multiple Endocrine Neoplasia

Participants
Bryan R. Foster, MD, Portland, OR, (fosterbr@ohsu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish between MEN 1, MEN 2A and MEN 2B syndromes. 2) Apply the appropriate modality for specific imaging indications. 3) Describe common and uncommon imaging findings for various tumors seen in MEN.

ABSTRACT

Multiple endocrine neoplasia (MEN) is a heterogenous group of inherited genetic disorders in which patients develop both endocrine and non-endocrine tumors. MEN 1 patients commonly develop pituitary adenomas, parathyroid adenomas and pancreatic neuroendocrine tumors. MEN 2 patients commonly develop meduallary thryoid cancers and pheochromocytomas. Familial meduallary thyroid cancer is also considered part of the MEN syndrome as these patients have mutations in genes similar to MEN 2 patients. Imaging plays an important role in the detection, staging and followup of tumors in these patients and often many different modalities are employed to optimally image these patients.

RC418D   Lynch and Other Hereditary Colonic Cancer Syndromes

Participants

Richard Kinh Gian Do, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the advances in genetics for Lynch and other hereditary colonic cancer syndromes. 2) Identify the gastrointestinal and non-GI malignancies of Lynch and other polyposis syndromes. 3) Examine the role of imaging for monitoring hereditary colonic cancer syndromes.

Active Handout:Richard Kinh Gian Do

http://abstract.rsna.org/uploads/2015/13010497/Active RC418D.pdf

RC420

Image-guided Stereotactic Body Radiotherapy (SBRT) for Spinal Metastases - Spinal Imaging, Target Delineation and Post-SBRT Response Evaluation

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S102C

NR **OI** **RO**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Simon S. Lo, MD, Cleveland, OH, (Simon.Lo@UHhospitals.org) (*Moderator*) Research support, Elekta AB;

LEARNING OBJECTIVES

1) To understand the basics of stereotactic body radiotherapy (SBRT) for spinal metastasis. 2) To know the basics of diagnostic imaging for spinal metastasis. 3) To learn the principles and methods of target delineation for SBRT for spinal metastasis. 4) To know the principles and methods of response evaluation after SBRT for spinal metastasis.

ABSTRACT

Stereotactic body radiotherapy (SBRT) has become an important treatment modality for spinal metastases in various settings. To facilitate safe and effective delivery of SBRT for spinal metastases, proper pre-SBRT evaluation including appropriate diagnostic imaging, and proper target delineation and contouring of organs-at-risk are necessary. The gold standard for post-SBRT response evaluation for spinal metastases is not well-defined and this is an emerging area of research interest. This refresher course will provide an overview of the spinal SBRT process, diagnostic imaging for spinal metastasis, target delineation for SBRT for spinal metastases, and post-SBRT response evaluation for spinal metastases.

Sub-Events

RC420A   Overview of SBRT for Spinal Metastases

Participants
Simon S. Lo, MD, Cleveland, OH (*Presenter*) Research support, Elekta AB;

LEARNING OBJECTIVES

1) To know the indications for stereotactic body radiotherapy (SBRT) for spinal metastasis. 2) To know the technical aspects of SBRT for spinal metastasis. 3) To know the expected outcomes of SBRT for spinal metastasis. 4) To know the potential toxicities of SBRT for spinal metastasis.

ABSTRACT

This subsection will provide an overview of the indications, technical aspects, expected outcomes, and toxicities of stereotactic body radiotherapy (SBRT) for spinal metastasis.

RC420B   Pre-SBRT Imaging of Spinal Metastases

Participants
Pejman Jabehdar Maralani, MD, FRCPC, Toronto, ON, (pejman.maralani@utoronto.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the role of different imaging modalities in diagnosis of spinal metastasis. 2) To understand relevant imaging characteristics of spinal metastasis.

ABSTRACT

This section will provide an overview of multiple imaging modalities used for diagnosis and treatment planning of spinal metastasis.

Active Handout:Pejman Jabehdar Maralani

http://abstract.rsna.org/uploads/2015/15002564/Active RC420B.pdf

RC420C   Target Delineation of Spinal Metastases

Participants
Kristin J. Redmond, MD, MPH, Baltimore, MD (*Presenter*) Research support, Elekta AB

LEARNING OBJECTIVES

1) To understand target and normal tissue delineation for patients receiving SBRT for malignant spinal metastases.

ABSTRACT

The purpose of this section will be to review principles involved with target and normal tissue delineation in patients being treated with SBRT for malignant spinal metastasis. This will include review of both current consensus guidelines as well as areas of controversy.

Active Handout:Kristin Janson Redmond

http://abstract.rsna.org/uploads/2015/15002565/RC420C RSNA_target delineation_handout_2015.pdf

RC420D   Post-SBRT Response Evaluation of Spinal Metastases

Participants
Arjun Sahgal, Toronto, ON, (arjun.sahgal@sunnybrook.ca) (*Presenter*) Speaker, Medtronic, Inc; Speaker, Elekta AB; Medical Advisory Board, Varian Medical Systems, Inc; Speaker, Accuray Incorporated; Research Grant, Elekta AB

LEARNING OBJECTIVES

1) To understand the challenges of post-spine SBRT response assessment. 2) To understand the current state of response criteria consensus.

ABSTRACT

The aim of this presentation is to highlight the challenges of post spine SBRT response assessment, and current consensus work to standardize imaging and evalaution.

Molecular Imaging Mini-Course: Clinical Applications of Molecular Imaging - Oncology

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E352

`MI` `OI` `RO` `PH`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

`FDA` Discussions may include off-label uses.

Participants

Sub-Events

RC423A   Diagnosis

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the potential roles and limitations of PET imaging for amyloid and tau protein in evaluating patients with dementia. 2) Describe anatomic and functional MRI techniques for evaluating Alzheimer's disease. 3) Understand the clinical challenges of diagnosing and managing patients with dementia.

RC423B   Staging

Participants
Dominique Delbeke, MD, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The potential clinical indications of PET and PET/CT in the evaluation of patients with malignancies. 2) The impact on patient care. 3) Recommendations for PET/CT in the NCCN guidelines.

RC423C   Evaluation of Treatment

Participants
David A. Mankoff, MD, PhD, Philadelphia, PA, (david.mankoff@uphs.upenn.edu) (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company

LEARNING OBJECTIVES

1) List applications of quantitative imaigng for clinical trials. 2) Describe the approach to the design of cancer imaging trials. 3) Discuss biomarkers applicationf forf cancer imaging.

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David A. Mankoff, MD, PhD - 2013 Honored Educator

Histiocytosis from Head to Toe (In Conjunction with the American Institute for Radiologic Pathology)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: N229

OI **OT**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Mark D. Murphey, MD, Reston, VA, (mmurphey@acr.org) (*Moderator*) Nothing to Disclose
Mark D. Murphey, MD, Reston, VA, (mmurphey@acr.org) (*Presenter*) Nothing to Disclose
Jeffrey R. Galvin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Kelly K. Koeller, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Darcy J. Wolfman, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Ellen M. Chung, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the typical clinical and pathological features of Langerhans cell histiocytosis. 2) Define the characteristic imaging patterns of Langerhans cell histiocytosis. 3) Understand the pathological basis for the imaging patterns of Langerhans cell histiocytosis.

Honored Educators

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Mark D. Murphey, MD - 2015 Honored Educator

Lung Cancer Screening: Getting Paid to Do Good

Tuesday, Dec. 1 4:30PM - 6:00PM Location: N228

CH **OI** **HP**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Pamela Kassing, Reston, VA (*Coordinator*) Nothing to Disclose
Pamela Kassing, Reston, VA (*Moderator*) Nothing to Disclose
Geraldine B. McGinty, MD,MBA, New York, NY (*Presenter*) Nothing to Disclose
Ezequiel Silva III, MD, San Antonio, TX, (zekesilva3@gmail.com) (*Presenter*) Nothing to Disclose
Mark O. Bernardy, MD, Conyers, GA (*Presenter*) Nothing to Disclose
Robert K. Zeman, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the current process of how reimbursement for new procedures and technology is obtained from CPT code development, valuation and coverage. 2) Using Lung Cancer Screening as an example, the participants will become familiar with the specific processes for obtaining coverage for new screening programs in the public and private sectors and how a myriad of governmental agencies and other policymaking groups are involved in determining which new procedures are covered. 3) Understand how obtaining coverage will bring this new technology to the mainstream. 4) Interactive techniques will be used to engage the audience in the consideration of strategic partnerships between industry, clinical research, governmental agencies and third party payors.

URL

Handout:Pamela Kassing

http://abstract.rsna.org/uploads/2015/14000570/RSNA2015-PPT slides MOB 11-23 final.pptx

Handout:Ezequiel Silva

http://abstract.rsna.org/uploads/2015/14000570/Lung Cancer Screening_speaker notes.docx

Hepatocellular Carcinoma in the Cirrhotic Liver and LI-RADS (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S402AB

`GI` `MR` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC429A   LI-RADS Overview, Current Status, and Future Directions

Participants
Cynthia S. Santillan, MD, San Diego, CA, (csantillan@mail.ucsd.edu) (*Presenter*) Consultant, Robarts Clinical Trials Research Group

LEARNING OBJECTIVES

1) To teach participants how to apply the Liver Imaging Reporting and Data System (LI-RADS) to their interpretation of imaging studies for the evaluation of hepatocellular carcinoma in at-risk patients. 2) To inform radiologists about the various online resources available via the ACR LI-RADS website, including an atlas, lexicon, reporting templates, and flashcards. 3) To update radiologists about future content in LI-RADS, including ultrasound and treatment response assessment guidelines.

ABSTRACT

RC429B   LI-RADS Imaging Features: What´s the Evidence?

Participants
An Tang, MD, Montreal, QC (*Presenter*) Speaker, Boehringer Ingelheim GmbH; Speaker, Siemens AG, ; Advisory Board, Imagia

LEARNING OBJECTIVES

1) To review the major and ancillary CT and MRI features used in LI-RADS categorization for assessment of hepatocellular carcinoma (HCC). 2) To highlight the scientific literature supporting the major imaging features and criteria. 3) To summarize the evidence supporting ancillary features.

ABSTRACT

The Liver Imaging Reporting and Data System (LI-RADS) relies on major and ancillary CT and MRI features to categorize observations for assessment of hepatocellular carcinoma (HCC). The major features include arterial phase enhancement, diameter, "washout" appearance, "capsule" appearance and threshold growth. In this course, we will discuss the scientific literature supporting the major imaging features. This will include estimates of diagnostic performance, and intra- and inter-reader agreement. LI-RADS also includes ancillary imaging features that modify the likelihood of HCC. We will provide a brief overview of the evidence supporting these ancillary features.

RC429C   LI-RADS and Hepatobiliary Agents

Participants
Kathryn J. Fowler, MD, Chesterfield, MO (*Presenter*) Research support, Bracco Group

LEARNING OBJECTIVES

1) To provide an overview of LI-RADS content that refers to hepatobiliary contrast agents. 2) To review the ancillary features that are described with hepatobiliary contrast agents. 3) To present case examples to illustrate the role of hepatobiliary contrast agents in the diagnosis of hepatocellular carcinoma.

ABSTRACT

Hepatobiliary contrast agents are routinely used in practice for diagnosing and staging HCC. Despite the potential diagnostic benefits, the role of hepatobiliary phase imaging has not been well defined in diagnostic algorithms. LI-RADS provides information on the use of these agents, their role in diagnosis, and potential pitfalls. The aim of this presentation is to provide an overview of hepatobiliary content included in the current version of LI-RADS.

RC429D   LI-RADS LR-5 versus LR-M

Participants
Thomas A. Hope, MD, San Francisco, CA, (thomas.hope@ucsf.edu) (*Presenter*) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Understand the LR-M categorization and its role in LI-RADS. 2) Review imaging features that suggest LR-M. 3) Apply LI-RADS categorizations in cases of LR-5 and LR-M.

ABSTRACT

In at patients at risk for hepatocellular carcinoma (HCC), the diagnosis of malignancies other than HCC can be difficult. LI-RADS provides a categorization (LR-M), which should be used to indicate lesions that may represent malignancies other than HCC. In this

course, we will review the LI-RADS categorization LR-M and its relationship to LR-5. We will discuss findings that suggest LR-M and provide case examples where the diagnosis of LR-M and LR-5 should be made. We will also discuss how a LR-M categorization may affect clinical decision making.

Targeted Treatment and Imaging of Liver Cancers: Basic to Advanced Techniques in Minimally-Invasive Therapies and Imaging

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S403A

| GI | OI | IR |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
John J. Park, MD, PhD, Duarte, CA (*Moderator*) Proctor, Sirtex Medical Ltd; Advisory Board, Guerbet SA
Jinha Park, MD, PhD, Duarte, CA (*Moderator*) Speakers Bureau, Bayer AG; Advisory Board, Guerbet SA
John J. Park, MD, PhD, Duarte, CA (*Presenter*) Proctor, Sirtex Medical Ltd; Advisory Board, Guerbet SA
Jinha Park, MD, PhD, Duarte, CA (*Presenter*) Speakers Bureau, Bayer AG; Advisory Board, Guerbet SA
Andrew C. Price, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Presenter*) Nothing to Disclose
Marcelo Guimaraes, Charleston, SC (*Presenter*) Consultant, Cook Group Incorporated ; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES

1) Discuss the role of the interventional radiologist in the treatment and management of patients with primary and metastatic liver cancer as part of the multidisciplinary team. 2) Learn best practice techniques in the treatment of liver cancers, with emphasis on both locoregional and focal therapeutic approaches, and indications for treatment. 3) Explore various tips and tricks for each treatment modality and learn how to avoid complications through good patient selection, choosing the appropriate techniques, and knowing what common mistakes to avoid. 4) Learn about newer and developing techniques and devices, their potential roles and indications, and potential pitfalls. 5) Explore advanced imaging modalities in the detection of tumors and for monitoring treatment response.

ABSTRACT

Hot Topic Session: Molecular Imaging and Radionuclide Therapy for Prostate Cancer

Wednesday, Dec. 2 7:15AM - 8:15AM Location: E451A

GU **MI** **OI** **RO**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants

Uwe Haberkorn, MD, Heidelberg, Germany, (uwe.haberkorn@med.uni-heidelberg.de) (*Moderator*) Nothing to Disclose
Eric M. Rohren, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose
Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Speakers Bureau, Piramal Enterprises Limited; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited; ; ; ; ; ;

ABSTRACT

Radium-223 is a recently approved therapy for treatment of bone metastases in patients with metastatic prostate carcinoma. As an alpha-emitting radioisotope, radium has the potential to be a powerful therapy for treatment of a variety of skeletal malignancies. In this presentation, the use of radium-223 in the treatment of prostate cancer will be reviewed through a case-based format. Future directions in radium-223 therapy will be discussed.

URL

Sub-Events

SPSH40A   Ra-223 Therapy for Skeletal Metastases from Prostate Cancer

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the chemical and physical features of radium-223 dichloride. 2) Discuss the clinical utility of radium-223 therapy. 3) Understand the technique for radium-223 administration. 4) Review the anticipated outcomes of radium-223 therapy through case-based review.

ABSTRACT

Radium-223 is a recently approved therapy for treatment of bone metastases in patients with metastatic prostate carcinoma. As an alpha-emitting radioisotope, radium has the potential to be a powerful therapy for treatment of a variety of skeletal malignancies.

URL

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

SPSH40B   Comparison of Ga-68 and F-18 Labeled Small Molecule PSMA Tracers for Prostate Cancer Imaging

Participants
Carsten Kobe, Cologne, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the concept of PSMA PET-imaging in the diagnosis of prostate cancer in general and in comparison to conventional methods. 2) Learn about the currently available alternatives for radiolableling of PSMA-tracers, e.g. 68-Gallium and 18F-Fluoride and their characteristics. 3) Gain insights from first comparative studies about the clinical value of the availble tracers with regard to their sensitivity, specificity and practicability.

SPSH40C   PSMA Ligands for Imaging and Therapy of Prostate Cancer

Participants
Uwe Haberkorn, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and pharmacokinetics of PSMA ligands for PET/CT. 2) Estimate the value of PSMA-based imaging in comparison to choline-based imaging. 3) Assess the value of PSMA-targeting for diagnosis and therapy. 4) Estimate the effects and side effects of endoradiotherapy with PSMA ligands

ABSTRACT

The prostate-specific membrane antigen (PSMA) is frequently over-expressed in prostate cancer (PCa) which led to the

The prostate-specific membrane antigen (PSMA) is frequently over-expressed in prostate cancer (PCa) which led to the development of several PSMA-targeting molecules are for the detection and therapy of metastatic castration resistant prostate cancer (mCRPC).In a first diagnostic study 82.8% of 319 patients investigated with 68Ga-PSMAHBED-PET/CT at least one lesion indicative for PCa was detected. Amongst lesions investigated by histology, 30 were false-negative in 68Ga-PSMAHBED-PET/CT, all other lesions (n=416) were diagnosed true-positive or -negative. Fifty of 116 patients available for follow-up received a local treatment after 68Ga-PSMAHBED-PET/CT. A comparison of the 68Ga-PSMA-ligand with 18F-fluoromethylcholine PET/CT revealed 78 PC-suspicious lesions in 32 patients using 68Ga-PSMA-PET/CT and 56 lesions in 26 patients using Choline-PET/CT (significant with p=0.04). All lesions detected by 18F-fluoromethylcholine-PET/CT were also seen by 68Ga-PSMA-PET/CT. Since the ligand bound to PSMA is internalized, the target may also be used for endoradiotherapy. We used a small molecule inhibitor of PSMA MIP-1095 for therapy in 25 men with final stage mCRPC. PSA values decreased by >50% in 60.7% of the men treated. 84.6 % of men with bone pain showed complete or moderate reduction in pain. Hematological toxicities were mild. 25% of men treated had a transient slight to moderate dry mouth. No adverse effects on renal function were observed.In order to increase the therapeutic flexibilty a theranostic PSMA ligand coupled to DOTA was synthesized which allows coupling to Ga-68 for diagnostic use or to Lu-177 or Ac-225 for therapy. Initial experience in 30 patients shows promising results concerning antitumor activity with mild side effects.

URL

Nuclear Medicine Series: Non-FDG PET Radiotracers in Oncology

Wednesday, Dec. 2 8:30AM - 12:00PM Location: S505AB

CT **NM** **OI**

ARRT Category A+ Credits: 3.50
AMA PRA Category 1 Credits ™: 3.25

FDA Discussions may include off-label uses.

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Moderator*) Nothing to Disclose
David A. Mankoff, MD, PhD, Philadelphia, PA (*Moderator*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company

Sub-Events

RC511-01 Proliferation Imaging: FLT/PET in Oncology

Wednesday, Dec. 2 8:30AM - 9:00AM Location: S505AB

Participants
David A. Mankoff, MD, PhD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company

LEARNING OBJECTIVES

1) Describe the kinetics of thymidine relevant to FLT PET imaging. 2) Discuss approaches to FLT image interpretation. 3) Describe studies that have tested FLT PET as a marker cancer response to treatment.

Honored Educators

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David A. Mankoff, MD, PhD - 2013 Honored Educator

RC511-02 Positron Emission Tomography (PET) Imaging of Chemokine Receptor CXCR4 in Patients with Solid Cancers: Initial Results

Wednesday, Dec. 2 9:00AM - 9:10AM Location: S505AB

Participants
Tibor Vag, MD, PhD, Munich, Germany (*Presenter*) Nothing to Disclose
Carlos Gerngross, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Jurgen Wester, Munchen, Germany (*Abstract Co-Author*) CEO, SCINTOMICS GmbH
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CXCR4 is a chemokine receptor that is overexpressed in various human cancers and is involved in tumor metastasis. In this feasibility study we performed Positron Emission Tomography (PET) imaging of CXCR4 expression in patients suffering from various solid cancers.

METHOD AND MATERIALS

21 patients with histologically proven solid tumors underwent PET imaging using the novel CXCR4 nuclear probe [68Ga]Pentixafor. Maximum standardized uptake values (SUVmax) of the liver, spleen and bone marrow were measured for determination of physiological tracer distribution. For evaluation of in vivo CXCR4 expression on tumors, SUVmax and tumor-to-background ratios (T/B ratio) were determined in a total of 43 malignant lesions including 8 primary tumors, 3 local recurrent tumors and 32 metastases. When available, SUVmax of malignant lesions was compared to corresponding SUVmax measured in standard routine [18F]FDG PET.

RESULTS

Moderate tracer uptake was detectable in the liver, bone marrow and spleen with a mean SUVmax of 3.1, 3.7 and 5.6, respectively. By visual interpretation criteria, 9 of 11 primary and local recurrent tumors were detectable, exhibiting a mean SUVmax of 4.7 (range 2.1 to 10.9) and a mean T/B ratio of 2.9. 20 of 32 evaluated metastases were visually detectable (mean SUVmax of 4.5, range 3.2 to 13.8; mean T/B ratio of 2.8). Spearman´s correlation revealed a low correlation between SUVmax and number of lesions per patient (r=0.3). Compared to [18F]FDG PET obtained in 10 patients, tracer uptake in [68Ga]Pentixafor PET revealed a lower SUVmax in all measured lesions.

CONCLUSION

PET Imaging of CXCR4 in patients with solid cancers is feasible. Based on the experience gained within this small number of patients, SUVmax of malignant solid tumors seems to be lower in [68Ga]Pentixafor PET compared to [18F]FDG PET. Moreover, CXCR4 expression in solid malignancies seems to be highly heterogeneous depending on factors, that have to be elucidated in further studies.

CLINICAL RELEVANCE/APPLICATION

Once the areas of Pentixafor imaging are more clearly defined, PET imaging of CXCR4 might prove as a valuable modality, either as a

stand alone diagnostic tool, or in combination with [18F]FDG PET, i.e. when considering [68Ga]Pentixafor for monitoring CXCR4 directed pharmacological or endoradiotherapeutic treatment.

RC511-03   Dual-tracer (11C-acetate and 18F-FDG) PET/CT in Evaluating Gastrointestinal Stromal Tumors and Predicting the Mitotic Rate

Wednesday, Dec. 2 9:10AM - 9:20AM Location: S505AB

Participants
Thomas K. Cheng, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Sirong Chen, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
Yim Lung Leung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Ka Nin Wong, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
William Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Chi Lai Ho, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

18F-FDG (FDG) PET/CT is useful in risk stratification of Gastrointestinal stromal tumors (GIST) because it provides information for 3 predictors of tumor aggressiveness: mitotic rate (MiR), tumor size and primary site of involvement. GIST typically demonstrates high FDG avidity but false negative (FN) reports are not uncommon in those with low MiR. This study explores the detection sensitivity of 11C-acetate (ACT) and FDG PET/CT in GIST, and their relationship to cellular mitotic behavior.

METHOD AND MATERIALS

From 2013-14, 10 patients (M;7, F:3; mean age=63±17y) with primary GIST and 6 patients (M:5, F:1; mean age=66±13y) with metastatic GIST (primary excised previously) underwent preoperative ACT and FDG PET/CT. Postoperative pathology confirmed all primary/secondary GIST. The MiR was categorized as low (≤5/50) or high (>5/50 mitoses/50 high-power fields) according to the mitotic index recommended by NCCN guidelines. ROC curve analysis was performed to explore the relationship of lesion SUVmax to MiR for ACT and FDG, respectively.

RESULTS

10 lesions were found in 10 patients with primary GIST (stomach:5, small bowel:4, omentum:1): 3 with high and 7 with low MiR (size:14.2±11.2 vs 3.7±0.7cm). FDG PET/CT was positive in 7/10 (70%) but FN in 3/7 lesions with low MiR. ACT PET/CT was positive in 9/10 (90%) including all 3 FDG-negative lesions. 6 metastatic GIST patients presented with 11 lesions (liver:2, adrenal:1, retroperitoneal lymph node:1, peritoneum:7): 6 with high and 5 with low MiR. FDG PET/CT was positive in 8/11 (73%) but FN in 1/6 with high and 2/5 with low MiR. ACT PET/CT was positive in all metastatic lesions (11/11:100%). The incremental value of ACT over FDG is significant for primary and metastatic GIST with low MiR (both P<0.05). By ROC curve analysis, a FDG SUVmax cut-off value>=4.4 and 3.1 could differentiate lesions of high from low MiR for primary and metastatic GIST, respectively (AUC=0.905 vs 0.875, both P<0.05).

CONCLUSION

Metabolic avidity of GIST for FDG has a predictive value for cellular mitotic behavior, but with the disadvantage of FN for lesions having low MiR. ACT PET/CT has a distinct incremental value over FDG for detecting primary/metastatic GIST, but appears to be independent of mitotic behavior.

CLINICAL RELEVANCE/APPLICATION

ACT PET/CT has a high sensitivity for both primary and metastatic GIST, particularly for lesions with low mitotic rate and non-avid for FDG. FDG avidity, however, predicts mitotic behavior of GIST.

RC511-04   Monitoring Response to Antiangiogenic Therapy of Non-Small Cell Lung Cancer using 15O-water PET: The Relationship between Tumor Blood Flow and the Prognosis

Wednesday, Dec. 2 9:20AM - 9:30AM Location: S505AB

Participants
Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
Keiko Matsunaga, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Eku Shimosegawa, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hatazawa, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Honda, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Kijima, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Hirata, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Otsuka, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Kumanogoh, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Bevacizumab (BEV) is a humanized monoclonal antibody that targets circulating vascular endothelial growth factor. The purposes of this study were to evaluate tumor blood flow in patients with non small cell lung cancer (NSCLC) before and after treatment of BEV using 15O-water PET and to examine the tumor blood flow change and time to tumor progression.

RESULTS

In 5 patients without BEV, median of tumor blood flow before and after treatment was 0.3506 and 0.3351, respectively. There was no significant difference (Wilcoxon test, p=0.81). Mean time to tumor progression after treatment was 80.4 days (range, 21 to 203). In 6 patients with BEV, median of tumor blood flow before and after treatment was 0.2785 and 0.1777, respectively. There was a significant difference (p=0.03). Mean time to tumor progression after treatment was 242.5 days (range, 86 to 413). The mean ratio (Fa/b) of tumor blood flow after BEV to that before BEV was 0.665 ml/cm³/min (range, 0.231 to 0.899). There was significant correlation between Fa/b and time to tumor progression (Correlation coefficient r=0.86, p=0.03): large decrease in blood

flow early after treatment of BEV was associated with short time to tumor progression.

CONCLUSION

Mean tumor blood flow decreased within 1-2 days after administration of BEV. Large decrease in blood flow early after treatment of BEV correlated with short time to tumor progression.

CLINICAL RELEVANCE/APPLICATION

The antiangiogenic therapy might not have a benefit for patients with large decrease in blood flow early after treatment of BEV.

RC511-05 68Ga-PSMA-PET/CT in Patients with Renal Cell Cancer: Initial Results

Wednesday, Dec. 2 9:30AM - 9:40AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Giessing, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Hubertus Hautzel, MD, Juelich, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

68Gallium (68Ga) labelled prostate specific membrane antigen (PSMA) positron emission tomography / computed tomography (PET/CT) has been shown to be a reliable imaging method for the detection of prostate cancer and its metastases. Immunohistochemic studies revealed that PSMA is also expressed in the neovasculature of other solid tumors, especially renal cell cancer (RCC), making these cancers a potential target for 68Ga-PSMA-PET imaging. The aim of this study was to explore the feasibility of 68Ga-PSMA-PET/CT for detection of RCC in patients.

METHOD AND MATERIALS

Three male patients (mean age 66 years; range 52 - 74) with primary or metastatic RCC (n=2 clearcell RCC; n=1 papillary RCC) prospectively underwent whole body 68Ga-PSMA-PET/CT (mean Mbq: 179,3; Scanner: Siemens Biograph mCT, Siemens Healthcare, Erlangen, Germany). Quantitative assessement of tracer uptake was performed 1 hour after injection (p.i.) by measuring maximum standard uptake values (SUVmax) using isocontour VOIs in histopathologically proven tumor lesions. Additionally, for each lesion tumor-to-background ratios were claculated.

RESULTS

All primary RCCs and known metastastic sites were detected by 68Ga-PSMA-PET/CT. Average SUVmax in clear cell and papillary RCC tumour lesions was 16.7 and 4.1, respectively. Mean tumor-to-background ratio was 18.6 for clear cell RCC lesions and was 4.1 for papillary RCC lesions.

CONCLUSION

Detection of primary tumors and metastases in RCC patients using 68Ga-PSMA-PET/CT is feasible. 68Ga-PSMA uptake is high in clear cell RCC but rather weak in papillary RCC. Thus the promising diagnostic potential of 68Ga-PSMA-PET/CT rather has to be investigated in clear cell RCC patients.

CLINICAL RELEVANCE/APPLICATION

Since RCCs have high metastatic potential exact staging is crucial. Imaging with CT, MRI but also 18F-FDG-PET/CT offers limited sensitivity. PET/CT using 68Ga-PSMA seems to be a promising alternative.

RC511-06 Hypoxia Imaging: FMISO PET Imaging in Oncology

Wednesday, Dec. 2 9:40AM - 10:10AM Location: S505AB

Participants
Kenneth A. Krohn, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the evolution of tumor hypoxia and its biological implications. 2) Identify the mechanistic changes in tumor biology that will result in tumor resistance and poor patient outcome. 3) Learn novel ways to image tumor hypoxia with focus on FMISO PET imaging. 4) Understand the potential approaches to overcoming the negative impact of hypoxia.

ABSTRACT

The physiological microenvironment for a tumor is largely dictated by abnormal vasculature and metabolism. Many solid tumors develop areas of hypoxia during their evolution caused by unregulated cellular growth, resulting in greater demand on oxygen for energy metabolism. Hypoxia induces a cascade of changes that reflects the homeostatic attempts (highly conserved evolutionally) to maintain adequate oxygenation that may result in tumor cells to adapt by developing more aggressive survival traits; mediated by Hypoxia Inducible Factor (HIF1a) part of the cellular oxygen sensing mechanism. Hypoxic tumors are not effectively eradicated with conventional doses of radiation and show resistance to several chemotherapy drugs. Hypoxia may also result in angiogenesis (itself a marker of tumor aggressiveness) mediated by Vascular endothelial growth factor (VEGF). While angiogenesis is a frequent consequence of hypoxia, some tumors develop extensive angiogenesis without the presence of hypoxia and vice versa. Advances in PET imaging instrumentation, coupled with the development of an increasing array of novel molecular probes, provide opportunities for imaging and selection of appropriate therapies to overcome the cure limiting effects of these two fundamental aspects of tumor microenvironment. The biology of tumor microenvironment related to hypoxia and its effect on patient outcome and developments in imaging technology and novel radiotracers for hypoxia imaging with a focus on F-18 FMISO would be reviewed.Challernges and novel treatments to overcome the cure limiting ability of hypoxia will be discussed.

RC511-07 Prostate Cancer Choline PET Imaging and Other PET Tracers

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the major biological targets that may be useful for imaging in prostate cancer. 2) Understand the need for tailoring the imaging technique to the particular clinical phase of disease. 3) Analyze the current evidence with the potential utility of PET with various radiotracers in the imaging evaluation of prostate cancer.

ABSTRACT

ABSTRACT

Recent advances in the fundamental understanding of the complex biology of prostate cancer have provided increasing number of potential targets for imaging and treatment. In this presentation, I review the experience with a number of major PET radiotracers for potential use in the imaging evaluation of men with prostate cancer.

RC511-08 Primary Tumor Detection in CUP of Neuroendocrine Origin: Additional Value of 68Ga-DOTATATE-PET/CT Compared to Contrast-enhanced CT

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S505AB

Participants
Philipp M. Kazmierczak, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Axel Rominger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine Spitzweg, Munich, Germany (*Abstract Co-Author*) Advisory Board, Novartis AG; Advisory Board, Pfizer Inc; Advisory Board, Ipsen SA; Speaker, Novartis AG; Speaker, Pfizer Inc; Speaker, Ipsen SA
Christoph Auernhammer, MD, PhD, Munich, Germany (*Abstract Co-Author*) Research Grant, Novartis AG; Speaker, Novartis AG; Research Grant, Ipsen SA; Speaker, Ipsen SA; Advisory Board, Novartis AG
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Carsten Rist, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the additional value of 68Ga-DOTATATE-PET/CT compared to contrast-enhanced CT for primary tumor detection in cancer of unknown primary (CUP) of neuroendocrine origin.

METHOD AND MATERIALS

Patients (n=38, 27 male, 11 female, mean age 62 years) with histologically proven metastatic disease of neuroendocrine origin undergoing contrast-enhanced 68Ga-DOTATATE-PET/CT (Biograph 64, Siemens Healthcare, Erlangen, Germany) for primary tumor detection and staging were consecutively included in this retrospective study. Two blinded readers independently evaluated the separated contrast-enhanced CT and 68Ga-DOTATATE-PET data sets and noted from which of the two imaging modalities they suspected a primary tumor. In case of divergent blinded reading results, a consensus was reached. The final diagnosis, confirmed by either histopathology (n=24) or clinical follow-up (n=14), served as standard of reference.

RESULTS

Primary tumors were suspected in n=33 patients, localized in the small bowel (n=19), the pancreas (n=12), the lung (n=1), and the thyroid gland (n=1) (mean tumor-to-spleen ratio 1.10±0.69; PET/CT: true positive n=30, true negative n=3; CT: true positive n=20, true negative n=5). In n=4 patients, no primary tumor was identified (true negative n=3). N=10 primary tumors were correctly detected by PET but not contrast-enhanced CT, resulting in a diagnostic accuracy of 87 % for the fused 68Ga-DOTATATE-PET/CT, compared to 66 % for the contrast-enhanced CT alone. High interobserver agreement was noted regarding the localization of the primary tumor (Cohen's k 0.90, p<0.001).

CONCLUSION

68Ga-DOTATATE-PET/CT provides a significantly higher diagnostic accuracy for primary tumor detection in CUP of neuroendocrine origin as compared to contrast-enhanced CT alone.

CLINICAL RELEVANCE/APPLICATION

The present study provides evidence for the routine use of 68Ga-DOTATATE-PET/CT in neuroendocrine CUP, allowing for a comprehensive tumor staging at improved diagnostic accuracy as compared to standard whole-body imaging.

RC511-09 Do we Need High-Dose Contrast-enhanced CT in the Detection of Extra-hepatic Metastasesusing Gallium-68-DOTATATE-PET/CT in Patients with Neuroendocrine Tumors (NET)?

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S505AB

Participants
Jonas C. Apitzsch, MD, Marburg, Germany (*Presenter*) Nothing to Disclose
Dirk R. Albanus, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Z. Erdem, Zonguldak, Turkey (*Abstract Co-Author*) Nothing to Disclose
Oktay Erdem, MD, Zonguldak, Turkey (*Abstract Co-Author*) Nothing to Disclose
Anton F. Verburg, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian F. Behrendt, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Felix Mottaghy, MD, PhD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas H. Mahnken, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Heinzel, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous studies have shown that PET/CT with 68Ga-labeled somatostatin analogues is useful in the assessment of metastatic disease in in patients with neuroendocrine tumors especially with regard to extra-hepatic lesions. It has to be noted that PET in combination with full-dose contrast-enhanced CT (ceCT) exposes the patients to a high dose of radiation whereas the non-contrast-enhanced low-dose CT (ldCT) might reduce the radiation and may in addition avoid side effects such as allergic reactions. Thus, we aimed to determine whether ceCT can be omitted from assessment for extra-hepatic metastases in patients with NET.

METHOD AND MATERIALS

We retrospectively compared the performance of PET/ldCT and PET/ceCT in 54 patients (26 male, 28 female) who underwent a Gallium-68-DOTATATE-PET/CT in our clinic. Selection criteria were as follows: available ldCT and ceCT; histologically confirmed NET; available follow-up of at least 6 months (median 12.6 months; range 6.1-23.2). PET/ldCT and PET/ceCT images were analyzed separately by four experienced physicians. The review process focused on metastases to lungs, bones and lymph nodes. Afterwards, the PET/ldCT and PET/ceCT results were compared to the reference standard consisting of clinical follow-up data to evaluate the diagnostic accuracy.

RESULTS

In PET/ceCT 139 true positive bone-lesions were detected compared to 140 in PET/ldCT, 106 true positive lymph node metastases (PET/ceCT) vs. 90 (PET/ldCT) and 26 true positive lung lesions (PET/ceCT) whereas PET/ldCT found ?? true positive lung lesions. On a per patient basis ld and ce PET-CT achieved similar sensitivity (both 100%) however, specificity was lower for PET/ldCT (89% vs. 77%). For lymph nodes PET/ceCT showed superior sensitivity and specificity (sensitivity 92% vs. 80% and specificity 83% vs. 65%). For the detection of pulmonary lesions the sensitivity of PET/ldCT was also clearly inferior (23 vs 100%) while specificity was similar (94% vs. 93%).

CONCLUSION

These results represent first evidence that ceCT should not be omitted for extra-hepatic staging using Gallium-68-DOTATATE-PET/CT in patients with neuroendocrine tumors. However, the results need to be confirmed in a prospective trial.

CLINICAL RELEVANCE/APPLICATION

PET/ldCT is sufficient in the detection of extrahepatic metastatic desease in NET. There is no further need for high-dose CeCT.

RC511-10   PSA and PSA Kinetics in Predicting 18F-NaF PET Positivity for First Bone Metastases in Patients with Biochemical Recurrence after Radical Prostatectomy

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S505AB

Participants
James Yoon, BA, Los Angeles, CA (*Presenter*) Nothing to Disclose
Leslie Ballas, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Lingyun Ji, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Susan Groshen, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Hossein Jadvar, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate PSA and PSA kinetics in addition to other pathologic factors to determine their predictive value for 18F-NaF PET positivity for first bone metastases in patients with biochemical recurrence after radical prostatectomy.

METHOD AND MATERIALS

All 18F-NaF PET scans that were performed at USC between 2010 and 2014 were queried to find patients who demonstrate biochemical recurrence after radical prostatectomy. Patients with known metastatic disease at the time of 18F-NaF PET were excluded. Records were reviewed to obtain data on PSA at the time of 18F-NaF PET, PSA kinetics, and pathologic features of the prostatectomy specimen, which were then used for receiver operating characteristic (ROC) analysis to determine predictability for 18F-NaF PET positivity.

RESULTS

36 patients met our inclusion criteria. Of these, 8 (22.2%) had positive 18F-NaF PET scans. Mean values for PSA, PSA doubling time, and PSA velocity were 2.02 ng/mL (range 0.06-11.7 ng/mL), 13.2 months, and 1.28 ng/mL/yr for 18F-NaF PET negative patients and 4.11 ng/mL (range 0.04-14.38 ng/mL), 8.9 months, and 9.06 ng/mL/yr for 18F-NaF PET positive patients (p=0.07, 0.47, and 0.02 respectively). ROC analysis for 18F-NaF positivity gave AUC values of 0.634 for PSA, 0.598 for PSA doubling time, and 0.688 for PSA velocity. ROC analysis with combined models gave AUC values of 0.723 for PSA and PSA doubling time, 0.689 for PSA and PSA velocity, and 0.718 for PSA, PSA doubling time, and PSA velocity. There was no significant association found between 18F-NaF PET positivity and Gleason score, TN staging, and status of surgical margins.

CONCLUSION

18F-NaF PET detected first time osseous metastases in 22.2% of patients with PSA relapse. PSA velocity was the best single variable for predicting 18F-NaF PET positivity. Combining PSA with PSA doubling time or PSA with PSA doubling time and PSA velocity resulted in higher predictability than any variable independently.

CLINICAL RELEVANCE/APPLICATION

18F-NaF PET can detect early prostate cancer bone metastases in the post-prostatectomy setting.

RC511-11   Bone PET Imaging: NaF PET in Oncology

Wednesday, Dec. 2 11:30AM - 12:00PM Location: S505AB

Participants
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify the advantages of F-18 NaF PET/CT in oncology 2) To understand the importance of a standardized imaging protocol and reporting for F18-NaF PET/CT 3) To become comfortable in differentiating benign lesions from malignant ones on F18-NaF PET/CT

ABSTRACT

F-18 NaF PET/CT has been shown to have higher sensitivity than planar 99m-Tc MDP bone scanning in several studies. The concomitant acquisition of anatomic images permits immediate correlation of any abnormal findings. Additionally, F-18 NaF PET/CT bone imaging can be quantitated, allowing bone disease to be 'measureable', increasing its utility therapy monitoring. When a consistent F-18 NaF uptake period is used, the SUV values are highly reproducible, and due to the high extraction fraction, high quality images can be obtained with a radiation dose exposure similar to that of Tc-99m MDP (including the low dose CT scan). This presentation will discuss the benefits and challenges of F-18 NaF PET/CT in oncology.

ABSTRACT

F-18 NaF PET/CT has been shown to have higher sensitivity and specificity than planar 99m-Tc MDP bone scanning in several small studies. The concomitant acquisition of anatomic images permits immediate correlation of any abnormal findings. Additionally, F-18 NaF PET/CT bone imaging can be quantitated, allowing bone disease to be "measureable", increasing its utility therapy monitoring. When a consistent F-18 NaF uptake period is used, the SUV values are highly reproducible, and due to the high extraction fraction, high quality images can be obtained with a radiation dose exposure similar to that of Tc-99m MDP (including the low dose CT scan). This presentation will discuss the benefits and challenges of F-18 NaF PET/CT in oncology.

Radiogenomics of Lung Cancer-Changing Landscape and Challenges

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S403A

CH   BQ   OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC518A   **Lung Cancer in the Radiogenomic Era-Implications for Imaging**

Participants
Lawrence H. Schwartz, MD, New York, NY (*Presenter*) Committee member, Celgene Corporation; Committee member, Novartis AG; Committee member, ICON plc; Committee member, BioClinica, Inc

LEARNING OBJECTIVES

1) To understand the clinical needs for Radiogenomic Imaging in Lung Cancer. 2) To understand what imaging modalities and quantification techniques can be used in Radiogenomic Imaging in Lung cancer. 3) To illustrate examples of successes and failures in Radiogenomic Imaging approaches in Lung Cancer.

RC518B   **Qualitative Assessments of Lung Cancer for Radiogenomic Analysis**

Participants
Hyun-Ju Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To introduce the results of correlation between imaging features and genetic phenotypes of lung cancer. 2) To describe the implications of imaging traits on pathology, patient prognosis, and genetics. 3) To introduce the role of qualitative assessment for the next step high-throughput quantitative feature selection.

ABSTRACT

RC518C   **Quantitative Assessment in Lung Cancer Radiogenomics-Reproducibility and Reliability**

Participants
Binsheng Zhao, DSc, New York, NY (*Presenter*) License agreement, Varian Medical Systems, Inc; License agreement, Keosys SAS; License agreement, Hinacom Software and Technology, Ltd; License agreement, ImBio, LLC; License agreement, AG Mednet, Inc

LEARNING OBJECTIVES

1) Familiarize the audience with quantitative image features that can be computed to characterize tumors. 2) Discuss reproducibility and reliability of image features due to, repeat CT scans, CT acquisition and reconstruction techniques, tumor segmentations.

ABSTRACT

The way tumors look on radiological images may also reveal their underlying cancer gene expressions. Tumor imaging phenotypes can be characterized not only qualitatively by the radiologist's eyeballing, but also quantitatively by computer through image feature analysis. Radiogenomics promises the ability to assess cancer genotype though the tumor's imaging phenotype. However, to date, little attention has been paid to the sensitivity of image features to repeat scans, imaging acquisition techniques, reconstruction parameters and tumor segmentations. This refresher course will first familiarize the audience with quantitative image features that can be computed to characterize tumor size, shape, edge and density texture statistics. Both phantom and in-vivo studies will be introduced to explain how repeat CT scans and CT imaging acquisition and reconstruction techniques affect the assessment of quantitative image features in lung cancer Radiogenomics studies. Last but not least, the effects of image segmentation on feature calculations will be addressed.

BOOST: Genitourinary-Integrated Science and Practice (ISP) Session

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S103CD

`GU` `OI` `RO`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

`FDA` Discussions may include off-label uses.

Participants
Stanley L. Liauw, MD, Chicago, IL (*Moderator*) Nothing to Disclose
George B. Rodrigues, MD, London, ON (*Moderator*) Nothing to Disclose

Sub-Events

MSRO42-01 Invited Speaker:

> Wednesday, Dec. 2 10:30AM - 10:40AM Location: S103CD

Participants
Rodney J. Ellis, MD, Pepper Pike, OH (*Presenter*) Nothing to Disclose

MSRO42-02 A Phase I Dose Escalation Study of Hypofractionated Radiation Therapy for Favorable Risk Prostate Cancer: Acute Toxicity and Early Efficacy

> Wednesday, Dec. 2 10:40AM - 10:50AM Location: S103CD

Participants
Nicholas J. Sanfilippo, MD, New York, NY (*Presenter*) Nothing to Disclose
William C. Huang, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Herbert Lepor, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Silvia C. Formenti, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Benjamin Cooper, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Smith Beverly, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Barry Rosenstein, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samir S. Taneja, MD, New York, NY (*Abstract Co-Author*) Consultant, Eigen Consultant, GTx, Inc Consultant, Bayer AG Consultant, Healthtronics, Inc Speaker, Johnson & Johnson Investigator, STEBA Biotech NV Royalties, Reed Elsevier

ABSTRACT

Purpose/Objective(s): The optimal radiation schedule for the curative treatment of prostate cancer remains unknown. Prostate cancer patients receiving definitive external beam radiation therapy (EBRT) are typically treated 5 days per week for 7-9 weeks. This prolongation of treatment time increases healthcare costs and is less convenient for patients. There is data supporting the notion that the a/ß ratio for prostate cancer cells is between 1 and 3, suggesting a clinical benefit to hypofractionation. We therefore conducted a Phase I dose escalation trial in men with low to low-intermediate risk prostate adenocarcinoma.Materials/Methods: All men with clinical T1-2c, Gleason Score (GS) 6, prostate cancer with a prostatic specific antigen (PSA) less than 10 ng/dL were eligible for this trial. Men with clinical T1-2c, GS 7 prostate cancer and/or PSA 10 - 20 ng/dL were included provided the biopsy demonstrated low volume disease (Results: From June, 2012 to December, 2014, 9 patients were accrued to the three dose cohorts with a median follow-up of 11 months (range: 2 – 30). Patients had a median age of 63, pre-treatment PSA of 4.9 ng/dL, and pre-treatment AUA score of 10. Four patients had a GS of 7. The maximum tolerated dose (MTD) was 57.6 Gy with all patients completing treatment with less than or equal to grade 2 maximum gastrointestinal, genitourinary, dermatologic or fatigue related toxicity (Table 1). Six patients have at least 1 PSA post-treatment (3 months after completion) with a median PSA decrease of 65%. One patient of the six with > 11 month follow-up had grade 2 rectal telangiectasia requiring minor endoscopic cautery.   The remaining 5 patients had no grade 2 toxicity thus far.Conclusion: All three dose levels were well tolerated with no MTD identified. Further follow-up is warranted for long term toxicity and efficacy.Table 1: Acute toxicity in patients undergoing hypofractionated radiation.Grade of ToxicityCTCAE v. 4.0Dose Level 154 Gy/ 18 Fxn = 3Dose Level 255.8 Gy/ 18 Fxn = 3Dose Level 357.6 Gy/ 18 Fxn = 3Gastrointestinal023011032000Genitourinary000212312100Dermatitis0333Fatigue03111022

MSRO42-03 Robotic Stereotactic Body Radiation Therapy for Organ Confined Prostate Cancer

> Wednesday, Dec. 2 10:50AM - 11:00AM Location: S103CD

Participants
Jonathan A. Haas, MD, Mineola, NY (*Presenter*) Speaker, Accuray Incorporated
Aaron E. Katz, MD, Garden City, NY (*Abstract Co-Author*) Nothing to Disclose
Seth Blacksburg, MD, MBA, New York, NY (*Abstract Co-Author*) Speakers Bureau, Bayer AG;
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Michael Santoro, MD, East Meadow, NY (*Abstract Co-Author*) Nothing to Disclose
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William Macmelville, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher Mendez, BA, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Matthew R. Witten, PhD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The unique radiobiology of prostate cancer supports a hypofractionated as opposed to a conventionally fractionated dose regimen with a potential for improved outcomes and reduced toxicities. We report on our continued experience using a robotic linear accelerator to deliver stereotactic body radiation therapy for localized prostate cancer.Materials/Methods: From April 2006 through December 2014, a total of 1207 patients with localized carcinoma of the prostate were treated with robotic stereotactic body radiation therapy at a single institution. All patients had T1c to T2b disease. 493 patients had low risk disease. 548 patients had intermediate risk disease. 166 patients had high risk disease. Pretreatment PSAs ranged from .77 to 205. 126 patients received hormonal therapy prior to treatment at the discretion of their urologist. Treatment planning was done with CT scans fused with an MRI scan except in 31 cases where an MRI scan could not be done for medical reasons such as a pacemaker. Dose was prescribed to the 83% to 87% line, 5 mm beyond the capsule except posteriorly 3 mm. 1037 patients with low and intermediate risk disease received CyberKnife only to a dose of 3500 to 3625 cGy over 5 fractions. All patients received 1500 mg of amifostine intrarectally 50 minutes prior to each treatment fraction.Results: The median initial PSA was 6.2. The median follow-up was 33 months. The median post treatment PSA is 0.35. At the time of last follow-up, 12 patients have had a PSA failure by Phoenix biochemical definition. 1 patient with low risk disease failed. 7 patients with intermediate risk disease failed and 4 patients with high risk disease failed. There were 136 patients with a minimum follow up of at least 36 months and 56 patients with a minimum follow up of at least 48 months. There are 26 patients with a minimum follow up of 60 months. 272 patients achieved a PSA below 0.2 and 413 patients reached a PSA below 0.4. The median treatment PSA at 12 months is 0.90. The median PSA at 24 months is 0.45. The median PSA at 36 months is 0.40. the median PSA at 48 months is 0.25. The median treatment PSA at 60 months is 0.20. With a median follow up of 33 months, the biochemical disease free survival for low risk, intermediate risk, and high risk was 99.7%, 98.7%, and 97.5% respectively. 2 patients had symptomatic hematuria which resolved with hyperbaric oxygen. 2 patients required green light laser for urinary retention. 1 patient has required catheterization. 3 patients had rectal bleeding which resolved with rowasa enemas and hyperbaric oxygen.Conclusion: Stereotactic body radiation therapy using a robotic linear accelerator continues to be extremely well tolerated and efficacious in the management of localized prostate cancer. High rates of local control can be achieved while also achieving low rates of bladder and rectal toxicity. This study confirms prior reported series with a larger number of patients.

MSRO42-04 The Effect of Radiation Timing on PSA Reduction in High Risk Prostate Cancer Patients Treated with Definitive Radiation Therapy

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S103CD

Participants
Apar Gupta, Boston, MA (*Presenter*) Nothing to Disclose
Steven Vernali, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ankit Agarwal, BS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Muhammad M. Qureshi, MBBS,MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Alexander E. Rand, BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ariel E. Hirsch, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): We previously found that neither time to treatment (TTT) nor elapsed time of treatment (ETT) had any effect on PSA velocity in patients with low- and intermediate-risk prostate cancer. In this analysis, we sought to examine the effects of TTT and ETT on PSA change in patients with high-risk prostate cancer.Materials/Methods: We performed a retrospective review of 1,584 patients who were diagnosed with prostate cancer at our institution between January 2005 and December 2013, and found 412 patients with non-metastatic disease who completed treatment with definitive external beam radiation therapy (EBRT). A total of 146 patients who also received concurrent androgen-deprivation therapy (ADT) were included in the analysis. TTT was calculated as days between positive prostate biopsy and EBRT start date, and ETT was calculated as days between EBRT start and stop date. Demographic data on race/ethnicity, primary language spoken, insurance status, marital status, and age were also collected. Analysis of variance was performed to analyze the relationship of these factors with absolute and percentage change in pre- and post-EBRT PSA levels. Data were analyzed using a 0.05 level of significance.Results: Median age at diagnosis was 67 years (range 50-85 years); 11% had a Gleason score (GS) of 6, 49% GS 7, and 40% GS 8-10. Median TTT was 134 days and median ETT was 62 days. No demographic variable was found to be significantly related to absolute or percentage change in PSA. No optimal threshold of days from diagnosis to treatment (TTT) was identified to predict change in PSA level. ETT was significantly related to PSA change, after adjusting for demographic variables. Those who fell in the upper quartile of ETT (>64 days) were found to have a 94.2% decline in PSA, compared to 98.0% for those who fell in the lower three quartiles (p=0.03).Conclusion: A delay in treatment prior to starting EBRT did not have an effect on post-EBRT PSA level, relative to initial PSA level. However, a delay during EBRT was related to a lesser reduction in PSA decline. Further research is warranted in this area to elucidate the clinical significance of differences in PSA reduction.

MSRO42-05 Patient Inversion Therapy for Bowel (PITB) to Achieve Maximum Displacement in Radiotherapy for Prostate Cancer

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S103CD

Participants
Gordon L. Grado, MD,PhD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
David Constantinescu, Charleston, IL (*Presenter*) Nothing to Disclose
Scott Thompson, CMD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Carrie S. Petrone, RN, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Mary M. Grado, BSN,MS, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Michael C. Grado, BA, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Thayne Larson, MD, Scottsdale, AZ (*Abstract Co-Author*) Research Consultant, NxThera, Inc

PURPOSE

The purpose of this study was to evaluate a new and novel approach to the valuation and reduction of small bowel volume from the irradiated fields in the treatment of prostate cancer. This technique utilizes inversion therapy to either completely displace small or large bowel from the irradiated field or to significantly reduce the volume of bowel irradiated in the PTV. This procedure has potential application in multiple areas of abdominal and pelvic radiation therapy.

METHOD AND MATERIALS

Between January 2014 and March 2015, 14 consecutive patients were identified where small or large bowel was directly within the irradiated PTV. Patients were evaluated with bladder distention, patient positioning, and inversion therapy to displace bowel from the irradiated PTV. Inversion therapy had the greatest effect in displacing and maintaining displacement of bowel from the irradiated volume. Several inversion tables were evaluated prior to the procedure and the two safest devices with the most clinical experience for inversion therapy were selected for this trial. Dose volume histograms were compared with and without inversion.

RESULTS

Patients were identified with loops of bowel directly within the radiated field due to previous surgery or anatomy. Standard techniques for bowel displacement (patient positioning, bladder distention, belly-board), were ineffective at displacing sufficient bowel from the irradiated volume to affect greater radiation dose delivery. Inversion therapy was selected for bowel displacement which when combined with bladder distention maintained the displacement during the course of radiation therapy. 13/14 patients were found to have sufficient bowel displacement to allow greater radiation dose delivery to the PTV without compromising field size or prescribed dose. 1/14 patients did not benefit from this technique.

CONCLUSION

Patient inversion therapy for bowel (PITB) achieved excellent bowel displacement for radiation therapy to the pelvis. In these patients, neither the radiation therapy field nor the prescribed dose had to be compromised. Patients also had fewer bowel and bladder symptoms during the pelvic radiation therapy. This technique is determined to be useful, easily applicable, and well tolerated by patients.

CLINICAL RELEVANCE/APPLICATION

This procedure permits higher radiation therapy dose delivery to the PTV with fewer side effects and morbidity due to less small/large bowel volume irradiated.

MSRO42-06   Institutional Experience of Long-term (10-15 Years) Results with High Dose Rate (HDR) Salvage Therapy for Recurrent Prostate Cancer

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S103CD

Participants
Nevine M. Hanna, MD, Sandy, UT (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Limited treatments are available for recurrent prostate cancer patients. Modality selection can be challenging for both the patient and their physicians. HDR brachytherapy has been used extensively as a boost after external beam radiation therapy, but is increasingly being tested as salvage treated for locally recurrent prostate cancer. We report our long-term results for HDR salvage brachytherapy in patients with initially low, intermediate, and high risk prostate cancer.Materials/Methods: Patients (n=27) with a median age of 71 (57-84) years at recurrence with low- (n=10), intermediate- (n=8), and high-risk prostate cancer (n=9) treated at the California Endocurietherapy (CET now at UCLA) between 1991 and 2009 were analyzed. Median HDR brachytherapy dose prescription was 36 (22-46) Gy in 6 (3-8) fractions. Five patients did receive additional external beam radiation therapy (EBRT) after HDR brachytherapy to an EBRT dose of 36 (36-50) Gy. Presenting disease characteristics were median recurrent PSA 8.1 (1.4-86.7) ng/mL, Gleason Score 7 (5-10), median prostate volume 23.2 (0-80) cc. Androgen deprivation therapy (ADT) was administered in 68% for a median of 6 (3-96) months. Risk groups were defined according to the NCCN guidelines. Sustained PSA nadir+2 was used to define biochemical relapse. Statistical analyses being performed are to include Kaplan-Meier analyses and univariate and multivariate Cox proportional analyses.Results: Preliminary analysis shows that the median overall follow-up time was 6.90 (0.30-15.92) years. The 5, 10 and 15 year overall survival (OS) rates were 86%, 36% and 11%, respectively. The 5, 10 and 15 year distant metastases-free survival (DMFS) rates were 68%, 29% and 11%, respectively. Biochemical progression free survival (BPFS) for the initially presenting low, intermediate and high grade patients is 122, 59, and 41 months, respectively. On univariate analyses, BPFS after salvage HDR was most significantly impacted by PSA at recurrent diagnosis (p=0.007) but not significantly affected by risk group at initial diagnosis (P>0.05). Univariate Cox analyses and multivariate analyses are currently underway to determine the impact of ADT on these parameters.Conclusion: Our long-term data validates HDR salvage brachytherapy in recurrent prostate cancer patients as a standard treatment option which offers excellent rates of disease control.

MSRO42-07   Designing and Implementing an Innovative Phantom-Based Simulator Training Program for Prostate Brachytherapy Using Advanced Magnetic Resonance Imaging

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S103CD

Awards
Trainee Research Prize - Resident

Participants
Nikhil G. Thaker, MD, Houston, TX (*Presenter*) Nothing to Disclose
Tze Yee Lim, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rajat Kudchadker, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Tharakeswara K. Bathala, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Thomas Pugh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Usama Mahmood, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Deborah A. Kuban, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Teresa Bruno, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jihong Wang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
R. Jason Stafford, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Thomas A. Buchholz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
S J. Frank, MD, Houston, TX (*Abstract Co-Author*) Board Member, C4 Imaging LLC; Stockholder, C4 Imaging LLC; Advisory Board, Elekta AB

PURPOSE

Prostate brachytherapy (PB) is a well-established treatment for localized prostate cancer and has the potential to deliver excellent

outcomes at low cost. However, high-quality PB requires hands-on training and expertise in image-guidance, which is minimally emphasized in current radiation oncology training. Additionally, MRI holds promise of improving target delineation over CT imaging. Our objective was to design and implement a unique pilot training program that utilizes advanced MRI and a phantom simulator approach to improve the quality of PB education.

METHOD AND MATERIALS

Our existing PB phantom simulator program was adapted to introduce MRI treatment planning and post-implant evaluation. The simulator program emphasized six core areas: patient selection, simulation, treatment planning, implantation, treatment evaluation, and outcome assessment. Trainees in the simulator program were residents, fellows, or physicists. The program utilized the Iodine-125 pre-operative planning technique and a transrectal ultrasound device to implant prostate phantoms. MRI markers were substituted for spacers to allow for visualization.

RESULTS

Forty one trainees have completed the phantom simulator program to date. Ten implants were successfully conducted during the MRI-phantom simulator pilot program. MRI 3DT2 CUBE sequence could adequately delineate the prostate, seminal vesicles, rectum and bladder in the CIRS 053MM phantom. Dummy seeds could be well-visualized with post-implant CT scans. However, seed identification on MRI required a learning curve due to the need to identify MRI markers, which flanked each dummy seed (Figure). The MRI markers facilitated detection of up to 97% of seeds in implanted phantoms by identifying the signal voids between MRI markers.

CONCLUSION

This proof-of-principle educational curriculum successfully adapted a phantom simulator training program to implement advanced MRI simulation, treatment planning, and post-implant dosimetry. Analysis of implants showed that most organs could be adequately visualized with MRI and that most seeds could be identified with the aid of MRI markers. Phantom-based simulator training programs can provide a valuable educational opportunity to learn the PB process and to learn how to implement advanced image-guidance.

CLINICAL RELEVANCE/APPLICATION

Phantom-based simulator training can enhance practical expertise with advanced imaging technology and image-guide therapies.

MSRO42-09 **Stereotactic Body Radiation Therapy for Primary Lesion of Renal Cell Carcinoma**

Wednesday, Dec. 2 11:50AM - 12:00PM Location: S103CD

Participants
Hotaka Nonaka, Chuo, Yamanashi, Japan (*Presenter*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): We assessed the efficacy and toxicity of stereotactic body radiation therapy (SBRT) for primary lesion of renal cell carcinoma (RCC).Materials/Methods: We retrospectively reviewed 9 patients (7 male and 2 female) with stage I RCC treated with SBRT between 2007 and 2014. The diagnosis of RCC was judged according to imaging. The median age was 73 years old (range, 59-79). Three patients had high serum creatinine level before SBRT. Four patients had history of prior contralateral nephrectomy. The median diameter of tumor was 18 mm (range, 9-26). A total dose of 60-70 Gy in 10 fractions was administered at the 95% of planning target volume or internal target volume. Median biologically effective dose was 119 Gy (range 96-119), using an a/ß value of 10 Gy. Overall survival (OS) and local progression-free survival (LPFS) were based on Kaplan Meier estimates. Toxicity was scored according to NCI-CTCAE, version 4.0. Renal disorder was graded by referring to pretreatment renal function.Results: The median follow-up duration after SBRT was 28 months (range, 11-89). Clinical response was partial response (PR) in 5 tumors, stable disease (SD) in 4 tumors. Five tumors with PR has decreased gradually in size for 11-56 months (median, 42) after SBRT. Three patients developed distant metastases. The 2- and 3- year OS rate were 85.7% and 64.3%, respectively (median survival time, 44 months). The 3- year LPFS rate was 100%. In a case of a patient with SD tumor, autopsy was performed at 29 months after SBRT, and it showed almost complete necrosis of tumor tissues with a small amount of viable renal carcinoma cells. Three patients developed Grade 3 chronic kidney disease (CKD), 1 had Grade 2 CKD. All patients with Grade 3 CKD had high serum creatinine level before SBRT, and 2 of these patients had prior contralateral nephrectomy before SBRT. Severe toxicity for other organs at risk was not observed.Conclusion: SBRT for primary lesion of RCC resulted in acceptable LPFS and toxicity. Because of slow tumor response, we need long-term follow up to observe the effect of SBRT for RCC. Multicenter prospective study is mandatory to evaluate true local effect and toxicity and to compare SBRT versus other local treatment modalities for RCC.

ISP: Gastrointestinal (Colon Cancer Screening and Staging)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E351

GI **CT** **MR** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
David H. Kim, MD, Madison, WI (*Moderator*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc
Christine O. Menias, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SSK06-01   Gastrointestinal Keynote Speaker: Update on Colon Cancer Screening and CTC

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E351

Participants
David H. Kim, MD, Madison, WI (*Presenter*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc

SSK06-02   CT Colonography versus Flexible Sigmoidoscopy for Colorectal Cancer Screening. Outcomes of a Randomized Controlled Trial (RCT)

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E351

Participants
Daniele Regge, MD, Candiolo, Italy (*Presenter*) Speakers Bureau, General Electric Company
Loredana Correale, PhD, Turin, Italy (*Abstract Co-Author*) Researcher, im3D SpA
Carlo Senore, MD, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Cesare Hassan, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriella Iussich, MD, Locarno, Switzerland (*Abstract Co-Author*) Consultant, im3D SpA
Nereo Segnan, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare detection rate (DR) of CT colonography (CTC) and flexible sigmoidoscopy (FS) for CRC screening.

METHOD AND MATERIALS

An invitation letter to participate in a multicenter randomized screening trial was mailed to people aged 58-60 years, living in the Piedmont Region, Italy and in Verona, Italy. Individuals with a history of CRC/adenomas, inflammatory bowel disease, recent colonoscopy, or two first-degree relatives with CRC were excluded from invitation by their general practitioners. Responders to the invitation were randomized to either CTC or FS and scheduled for screening procedure. CTC interpretations were remotely performed via telediagnosis, and were assisted by a Computer-aided detection software. Participants with polyps≥6-mm at CTC and those with "high-risk" distal lesions (i.e., adenomas>10-mm, or high-grade dysplasia, or villous component >20%, or >2 adenomas of any type) at FS were referred for colonoscopy (CC). The primary outcome was DR of advanced neoplasia (AN), namely, the number of participants with CRC or advanced adenomas relative to the total number of participants. Differences were expressed as relative risk (RR) with 95% CIs.

RESULTS

5412 people agreed to take part in the trial: 2738 randomly assigned to FS and 2674 to CTC. After excluding participants with inadequate bowel preparation, analysis included 2673 (1298 females) adequate FS examinations and 2595 (1266 females) diagnostic CTC exams. Of FS participants, 271 (10.1%) were referred to CC; compliance to CC was 86.7% (235). Of CTC participants. 264 (10.2%) were offered CC, of whom 260 (98.5%) performed the exam. DR of AN was 4.7% (127 including 9 CRCs) for FS vs. 5.1% (133 including 10 CRCs) for CTC [RR: 1.1; 95% CI: 0.9-1.4; P=0.524]. DR of distal AN was 4.1% (109) for FS and 2.9% (76) for CTC [RR: 0.72; 95% CI: 0.54-0.96; P=0.025]. DR of proximal AN was 1.3% (34) for FS and 2.7% (69) for CTC [RR: 2.06; 95% CI: 1.37-3.10; P<0.001]. Isolated proximal AN were present in 2.3% and 0.67% of CTC and FS participants, respectively.

CONCLUSION

No significant differences were seen in AN detection for the two screening groups. However, DR of distal AN was 30% lower in CTC than in FS screening, while DR of proximal AN was two times higher following screening with CTC than with FS.

CLINICAL RELEVANCE/APPLICATION

Our study supports the hypothesis that CTC screening may have a larger impact on reduction of proximal CRC incidence than FS.

SSK06-03   Natural Course of Medium-sized Polyps during a 3-year Surveillance Interval: Linear and Volumetric Assessment with CT Colonography in Correlation with Histology

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E351

Participants
Charlotte J. Tutein Nolthenius, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Thierry N. Boellaard, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Yung Nio, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Maarten G. Thomeer, MD, Rotterdam, Belgium (*Abstract Co-Author*) Nothing to Disclose
Shandra Bipat, MS, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Margriet de Haan, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
A D. Montauban van Swijndregt, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Katharina Biermann, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marc van de Vijver, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ernst Kuipers, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Evelien Dekker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials

PURPOSE

Volumetric growth assessment in medium-sized polyps has shown to be more reliable than linear measurements and it seems a promising biomarker for determination of clinical importance. This is however not standard practice in reporting on polyps with CT colonography (CTC) and more experience and research is needed.

METHOD AND MATERIALS

Ethics approval and written informed consent were obtained. After participating in an invitational population-based CTC screening trial 101 participants harbored one or two 6-9 mm polyps as the largest lesion(s) for which surveillance CTC was advised after 3 years. Participants with lesion(s) of ≥6 mm at surveillance CTC were offered colonoscopy and polypectomy. Volumetric and linear measurements were performed on index and surveillance CTC and polyps were classified into baseline growth categories according to ±30% volumetric change over the entire surveillance interval (>30% growth as progression, 30% growth to -30% decrease as stable and >-30% decrease as regression). Polyp growth was correlated to histopathological findings and other polyp characteristics.

RESULTS

Between July 2012 and May 2014, 78 of 101 patients underwent surveillance CTC (mean age 65.6 (SD 6.7); 51% male). After a mean surveillance interval of 3.3 years (SD 0.3; range 3.0-4.6 years) of 95 polyps 33 (35%) progressed, 36 (38%) remained stable and 26 (27%) regressed, including an apparent resolution in 13 (14%) polyps. Of 20 proven advanced adenomas, 14 (70%) progressed and 6 (30%) remained stable, compared to 13 (37%) and 16 (46%) of 35 non-advanced adenomas. No associations were found between growth categories and polyp morphology, location and size at index CTC. Other linear or volumetric thresholds used did not identify more advanced adenomas.

CONCLUSION

Volumetric assessment showed one-third of medium-sized polyps to progress over time emphasizing the importance of these polyps. However, growth assessment was not able to identify all advanced adenomas as one-third remained stable in size over a 3-year surveillance interval. These findings must be taken into account when deciding on proper colonoscopy referral guidelines.

CLINICAL RELEVANCE/APPLICATION

Volumetric assessment showed one-third of medium-sized polyps to progress over time emphasizing the importance of these polyps.

SSK06-04   Five Years of CT Colonography in One Institution - How Many Cancers Have We Missed?

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E351

Participants
David Little, MBChB, FRCR, Bristol, United Kingdom (*Presenter*) Nothing to Disclose
Will Loughborough, MBChB,BSC, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Adam Youssef, BMedSc, BMBS, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Thomas Mendes da Costa, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul McCoubrie, MBBS, FRCR, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT colonography is used in our institution in the diagnosis of colorectal carcinoma in both screening and symptomatic populations. The primary purpose of this study was to determine the sensitivity of CT colonography in our institution and compare with published evidence to ensure we are meeting quality standards.

METHOD AND MATERIALS

Our sample includes all patients with a diagnosis of colorectal carcinoma entered onto the cancer registry (the gold standard in UK cancer monitoring) between January 2010 and January 2015 who had previously had a CT colonography investigation. Each of these patients were reviewed on our radiological information system (RIS) to confirm whether CT colonography was used as part of the primary diagnosis. Demographic data and details about the tumour (such as location within the colon) were recorded. Any patients in which there was a suggestion that a carcinoma had been missed were reviewed in detail.

RESULTS

5058 CT colonography studies were performed in 4921 patients between January 2010 and January 2015 at our institution. 261 (5.1%) of these patients were identified as having a diagnosis of colorectal carcinoma on the cancer registry. 63 patients that underwent CT colonography following diagnosis (i.e. to look for synchronous tumour or as follow-up) were excluded. 198 (3.9%) of patients were diagnosed with colorectal carcinoma following a CT colonography investigation. In 3 (1.5%) of these patients the colorectal carcinoma was missed on CT colonography.

CONCLUSION

The sensitivity of CT Colonography for colorectal carcinoma in our institution is 98.5% which compares favourably with other published studies on CT colonography and colonoscopy. This confirms CT colonography as an important and valid tool in the diagnosis of colorectal carcinoma.

CLINICAL RELEVANCE/APPLICATION

Our study confirms that CT colongraphy is an important tool in the diagnosis of colorectal malignancy and is an example to other institutions in monitoring CT colonography outcomes and maintaining quality standards. During this presentation we will explore the common reasons for missed malignancy on CT colonography.

SSK06-05   CT Findings of Postpolypectomy Coagulation Syndrome in Patients Who Underwent Colonoscopic Polypectomy: Comparison with Those of Perforation

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E351

Participants
Yoon Joo Shin, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Hoon Kim, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Jin Lee, MD, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Hoon Park, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Bracco Group
Kyoung Ho Lee, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Ye Sim, MD, MS, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe CT findings of postpolypectomy coagulation syndrome (PPCS) and to identify the features that can distinguish it from colonic perforation after colonoscopic polypectomy.

METHOD AND MATERIALS

From January 2011 to November 2014, a total of 5542 adult (age>40yr) patient who underwent colonoscopic polypectomy were found according to search through hospital database. After reviewing the patient's medical and imaging records, eight patients (0.14%) with PPCS and six patients (0.11%) with perforation were identified. Because five patients were excluded due to absence of CT examination, four (1 male; age range, 52-75 years with mean age, 69 years) with PPCS and five patients (5 male; age range, 46-67 years with mean age, 54 years) with perforation were finally included. Two abdominal radiologists reviewed the abdominal CT images in a consensus manner. The following CT findings were assessed: presence of pneumoperitoneum or pneumoretroperitoneum, presence of fluid collection, presence of colonic wall thickening, if present, patterns, thickness and length of an involved segment, enhancement pattern of an involved segment, presence of mural defect in an involved segment, and presence of surrounding infiltration around an involved segment. Clinical findings including patient's symptom and sign were also assessed.

RESULTS

Although three patients with perforation eventually underwent surgery, all patients with PPCS were completely recovered only with conservative management. The clinical presentation including presence of abdominal pain or leukocytosis was not different between two groups. On CT, an involved colonic wall was more longer and thicker in PPCS group (mean length and width: 124 ± 81.3 mm, 16 ± 4.9 mm) than perforation group (41.4 ± 11.8mm, 7.4 ± 1.5mm). In all four patients with PPCS, CT images showed a marked low attenuation wall thickening with severe pericolic infiltration around an involved segment. None of the patients with PPCS showed free air on CT.

CONCLUSION

PPCS, a very rare complication after colonoscopic polypectomy (prevalence of 0.14%), shows severe low attenuating mural thickening. In comparison with perforation, PPCS does not demonstrate free air in peritoneal or retroperitoneal space

CLINICAL RELEVANCE/APPLICATION

The imaging features on CT can be useful to promptly distinguish PPCS from colonic perforation.

SSK06-06   Extracolonic Findings at Screening CT Colonography: Analysis of Incompletely Characterized and Likely Insignificant (C-RADS E3) Findings

Wednesday, Dec. 2 11:20AM - 11:30AM Location: E351

Participants
Bryan D. Pooler, MD, Madison, WI (*Presenter*) Nothing to Disclose
David H. Kim, MD, Madison, WI (*Abstract Co-Author*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV

PURPOSE

To assess the incidence and outcomes of unexpected extracolonic findings at screening CTC which are likely insignificant and/or incompletely characterized (C-RADS E3), but may require further evaluation.

METHOD AND MATERIALS

7,952 consecutive patients (mean age 56.7±7.3 years, M:F 3,675:4,277) underwent first-time CTC screening over a 98-month interval. Persons with unsuspected C-RADS E3 findings were extracted and outcomes determined.

RESULTS

Previously unknown C-RADS E3 findings were identified in 9.2% (731/7,952; mean age 57.2±7.7 years; M:F 268:463) of the screening CTC population; 25 patients had multiple findings for a total of 757 E3 findings. Consideration for further imaging, if clinically appropriate, was suggested for 84% (634/757) of these findings, with clinical correlation suggested in the remainder. Dedicated follow-up imaging was obtained in 4.4% (353/7,952) of patients. Conditions requiring treatment or ongoing surveillance were diagnosed in 0.9% (72/7,952) of patients. Common extracolonic finding categories included: adnexal/uterine (24%, 185/757), lung (20%, 155/757), kidney/GU (20%, 149/757), and liver (11%, 85/757). Malignant or potentially malignant lesions were found in 0.2% (18/7,952) of patients, including renal cell carcinoma, lymphoma, breast cancer, and malignant/borderline ovarian cancer.

CONCLUSION

Likely insignificant/incompletely characterized (C-RADS E3) findings were found in 9.2% of patients undergoing screening CTC with consideration for additional imaging suggested in the majority. Follow-up imaging was actually obtained in 4.4%, with conditions ultimately requiring treatment or ongoing surveillance diagnosed in 0.9%. Malignant or potentially malignant lesions were found in 0.2% of the total cohort.

CLINICAL RELEVANCE/APPLICATION

Incompletely characterized and likely insignificant extracolonic (C-RADS E3) findings are uncommon, occurring in less than 10% of patients. Fewer than 1% of patients were diagnosed with conditions requiring treatment or continued surveillance. Extracolonic malignancies are rare in this group.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Perry J. Pickhardt, MD - 2014 Honored Educator

SSK06-07 Effect of Reducing Abdominal Compression during Prone CT Colonography on Ascending Colonic Rotation Occurring with Supine-to-prone Positional Change

Wednesday, Dec. 2 11:30AM - 11:40AM Location: E351

Participants
Jong Keon Jang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Seok Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Kwon Ha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Colonic rotation that mimics lesion mobility on CT colonography (CTC) can be particularly deceptive when it happens in unexpected locations such as the ascending colon. This study was to evaluate the effect of reducing abdominal compression during prone CTC on ascending colonic rotation that occurs with supine-to-prone positional change.

METHOD AND MATERIALS

Consecutive patients fulfilling following criteria were found from 1218 CTC cases (January 2013 to July 2014): a) prone CTC obtained with cushion blocks placed under the chest and pelvis to reduce abdominal compression, b) air-distended ascending colon on both supine and prone CTC, and c) colonoscopy-proven sessile polyps >=6mm in straight mid-ascending colon. Radial locations along the luminal circumference (°) of 24 polyps and 54 colonic teniae (3 teniae in each patient) in mid-ascending colon of 18 patients (M:F, 16:2; 65±12 years) were measured on supine and prone CTC images and supine-to-prone difference was determined. A coordinate system designed to offset effects of torso rotation was used. The supine-to-prone difference was given a value between -180° (- for internal rotation) and +180° (+ for external rotation). Degrees of abdominal compression (Abd comp) and posterior displacement of mid-ascending colon (Asc disp) in prone position were quantitatively measured and were correlated with the radial location change of ascending colonic polyps and teniae.

RESULTS

The radial location change was -22° to 61° (median, 10.4°) for the polyps and was similar for colonic teniae, which was considerably smaller than the reported ascending colonic rotation. However, 50-56% of the polyps and teniae still showed external rotation >10°. The radial location change was not significantly correlated with Abd comp (P =.131 to .287) but was correlated with Asc disp (r =.562 to .702; P =.001 to .015). Posterior displacement of the ascending colon still occurred in prone position due to gravitational anterior displacement of other mobile abdominal contents despite the lack of abdominal compression.

CONCLUSION

Ascending colonic rotation on CTC ocurring with supine-to-prone positional change was incompletely prevented by reducing abdominal compression during prone CTC.

CLINICAL RELEVANCE/APPLICATION

Careful confirmation of lesion mobility or lack of it is fundamental for accurate CTC interpretation although reducing abdominal compression during prone CTC may decrease the related pitfall in the ascending colon.

SSK06-08 Computer-aided Supine-only Reading in Full-cathartic CT Colonography: Observer Performance Study

Wednesday, Dec. 2 11:40AM - 11:50AM Location: E351

Participants
Yasuji Ryu, MD, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To assess the performance of an advanced computer-aided "supine-only reading" of full-cathartic CTC in the detection of polyps in patients with average or high risk of colorectal cancer.

METHOD AND MATERIALS

A total of 266 CTC cases were sampled from a multi-center CTC trial for patients with average or high risk of colorectal cancer, in which patients underwent cathartic bowel preparation with 2L polyethylene glycol solution and 20mL sodium diatrizoate for tagging of residual fluid, followed by automated CO2 insufflation. A computer-aided detection (CADe) system that had been trained with cases independent from this study was used to review the CTC cases. One expert reader (≥600 cases reading experience) reviewed the cases in "supine-only reading" mode, in which only the supine scans of these cases were interpreted using CADe as a second reader, and recorded all detected lesions ≥6 mm. The per-patient sensitivities and the areas under the receiver operating curve (AUC) in the detection of adenomas and carcinomas were compared between unaided and CADe-aided readings, as well as between the supine-only reading and "conventional reading" result from the trial, in which both supine and prone scans were used for interpretation of the CTC cases.

RESULTS

There were 53 and 28 patients with adenomas and/or carcinomas ≥6 mm and ≥10 mm, respectively. Corresponding per-patient sensitivities (AUCs) for CADe-aided supine-only reading were 91% (.92) and 93% (0.96), respectively, whereas those of conventional reading were 90% (.91) and 93% (.96), respectively. The differences in sensitives and AUCs were not statistically significant (Fisher's exact test, P>.5). For 6-9 mm lesions, the per-patient sensitivity (AUCs) of CADe-aided supine-only reading was 83% (.88), which was higher (McNemar's test, P<.05) than those of unaided, supine-only reading of 69% (.81).

CONCLUSION

In full-cathartic CTC, CADe-aided supine-only reading may yield an equally high performance in the detection of adenomas and carcinomas as that of the conventional, supine-prone reading. CADe may also significantly improves the detection performance of polyps 6-9 mm in size in size in the supine-only reading

CLINICAL RELEVANCE/APPLICATION

Computer-aided supine-only reading has the potential to allow one-position scanning in CTC, thereby effectively reducing the radiation dose and reading time into a half of those of conventional reading.

SSK06-09 Observer Study for Detection of Lesions in Viewing CT Colonography Using a New Eye Gaze Tracking System

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E351

Participants
Mitsuru Sato, Maebashi, Japan (*Presenter*) Nothing to Disclose
Toshihiro Ogura, PhD, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Mika Okajima, Gunma, Japan (*Abstract Co-Author*) Nothing to Disclose
Yushi Hirano, Otaru, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikio Hasegawa, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kunio Doi, PhD, Chicago, IL (*Abstract Co-Author*) Shareholder, Hologic, Inc; License agreement, Hologic, Inc; License agreement, Deus Technologies, LLC; License agreement, Riverain Technologies, LLC; License agreement, Mitsubishi Corporation; License agreement, MEDIAN Technologies; License agreement, General Electric Company; License agreement, Toshiba Corporation; Research support, Deus Technologies, LLC; Research support, E. I. du Pont de Nemours & Company; Research support, Elcint Medical Imaging Ltd; Research support, FUJIFILM Holdings Corporation; Research support, General Electric Company; Research support, Hitachi, Ltd; Research support, Eastman Kodak Company; Research support, Konica Minolta Group; Research support, Mitaya Manufacturing Co, Ltd; Research support, Mitsubishi Corporation; Research support, Koninklijke Philips NV; Research support, Hologic, Inc; Research support, Riverain Technologies, LLC; Research support, Seiko Corporation; Research support, Siemens AG; Research support, 3M Company; Research support, Toshiba Corporation
Shoko Tsutsumi, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Isobe, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsuko Torimoto, Otaru, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Monitoring the eye tracking of the observer in the detection of lesions is important in order to understand image interpretation process for CT colonography. Head-mount eye tracker system has been used to track observers' viewing points on radiological images. However, it is difficult to use this system casually due to a problem of an obtrusive device for observation. We investigated gaze points for image interpretation of CTC images by experts and non-experienced observers, and analyze the time and the gaze point for detection of lesions using a new eye gaze tracking system, which was designed to detect the pupil point and corneal reflection point in the dark pupil eye tracking by using two infrared cameras.

METHOD AND MATERIALS

Observers for CTC image reading commonly use virtual gross pathology (VGP) images which were obtained as a stretched views of the inner colonic surface. We used an eye gaze point sensing system (JVCKenwood Co.,Yokohama,Japan) which consisted of an eye tracking sensor with two infrared light emitting diode (LED) laser emitters combined with two infrared cameras. Observer studies were performed by two expert observers (over 13 years experience) and two non-experienced observers on nineteen VGP images including tumors, polyps and other abnormalities.

RESULTS

Eye gaze tracking data of the observers can be obtained without a device put on the head such as a headgear, with proper training of about 20 minutes. The average reading time (32.6sec) by expert observers was significantly shorter (p<0.001) than that (46.2sec) by non-experienced observers. The detection rates of target areas such as tumors by expert observers (84.18%) was higher than that of non-experienced observers (68.35%). Non-experienced observers in CTC reading were prolonged with low detection rates. On other hand, experienced observers provided shortened viewer's gaze dwells time on the target areas.

CONCLUSION

A new eye gaze tracking system for CTC images can be performed without a head-mount eye tracker. Although the reading time of expert observers was short, the target areas on VGP images were observed with a high detection rate.

CLINICAL RELEVANCE/APPLICATION

An eye gaze tracking analysis using infrared cameras can be set-up easily. Gaze points on CTC images by experts and non-experienced observers can be determined for understanding of image readings for detection of lesions.

Genitourinary (Prostate Imaging and Staging)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N228

`GU` `MR` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Andrew B. Rosenkrantz, MD, New York, NY (*Moderator*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Moderator*) Nothing to Disclose
Ronaldo H. Baroni, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Sub-Events

SSK09-01   Computed Very High B-Value Diffusion-Weighted Imaging of the Prostate: How High Should We Go?

Wednesday, Dec. 2 10:30AM - 10:40AM Location: N228

Participants
Nainesh Parikh, MD, New York, NY (*Presenter*) Nothing to Disclose
Justin M. Ream, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Andrea S. Kierans, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Max X. Kong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samir S. Taneja, MD, New York, NY (*Abstract Co-Author*) Consultant, Eigen Consultant, GTx, Inc Consultant, Bayer AG Consultant, Healthtronics, Inc Speaker, Johnson & Johnson Investigator, STEBA Biotech NV Royalties, Reed Elsevier
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the impact of a broad range of computed b-values (1,500-5,000 s/mm2) on prostate cancer detection.

METHOD AND MATERIALS

49 patients undergoing 3T prostate MRI before radical prostatectomy were included. Exams included DWI with a maximal acquired b-value of 1,000 s/mm2, from which six computed DWI image sets (b-values ranging from 1,500-5,000 s/mm2) were generated. Two radiologists [R1 (attending), R2 (fellow)] independently evaluated the ADC map as well as each DW image set, blinded to the b-value, to assess dominant lesion location. Pathologic findings from radical prostatectomy served as the reference standard.

RESULTS

Sensitivity for tumor: R1-82% (ADC), 80% (b1000), 86% (b1500), 88% (b2000), 86% (b2500), 84% (b3000), 76% (b4000), 65% (b5000); R2-71% (ADC), 63% (b1000), 76% (b1500), 71% (b2000), 70% (b2500), 65% (b3000), 57% (b4000), 37% (b5000). Sensitivity for Gleason score≥7 tumor: R1-83% (ADC), 80% (b1000), 93% (b1500), 93% (b2000), 90% (b2500), 90% (b3000), 80% (b4000), 65% (b5000); R2-75% (ADC), 68% (b1000), 80% (b1500), 78% (b2000), 78% (b2500), 70% (b3000), 60% (b4000), 38% (b5000). PPV for tumor: R1-95% (ADC), 95% (b1000), 93% (b1500), 96% (b2000), 98% (b2500), 93% (b3000), 95% (b4000), 87% (b5000); R2-85% (ADC), 82% (b1000), 93% (b1500), 88% (b2000), 92% (b2500), 94% (b3000), 93% (b4000), 75% (b5000). Dominant lesion visual conspicuity (1-5 scale): R1-3.4±1.5 (ADC), 2.5±1.2 (b1000), 3.3±1.4 (b1500), 3.2±1.3 (b2000), 3.2±1.4 (b2500), 3.1±1.4 (b3000), 2.8±1.4 (b4000), 2.7±1.5 (b5000); R2-3.2±1.6 (ADC), 2.1±1.1 (b1000), 3.2±1.5 (b1500), 3.1±1.6 (b2000), 3.0±1.6 (b2500), 2.5± 1.5 (b3000), 1.8±1.0 (b4000), 1.3±0.6 (b5000). Reader confidence (1-5 scale): R1-3.2±1.5 (ADC), 2.6±1.3 (b1000), 3.1±1.4 (b1500), 3.1±1.4 (b2000), 3.1±1.5 (b2500), 3.1±1.5 (b3000), 3.0±1.6 (b4000), 2.8±1.7 (b5000); R2-3.3±1.7 (ADC), 2.2±1.2 (b1000), 3.2±1.6 (b1500), 3.4±1.7 (b2000), 3.4±1.8 (b2500), 3.1± 1.8 (b3000), 2.6±1.6 (b4000), 1.9±1.3 (b5000).

CONCLUSION

Computed b-values in the range of 1,500-2,500 s/mm2 were optimal for prostate cancer detection, comparing favorably with the ADC map. b-values of 1,000 or 3,000-5,000 exhibited lower performance.

CLINICAL RELEVANCE/APPLICATION

Computed b-values of 1,500-2,500 s/mm2 (but not higher) help optimize prostate DWI, thereby facilitating targeted prostate biopsy and tailored treatments based on imaging guidance.

SSK09-02   Utility of Apparent Diffusion Coefficient (ADC) in Intermediate Grade (Gleason score 3+4=7) Prostate Cancer Diagnosed at Non-targeted TRUS-guided Needle Biopsy

Wednesday, Dec. 2 10:40AM - 10:50AM Location: N228

Participants
Radu Rozenberg, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Nicola Schieda, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Shaheed Hakim, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Trevor A. Flood, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Rebecca Thornhill, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Christopher Lim, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

PURPOSE

To determine the ability of ADC analysis to predict Gleason score (GS) upgrading of tumor and extra-prostatic extension (EPE) after radical prostatectomy (RP) in 3+4=7 prostate cancer (PCa).

METHOD AND MATERIALS

With REB approval, 54 men with GS 3+4=7 PCa at non-targeted TRUS-guided biopsy underwent 3-Tesla MRI and RP between 2012-2013. Outcomes at RP included: A) upgrading to GS 4+3=7 and B) organ confined disease (OCD). >0.5 mL tumors were contoured by a blinded GU radiologist by correlating ADC to RP histopathology map. Mean ADC, ADC ratio (normalized to peripheral zone), histogram analysis (10th, 25th and 50th centile ADC) and texture analysis features were compared between groups using multi-variate analysis, regression modeling and ROC analysis.

RESULTS

25.9% (14/54) patients were upgraded to GS 4+3=7 and 51.9% (28/54) patients had EPE after RP. There was no difference in age (p=0.38, 0.85), PSA (p=0.96, 0.95) or % of core biopsies with Gleason pattern 4 (p=0.56, 0.89) between groups. Mean ADC (mm2/sec), ADC ratio, 10th, 25th and 50th centile ADC were similar between GS 3+4=7 (0.94 ± 0.24, 0.58 ± 0.15, 0.77 ± 0.31, 0.94 ± 0.28 and 1.15 ± 0.24) and GS 4+3=7 tumors (0.96 ± 0.20, 0.55 ± 0.11, 0.71 ± 0.26, 0.89 ± 0.19 and 1.11 ± 0.16), p>0.05. 10th centile ADC was lower in tumors with EPE (0.69 ± 0.31 versus 0.82 ± 0.28), p=0.02; with no difference comparing all other conventional ADC parameters, p>0.05. Regression models combining texture features improved prediction of GS upgrade: A) Kurtosis+Entropy+Skewness (AUC 0.76 [SE=0.07], p<0.001; sensitivity 71%, specificity 73%) and B) Kurtosis+Heterogeneity+Entropy+Skewness (AUC 0.77 [SE=0.07], p<0.001); sensitivity 71%, specificity 78%).

CONCLUSION

Amongst Gleason score 3+4=7 prostate cancers diagnosed at TRUS-guided biopsy, mean ADC and ADC histogram analysis is not predictive of upgrading after RP, while ADC texture-analysis improves accuracy. 10th centile ADC is predictive of EPE.

CLINICAL RELEVANCE/APPLICATION

Conventional ADC analysis cannot predict upgrading of Gleason score 3+4=7 prostate cancer diagnosed at TRUS-guided biopsy; however, ADC texture-analysis improves accuracy and 10th centile ADC can predict organ confined disease.

SSK09-03   High Resolution 3-Tesla Endorectal Prostate MR Imaging: A Multireader Study of Radiologist Preference and Perceived Interpretive Quality of 2D and 3D T2-weighted FSE MR Images

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N228

Participants
Antonio C. Westphalen, MD, Mill Valley, CA (*Presenter*) Nothing to Disclose
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Saunak Sen, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kartik S. Jhaveri, MD, Toronto, ON (*Abstract Co-Author*) Speaker, Bayer AG
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose
Ronald J. Zagoria, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Kurhanewicz, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of this study was to compare the perceived quality of 3-Tesla axial T2-weighted high-resolution 2D and high-resolution 3D FSE endorectal MR images of the prostate.

METHOD AND MATERIALS

We studied 85 men (median age=65 years, 46 to 83) with proven or suspected prostate cancer who had endorectal MR imaging with 2D and 3D T2-weighted FSE MR images. Six radiologists from various institutions independently reviewed axial T2 weighted MR images shown individually and paired. Readers identified their preferred images and scored using a 5-point scale their confidence in identifying tumor. They also scored the delineation of the zonal anatomy and capsule, tumor conspicuity, and image quality (artifacts, distortion, and sharpness) using a 3-point scale. We used a meta-analysis routine to calculate pooled estimates based on a random-effects model. A formal analysis of heterogeneity was also done. The presence of heterogeneity is consistent with differences in the readers' scores. We used a mixed effect logistic regression, taking into account the clustering effect, to determine if prior treatment and number of years of reader's experience were predictors of the option for 2D or 3D images.

RESULTS

Each reader had a strong preference for a given T2-weighted MR sequence, favoring one of the two techniques in at least approximately 70% of cases; but the choices were evenly distributed between the two sequence options. The pooled estimate shows that the 3D image is preferred in about 47% of the times (95% CI=20% to 74%). The choice for one or other techniques was not associated with prior treatment or readers' years of experience. There was no significant difference in confidence in tumor identification (p=0.16 to 1.00). There was no difference in delineation of the zonal anatomy (p=0.19), prostatic capsule (p=0.14), and tumor conspicuity (p=0.89). Similarly, no difference was found when assessing motion artifact (p=0.48) and distortion (p=0.41). 2D FSE images were significantly sharper than 3D FSE (p<0.001), but also more likely to exhibit artifacts not related to motion (p=0.002).

CONCLUSION

There are strong individual preferences for the 2D or 3D FSE MR images, but a wide variability among radiologists. There were differences in image quality, but not in the sequences' ability to delineate the glandular anatomy and depict cancer.

CLINICAL RELEVANCE/APPLICATION

2D and 3D FSE techniques appear to be equally adequate fro clinical use.

SSK09-04   Multi-Parametric MRI Performance in Prostate Cancer Detection: Stratified by Gleason Scores and Tumor Size on Whole Mount Histopathology

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N228

Participants

Pooria Khoshnoodi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Daniel J. Margolis, MD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG
Hector E. Alcala, MPH, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Wei-Chan Lin, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
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Jiaoti Huang, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Robert E. Reiter, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prostate cancer (CaP) detection rate by multi-parametric MR imaging (MP-MRI) confirmed by whole mount histopathology (WMHP) stratified by Gleason Scores (GS) and tumor size.

METHOD AND MATERIALS

A HIPPA-compliant, IRB-approved study of 290 consecutive men who underwent prostate MP-MRI before radical prostatectomy (RP) from October 2010 to January 2015 was performed. Clinical, MP-MRI (T2W, DWI and DCE) and pathologic features (WMHP slides, GS, maximal diameter) were obtained. The index tumor was defined as the pathological lesion with the highest GS or largest tumor when multiple foci had identical GS. A genitourinary (GU) radiologist and a GU pathologist reviewed each case. Each tumor focus on WMHP which matched with concordant target on MP-MRI was considered detected tumor. Chi-squared tests were used to test difference in MRI tumor detection rates by tumor grade (GS=3+3 defined as low grade vs. GS>6 as high grade) and tumor size (<1 cm defined as small vs. ≥ 1cm as large tumor). Logistic regression was used to test a tumor grade by tumor size in MRI detection. Statistical analyses were conducted using Stata 12.1. P-values below .05 were considered significant.

RESULTS

290 patients had 639 unique CaP foci on WMHP. Of 639 total tumors foci on pathology, 310 (48.5%) and of 290 total index lesions, 224 (77.2%) were detected on MP-MRI. MRI detected 86/326 (26.4%) of low grade tumors vs. 223/313 (71.2%) of high grade tumors, and 56/257 (21.8%) of small vs. 253/382 (66.2%) large tumors. MRI detected 44/212 (20.8%) of low grade small tumors vs. 12/45 (26.7%) of high grade small tumors, and 42/114 (36.8%) low grade large tumors vs. 211/268 (78.7%) of high grade large tumors. (p<.05)

CONCLUSION

We found that MP-MRI missed 51.6% of all CaP. However, when CaP stratified by size and GS, larger tumors were associated with increased detection rate for both high and low grade tumors. There was also a significant size by grade interaction, such that the difference in detection rates by grade was much larger among tumors 1cm or larger. These findings suggest that the MP-MRI tends to detect larger with higher grade CaP lesions. In our study, MP-MRI detected 78.7% of all high grade large CaP foci.

CLINICAL RELEVANCE/APPLICATION

MP-MRI which combines anatomic with functional and physiologic assessment of prostate cancer has substantially improved diagnostic capabilities of detecting clinically significant prostate tumors.

SSK09-05 Distortion in Diffusion-Weighted Prostate MRI: Readout-Segmented EPI DWI vs. Single-Shot EPI DWI

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N228

Participants

Ivan Platzek, MD, Dresden, Germany (*Presenter*) Nothing to Disclose
Angelika Borkowetz, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Marieta Toma, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Brauer, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Hagen H. Kitzler, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Verena Plodeck, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Manfred Wirth, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Laniado, MD, Dresden, Germany (*Abstract Co-Author*) Reviewer, Johnson & Johnson

PURPOSE

The aim of this study was to evaluate the utility of segmented-readout echo planar diffusion-weighted imaging (SR EPI DWI) for prostate imaging in comparison to conventional single shot EPI DWI (SS EPI DWI), with an emphasis on distortion artifacts.

METHOD AND MATERIALS

Sixty-eight patients with suspected prostate cancer were included in this prospective study. Patient age varied between 46 and 77 y (65 y on average). All patients underwent multiparametric prostate MRI (mpMRI) at 3T, which included T2-weighted images, dynamic contrast-enhanced (DCE) images, and both SR EPI DWI and SS EPI DWI. Apparent diffusion coefficient maps (ADC) maps were generated for both SR EPI DWI and SS EPI DWI. Overall lesion classification was based on the PI-RADS scoring system proposed by the European society of Urogenital Radiology (ESUR). Distortion on ADC maps was classified on a five point scale. Furthermore, the maximum distortion in the anteroposterior direction was measured in each patient for both SR EPI DWI and SS EPI DWI.

RESULTS

ADC maps based on SR EPI DWI showed no evidence of distortion in 58/68 patients (85%), while ADC maps based on SS EPI DWI showed no distortion in 42/68 patients (61.7%). Distortion scores were higher (indicating stronger distortion) for SS EPI DWI as compared to SR EPI DWI in 19/68 patients (27.9%) and lower in only one patient (1.5%). Visual evaluation showed significantly less distortion for SR EPI DWI in comparison to EPI DWI (p = 0.0001). Average maximum distortion (1.5 ± 2.6 mm) was significantly lower

in SR EPI DWI in comparison to SS EPI DWI (4.9 ± 9.7 mm) (p < 0.0001). Ninety-six prostate lesions were detected with mpMRI in total. PI-RADS scores did not differ significantly between mpMRI including SR EPI DWI and mpMRI including SS EPI DWI (p = 0.464). Mean ADC values based on SS EPI DWI (0.93 ± 0.21) were slightly lower than those based on SR EPI DWI (0.96 ± 0.22)(p = 0.047).

CONCLUSION

SR EPI DWI of the prostate has significantly less pronounced distortion artifacts compared to SS EPI DWI. As prostate lesion detection and lesion classification based on PI-RADS scores do not change significantly when SR EPI DWI is used instead of SS EPI DWI, SR EPI DWI is a promising alternative to conventional diffusion-weighted sequences.

CLINICAL RELEVANCE/APPLICATION

The use of SR EPI DWI instead of conventional SS EPI DWI in prostate MRI reduces distortion and can help improve correlation between DWI and T2-weighted images.

SSK09-06 Accuracy and Inter-Observer Variability of Prostate Imaging-Report and Data System (PI-RADS) Version 2.0 for Characterization of Lesions Identified on Multiparametric Magnetic Resonance Imaging of the Prostate

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N228

Participants
Andrei S. Purysko, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Erick M. Remer, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Jennifer Bullen, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To measure the accuracy and inter-observe variability of PI-RADS version 2.0 for the characterization of prostate lesions identified on mpMRI.

METHOD AND MATERIALS

IRB-approved, HIPAA compliant retrospective study including 171 men (mean age: 61.5 yrs.) either being investigated for prostate cancer (n = 128) or enrolled in active surveillance (n =43), who were examined on a 3.0 T magnet without endorectal coil, and were found to have potential targets for biopsy. Two readers with 8 yrs. of experience in abdominal imaging independently reviewed and assigned a PI-RADS V.2 assessment category to the dominant MRI targets. The reference standard was the combined results from the MR/US fusion biopsy and transrectal ultrasound guided 12-core systematic biopsy (SB) performed in all the patients and in the same procedure. Clinically significant (CS) PCa was defined as tumors with Gleason score >= 3 + 4. Receiver operating characteristic (ROC) analysis was performed.

RESULTS

PCa was detected in 49.1% (84/171) and CS PCa was detected in 32.3% (55/171) of the men. Using PI-RADS category > 3 to discriminate any PCa from non-cancerous lesions, the sensitivity (Sen), specificity (Sp) and area under the ROC curve (AUC) were 77.4%, 84.9% and 85.7% for reader 1 and 69.1%, 87.2%, and 77.9% for reader 2. Using PI-RADS category > 3 to discriminate only clinically significant PCa from clinically insignificant prostate cancer and benign lesions, the Sen, Sp, and AUC were 98.2%, 79.1%, and 91.1% for reader 1 and 92.7%, 84.4%, and 90.4% for reader 2. The inter-observer agreement coefficient was 0.68 (95% CI: 0.61- 0.75).

CONCLUSION

PI-RADS V.2 had high sensitivity, specificity and accuracy for the discrimination of clinically significant PCa from other pathology, with good inter-observer agreement.

CLINICAL RELEVANCE/APPLICATION

Lesions with a PI-RADS V.2 assessment category > 3 should be considered for targeted biopsy, while avoiding the biopsy of lesions with a category < 3 reduces the number of negative biopsies and/or detection of clinically insignificant lesions.

SSK09-07 Predicting Organ-confined Prostate Cancer in the Era of Multiparametric MRI: Comparing the Accuracy of the Partin Tables and mpMRI

Wednesday, Dec. 2 11:30AM - 11:40AM Location: N228

Participants
Alison F. Brown, BA, Durham, NC (*Presenter*) Nothing to Disclose
Thomas J. Polascik, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rachel K. Silverman, MS, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Kae Jack Tay, MBBS,MMed, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rajan T. Gupta, MD, Durham, NC (*Abstract Co-Author*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation

PURPOSE

To investigate the accuracy of the Partin tables and multiparametric magnetic resonance imaging (mpMRI) in predicting organ-confined (OC) prostate cancer (PCa) after radical prostatectomy (RP), and to determine if radiologic staging information from mpMRI versus digital rectal exam (DRE) to augment the Partin tables increases the predictive accuracy of this widely used nomogram.

METHOD AND MATERIALS

In this retrospective, HIPAA-compliant, IRB-approved study, 157 patients underwent 3T mpMRI with endorectal coil before RP. MpMRI was used to assess clinical stage and an updated version of the Partin tables was used to calculate the probability of each patient to harbor OC disease. Logistic regression models predicting OC disease were created using mpMRI staging alone and with PSA as a covariate. Two sets of probabilities were obtained from the Partin tables, using clinical staging from either DRE or mpMRI. The area under curve (AUC) was used to calculate the predictive accuracy of each of these four predictive methods.

RESULTS

The predictive accuracy of mpMRI alone in predicting OC disease on pathological analysis is greater (AUC=0.86) than the Partin tables (AUC=0.70), and is further improved when combined with PSA values (AUC=0.88). The accuracy of the Partin nomogram in predicting OC disease decreases (AUC=0.59) when clinical stage is based on mpMRI versus DRE.

CONCLUSION

The superior predictive accuracy of mpMRI compared to Partin tables in predicting OC disease on pathological analysis validates results of smaller previously published studies, including one from our group. Partin table probabilities are calculated using clinical stage based on DRE result, a less sensitive test than mpMRI; therefore, this frequently leads to disease understaging. Consequently, although mpMRI has been shown to more accurately predict clinical stage than DRE, using mpMRI stage in the Partin nomogram does not improve its accuracy. In conclusion, mpMRI staging information is valuable as a stand-alone test when available based on its AUC value, but should not be applied to the Partin nomogram in its existing form.

CLINICAL RELEVANCE/APPLICATION

As more accurate clinical staging information is becoming available due to mpMRI, nomograms that incorporate mpMRI stage are needed to better predict OC PCa and assist in surgical planning prior to RP.

SSK09-08   Diagnostic Differentiation of Prostate Cancer from Prostatic Hyperplasia: What Diffusion Kurtosis Imaging Can Help Us?

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N228

Participants
Chen Lihua, Dalian, China (*Presenter*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Qingwei Song, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ma Chunmei, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Zibin Tong, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ye Li, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of the typical parameters of DKI in diagnositic differentiation of prostate carcinoma from prostatic hyperplasia.

METHOD AND MATERIALS

One hundred and thirteen patients with the suspicion of prostate disease were recruited in the study. All the patients, with written informed consent obtained, were performed MRI exams on a 3.0T scanner in a protocol containing the routine T1WI, T2WI, contrast-enhanced MRI, DWI and DKI. From the following histopathological examination, it was confirmed that prostate carcinoma was in 30 and prostatic hyperplasia in 29. MR images were reviewed and analyzed by author and one experienced radiologist who has five years experience in prostate diagnosis, using a dedicated software in Functool on GE ADW4.4 workstation. For each focus, the mean value of the parameters of DKI (MK, Ka, Kr, FA, MD, Da, Dr) and DWI(ADC) was measured: in PCa group, the area where shows low signal on T2WI image, high signal on MK image and histopathological positive was the focus, regions of interest (ROIs) drew three times in the tumor, the size of the ROI was chosen to cover the 2/3 of the tumor(fig 1) , then the average value was used in statistics. In BPH group, three identical ROIs (70mm2)were drew in the central zone, the average value was used in statistics. The type of time-signal intensity curve(TIC) was observed by two observers collectively. ICC test was used to examine the consistency of the measurements, Pearson test was used to examine the relevance between MD and ADC value,and student's t-test was executed to compare the obtained parametric values with p> 0.05 concerned statistical significant. The ROC curve of all the parameters were drew and analyzed.

RESULTS

The ICC value of the DKI parameters and DWI parameter in the PCa group and BPH group were respectively, 0.963,0.935,0.959,0.905,0.970,0.909,0.967,0.977and 0.804,0.899,0.913,0.901,0.923,0.902,0.911,0.931, exhibiting an amenable consistency. The mean MK, Ka, Kr of PCa were significantly higher ($p < 0.01$) than the BPH, while the mean MD, Da, Dr of cancerous tissue was found to be significantly lower ($p < 0.01$) than the hyperplasia tissue. No statistically significant difference was observed between FA values of two groups ($p > 0.05$). The area under the ROC curve of all parameters were higher than 0.9.

CONCLUSION

DKI demonstrated can supply many meritorious parameters, with most useful in diagnostic differentiation of prostate cancer from prostatic hyperplasia. Combining with the routine prostate MRI, DKI may help in increasing the sensitivity and specificity of cancer detection.

CLINICAL RELEVANCE/APPLICATION

Combining with the routine prostate MRI, DKI may help in increasing the sensitivity and specificity of cancer detection.

SSK09-09   Incidental Bone Lesions on Staging MRI for Prostate Cancer: Prevalence and Clinical Importance

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N228

Participants

Rachel Schor-Bardach, MD, New York, NY (*Presenter*) Nothing to Disclose
Niamh M. Long, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jane D. Cunningham, FFRRCSI, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Kirzner, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Debra A. Goldman, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chaya Moskowitz, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
David M. Panicek, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prevalence of bone lesions identified on prostate MRI and determine the associations between their imaging features, clinical/pathologic characteristics and the presence of prostate cancer (PCa) bone metastases.

METHOD AND MATERIALS

In this IRB approved, retrospective study, the medical records of 3765 patients undergoing staging prostate MRI for newly-diagnosed (PCa) between 2000-2014 were reviewed. Amongst these, the MRI exams of all patients with bone metastases and a random selection of patients without bone metastases (matched with a 3:1 ratio to patients with bone metastases) were reviewed by 2 independent readers (R1 and R2) for presence, size and signal characteristics of bone lesions on T1-weighted sequences along with their subjective level of suspicion (1-5 Likert scale) for the likelihood of bone metastases on MRI. Prostate-specific antigen levels, biopsy Gleason Score, clinical stage and National Comprehensive Cancer Network (NCCN) risk categories were recorded. The reference standard was bone biopsy and/or at least 1-year follow-up after MRI. Associations between MRI and clinical/pathologic findings were tested using Fisher's exact and Wilcoxon Rank Sum tests. Inter-reader agreement and diagnostic accuracy for bone metastases detection were assessed using Cohen's simple Kappa statistic and areas under the receiving operating characteristics curve (AUC).

RESULTS

57 out of 3765 patients (1.5%) had bone metastases. None of the patients with low-risk PCa according to the NCCN criteria had bone metastases. Inter-reader agreement on MRI was fair to substantial (k=0.26-0.70). There was at least 1 bone lesion present on MRI in 72% (95% CI: 0.66-0.78) and 70% (95% CI: 0.64-0.76) of patients according to R1 and R2. The AUC for detecting bone metastases on MRI was 0.97 (95% CI: 0.94-1.00) and 0.90 (95% CI: 0.84-0.95) for R1 and R2. Larger lesion diameter (p<0.0001 for both) and absence of intratumoral fat (p=0.0013-0.0020) were significantly associated with bone metastases for both readers.

CONCLUSION

Bone lesions in prostate MRI are present in the majority of patients undergoing initial staging for PCa, and infrequently represent metastatic disease.

CLINICAL RELEVANCE/APPLICATION

MRI findings should be interpreted in the context of clinical features which increase the likelihood of metastatic disease.

Molecular Imaging (Staging and Therapy Control)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S504CD

MI **NM** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;
Suzanne E. Lapi, PhD, Saint Louis, MO (*Moderator*) Research Grant, ImaginAB, Inc

Sub-Events

SSK11-01 Noninvasive Monitoring of Early Antiangiogenic Therapy Response using RGD-conjugated Ultrasmall Superparamagnetic Iron Oxide Nanoparticles in an Orthotopic Human Nasopharyngeal Carcinoma Model

Wednesday, Dec. 2 10:30AM - 10:40AM Location: S504CD

Participants
Yanfen Cui, Shanghai, China (*Presenter*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Molecular imaging is merging as a powerful tool for the noninvasive imaging of the biological processes. The purpose of this study was to validate a novel integrin αvβ3-targeted ultrasmall superparamagnetic iron oxide (USPIO) nanoparticles, Fe3O4@PAA-RGD, for its ability to detect tumor angiogenesis and assess the early response of an antiangiogenesis agent Avastin® in an orthotopic human nasopharyngeal carcinoma (NPC) model.

METHOD AND MATERIALS

The specific uptake of Fe3O4@PAA-RGD in HUVECs and CNE-2 Cells was evaluated using Prussian blue staining, transmission electron microscopy (TEM).The ability of Fe3O4@PAA-RGD to noninvasively assess αvβ3 integrin positive vessels in NPC tumor xenografts was evaluated with a 3.0T MR scanner. For the assessment of antiangiogenesis therapy, the mice bearing human NPC tumor xenografts were intraperitoneally injected with Avastin® (n=12) or normal saline (n=12) three times in a week at a dose of 200 μg/mouse .T2* mapping was performed baseline and after 2 and 7 days of treatment.

RESULTS

The specific uptake of the particles was mainly dependent on the interaction between RGD and integrin αvβ3 of HUVEC, which could be competitively inhibited by addition of unbound RGD. The tumor targeting of Fe3O4@PAA-RGD was observed in the orthotopic NPC model, which demonstrates accumulation of nanoparticles exclusively at the neovasculature but not within tumor cells. The vascular accumulation of Fe3O4@PAA-RGD caused significantly higher changes of the R2* value of tumors than observed for unlabelled USPIO. Bevacizumab treatment resulted in a significant reduction of the R2* values compared with the control group both at day2 and day7, confirmed by the immunohistochemistry of MVD after treatment.

CONCLUSION

This study demonstrates that RGD-coupled, PAA-coated USPIOs efficiently label integrin αvβ3expressed on endothelial cells. Furthermore, these molecular MR imaging probes are capable of noninvasive monitoring of the tumor response to bevacizumab therapy at early stages of treatment.

CLINICAL RELEVANCE/APPLICATION

RGD-coupled, PAA-coated USPIOs efficiently label integrin αvβ3expressed on endothelial cells. Furthermore, these molecular MR imaging probes are capable of noninvasive monitoring of the tumor response to bevacizumab therapy at early stages of treatment.

SSK11-02 Point of Care Assessment of Melanoma Tumor Signaling and Metastatic Burden from μNMR Analysis of Tumor Fine Needle Aspirates and Peripheral Blood

Wednesday, Dec. 2 10:40AM - 10:50AM Location: S504CD

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Presenter*) Nothing to Disclose
Arezou Ghazani, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hakho Lee, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ralph Weissleder, MD, PhD, Boston, MA (*Abstract Co-Author*) Investor, T2 Biosystems, Inc

PURPOSE

To use μNMR technology for molecular profiling of tumor fine needle aspirates and peripheral blood of melanoma patients, in order to assess BRAF signaling compared with genetic reference and metastatic burden compared with imaging reference.

METHOD AND MATERIALS

μNMR in vitro assessment of expression of melanocyte (MelanA, HMB45) and MAP kinase signaling (pERK, pS6K) molecules was

performed in human cell lines on a miniaturized μNMR device as described (JB Haun, Sci Transl Med 2011) using nanoparticle-conjugated antibodies. Clinical μNMR validation was performed in an IRB-approved study of melanoma patients scheduled for biopsy of suspected metastasis, who also underwent tumor FNA and peripheral blood sampling for μNMR. Tumor FNA specimens were assessed for pERK and pS6K, while peripheral blood was evaluated for circulating tumor cells (CTC) as described (AA Ghazani, Neoplasia 2012). Reference standards for μNMR results included Western blot, BRAF genetic analysis, and metastatic burden on clinical imaging obtained near the time of biopsy. Student's t-test was used to assess for statistical significance.

RESULTS

μNMR in vitro analysis showed increased expression of melanocyte markers MART1 and HMB45 in human melanoma cell lines compared with nonmelanoma cells (P<0.0001). Expression of MAP kinase targets pERK and pS6K was significantly increased in BRAF mutant compared with BRAF WT melanoma cells (P < 0.01), with levels confirmed by Western blot. Ten patients in the clinical study included 5 BRAF wild-type and 5 BRAF V600E mutant melanoma patients. μNMR analysis of tumor FNA samples showed increased pERK (41.0 +/- 8.6) and pS6K (34.4 +/- 15.5) levels in BRAF mutant compared with BRAF WT (24.8 +/- 15.0 and 23.5 +/- 9.0; P= 0.009 and 0.13 respectively) melanomas. μNMR blood CTC level was significantly increased in patients with multiple metastases on imaging (90.3 +/- 57.9) compared with those with 0-1 lesions (39.3 +/- 31.5; P = 0.045). CTC threshold >60 was associated with significantly higher RECIST metastatic score on imaging and had 80% acc/83% sens/75% spec for multiple metastases.

CONCLUSION

μNMR technology provides point of care evaluation of tumor signaling in patients with cancer in a minimally invasive manner. μNMR-based blood CTC level is significantly associated with metastatic burden on imaging.

CLINICAL RELEVANCE/APPLICATION

Molecular tracking of metastatic disease is possible by serial sampling of tumor cells and peripheral blood.

SSK11-03   Optical Molecular Imaging of Mesenchymal-Epithelial Transition Factor (c-Met) for Enhanced Detection and Characterization of Primary and Metastatic Hepatic Tumors

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S504CD

Awards
Trainee Research Prize - Resident

Participants
Shadi A. Esfahani, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

Primary liver cancer as well as metastatic liver disease, predominantly from colorectal cancer (CRC) are major causes of cancer death. The success of liver cancer therapy depends on accurate diagnosis at the time of biopsy and efficiency of cytoreductive surgery. c-Met is a proto-oncogene overexpressed in 74-90 % of hepatocellular carcinoma (HCC) and CRC. We assessed whether optical imaging of c-Met using a targeted fluorescence probe, can be used to delineate and characterize the liver tumors and be effectively employed for intraoperative interventions and personalized therapy.

METHOD AND MATERIALS

A modified cyanine 5-tagged peptide with high affinity to c-Met was used. Cell binding assay was performed by incubation of human HCC cells (HepG2,Huh-7), CRC cells (HT-29), and cMET-negative cells (LNCaP) with probe ± HGF. Fluorescence signal was correlated to c-Met expression level. Focal models of primary and metastatic liver cancer were generated by injection of HepG2, Huh-7, and HT-29 in hepatic subcapsular space of nude mice (n=24). Near infrared fluorescence (NIRF) imaging was performed over 8 h after probe injection. Uptake in liver and tumor, and tumor to background ratio (TBR) were calculated. Probe biodistribution was assessed by measuring NIRF signal in multiple organs. IHC evaluation of c-Met expression in human CRCs and HCCs was performed using tissue arrays.

RESULTS

Incubation of cells with probe showed enhanced fluorescence signal in c-Met expressing cells compared to LNCaP, and strong correlation between signal and c-MET expression level (R2=0.99,p<0.0001). NIRF imaging showed high uptake in subcapsularly grown tumors and greater signal compared to the liver over 8 h; TBR reached a peak of 5.46±0.46 in Huh-7, 3.55±0.38 in HepG2 and 15.93±0.61 in HT-29, 4 h post-injection. IHC of tissue arrays confirmed c-Met overexpression in 86% of CRC and 84.9% of HCC cores.

CONCLUSION

High TBR achieved in our tumor models and overexpression of c-Met in a majority of human HCC and metastatic CRC tumors suggest that optical imaging of c-Met is a promising approach for accurate delineation and characterization of liver tumors. This is a translatable advancement for intraoperative image-guided interventions and personalized treatment.

CLINICAL RELEVANCE/APPLICATION

c-MET receptor imaging helps in precise delineation and in-situ characterization of primary hepatic tumors and metastases of other cancers to the liver.

SSK11-04   Volumetric Molecular Ultrasound Imaging of Tumor Angiogenesis: Intra-Animal Comparison with Volumetric Dynamic Contrast-Enhanced Imaging

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S504CD

Participants
Huaijun Wang, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Dimitre Hristov, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Partner, SoniTrack Systems, Inc

Lu Tian, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

PURPOSE

To perform an intra-animal comparison between 3D ultrasound molecular imaging (USMI) using clinical grade vascular endothelial growth factor receptor 2 (VEGFR2)-targeted contrast microbubble (MBVEGFR2) and 3D dynamic contrast-enhanced (DCE)-US for assessing tumor angiogenesis and anti-angiogenic treatment effects in a murine model of human colon cancer.

METHOD AND MATERIALS

Subcutaneous human colon cancers were induced in 19 mice and randomized to either anti-angiogenic treatment (n=11; i.v. single dose of anti-angiogenic agent, bevacizumab at 10mg/kg) or vehicle treatment (n=8; saline). 3D US imaging was performed with a clinical system (IU22 xMATRIX; Philips) and a matrix array transducer (X6-1; 3.2MHz) using 2 techniques: 1) USMI was performed 4min after i.v. injection of 5×10^7 MBVEGFR2; and 2) DCE-US was performed with destruction-replenishment approach by constantly infusing non-targeted microbubbles at 40μL/min. VEGFR2-targeted signal intensity (SI) was quantified from USMI and 2 perfusion parameters, relative blood volume (rBV) and flow (rBF) were calculated from DCE-US. VEGFR2 expression levels and the percent area of blood vessels (PABV) were assessed ex vivo using immunofluorescence (IF) and correlated with correponding in vivo US parameters.

RESULTS

Both 3D US imaging techniques showed strong anti-angiogenic treatment effects. All 3 parameters including VEGFR2-targeted SI (58%, P=0.002), rBV (52%, P=0.002) and rBF (38%, P=0.02) significantly decreased following anti-angiogenic treatment compared to controls. IF showed significantly diminished VEGFR2 expression (P=0.03) and PABV (P=0.03) in treated tumors, while no significant change was observed in control tumors. SI was highly correlated with VEGFR2 expression (r=0.95, P=0.001), and rBV (r=0.71, P=0.08) and rBF (r=0.82, P=0.02) showed good correlation with PABV.

CONCLUSION

Both 3D USMI and 3D DCE-US provide complementary in vivo information on anti-angiogenic treatment effects and allow accurate quantification of tumor angiogenesis in human colon cancer xenografts compared to ex vivo reference gold standard techniques.

CLINICAL RELEVANCE/APPLICATION

3D imaging capabilities may further expand the future clinical role of both USMI and DCE-US in cancer imaging.

SSK11-05   Accurate Prediction of Nodal Status in Preoperative Patients with Thyroid Carcinoma Using Next-Gen Nanoparticle

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S504CD

Participants
Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Roy Phitayakorn, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gilbert H. Daniels, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sareh Parangi, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gregory Randolph, Bosotn, MA (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of the study is to test the ability to image lymph node metastases in thyroid cancer by a novel MRI imaging agent the ferromagnetic nanoparticle Ferumoxytol (Feraheme; AMAG Pharmaceuticals, Lexington, MA), which has residual magnetic properties that are detectable by MRI. These carboxymethyl dextran-coated iron oxide $((FeO)1 - n(Fe2O3)n)$ nanoparticles slowly extravasate and travel through the lymphatic system to lymph nodes. The particles are subsequently internalized into macrophages, presumably through macropinocytosis. Prior studies using this approach with other malignancies (such as prostate cancer) demonstrated abnormal nanoparticle accumulation patterns which are detectable by MRI. We prospectively enrolled 12 patients with confirmed metastatic thryroid carcinoma (3 medullary, 9 papillary) undergoing surgery and compared preoperative MRI appearance of lymph nodes to post-operative histopathologic analysis. The study group consisted of 5 male and 7 female patients, with an mean of 34 nodes resected (range from 1 - 135).

METHOD AND MATERIALS

This exploratory study was performed as a prospective, single-dose pilot study and was approved by the Institutional Review Board. All patients with known thyroid cancer who were scheduled for surgical resection were eligible for enrollment in this study. Exclusion criteria included: age < 18, history of iron overload or known allergy to parenteral iron.

RESULTS

)We demonstrated 76.92% sensitivity and 95.74% specificity, 90.91% PPV (CI 70.84% to 98.88%) NPV 88.24% (76.13% to 95.56%) for the detection of central nodes. There was 82.76% sensitivity and 91.78% specificity, PPV 61.54% (CI 49.83% to 72.34%) NPV 97.1% (CI 94.73% to 98.6%) for the detection of peripheral nodes.

CONCLUSION

Lymph node metastases correlate with recurrent disease in patients with thyroid carcinoma. We currently have limited ability to image central lymph nodes prior to thyroidectomy in patients with thyroid carcinoma. This preliminary study suggests that MRI imaging following nanoparticle injection is a potentially worthwhile imaging modality. Additional studies are necessary comparing this with other established methods.

CLINICAL RELEVANCE/APPLICATION

Our study has demonstrated that nanoparticle-enhanced MRI is an accurate and safe method for pre-operatively detecting nodal metastases in patients with thyroid carcinoma.

SSK11-06 Chemical Exchange Saturation Transfer (CEST) Imaging: Comparison of Capability for Differentiation of Malignant from Benign Pulmonary Nodules and/ or Masses with FDG-PET/CT

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S504CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Cheng Ouyang, Vernon Hills, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
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Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To directly and prospectively compare the capability of chemical exchange saturation transfer (CEST) imaging targeted to amide groups (-NH) for differentiation of malignant from benign pulmonary nodules and/ or masses with FDG-PET/CT.

METHOD AND MATERIALS

Thirty-six consecutive patients (26 men and 10 women; mean age 67 years) with pulmonary nodules and/ or masses underwent CEST imaging, FDG-PET/CT and pathological and/or follow-up examinations. According to final diagnoses, all lesions were divided into malignant (n=26) and benign (n=10) groups. To obtain CEST imaging data in each subject, respiratory-synchronized fast advanced spin-echo images were conducted following a series of magnetization transfer (MT) pulses. Then, magnetization transfer ratio asymmetry (MTRasym) was calculated from z-spectra at 3.5ppm in each pixel, and MTRasym map was computationally generated. To evaluate the capability for differentiation between two groups at each lesion, MTRasym and SUVmax were assessed by ROI measurements. Then, MTRasym was statistically correlated with SUVmax. To compare each index between two groups, Student's t-test was performed. Then, ROC-based positive test was performed to determine each feasible threshold value for differentiation of two groups. Finally, sensitivity, specificity and accuracy were compared each other by McNemar's test.

RESULTS

MTRasym had no significant correlation with SUVmax (p=0.10). Mean MTRasym (0.1±5.5%) and SUVmax (3.0±0.8) of malignant group were significantly higher than those of benign group (MTRasym: -4.2±4.4%, p=0.03; SUVmax: 2.5±0.5, p=0.04). When applied each feasible threshold value, sensitivity (SE: 80.8 [21/26] %), specificity (SP: 70.0 [7/10] %) and accuracy (77.8 [28/36] %) of MTRasym had no significant difference with those of SUVmax (SE: 69.2 [18/26] %, p=0.25; SP: 60.0 [6/10] %, p=1.0; AC: 66.7 [24/36] %, p=0.13).

CONCLUSION

CEST imaging is considered at least as valuable as FDG-PET/CT for differentiation of malignant from benign pulmonary nodules and/ or masses.

CLINICAL RELEVANCE/APPLICATION

CEST imaging is considered at least as valuable as FDG-PET/CT for differentiation of malignant from benign pulmonary nodules and/ or masses.

SSK11-07 Radiofrequency Hyperthermia (RFH)-Enhanced Herpes Simplex Virus-Thymidine Kinase/Ganciclovir (HSV-TK/GCV) Gene Therapy of Hepatocellular Carcinoma: Monitored by Ultrasound and Optical Imaging

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Jianfeng Wang, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yaoping Shi, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Zhibin Bai, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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Renyou Zhai, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the possibility of using radiofrequency hyperthermia (RFH) to enhance therapeutic effect of herpes simplex virus thymidine kinase/ganciclovir (HSV-TK/GCV) on hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

Human HCC cells (HepG2) were first transfected with lentivirus/luciferase. For both in-vitro confirmation and in-vivo validation, Luciferase-labeled HCC cells and HCC tumor xenografts on mice received different treatments: (i) combination therapy of intratumoral HSV-TK/GCV-mediated gene therapy plus MR imaging-heating-guidewire (MRIHG)-mediated RFH; (ii) gene therapy only; (iii) RFH only; and (iv) phosphate-buffered saline (PBS) as control. Cell proliferation was quantified by MTS assay. Tumor size and signal changes were monitored by ultrasound imaging and optical imaging before and at days 7 and 14 after treatments, which were

correlated with subsequent histology.

RESULTS

Of in vitro experiments, MTS assay demonstrated the lowest cell proliferation in combination therapy group compared with those in three control groups (29±6% VS 56±9%, 93±4%, and 100±5%, ρ<0.05). Of in vivo experiments, ultrasound imaging showed smaller relative tumor volume in combination therapy group than those in three control groups (0.74±0.19 VS 1.79±0.24, 3.14±0.49 and 3.22±0.52, ρ<0.05). Optical imaging demonstrated significant decrease of bioluminescence signals of tumors in the combination therapy group, compared to those in three control groups (1.2±0.1 VS 1.9±0.2% VS 3.3±0.6% VS 3.5±0.4%, ρ<0.05)(Figure). These imaging findings were correlated well with histologic confirmation.

CONCLUSION

RF-hyperthermia can enhance HSV-TK/GCV-mediated gene therapy of hepatocellular cancer, which may open new avenues for efficient management of hepatocellular carcinoma using MR/RF hyperthermia-integrated interventional gene therapy.

CLINICAL RELEVANCE/APPLICATION

RF-hyperthermia can enhance HSV-TK/GCV-mediated gene therapy of hepatocellular cancer.

SSK11-08　Identification of a Prognostic PET-miRNA Radiogenomic Signature Associated with the mir-200 Family

Wednesday, Dec. 2 11:40AM - 11:50AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Shota Yamamoto, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Christopher W. Migdal, Petaluma, CA (*Abstract Co-Author*) Nothing to Disclose
Ronald L. Korn, MD, PhD, Scottsdale, AZ (*Abstract Co-Author*) Chief Medical Officer, Imaging Endpoints; Founder, Imaging Endpoints; Shareholder, Imaging Endpoints
Michael B. Gotway, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Neema Jamshidi, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Kuo, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To use radiogenomic analysis to define and contextualize a prognostic microRNA signature in non-small-cell lung carcinoma (NSCLC).

METHOD AND MATERIALS

Using a known prognostic PET signature, differential expression analysis using linear models of microarray data (limma) was performed on 10 NSCLC (adenocarcinoma ad squamous cell carcinoma) patients with Positron Emission Tomography (PET) and microRNA (miRNA) expression data to identify potential prognostic PET associated radiogenomic signatures. The same signature candidate was selected and analyzed on a public dataset of 105 patients with clinical outcome and miRNA expression data to confirm its prognostic value. Furthermore, the PET phenotype was validated in an independent dataset with PET and outcomes data in 21 patients.

RESULTS

Significant correlations between high SUV max lesion normalized to the SUV mean liver and the downregulation of hsa-mir-200b and hsa-miR-149 were identified (p<0.05). Low expression of the mir-200 family is a well known marker for aggressive lung cancer behavior and chemoresistance.Testing of the miRNA surrogate for SUV signature in the PET-miRNA validation was validated in the public dataset as a predictor of survival (P=0.04). The PET trait also stratified patient outcome in an independent dataset (p=0.048).

CONCLUSION

Radiogenomic analysis allows integration of multiple independent datasets thereby providing not only molecular biological context behind a given biomarker, but also enabling robust validation of biomarkers that is often not feasible with existing approaches.

CLINICAL RELEVANCE/APPLICATION

This approach allows integration of independent datasets thereby providing biological context behind a given biomarker in a cost effective way.

SSK11-09　Differential Receptor Tyrosine Kinase PET Imaging in Response to Targeted Inhibition

Wednesday, Dec. 2 11:50AM - 12:00PM Location: S504CD

Awards
Trainee Research Prize - Resident

Participants
Eric Wehrenberg-Klee, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nafize S. Turker, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mauri Scaltriti, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

The targeted AKT inhibitor GDC-0068 shows promise for the treatment of triple-negative breast cancer (TNBC). Resistance to AKT inhibition is mediated through upregulation of the receptor tyrosine kinases (RTK) EGFR and HER3, however the profile of upregulation differs across cell lines, and may be predictive of treatment response. We sought to noninvasively image these

expression changes for the purpose of therapeutic guidance.

METHOD AND MATERIALS

64Cu-DOTA-cetuximab F(ab´)2 and 64Cu-DOTA-HER3 F(ab´)2 were prepared and probe affinity for their targets assessed. The TNBC cell lines MDMBA468 and HCC70 were treated with the AKT inhibitor GDC-0068 for one day at a range of concentrations. Following treatment, uptake of EGFR probe or HER3 probe was assessed, and results compared to protein expression changes of EGFR or HER3, respectively, as assessed by Western blot. MDAMB468 mice were then treated with GDC-0068 or control for 2 days. After treatment, mice were imaged with either 64Cu-DOTA-EGFR F(ab´)2 or 64Cu-DOTA-HER3 F(ab´)2 to assess changes in EGFR or HER3 expression, respectively.

RESULTS

Treatment of the TNBC cell lines MDAMB468 and HCC70 with GDC-0068 resulted in increased EGFR Probe uptake of 6% and 88% respectively. Interrogation of the same cell lines with HER3 Probe demonstrated uptake changes of 74% and 102%. These findings correlate closely to changes in protein expression as assessed by Western blot. MDAMB468 mouse xenografts treated with control or AKT inhibitor for two days and then imaged demonstrate no significant change in SUVmean of EGFR PET Probe (0.48 vs. 0.53, p=0.11), however demonstrate a significant change in SUVmean of HER3 PET Probe (0.35 vs 0.73, p<0.01).

CONCLUSION

TNBC resistance to AKT inhibition can be mediated through increased RTK expression in a pattern that differs across cell lines and patient tumors. We demonstrate that the differential change in RTK expression can be noninvasively assessed, demonstrating in a model of TNBC that while imaged EGFR expression does not change, imaged HER3 expression increases by 108%. These noninvasively assessed differential changes in RTK expression may inform subsequent therapeutic choices.

CLINICAL RELEVANCE/APPLICATION

The pattern of RTK expression change induced by AKT inhibition is not known prior to treatment. RTK PET imaging may allow for noninvasive assessment of these changes to optimize therapeutic regimens.

Gastrointestinal (Loco-regional Therapy Liver Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353A

`GI` `CT` `IR` `MR` `OI` `US`

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (*Moderator*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSM08-01   Irreversible Electroporation in Patients with Hepatocellular Carcinoma: Immediate Versus Delayed Findings on MR Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353A

Participants
Guy E. Johnson, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Kogut, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
James O. Park, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Raymond S. Yeung, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Siddharth A. Padia, MD, Seattle, WA (*Presenter*) Nothing to Disclose

PURPOSE

Irreversible electroporation (IRE) is a non-thermal technique used to ablate soft tissue tumors. Our study assessed MR imaging appearance after IRE for the treatment of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

In this institutional review board-approved retrospective study with waiver of informed consent, twenty patients with HCC were treated with IRE over a 2.5 year period. Median patient age was 62, and 75% of patients had Child-Pugh A cirrhosis. Median tumor diameter was 2.0 cm (range 1.0-3.3 cm). Contrast-enhanced multiphase MR was performed on post-procedure day 1, 30, and every 90 days thereafter. Ablation zone sizes and signal intensities were compared between each time point for both T1- and T2-weighted images. Trends in MR signal intensity and tumor dimensions over time were quantified using generalized linear models.

RESULTS

MR appearance of a treated tumor includes a zone of peripheral enhancement with centripetal filling on delayed post-contrast images. Compared to post-procedure day one, there is a decrease in enhancing ablation zone size of 28.9% (mean) every 90 days. There is a trend towards decreasing signal intensity of the peripheral ablation zone over time on both T2 ($p=0.01$) and contrast-enhanced T1 weighted images ($p<0.08$). Conversely, the tumor itself typically demonstrates increased signal intensity over the same sequences.

CONCLUSION

IRE of HCC results in a large region of enhancement on immediate post-procedure MR, which involutes on follow-up imaging. This is associated with decreasing signal intensity of the peripheral ablation zone over time. This phenomenon may represent resolution of the reversible penumbra.

CLINICAL RELEVANCE/APPLICATION

1. Understanding of the standard MR imaging appearance after IRE can help guide future therapy and assess prognosis with respect to tumor response.2. The large area of enhancement seen after IRE may represent regions of reversible electroporation, which may be used to optimize treatment protocols or target localized drug delivery in future studies.

SSM08-02   Local Hepatic Tumor Control in Patients with HCC Undergoing Transarterial Lipiodol Embolisation Followed by Microwave Ablation

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E353A

Participants
Roland M. Seidel, MD, Homburg, Germany (*Presenter*) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Guenther K. Schneider, MD, PhD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE

To investigate local tumor control in patients with HCC undergoing lipiodol embolization and subsequent microwave ablation.

METHOD AND MATERIALS

25 patients with 35 HCC (mean size 23mm, SD 9mm) underwent superselective transarterial embolization with lipiodol. Subsequently

percutaneous CT guided microwave ablation of the tumors was performed using a 2,45 GHz generator (power output 80 to 120W) with cooled tip probes (Acculis , Angiodynamics, USA). All patients were investigated before therapy by unenhanced and dynamic contrast enhanced MR or CT; follow up was performed within 1, 3, 6 and more months after treatment. Treatment was rated as successful in case of a complete rim of necrosis surrounding the lesion and no further tumor growth. Patient data were evaluated retrospectively on a PACS workstation by two readers in consensus.

RESULTS

In 24 of 25 (96%) patients a complete ablation was diagnosed on the early follow up imaging. The patient rated with incomplete ablation presented tumor progression on follow up imaging. 1 patient initially rated as complete ablation presented lesion progression and underwent chemoembolization with no residual tumor up to 510 d after microwave ablation. Overall complete ablation rate per patient was 92% (23 of 25 patients) and 94% per lesion (33 of 35 lesions).

CONCLUSION

Microwave ablation in combination with lipiodol embolization for patients with HCC is a valuable therapeutic procedure for smaller hepatic tumors. Especially the targeting and embolizing potential of the retained lipiodol is likely to contribute to a more reliable tumor access and ablation effect .

CLINICAL RELEVANCE/APPLICATION

The treatment of smaller local HCC tumors becomes more and more an issue in the bridging to transplant situation and therefore minimal invasive percutaneous ablation techniques become attractive, since local tumor control is in the range of surgical treatments. This study demonstrates a reliable minimal invasive targeting and embolization technique in combination with microwave ablation for the enhancement of local tumor control.

SSM08-03   Analysis of a Series of Microwave Ablated Native HCCs: Which Parameters do Affect Outcome after Treatment?

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353A

Participants
Valentina Battaglia JR, MD, Pisa, Italy (*Presenter*) Nothing to Disclose
Salvatore Mazzeo, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carla Cappelli, MD,PhD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Rosa Cervelli, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Piercarlo Rossi, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Bartolozzi, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the efficacy at 1 month after treatment of ultrasound-guided percutaneous microwave ablation (MWA) of series of native HCCs.

METHOD AND MATERIALS

From January 2013 to February 2015, 221 patients with a single HCC lesion were candidate for ultrasound-guided percutaneous MWA. Of them, 113 were excluded because of patients' habitus or limited US visibility of the lesion (42 and 71 patients respectively). Finally, our study included 108 patients who were treated with MWA for a single hepatic lesion. All lesions were classified on the basis of dimensions, location and venous vessel contiguity. A cooled shaft antenna of 16 or 14 Gauge was percutaneously inserted into the tumor under ultrasound guidance. Microwave emitting power and time of treatment were tailored to tumor size (ranging from 35 to 50W). Lesions were classified on the basis of dimensions (1.5cm to 2cm: 31/108; 2.1 to 3cm: 54/108; 3.1 to 4cm: 23/108), of location: centrohepatic, subcapsular, close to gallbladder, para-hilar and para-caval. Moreover, lesions were divided into subdiaphragmatic (23: yes; 86: no) and on the basis of proximity (<5mm) to vascular structures (59: yes; 49: no).In all cases, a CT evaluation performed 1 month after procedure was done. Tumor response after treatment was evaluated by means of mRECIST.Statistical analysis was performed by means of Chi-square test and bivariate correlation.

RESULTS

All neoplasm were ablated in a single session and no major complication occurred.At CT evaluation, 84 lesions showed a Complete Response, 23 Partial response and 1 lesion Stable Disease.Statistical analysis showed no significant relationship between complete response and tumor size, time of ablation or power applied. At bivariate analysis, tumor location and subdiaphragmatic position did correlate (p<0.0001) with lesions'response to treatment, independently from dimensions and technical parameters of power emission.

CONCLUSION

In our series, tumor size did not appear to impact complete ablation rates, whereas lesion localization represents the most important factor influencing tumor response.

CLINICAL RELEVANCE/APPLICATION

Lesions'characteristics might lead to formulate a grading on the basis of whom to predict tumor response after treatment.

SSM08-04   Local Treatment for Colorectal Cancer Liver Metastases, Comparison of Radiofrequency Ablation and Surgical Metastasectomy

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353A

Participants
Naik Vietti Violi, Lausanne, Switzerland (*Presenter*) Nothing to Disclose
Alban L. Denys, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Pierre E. Bize, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Demartines, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Nermin Halkic, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Jean-Francois Knebel, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare local recurrence rate of radiofrequency ablation (RFA) and surgical metastasectomy for colorectal cancer liver metastases from a surgical and radiological database of consecutive patients and to define the best candidates for each treatment.

METHOD AND MATERIALS

We analyzed, lesion by lesion, 121 metastases treated by metastastectomy (in 43 patients, median follow up 798 days) and 110 metastases treated by RFA (in 60 patients, median follow up 590 days). We compared rate of local recurrence (LR) and hepatic recurrence (HR) between the two groups. Predictive factors for recurrence (patients and primary tumor characteristics and metastasis data - size, depth in the liver (distance between metastasis and hepatic capsule), distance to vascular structures (all veins located within 10 mm to the metastasis were registered), pathological margins in case of surgery (R0/R1 status)), were analyzed by Chi square and logistic regression in uni and multivariate analysis.

RESULTS

We found no difference between the two groups for patients and primary tumor characteristics. Survival curves were similar between the two groups. Mean metastasis size was larger in metastectomy group than RFA group (18mm, range 2-90mm, standard error=0.11 and 15mm, range 3-55mm, standard error=0.06; p=0.03). Rate of LR and HR between the two groups were nearly statistically different in favor of RFA: LR was 19% for metastasectomy group and 10% for RFA group (p=0.06, delay: 245 and 289days, p=0.56), HR were 78.5% for metastasectomy and 66% for RFA (p=0.054, delay: 226 and 235days, p=0.81). R1 status and metastasis deepness were predictive factors for recurrence in the metastasectomy group (p=0.03 and p=0.02, respectively). Metastases deepness and proximity to vascular structure increased risk for R1 (p=0.04 and p<0.001, respectively). We found no predictive factor for recurrence in RFA group.

CONCLUSION

Pending proper selection (small lesions visible under imaging guidance), RFA tends to have a lower recurrence rate than metastasectomy. Lesions localized in depth in the liver parenchyma, close to large veins are at risk of local recurrence after metastasectomy.

CLINICAL RELEVANCE/APPLICATION

Metastasectomy and radiofrequency ablation are currently used for treatment of colorectal cancer liver metastasis aiming for total tumor ablation and sparing liver parenchyma. There is no study comparing results and risk of local recurrence between metastasectomy and RFA.

SSM08-05   Diagnostic Performance of DECT in the Assessment of Treated Zone Following Percutaneous Ablation in Renal Cell Cancer: Image Quality and Radiation Dose Considerations

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353A

Participants
Diana Murcia, MD, Boston, MA (*Presenter*) Nothing to Disclose
Andrea Prochowski Iamurri, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the diagnostic performance of DECT in the evaluation of treated zone following percutaneous ablation of renal cell cancer (RCC) with assessment of value of iodine images (MD-I), image quality and radiation dose considerations.

METHOD AND MATERIALS

In this retrospective study, 26 patients (17 M, 9 F, mean age 69 years) with RCC treated with percutaneous ablation were included. The patients underwent contrast enhanced nephrographic phase dual energy CT scan with a single-source dual energy CT (750HD GE Healthcare, Milwaukee WI) as part of post ablation surveillance. In this cohort, 13 patients had single energy unenhanced scans. All the patients in this cohort had renal mass protocol single energy CT (SECT) at different time-points. Post processed subtraction, material density iodine (MD-I) and virtual unenhanced images were generated. Two blinded radiologists reviewed the SECT and DECT images in two separate sessions for ablation zone margin, presence of residual/recurrent tumor, image quality and presence of artifacts with a 5 point confidence score. The CTDI and DLP were recorded and compared between DECT series and SECT series.

RESULTS

A total of 28 RCC underwent percutaneous ablation. DECT with MD-I iodine images demonstrated higher specificity for detection of abnormal enhancement in the ablation zone suggesting residual tumor/recurrence compared to SECT (30% vs 91%). The image quality score for DECT (with MD-I) was higher compared to standard SECT images (5 vs 4.1 of SECT with p<0.05) with higher number of artifacts recorded in the subtraction images generated from standard non-contrast and contrast enhanced CT images (25% of cases). A single phase DECT had significant radiation dose reduction in comparison to dual phase SECT scans (736.11±231.6 mGy-cm vs 1596.5±450.2 mGy-cm; p<0.001) and the radiation dose considerations of nephrographic phase DECT and SECT were comparable (736.11±231.6 mGy-cm vs 609.5±169.1 mGy-cm; p=0.179)

CONCLUSION

DECT with iodine specific images improves diagnostic performance in the evaluation of ablation zone in RCC as compared to standard SECT images with significant reduction of radiation dose due to exclusion of non-contrast phase.

CLINICAL RELEVANCE/APPLICATION

Post ablation surveillance of treated zone in patients with RCC can present diagnostic challenges with the need for non-contrast

scans and subtraction images which increase the cumulative radiation dose and are affected by artifacts.

SSM08-06   CT and MR Imaging Features to Predict Residual or Recurrent Hepatocellular Carcinoma after Trans-arterial or Percutaneous Treatment

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353A

Participants
Eric C. Ehman, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Sarah Umetsu, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Nicholas Fidelman, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Linda Ferrell, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael A. Ohliger, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Judy Yee, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, EchoPixel, Inc
Thomas A. Hope, MD, San Francisco, CA (*Abstract Co-Author*) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

PURPOSE

To determine which CT and MR features are most predictive of viable hepatocellular carcinoma (HCC) following percutaneous or transarterial therapy.

METHOD AND MATERIALS

Pathology reports for liver explants from 12/2012-7/2014 with CT or MR imaging performed within 90 days of transplant (45±28 days) were reviewed. Patients with a history of hepatocellular carcinoma and preoperative treatment including transarterial chemoembolization (TACE) or percutaneous ablation (radiofrequency, microwave, cryo, ethanol) were included. Each lesion was reviewed on the most recent pre-transplant imaging study and size, location and enhancement features recorded. Pathology slides were reviewed and the size of viable tumor nodule recorded (if present).

RESULTS

91 patients with 135 treated lesions were included. 88(65%) lesions were imaged with CT and 47(35%) with MR, including 89(66%) post-TACE, 24(18%) post-ablation, and 22(16%) post both TACE and ablation. At explant, 69(51%) of lesions showed viable tumor. 11/42(26%) of viable lesions at CT and 15/27(56%) at MR demonstrated nodular arterial enhancement (p=0.02). Washout was seen in 13/42(31%) of viable HCCs at CT and in 6/27(22%) at MR (p>0.05). Capsule appearance was seen in 2/42(5%) of viable lesions at CT and in 1/27(4%) at MR (p>0.05). Using each criteria to diagnose a study positive for recurrence, sensitivity and specificity were 38% and 92% for nodular enhancement, 28% and 94% for washout and 4% and 100% for capsule. Using any of the three criteria, overall sensitivity and specificity were 45% and 91%. Detection rate for nodular recurrence was 33% for lesions <1cm, 55% for lesions 1-2cm and 71% for lesions >2cm. Lesion detection by size was similar at CT and MR.

CONCLUSION

No single imaging finding was sensitive for viable HCC following treatment. Nodular arterial enhancement was the most frequently seen, and seen significantly more at MR than at CT. Washout was less frequently seen and seen equally at MR and CT. Capsule was rarely seen but when present always predicted recurrence. There is limited detection of lesions <1cm both at MR and CT and only marginal detection between 1-2cm.

CLINICAL RELEVANCE/APPLICATION

Post-treatment imaging is difficult to interpret and imaging features predictive of recurrent or residual disease are not well understood. Accurate diagnosis of viable tumor at post-treatment imaging is important to guide future therapy such as repeat TACE or ablation.

Gastrointestinal (Esophagus Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353B

`GI` `CT` `MI` `MR` `NM` `OI`

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
David J. Lomas, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSM09-01 Changes in Esophageal Dimensions during Continuous Swallowing in Healthy Adults as Detected by Magnetic Resonance Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353B

Participants
Sabarish Narayanasamy, MBBS,MD, Aligarh, India (*Presenter*) Nothing to Disclose
Mehtab Ahmad, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Mudit Arora, DMRD, Aligarh Ho, India (*Abstract Co-Author*) Nothing to Disclose
Faisal Janal, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Breethaa J. Selvamani, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Anusha Sundararajan, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was designed to quantify the degree of fluctuation in esophageal dimensions during continuous swallowing on Magnetic Resonance (MR) Imaging.

METHOD AND MATERIALS

30 healthy volunteers (25 males and 5 females, age range: 15-45 years) were chosen for the study. MR examination was done using a 1.5 tesla magnet. Initially, the esophagus was imaged in the resting state (Resting MR). Then, the volunteer was asked drink water continuously and another set of MR images were obtained (Swallowing MR). The thoracic esophagus was divided into three segments (upper, middle and lower) based on anatomical landmarks. Diameter and the wall thickness of the esophagus were measured in each segment and the cross sectional area (CSA) was calculated.

RESULTS

The esophageal CSA increased by twofold on swallowing MR scans as compared to the resting scans [Median(interquartile range) increase in CSA in upper segment - 117.3%(61-162.2), in middle segment - 87.7%(54.3-162.9) and in the lower segment - 122.1% (78.9 - 188.1)]. The anteroposterior and transverse diameters of the thoracic esophagus increased by about 60% as compared to the resting MR scans. The mean wall thickness of the thoracic esophagus was reduced by about 25% on swallowing MR as compared to resting scan.

CONCLUSION

Our study helps to define normal changes in esophageal dimensions during continuous swallowing. The lower third of the thoracic esophagus appears to be the most distensible segment.

CLINICAL RELEVANCE/APPLICATION

Swallowing MRI has been proposed as an experimental investigative modality for motility disorders of the esophagus and knowledge of the fluctuation in esophageal dimensions during swallowing might be of clinical utility.

SSM09-02 Differentiate Esophageal Cancer Stages with Spectral CT Imaging

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E353B

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of spectral CT imaging to differentiate esophageal cancer stages.

METHOD AND MATERIALS

67 patients with esophageal cancer diagnosed by esophagoscopy underwent plain and double-phase enhanced CT scan with spectral CT mode. Patients were divided into well-to-moderately differentiated and poorly differentiated squamous carcinoma groups. The iodine-based material decomposition (MD) images were generated and analyzed with GSI Viewer software to measure the iodine concentration (IC) in tumors. Normalized iodine concentration (NIC) was obtained by dividing tumor IC to that of aorta. Data from the two cancer groups were analyzed statistically by independent-samples t test and were correlated with pathological

findings.

RESULTS

There were 32 well-to-moderately differentiated(Picture 1) and 35 poorly differentiated(Picture 2) squamous carcinoma verified by pathology. IC values of the well-to-moderately differentiated squamous carcinoma in both the arterial phase (AP) (2.66±1.07mg/ml) and venous phase (VP) (2.12±0.94mg/ml) were lower than that of the poorly differentiated squamous carcinoma (2.85±1.25mg/ml and 2.57±1.06mg/ml, respectively). The NIC value of the well-to-moderately differentiated squamous carcinoma was also lower than that of the poorly differentiated squamous carcinoma: 0.12±0.05 vs. 0.13±0.06 in AP and 0.42±0.13 vs. 0.61±0.18 in VP, respectively. Statistical differences of IC and NIC were found between the two groups in VP (both p<0.05) but not in AP (p>0.05).

CONCLUSION

There are correlation between the iodine concentration and normalized iodine concentration of esophageal cancers and their histological differentiation stages. IC and NIC parameters obtained in spectral CT for the esophageal cancer in the venous phase can be used as new indexes to differentiate esophageal cancer stages.

CLINICAL RELEVANCE/APPLICATION

Parameters such as normalized iodine concentration in esophageal cancer determined in spectral CT may be used to differentiate esophageal cancer stages.

SSM09-03   Diffusion-Weighted MRI in the Staging of Esophageal Cancer: Ready for Clinical Use? Prospective Comparison with EUS and MDCT

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353B

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Paolo G. Arcidiacono, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Nicoletti, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Elena Orsenigo, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This pilot study was intended to prospectively compare the diagnostic performance of Diffusion-Weighted Magnetic Resonance Imaging (DW-MRI), Multidetector Computed Tomography (MDCT) and Endoscopic Ultrasonography (EUS) in the preoperative loco-regional staging of esophageal cancer.

METHOD AND MATERIALS

This study was institutional review board-approved. Eighteen patients with biopsy proved esophageal or gastro-esophageal (Siewert I) tumor (9 directly treated with surgery and 9 addressed to chemo/radiotherapy before) underwent 1.5 T DW-MRI, 64-channels MDCT and EUS before and after neoadjuvant treatment. All images were analyzed and staged blindly by dedicated operators according to the 7th TNM edition and two radiologists calculated indipendently the Apparent Diffusion Coefficient (ADC) from the initial scan. The results were then compared with histopathological findings. Statistical analysis included Spearman and intraclass correlation coefficients, Mann-Whitney U test and receiver operator characteristic curve analysis. After the population had been divided according to local invasion (T1-2 vs T3-4) and nodal involvement (N0 vs N+), sensitivity, specificity, accuracy, positive and negative predictive value were calculated and compared for each technique. Quantitative measurements from DWI were also analyzed.

RESULTS

For T staging, EUS showed the best sensitivity (100%) while MR showed the highest specificity (92%) and accuracy (83%). For N staging, MR and EUS showed the highest sensitivity (100%) but none of the three techniques showed adequate results for specificity. Overall, MR showed the highest accuracy (66%) for N stage. Mean pathological ADC was different between surgery-only and chemo/radiotherapy groups (1.90 vs 1.30 x 10-3 mm2/s, respectively; p= 0.005), with an optimal cut off for local invasion of 1.33 x 10-3 mm2/s (p=0.05).

CONCLUSION

DW-MRI could improve the current preoperative staging workup for esophageal cancer, showing characteristic advantages for both staging and initial treatment decision-making.

CLINICAL RELEVANCE/APPLICATION

DW-MRI can be useful in the preoperative workup for esophageal cancer and could help to select appropriate treatments after initial staging.

SSM09-04   The Use of 3T Multiparametric MRI in the Staging of Esophageal Cancer (EC)

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353B

Participants
Daniela A. Cenzi, MD, Verona, Italy (*Presenter*) Nothing to Disclose
Lisa Zantedeschi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Camera, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giacomo Schenal, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Motton, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic feasability of MP-MRI for the preoperative staging of EC and to assess its efficacy in discrimination between

responders and non-responders in those who underwent neoadjuvant treatment (NT).

METHOD AND MATERIALS

Between 2011 and January 2015, 36 patients with biopsy-proven EC underwent 3T MRI with the same approach: T2 weighted images, DWI and DCE sequences, with cardiac and respiratory gating. According to local invasion (T1-2 vs T3-4) and nodal involvement (N- vs N+), we identified 11 patients with organ confined lesion who underwent surgery: MR-staging results were compared with histopathological findings directly. 25 patients were addressed to NT and restaging MRI after treatment was compared to histological findings after surgery. Sensitivity (SE), specificity (SP), positive (PPV) and negative (NPV) predictive value and accuracy were calculated for the both groups. For NT group, changes in ACD and changes in DCE time intensity curve at MRI before and after treatment were calculated. 2 readers indipendently determined: pre-NT and post-NT ADC, percentage changes in ADC (ΔADC), DCE time intensity curves and interobserver variability.

RESULTS

Surgery group: for T staging, SE was 98 %, SP 78 %, accuracy 90%; for N staging SE was 67 %, SP 60 %, accuracy 64%. NT group after NT: for T staging SE was 80 %, SP 85 %, PPV 67%, NPV 92%, accuracy 89% and 76%, 78%, 50%, 91% and 91% respectively for N staging.Responders showed lower pre-NT ADC (1.30 vs 1.80Å~10-3mm2/s; P=0.002) and higher post-NT ADC (2.50 vs 1.64Å~10-3mm2/s; P=0.001) than non-responders and ADC increased in responders (ΔADC, 90.28 versus 11 %, respectively). A slight difference was observed in DCE curves but without a significant difference (p>0.05).Interobserver reproducibility was good both for surgery (k 0.68) and post-NT (k 0.86).

CONCLUSION

MR can correctly stage organ-confined lesions according to the high specificity (for the T stage) and to rightly assess pathological nodal involvement (for the N stage) thanks to the good SE. The ADC can be used to assess esophageal tumour response to NT treatment as a reliable expression of tumour regression.

CLINICAL RELEVANCE/APPLICATION

Preoperative staging in esophageal cancer is critical in order to prompt a surgical (T1-T2 stages without nodal involvement) or neo-adjuvant therapy (T3-T4 stages with nodal involvement).

SSM09-05   Textural Analysis of Baseline 18F-FDG PET for Predicting Treatment Response and Prognosis in Patients with Locally Advanced Esophageal Cancer

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353B

Participants
Xiaorong Sun, Jinan, China (*Presenter*) Nothing to Disclose
Lu Sun, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Ligang Xing, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Textural features on baseline 18F-FDG PET have shown the potential role in predicting treatment response in mixed stage esophageal cancer. This study is aim to investigate the value of this new technique for locally advanced esophageal squamous cell cancer (ESCC) receiving chemoradiotherapy.

METHOD AND MATERIALS

Under a waiver from IRB, 48 patients with newly diagnosed locally advanced ESCC who treated with concurrent chemoradiotherapy were retrospectively reviewed. Thirty-nine patients with early stage ESCC were included as control. All patients underwent pretreatment whole-body 18F-FDG PET/CT. Fifty-four texture indices describing global, local, and regional features were measured in addition to 5 conventional indices as standardized uptake values (SUVs, including maximum, peak, and mean SUV), metabolic volume (MV), and total lesion glycolysis (TLG). Patients were classified as responders (R, complete or partial response) and non-responders (NR, stable or progressive disease) according to RECIST1.1. Progression-free survival (PFS) and overall survival (OS) were recorded. The prognostic significance of parameters was examined using receiver-operating-characteristic curves, Kaplan-Meier analysis, and Cox regression analysis.

RESULTS

Both intratumor heterogeneity and mean/peak intensity of FDG uptake were significantly higher in locally advanced ESCC than those in early stage. Thirty-four texture indices, MV, and TLG showed the ability to differentiate R from NR. Nine texture indices showed higher sensitivity (76.7%~86.7%) and specificity (77.8%~94.4%) than MV (76.7% and 83.3%) and TLG (73.3% and 83.3%). Ten texture indices and MV were hazard factors of PFS and OS. Large-zone emphasis, one of the regional texture indices, was the only independent predictor of survival, with hazard ratio of 4.22 (95%CI:1.83~9.72) for PFS and 3.90 (1.74~8.79) for OS. None of the SUVs could predict treatment response and survival.

CONCLUSION

FDG PET texture indices provide better predictive information than conventional parameters for locally advanced ESCC.

CLINICAL RELEVANCE/APPLICATION

The clinical application of FDG PET texture analysis could be an important step in personalized treatment of esophageal cancer.

SSM09-06   CT Signs Can Predict Treatment Response and Long-Term Survival: A Study in Locally Advanced Esophageal Cancer with Preoperative Chemotherapy

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353B

Participants
Xiao-Yan Zhang, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhilong Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accurate prediction of treatment response and prognosis before surgery will allow prompt therapy adjustment. This study proposed to evaluate the efficacy of CT signs on treatment response and survival for advanced esophageal squamous cell carcinoma patients with preoperative chemotherapy.

METHOD AND MATERIALS

This study retrospectively enrolled 135 consecutive patients with preoperative chemotherapy from September 2005 to December 2011. Logistic regression model was conducted to evaluate the association between pathological response and CT signs. Overall survival(OS) and disease-free survival (DFS) were estimated using Kaplan-Meier method and Cox proportional hazards model was constructed to determine associations between CT signs after neoadjuvant chemotherapy and survival outcomes.

RESULTS

The logistic regression showed the total LN number(> 6) at baseline and the CT value change rate ($\leq$ 17%) were significant for poor response; OR were 5.07 (95% CI, 1.86 to 13.81, P = 0.002) and 2.35 (95% CI, 1.05 to 5.23, P = 0.037), respectively. In Cox analyses, preoperative tumor thickness (> 10 mm), total LN number (>6), and short diameter of the largest LN (> 10 mm) were significant for OS, HR were 2.33(95% CI, 1.36 to 4, P = 0.002), 1.88(95% CI, 1.12 to 3.17, P = 0.017) and 1.87(95% CI, 1.07 to 3.28, P = 0.028), respectively; whereas only the short diameter of the largest LN was significant for DFS, HR was 2.36(95% CI, 1.23 to 4.54, P = 0.01).

CONCLUSION

CT signs can predict therapeutic efficacy and survival outcomes and provide an opportunity to offer additional treatment options before surgery.

CLINICAL RELEVANCE/APPLICATION

This study provided the first evidence that CT signs can predict survival outcomes and therapeutic efficacy of patients with esophageal cancer who received preoperative chemotherapy. Therefore, it is of great clinical significance to perform CT examinations before and after neo-adjuvant therapies in esophageal cancer patients. The CT images interpreted before surgery could provide important information about survival and response, which would improve individualized treatment programs.

ASRT@RSNA 2015: Prostate Cancer and MR Imaging: What Do We Want to See and How to Get It

Wednesday, Dec. 2 3:40PM - 4:40PM Location: N230

`GU` `MR` `OI`

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
James Stirling, DCR, DMS, Middlesex, United Kingdom, (james.stirling@kcl.ac.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the anatomy and comon pathology of the prostate gland. 2) To learn the factors and how to optimise prostate sequences eg. T1, T2 and STIR whole pelvis sequences, small field of view T2 axial, sagital and coronal sequences, diffusion weighted imaging, contrast enhanced T1 and T2* dynamic sequences. 3) To learn how different sequences are used with primary, secondary and metastatic prostate cancer. 4) To give a taste of hybid PET/MR 18F Choline imaging.

ABSTRACT

Over the last couple of years MRI of prostate cancer has moved from just T1 and T2 imaging to multi-parametric, multi-modality imaging. To produce high quality imaging, sequence parameter factors have to be optimized, balancing clinical requirements with patient comfort, total on-table time, scanner capabilities and limitations. The lecture will include prostatic anatomy and how different sequences can characterize benign and malignant disease. The talk will show the sequences that are needed and how to optimize them. This will include T2 small field of views, diffusion weighted imaging, T1 and T2* dynamic contrast enhanced sequences and intrinsic susceptibility weighted imaging. As prostate cancer develops and is treated the imaging protocols change. The protocols include surveillance and staging and then progress to recurrence and metastatic whole body imaging. MRI is now being complemented with PET in hybrid machines combining the strengths of both modalities. This lecture will show how MR imaging of malignant prostate disease changes as the disease progresses.

SPSC45

Controversy Session: Current USPSTF Lung Cancer Screening: Inclusive or Exclusive

Wednesday, Dec. 2 4:30PM - 6:00PM Location: S404AB

`CH` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SPSC45A   USPSTF Lung Cancer Screening: Pro

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List the major risk factors for lung cancer. 2) Describe the potential advantages of the inclusivity of USPSTF lung cancer screening eligibility criteria. 3) Understand the spectrum of lung cancer risk among patients meeting the USPSTF criteria. 4) Recognize how personalized risk assessment can facilitate shared decision making for patients meeting USPSTF criteria.

ABSTRACT

1. List the major risk factors for lung cancer.2. Describe the potential advantages of the inclusivity of USPSTF lung cancer screening eligibility criteria.3. Understand the spectrum of lung cancer risk among patients meeting the USPSTF criteria.4. Recognize how personalized risk assessment can facilitate shared decision making for patients meeting USPSTF criteria.

URL

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Ella A. Kazerooni, MD - 2014 Honored Educator

SPSC45B   USPSTF Lung Cancer Screening: Con

Participants
Doug Arenberg, Ann Arbor, MI, (darenber@umich.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the rationale for the USPSTF lung cancer screening criteria. 2) Understand the importance of identifying risk among those referred for lung cacner screening. 3) Identify the impact of lung cancer risk on the balance of harms and benefits of lung cancer screening. 4) Describe the clinical and demographic traists that increase one's risk fo rlung cancer.

ABSTRACT

Contemporary Imaging of Lung Cancer

Thursday, Dec. 3 8:30AM - 10:00AM Location: N227

CH CT MI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jeremy J. Erasmus, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC601A   Non-small Cell Lung Cancer Staging: Concepts and Controversies

Participants
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Presenter*) Research Consultant, Siemens AG Research Consultant, General Electric Company

LEARNING OBJECTIVES

1) Summarize the origins, basis and rationale of the current TNM classification of lung cancer. 2) Discuss the strengths and limitations of the current system and how to practically address these 3) Highlight areas where current radiology, oncological, surgical and pathological best practice and evolving knowledge in these area are progressing beyond the current staging system.

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

RC601B   Contemporary Concepts in Small Cell Lung Cancer

Participants
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Presenter*) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

LEARNING OBJECTIVES

1) To learn the clinical manifestations, staging and prognostic factors of small cell lung cancer. 2) To become familiar with the role of PET-CT in the investigation and management of small cell lung cancer. 3) To review unusual presentations of small cell lung cancer and their investigation and treatment.

ABSTRACT

Small cell lung cancer, SCLC, accounts for approximately 15% of all lung cancers, with its overall incidence decreasing, although it is increasing in women, with the male to female incidence ratio now 1:1. Small cell lung cancer has a more rapid doubling time than non-small cell lung cancer, with most patients presenting with hematogenous metastases, and only approximately one-third presenting with limited-stage disease confined to the chest.Small cell lung cancer uncommonly presents with a solitary pulmonary nodule, and the disease does not appear to have benefited from Lung Cancer Screening. There are multiple neurologic and endocrine paraneoplastic syndromes associated with small cell lung cancer, with marked improvement on treatment of the underlying tumour.Historically SCLC was staged according to the Veteran's Administration Lung Group's 2 stage classification of 1) extensive-stage disease or 2) limited-stage disease, and this classification used to guide therapy. More recently it has been recommended that SCLC is staged according to the International Association of the Study of Lung Cancer (IASLC) and the AJCC Cancer Staging Manual 7th edition, using the same staging system for NSCLC and SCLC.Whilst contrast enhanced CT scan of the chest and abdomen remain routine as the initial method for staging SCLC, FDG PET-CT now plays a more important role in staging and management. SCLC is a highly metabolic disease, and PET-CT both upstages and downstages disease, potentially altering management

RC601C   PET Imaging of Lung Cancer: Beyond Standard Metabolic Assessment

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review advanced image processing and metabolic parameters in FDG-PET/CT. 2) Discuss non-FDG radiotracers and their potential applications in non-small cell lung cancer. 3) Illustrate the application and clinical use of advanced metabolic imaging biomarkers derived from FDG-PET/CT using case examples.

ABSTRACT

Assessment of non-small cell lung cancer with PET is typically performed using F-18 fluorodeoxyglucose (FDG). The uptake and retention of FDG by the tumor is taken to be a measure of metabolism, which in turn can provide useful information on staging, grading, and prognosis. Advances in the field of PET/CT imaging may provide additional information for the evaluation and care of patients with lung cancer. Advanced semi-quantitative analyses including total lesion glycolysis (TLG) and metabolic tumor volume

(MTV) have been employed to capture additional information from FDG-PET/CT studies, which in some cases is additive to standard metabolic parameters such as SUVmax. New tracers are under development, with some nearing approval in the U.S. and elsewhere. These include tracers targeting proliferation, receptor expression, and protein catabolism, investigating molecular events and processes beyond glucose metabolism.

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC601D   MRI: Advances in Nodule Characterization and Lung Cancer Staging

Participants
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of, (kyungs.lee@samsung.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review most popular MRI techniques that are used in thoracic MR imaging. 2) To demonstrate how effective MR imaging is in nodule characterization and lung cancer staging, particularly focused on diffusion-weighted imaging (DWI) and diffusion-weighted whole-body imaging with background body signal suppression (DWIBS).

ABSTRACT

Diffusion-weighted MR imaging helps characterize lung nodule, and enables staging and prognosis prediction in lung cancer. Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) is known to be specific in nodal staging and effective in whole body MR imaging. Both whole body MRI and PET-CT may be used in extra-thoracic lung cancer staging, but each modality has its own and different merits in lung cancer staging. Whole body MRI-PET may be the future oncologic imaging modality.

URL

RC601E   CT Perfusion Imaging in Lung Cancer

Participants
Friedrich D. Knollmann, MD, PhD, Sacramento, CA, (fknollmann@ucdavis.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify suitable indications for the use of CT perfusion imaging in lung cancer. 2) To apply CT perfusion imaging to lung tumors. 3) To recognize important features of a valid CT perfusion imaging protocol. 4) To interpret the results of a CT perfusion study in lung tumors.

ABSTRACT

CT perfusion (CTP) imaging has become a tenable proposition with the advent of multislice CT. Preliminary data have indicated a potential role in the assessment of treatment response in lung cancer, but the method is not widely used. In this course, the rationale for using CT perfusion imaging as a quantitative imaging biomarker in lung cancer is discussed. A review of CT protocols includes factors that have impeded a wider adoption of the method in the clinical sphere, such as the reproducibility of measurements, and validation efforts. Solutions to these problems, such as improved anatomic coverage with wider detectors and table motion, reduced radiation exposure with iterative reconstruction, advanced postprocessing with dual blood supply algorithms, motion registration and correction, and volumetric perfusion analysis are addressed. With these methods, tumor classification, assessment of tumor response, and prognostic testing are promising applications of CTP imaging.

RC601F   Thoracic Oncologic Imaging: Treatment Effects and Complications

Participants
Brett W. Carter, MD, Houston, TX (*Presenter*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;

LEARNING OBJECTIVES

1) Understand the role of imaging in the evaluation of patients who have been treated for thoracic malignancies. 2) Recognize the manifestations of radiation therapy in the chest and be able to differentiate expected changes from residual or recurrent disease. 3) Identify intrathoracic complications from radiation therapy, chemotherapy, and surgery.

ABSTRACT

Imaging plays an important role in the evaluation of patients who have been treated with radiation therapy, chemotherapy, and/or surgery for intrathoracic malignancies such as lung cancer, esophageal cancer, malignant pleural mesothelioma, and thymoma. Following thoracic radiation therapy, radiation pneumonitis (1-6 months following therapy) and radiation fibrosis (6-12 months following therapy) are typically identified in the lungs. However, complications such as esophagitis, esophageal ulceration, and radiation-induced cardiovascular disease may develop. Patients treated with chemotherapy may develop pulmonary and cardiovascular complications such as drug toxicity, organizing pneumonia, thromboembolic disease, vasculitis, and cardiomyopathy. Knowledge of the spectrum of expected treatment-related changes, potential treatment complications and the appearance of tumor recurrence is critical in order to properly monitor patients, identify iatrogenic complications, and avoid misinterpretation.

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Brett W. Carter, MD - 2015 Honored Educator

Interactive Quiz Cases in Body Oncologic Imaging (An Interactive Session)

Thursday, Dec. 3 8:30AM - 10:00AM Location: E353A

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC618A   Chest Masses

Participants
Cristina Fuss, MD, Portland, OR, (fussc@ohsu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe characteristic imaging features of malignant chest masses. 2) Characterize benign pulmonary masses that may mimic malignancies. 3) Describe common imaging pitfalls in differentiating benign from malignant masses. 4) Determine the need for further imaging vs. invasive procedures of pulmonary masses depending on their imaging appearance.

ABSTRACT

Two common descriptors are used in describing pulmonary lesions: nodules and masses. A nodule is small and measures less than 3 cm. Masses by definition are larger than 3 cm. Given their larger size, masses are usually not as difficult to detect as are the smaller nodules. But once detected the differential diagnosis entails more than just primary pulmonary malignancy, although the majority may end up being diagnosed as cancer. Tissue sampling of large masses is usually one of the first steps, but several imaging criteria may help guide and sometimes even obviate invasive procedures. The chronicity, location of the mass and associated symptoms are important factors that should always be taken into consideration when evaluating pulmonary masses, only to name a few.

RC618B   Abdominal Masses

Participants
Chandana G. Lall, MD, Orange, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn typical and atypical features of some benign and malignant abdominal masses on CT and MRI. 2) Characterize features on CT and MRI that may mimic malignancy in benign lesions and vice versa. 3) Discuss logical work-up of lesions, further imaging, need for intervention and follow-up guidelines.

ABSTRACT

1. Describe characteristic imaging features of a few benign and malignant abdominal masses on CT and MRI 2. Illustrate benign masses that may mimic malignancy and imaging pitfalls in differentiating benign and malignant lesions 4. Logical work up of lesions; further imaging and need for intervention

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Chandana G. Lall, MD - 2013 Honored Educator

RC618C   MSK/Soft Tissue Masses

Participants
Sandra Schmahmann, MD, Portland, OR, (schmahma@ohsu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common benign soft tissue masses with characteristic MRI features, that do not require follow up or biopsy. 2) Evaluate soft tissue masses by location, signal intensity characteristics, size and relationship to certain anatomic structures in order to develop a differential diagnosis. 3) Suggest appropriate management of the soft tissue mass based on MRI features.

ABSTRACT

Several common benign soft tissue masses, such as lipoma, hemangioma, gangion, peripheral nerve sheath tumor, myositis ossificans and hematoma, have characteristic MRI features that allow the radiologist to make the diagnosis, and do not require follow up or biopsy.Lesions that arise from specific structures (e.g. giant cell tumor of the tendon sheath and peripheral nerve sheath tumor) or in certain anatomic locations (e.g. elastofibroma deep to the scapula) can further aid characterization. Size and

signal intensity characteristics are additional criteria that help develop an appropriate differential diagnosis.Based on MRI features, the radiologist can suggest appropriate management and advise whether a biopsy is necessary.

Radiomics Mini-Course: Oncologic Applications

Thursday, Dec. 3 8:30AM - 10:00AM Location: S103AB

| BR | CH | NR | BQ | CT | NM | OI | RO | PH |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sandy Napel, PhD, Stanford, CA (*Director*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

Sub-Events

RC625A   Breast Cancer with PET-CT

Participants
Richard L. Wahl, MD, Saint Louis, MO (*Presenter*) Research Consultant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES

1) Describe the FDG pet uptake characteristics before therapy of 'triple - negative' breast cancers vs other subtypes.

ABSTRACT

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Richard L. Wahl, MD - 2013 Honored Educator

RC625B   Radiogenomics of Lung Cancer

Participants
Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind lung cancer radiogenomics. 2) Highlight clinical applications of lung cancer radiogenomics.

ABSTRACT

RC625C   Brain Cancer: Radiomics, Radiogenomics, and Big Data

Participants
Rivka R. Colen, MD, Houston, TX, (rcolen@mdanderson.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the field of radiomics and imaging genomics. 2) Apply radiomics and imaging genomics in brain tumors. 3) Describe the use of MRI as a biomarker for genomic signatures and profiles. 4) Define role of MRI in personalized medicine for target discovery of therapeutic targets. 5) Explain the use of MRI in drug development and clinical trials. 6) Assess the research available in imaging genomics and radiomics. 7) Define and describe the integration of radiomics and imaging genomics into big data platforms.

ABSTRACT

This objective of this course is to introduce the recently emerged field of radiomics and imaging genomics (radiogenomics) in brain tumors, specifically glioblastoma (GBM). Emphasis will be on radiomics with regards to the high-dimensional, high-throughput feature extraction of imaging features from medical images, specifically MRI; the second emphasis will be on the use of imaging in relation to underlying tumor genomics, how to use MRI as a biomarker, surrogate and correlate of tumor genomics as well as the use of MRI as a genomic target discovery tool and its application in therapeutic discovery and drug development. The role of radiomics and imaging genomics in the era of big data and how we can leverage the imaging-omic data will also be discussed.

US for Thyroid Cancer: Diagnosis, Surveillance, and Treatment

Thursday, Dec. 3 8:30AM - 10:00AM Location: E351

| NR | US | HN | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jill E. Langer, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Kathryn A. Robinson, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Sheila Sheth, MD, Cockeysville, MD, (ssheth@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy. 2) a. Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. b. Describe the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. 3) a. Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer. b. Discuss the rationale and method of performance of US-guided ethanol ablation of malignant cervical adenopathy in post thyroidedctomy patients.

ABSTRACT

This presentation will consist of a three individual presentations. The first will review the sonographic characteristics of thyroid nodules that are suggestive of malignancy. Recommendations for selecting which thyroid nodules require ultrasound-guided biopsies which have been provided by both Radiology consensus conferences and published Endocrinology guidelines will be discussed. The second presentation will review with the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. Additionally this presentation describes the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. The last presentation will provide a detailed description of the technique for performing ultrasound guided biopsy of thyroid nodules and cervical lymph nodes. Various methods will be discussed and required equipment outlined. Possible complications, though rare, will be described. A comparison of the typical sonographic features of normal versus abnormal lymph nodes will be presented in an effort to identify those patients in whom sonographic follow up can be used instead of biopsy. A discussion of the possible advantages of adding thyroglobulin assay to cytologic evaluation will be provided. The rationale for and technique of performing ultrasound guided ethanol ablation of malignant cervical lymph nodes in patients with thyroid cancer will be undertaken.

Chest (Pulmonary Nodule)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E351

| CH | CT | MR | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Christian J. Herold, MD, Vienna, Austria (*Moderator*) Nothing to Disclose

Sub-Events

SSQ04-01 Pulmonary Thin-Section MR Imaging with Ultra-Short TE vs. Low- and Standard-Dose Thin-Section CTs: Capability for Lung Nodule Detection and Nodule Type Evaluation

Thursday, Dec. 3 10:30AM - 10:40AM Location: E351

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
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Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To compare the capability of pulmonary MR imaging with ultra-short echo time (UTE) for lung nodule detection and nodule type evaluation with thin-section low- and standard-dose CTs.

METHOD AND MATERIALS

170 consecutive patients (96 males: mean age, 70 years and 74 females: mean age, 70 years) with suspected pulmonary nodules at near-by hospital were examined with chest standard- and low-dose CTs (270 mA [SDCT] and 50 mA [LDCT]) and pulmonary MR imaging with UTE. According to standard-dose CT findings, all nodules were divided into solid and part-solid nodules and ground glass nodules. In each patient, probability of presence at each pulmonary nodule was assessed on all three methods by means of 5-point visual scoring system. To determine inter-observer and inter-method agreement for nodule detection, kappa statistics with $\chi 2$ test were performed. Then, ROC analyses were performed to compare detection capability among all methods. Finally, detection rate was compared each other by means of McNemar's test. To determine inter-observer and inter-method agreement for nodule type evaluation on each method, kappa statistics with $\chi 2$ test were also performed.

RESULTS

On nodule detection, inter-observer agreements on all methods ($0.81 < \kappa < 0.85$, $p < 0.0001$) and inter-method agreement among all methods ($0.87 < \kappa < 0.96$, $p < 0.0001$) were determined as almost perfect. Area under the curves (Azs) of all methods (SDCT: Az=0.97, LDCT: Az=0.96, MRI: Az=0.96) had no significant difference ($p > 0.05$). In addition, detection rates of all three methods (SDCT: 92.0 [252/274] %, LDCT: 91.5 [247/270] %, and MRI: 91.5 [247/270] %) had also no significant difference ($p > 0.05$). On nodule type assessment, inter-observer agreement of each method was almost perfect ($0.87 < \kappa < 0.91$, $p < 0.0001$). In addition, inter-method agreements among all methods were also determined as almost perfect ($0.81 < \kappa < 0.89$, $p < 0.0001$).

CONCLUSION

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.

CLINICAL RELEVANCE/APPLICATION

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.

SSQ04-02 Persistent Pulmonary Subsolid Nodules with Solid Parts of 5mm or Smaller: Their Natural Courses and Predictors for Interval Growth on Follow-ups

Thursday, Dec. 3 10:40AM - 10:50AM Location: E351

Participants
Jong Hyuk Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chang Min Park, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Guerbet SA;

PURPOSE

To investigate the natural courses of persistent pulmonary subsolid nodules (SSNs) with solid parts ≤5mm and the clinico-radiological predictors for their interval growth over follow-ups.

METHOD AND MATERIALS

From 2005 to 2013, natural courses of 213 persistent SSNs detected on chest CT (slice thickness ≤1.25mm) in 213 patients (mean age, 57.88 ± 10.38 years; range, 24-87 years) were evaluated in this study (median follow-up, 849 days; range, 90-2900 days). To identify significant predictors for interval growth, Kaplan-Meier analysis and Cox proportional hazard regression analysis were performed.

RESULTS

One-hundred thirty-six were pure ground-glass nodules (GGNs) (growth in 18; stable in 118) and 77 part-solid GGNs with solid parts ≤5mm (growth in 24; stable in 53). For 213 SSNs, lung cancer history (Hazard ratio (HR), 3.884; p=0.001), part-solid GGNs (HR, 3.570; p<0.001), and nodule diameter (HR, 3.576; p<0.001) were significant predictors for interval growth. In subgroup analysis, nodule diameter was an independent predictor for interval growth of both pure GGNs (HR, 6.620; p<0.001), and part-solid GGNs (HR, 2.749; p=0.037). For part-solid GGNs, lung cancer history (HR, 5.917; p=0.002) was another significant predictor for interval growth. The frequency of interval growth of pure GGNs ≥10mm (12.9%, 30.4%, 42.0%, 42.0%, 71.0% at 1, 2, 3, 4, 5 year's follow-up) and part-solid GGNs ≥8mm (11.5%, 38.0%, 43.6%, 78.9%, 78.9%) was significantly higher than those of pure GGNs <10mm (1.9%, 4.0%, 10.9%, 13.5%, 13.5%) (p<0.001) and part-solid GGNs <8mm (11.5%, 21.5%, 21.5%, 21.5%, 21.5%) (p=0.003), respectively.

CONCLUSION

Natural course of SSNs with solid parts ≤5mm was significantly different regarding their nodule types and nodule diameters, with which their managements can be subdivided.

CLINICAL RELEVANCE/APPLICATION

Nodule type and nodule diameter are significant predictors for interval growth of SSNs with solid parts ≤5mm, and managements of SSNs with solid parts ≤5mm can be categorized based on these predictors.

SSQ04-03   Ground Glass Nodule Detectability in Seven observers of Seventy-nine Clinical Cases: Comparison between Ultra-Low-Dose Chest Digital Tomosynthesis with Iterative Reconstruction and Chest Radiography by Receiver-Operating Characteristics Analysis

Thursday, Dec. 3 10:50AM - 11:00AM Location: E351

Participants
Yukihiro Nagatani, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Masashi Takahashi, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuru Ikeda, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsunori Miyata, RT, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hanaoka, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Nakano, MD, PhD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Noritoshi Ushio, RT, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare ground glass nodules detectability (GGND) between ultra-low-dose chest digital tomosynthesis (ULD-CDT) with 2 different reconstruction algorithms and chest radiography (CR) by using low-dose computed tomography (LDCT) as the standard of reference (SOR).

METHOD AND MATERIALS

The Institutional Review Board approved this study and written informed consent was obtained. In a single visit each, 79 subjects underwent ULD-CDT at 120kV and 10mA, CR both in posterior-anterior and lateral direction and LDCT (effective dose: 0.081, 0.117 and 3.52 mSv, respectively). In each of 79 cases, 63 reconstructed coronal images were obtained using CDT (SONIALVISION Safire 17 radiography/fluoroscopy system, Shimadzu, Kyoto, Japan) with and without iterative reconstruction (IR). SOR as to GGN presence with the longest diameter (LD) of 3mm or more was determined based on LDCT images by consensus reading of two radiologists. Another seven radiologists independently recorded GGN presence and their locations by continuously-distributed rating. Receiver-operating characteristic (ROC) analysis and detection sensitivity (DS) was used to compare GGND of ULD-CDT with IR, ULD-CDT without IR and CR in total and subgroups classified by nodular LD (> or < 9mm) and CT attenuation value (CTAV) (> or < -600 Hounsfield of Unit (HU)). DS were also compared between any pairs of 4 sub-groups in each of three modalities using t-test.

RESULTS

For SOR, 105 GGNs were identified. The minimal and maximal LDs of GGN were 3.0 and 26 mm, respectively, with a mean LD of 8.56 mm. In total as well as any sub-group, GGND at ULD-CDT with IR was higher than either that at ULD-CDT without IR or CR, as area under ROC curve was 0.66 ± 0.02, 0.59 ± 0.01 and 0.52 ± 0.01, respectively (p < 0.05) . DS at ULD-CDT with IR in more attenuated GGNs (CTAV >-600 HU) was higher than that in less attenuated GGNs (47.5 ± 8.1% vs 26.6 ± 6.7%) (p < 0.05). DS at ULD-CDT with IR in larger GGNs (LD > 9mm) was higher than that in smaller GGNs (44.6 ± 7.7% vs 22.1 ±5 .4%) (p < 0.05).

CONCLUSION

ULD-CDT with IR demonstrated better GGND than that without IR or CR, with increased DS for larger or more attenuated GGNs.

CLINICAL RELEVANCE/APPLICATION

ULD-CDT with IR has a potential to be used for detection of larger and more attenuated GGN.

Breath-hold Lung MR Imaging for Nodule Detection: Combination of 3D mDixon and Black-blood Fat-saturated HASTE Sequences

Thursday, Dec. 3 11:00AM - 11:10AM Location: E351

Ryotaro Kamei, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG
Koji Sagiyama, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of breath-hold lung MR imaging as a part of whole-body PET/MR hybrid imaging with that of low-dose CT from PET/CT in the detection of nodular lesions.

METHOD AND MATERIALS

We included 21 consecutive patients who underwent diagnostic CT, PET/CT, and MR of the whole lung from August 2014 to March 2015. MR images were acquired using Ingenia 3.0T MR (Philips) or the 3.0T MR part of Ingenuity TF PET/MR (Philips). The MR protocol consisted of T1-weighted image (T1WI) with 3D modified Dixon (mDixon) sequence, and black-blood fat-saturated T2-weighted image (FS-T2WI) with Half-Fourier Acquisition Single-shot Turbo Spin-echo (HASTE) sequence. Both were performed with breath-hold, and the mean scan duration was 21.2 s for T1WI and 14.5 s (two stations) for FS-T2WI. Low-dose CT was performed under free breathing. Diagnostic CT images were used as the reference standard. The location, number, size, and characterization (solid, pure, or mixed ground-grass opacity [GGOs]) of nodular lesions were recorded. Two radiologists reviewed the MR and CT images from PET/CT in consensus, with an interval of one week. Lesion-based sensitivity and lung lobe-based specificity were calculated. Statistical analyses were performed with McNemar test and Wilcoxon signed-rank test.

RESULTS

Overall sensitivity and specificity were 64.6% (31/48) and 96.9% (62/64) for MR, and 77.1% (37/48) and 82.8% (53/64) for low-dose CT, respectively. On the MR images, 76.9% (30/39) of nodules measuring ≥5 mm were pointed out, while only 11.1% (1/9) of nodules <5 mm were detected. For nodules ≥5 mm, detection rates were 81.5 % (22/27) for solid lesions and 66.7% (8/12) for GGOs. The size of solid lesions on the MR images did not differ significantly from the reference group. On the other hand, mixed GGOs tended to appear smaller on T1WI, and pure GGOs were only visible on T2WI.

CONCLUSION

Breath-hold lung MR imaging with combined use of 3D mDixon T1WI and black blood FS-T2WI HASTE provides brief examination with acceptable diagnostic accuracy and could be feasible as a part of whole-body PET/MR hybrid imaging.

CLINICAL RELEVANCE/APPLICATION

Breath-hold lung MR imaging has fair sensitivity and good specificity to detect nodular lesions. In addition to previously reported T1WI, FS-T2WI might be necessary to accurately depict GGOs.

SSQ04-05 **Value of [18F]Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography in Patients with Persistent Pulmonary Part-Solid Nodules Detected at CT**

Thursday, Dec. 3 11:10AM - 11:20AM Location: E351

Participants
Jihang Kim, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although current National Comprehensive Cancer Network guidelines suggest [18F]fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) for the pretreatment evaluation of early stage non-small cell lung cancer, the role of FDG-PET/CT in patients with persistent pulmonary part-solid nodules is yet to be determined. The purpose of our study was to evaluate the incremental value of FDG-PET/CT in the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT.

METHOD AND MATERIALS

From March 2011 through March 2015, 164 consecutive patients who underwent whole-body FDG-PET/CT for the pretreatment evaluation of non-small cell carcinoma detected as pulmonary part-solid nodules at chest CT were included. We analyzed the chest CT and FDG-PET/CT reports prospectively made by board-certified radiologists and nuclear medicine physicians as a part of our standard practice. The CT, FDG-PET/CT and histopathologic characteristics of the nodules were demonstrated and the incremental value of FDG-PET/CT over chest CT in the nodal or extrathoracic staging was evaluated.

RESULTS

For the pretreatment evaluation, FDG-PET/CT was performed in 164 patients with 181 part-solid pulmonary nodules (diameter; 23.4±8.2 mm, mean solid proportion; 67.8%). Among them, 156 patients with 172 nodules underwent subsequent surgical resection. All of the nodules were histopathologically confirmed as adenocarinoma (n = 1, 91, 51 and 29 for Tis, T1a, T1b, and T2a, respectively). In the retrospective analysis of prospective CT and FDG-PET/CT interpretations, only 4 and 3 patients were suspected to have lymph node metastases, respectively. In histopathologic confirmation, 5 of 156 patients had lymph node metastases and the maximum standardised uptake value of them varied from 1.2 to 6.1. The per-patient sensitivities of CT and FDG-PET/CT in detection of lymph node metastasis were 40% and 20%, respectively, and FDG-PET/CT showed no incremental value in nodal staging. While eight incidental extrathoracic malignancies were suspected at FDG-PET/CT, further diagnostic work-up revealed them as benign.

CONCLUSION

FDG-PET/CT showed no incremental value in the pretreatment evaluation of non-small cell lung cancer detected as part-solid

nodules at chest CT.

CLINICAL RELEVANCE/APPLICATION

In the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT, additional imaging study with FDG-PET/CT is not necessary.

SSQ04-06   Optimal Window Settings to Improve Visual Detection of Ground-glass Nodules (GGN) - Effect on Agreement and Time-to-detection

Thursday, Dec. 3 11:20AM - 11:30AM Location: E351

Participants
Julia Alegria, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Daniela Barahona, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

PURPOSE

To assess different window settings for visual detection of ground glass nodules (GGN), regarding inter-reader agreement for localization and diameter, measurement bias and time-to-detection (TTD).

METHOD AND MATERIALS

IRB approved retrospective study. Chest CT dataset with 40 GGN and 10 sets with no detectable nodules, was designed. After de-identification, all datasets were presented to two thoracic radiologists (acting as reference standard) and a fellow, independently, in four different reading sessions two weeks apart from each other, using IMPAX PACS viewers. Only axial slices were analysed, no MPR or MIP reconstructions were allowed. The settings assessed were Lung Window (W 1500 UH, L -500 UH), Emphysema Window (W 800 UH, L -800 UH), Inverted Lung Window and Inverted Emphysema Window. Location, maximum diameter and TTD were recorded for each nodule. Interreader agreement for localization was analyzed with Cohen's Kappa statistics with 95% CI, diameters agreement with Lin's correlation-concordance coefficient Rho 95%CI with average bias assessed with Bland-Altman with 95% limits of agreement (LOM).

RESULTS

High agreement was identified in all settings with Kappa values for Lung Window (LW) 0.71 (0.53-0.78), Emphysema Window (EW) 0.72 (0.63-0.82), Inverted Lung Window (ILW) 0.71 (0.62-0.74) and Inverted Emphysema Window (IEW) 0.79 (0.73-0.88). Lin's Rho ranged from 0.85 (0.78-0.92) in LW, 0.80 (0.72-0.89) in EW, 0.89 (0.84-0.95) in ILW and 0.92 (0.88-0.96) in IEW. Bland-Altman analysis showed average bias in mm (LOM) of -0.64 (-4.19 to 2.9) in LW, -0.69 (-4.91 to 3.52) in EW, -0.29 (-3.75 to 3.17) in ILW and 0.09 (-2.83 to 3.02) in IEW. Average TTD ranged from 21.3 sec in LW to 58.1 sec in ILW, and was significantly higher in all settings in the fellow's readings versus thoracic radiologists' (p<0.01), with a reduced TTD for both groups only in IEW (p<0.01).

CONCLUSION

IEW provides a visual setting with high reader agreement, measurements concordance with low measurement bias, and reduced TTD for GGN detection.

CLINICAL RELEVANCE/APPLICATION

IEW could be used as a visual aid for identifying GGN, in a similar fashion as MIP reconstructions assist in solid nodule detection.

SSQ04-07   The Moment of Recognition: Method and Analysis of Gaze Behavior in the Search for Lung Nodules in CT Scans

Thursday, Dec. 3 11:30AM - 11:40AM Location: E351

Participants
Geoffrey D. Rubin, MD, Durham, NC (*Presenter*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Brian Harrawood, MS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Justus E. Roos, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To understand the relationship between the distance from a reader's gaze point to visible lung nodule and the momentary likelihood that the nodule will be recognized by the reader.

METHOD AND MATERIALS

Time-varying gaze paths were recorded while 13 radiologists interpreted 40 lung CT scans with between 3 and 5 synthetic nodules (5-mm diameter) embedded randomly within the lung parenchyma. Viewing conditions resulted in a 5° visual angle (approx. foveal limits) corresponding to a 100 pixel distance from the center of gaze. True positive (TP) gaze path segments, corresponding to all x, y, z gaze positions preceding each TP detection, were analyzed. The moment of recognition (MoR) was derived based upon analysis of gaze velocity and direction. Proceeding backwards in time from the reader's confirmation of detection, the trajectory of the gaze path was analyzed for a distinct deviation of the gaze point toward the nodule. We modeled nodule recognition as a Markov process characterized by R(d,z), the instantaneous probability of recognizing a nodule when the gaze is centered d pixels and z sections away from the target nodule.

RESULTS

R(d) was a decreasing function of d for all readers that was well approximated by an exponential distribution. Across readers, R(d) had a median(SD) of 84(43) and 90th percentile(SD) of 269(129) pixels. The average (SD) proportion of nodules that were recognized beyond the 100 pixel foveal limit was 51.2% (15.6%) indicating a substantial contribution of peripheral vision for lung

nodule detection. R(z) was roughly equal at CT sections that were 0, 1, and 2 from the nodule centroid and was smaller 3 sections away, with no significant difference across readers (p = 0.99).

CONCLUSION

The momentary likelihood of lung nodule recognition appears to decrease exponentially with distance from a lung nodule center. While on average approximately half of detected nodules are recognized with peripheral vision, readers rely on their peripheral vision for nodule detection to varying degrees. Further study of search behavior and nodule recognition may lead to strategies for greater consistency and sensitivity for lung nodules detected in CT scans.

CLINICAL RELEVANCE/APPLICATION

Understanding the process of lung nodule detection in CT scans is important to assuring that radiologists maximize their effectiveness in diagnosing lung disease.

SSQ04-08 Association of Focal Radiation Dose Adjusted on Body Cross Sections with Ground Glass Nodules Visibility and Quantification on Computed Tomography Images Using AIDR 3D: Comparison Among Ultra-Low- Dose, Low-Dose and Standard-Dose Scanning

Thursday, Dec. 3 11:40AM - 11:50AM Location: E351

Participants
Yukihiro Nagatani, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Hiroshi Moriya, MD, Fukushima-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Noma, MD, PhD, Tenri, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Mitsuhiro Koyama, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Sadayuki Murayama, MD, PhD, Nishihara-Cho, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the visibility, dimension and density of ground glass nodules (GGNs) on computed tomography (CT) images using AIDR 3D between ultra-low-dose scanning (ULDS) and low-dose scanning (LDS) and assess the association of size specific dose estimate (SSDE) with difference in the measured values between ULDS as well as LDS, and standard dose scanning (SDS).

METHOD AND MATERIALS

This was part of the ACTIve Study, a multi-center research project in Japan. The Institutional Review Board of each institution approved this study, and written informed consent was obtained. In a single visit, 50 subjects underwent chest CT (64-row helical mode) using identical 320-row scanners with different tube currents: 240 (SDS), 120 (LDS), and 20 mA (ULDS). GGN visibility was assessed by 3-grade scales (1: obscure to 3: definitely visible) using SDS as standard of referenceand compared between ULDS and LDS using t-test. Dimension and mean CT density (MCTD) of 71 larger GGNs with the diameter of 5mm or more and SSDE based on antero-posterior and lateral body width were determined as the average value of two-times measurements in cross sections including GGN center. Measured values were compared using Friedman and Wilcoxon signed rank test among ULDS, LDS and SDS. Pearson's correlation analyses were performed to assess the association of SSDE with relative value change between ULDS and SDS (RVC#(ULDS/SDS): 100(ULDS-SDS)/SDS) and between LDS and SDS (RVC#(LDS/SDS): 100(LDS-SDS)/SDS).

RESULTS

GGN visibilities were similar between ULDS and LDS (2.746 versus 2.774) (p=0.67). SSDE had mild negative correlation with RVC# (ULDS/SDS) in dimension and MCTD (r= -0.40, p<0.01 and r= -0.31, p<0.05). Dimensions were larger at ULDS than those at LDS and SDS (p<0.01) (88.1±73.7, 82.4±69.3 and 80.2±66.9, respectively), whereas, MCTD were similar among three dose levels (p=0.131), as -626±110 Hounsfield of Unit (HU) at ULDS, -619±117 HU at LDS and -614±120 HU at SDS.

CONCLUSION

In larger GGNs at ULDS, nodular exaggerating effect in association with decreased SSDE exceeded nodular obscuration deficit due to reduced MCTD by enhanced smoothing effect, and paradoxically may result in visibilities comparable to LDS.

CLINICAL RELEVANCE/APPLICATION

ULDS is optimal for larger GGN detection, whereas, higher dose scanning such as LDS could be desirable as quantification tool in follow-up examination of detected GGNs.

SSQ04-09 A New Quantitative Radiomics Approach for Non-Small Cell Lung Cancer (NSCLC) Prognosis

Thursday, Dec. 3 11:50AM - 12:00PM Location: E351

Participants
Jiangdian Song, PhD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Caiyun Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yu Dongdong, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Feng Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Tian, PhD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

To determine if computed tomographic (CT) phenotypic features of Non-Small Cell Lung Cancer (NSCLC) have the predictive ability of auxiliary diagnosis for pathological type, TNM stage by a quantitative radiomics approach.

METHOD AND MATERIALS

The proposed method has been evaluated on a clinical dataset including 973 patients with NSCLC and a public dataset including 819 patients from the LIDC-IDRI database labelled by benign or malignancy. The proposed method consists of three phases: feature set extraction, key features selection and production. First we extracted a set of features, consisting of 3D features, Gabor features, texture features. Then a unified feature selection framework for general loss functions based on a generalized sparse regularizer was used for key feature selection. Then 25 key features were selected, the the key features were used to certify their prognostic ability.

RESULTS

A score of 83.21% accuracy for lung nodule classification on 819 patients from the LIDC-IDRI dataset was obtained by the features such as Gabor 'Entropy', wavelet 'Sum Entropy' and 'Gray Level Nonuniformity'. 83.80% pathology prediction accuracy between adenocarcinoma and squamous cell carcinoma was gained from the clinical dataset by the features such as 'Maximum 3D Diameter' and run length 'Long Run Emphasis'. And 84.40% diagnosis accuracy for the early phase cancer (T1, T2) and terminal cancer (T3, T4) classification in TNM staging was achieved by 'Energy' and run length 'Long Run High Gray Level Emphasis'.

CONCLUSION

Based on the key features selected from a predefined feature set we may provide a credible aided diagnosis for a tumor whose pathology type and TNM staging are unknown. The radiomics key features will be further expanded in larger data samples, which may provide more predictive information for clinical practice.Radiomics has a big potential to aid clinical diagnosis and treatment for NSCLC.

CLINICAL RELEVANCE/APPLICATION

By the new quantitative radiomics method a credible diagnosis of pathological type could be obtained, it may avoid invasive frozen section and anesthesia in the clinical surgery. TNM staging is an important reference for the assessment of tumor stage and now is always determined by doctor's subjective experience. The proposed radiomics method could provide a more objective and efficient clinical staging strategy.

Hot Topic Session: Cancer Screening: Breast Tomosynthesis, CT Colonography, Lung Cancer

Thursday, Dec. 3 3:00PM - 4:00PM Location: E451A

BR **CH** **GI** **CT** **OI**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Paul P. Cronin, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SPSH55A   Imaging in Breast Cancer Screening

Participants
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Stockholder, NeuWave Medical Inc

LEARNING OBJECTIVES

1) To review the foundation and evolution of scientific investigation that supports evidence-based breast cancer screening. 2) To critically evaluate the methodologies currently being used to construct screening guidelines. 3) To understand the outcomes by which successful screening programs are measured. 4) To review and assess the current controversies of breast cancer screening.

ABSTRACT

URL

SPSH55B   Imaging in Lung Cancer Screening

Participants
Ella A. Kazerooni, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ella A. Kazerooni, MD - 2014 Honored Educator

SPSH55C   Imaging in Colon Cancer Screening

Participants
David H. Kim, MD, Madison, WI (*Presenter*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc

LEARNING OBJECTIVES

1) Be able to compare/contrast image-based screening by CT colonography (CTC) against the other screening options for colorectal cancer. 2) Be familiar with the major trials that establish the performance profile of CTC. 3) Understand the rationale for the selective polypectomy strategy at CT colonography.

Imaging Tumor Response: Old and New Challenges

Thursday, Dec. 3 4:30PM - 6:00PM Location: S102AB

| BQ | MR | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC718A   Reporting Cancer Response-Practical Perspective

Participants
Elena K. Korngold, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define important terms and concepts in tumor response assessment. Describe the current use of imaging for evaluating response of GI cancers. 2) Understand the rationale for the creation of standardized and structured criteria for imaging evaluation of tumor response to therapy in research trials. 3) Understand the basic concept and organization of the RECIST (Response Evaluation Criteria in Solid Tumors) criteria. Understand the limitations of RECIST and other standardized reporting methods. 4) Recognize the reason for use of alternate criteria in specific diseases (i.e., Cheson for lymphoma, EASL/mRECIST for HCC), biomarkers, and the evolving role of imaging in evaluation of tumor response with novel therapeutic interventions.

RC718B   Prostate Cancer Treatment Assessment

Participants
Hedvig Hricak, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical challenges of prostate cancer post-treatment follow-up and the role of imaging in detecting local recurrence. 2) Know how MRI protocols for detecting local recurrence should be adjusted depending on the prior treatment and the questions being asked. 3) Understand standard and emerging uses of bone scanning, PET/CT and MRI/PET for detecting metastasis.

ABSTRACT

MRI has emerged as the key modality for assessing local recurrence of prostate cancer after radical prostatectomy (RP) or radiation therapy (RT). Early detection of local recurrence is important to allow potentially curative salvage therapy. The efficacy of MRI in detecting local recurrence is treatment dependent, and MRI protocols need to be adjusted to the questions being asked. After RT, T2-weighted MRI is limited due to post-radiation effects on the prostate such as glandular shrinkage, loss of normal zonal anatomy, and reduced contrast between cancer and normal tissue caused by glandular atrophy and fibrosis. MRI should include both T2-weighted and diffusion-weighted sequences; a recent study suggested that in most patients, dynamic contrast-enhanced (DCE)-MRI could be omitted after RT without lowering diagnostic performance, thereby eliminating the risks and costs associated with the use of contrast. If salvage treatment is an option after RT, MRI offers loco-regional staging. Post-RT MRI can evaluate the length of the urethra and may show urethral shortening (which has been associated with incontinence after primary RP), decreased urethral margin definition and other tissue changes that could conceivably affect treatment selection and planning. After surgery, in addition to DWI, the use of DCE-MRI is essential, as it can show small lesions and differentiate tumor from scarring. MRI may help to determine whether post-RP local recurrence is amenable to salvage RT and may aid RT planning. Assessment of recurrence after emerging focal therapies remains problematic, since methods for reliably differentiating necrosis or scarring from tumor are lacking. In the future, PET/CT with targeted tracers may be able to address this need. PET/CT and bone scanning are valuable in the search for nodal and osseous metastases, respectively. The implementation of clinical MRI/PET and the use of new tracers will likely open new horizons in the assessment of recurrence.

RC718C   Evaluating Response in Targeted Therapy of Abdominal Malignancy

Participants
Yves M. Menu, MD, Paris, France (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the main challenges in abdominal tumors treated with targeted chemotherapies in clinical situations like neoadjuvant therapy, tumor down staging or palliative treatment. 2) Know the specific situations of most common abdominal malignancies like liver primary and secondary tumors, pancreatic adenocarcinoma and colorectal cancer. 3) Understand how the Radiologist should manage the imaging techniques (CT, MRI, PET) in order to meet the clinical objectives and if targeted therapies require changes over cytotoxic chemotherapies.

ABSTRACT

Abdominal malignancies are very common. Imaging is pivotal for detection, staging and evaluation of tumor response to treatment. As targeted therapies are increasingly administered, the necessity for an update of tumor response criteria has become obvious. Tumor size and anatomy is still required important information, but evaluation of tissue viability is increasingly needed. Another specificity of abdominal malignancies is the increasing number of patients who are candidates for an integrated approach including systemic therapies, local therapies, radiation therapy and surgery. This underlines the necessity of a team approach and the major role of the radiologist within this group.In Hepatocellular Carcinoma (HCC), targeted therapies are widely used and mainly aimed at palliation, although potential downsizing may lead to reconsider this position. mRECIST criteria have been developed specifically

for HCC and are considered as the international standard nowadays.In secondary liver tumors, targeted therapies are usually administered in association with cytotoxic drugs. As up to 30% of patients with liver metastases from colon cancer might become resectable, the evaluation is not limited to volumetric response. The report should mention in addition relevant information on tumor viability and aggressiveness and also comment on useful elements for guidance of potential surgery or intervention.In other abdominal advanced malignancies, targeted therapies are not yet standard. However, due to the poor prognosis of these diseases, very active research develops in this field and interestingly favors a better selection of patients. Imaging may play a role with this issue, like classifying locally advanced vs metastatic patients as well as highly vs less agressive tumors.In summary, the Radiologist should have knowledge of the main clinical challenges, of ongoing and potential treatments in order to provide relevant information to the Multi Disciplinary Team.

RC718D   Evaluation of Lung Cancer Response

Participants
Jeremy J. Erasmus, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the applicability of anatomic imaging using World Health Organization (WHO) criteria and Response Evaluation Criteria in Solid Tumors (RECIST 1.1) in the assessment of tumor response in patients with non-small cell lung cancer (NSCLC). 2) To be aware of the limitations of World Health Organization (WHO) criteria and Response Evaluation Criteria in Solid Tumors (RECIST 1.1) in the assessment of tumor response. 3) To understand the potential role of metabolic tumor response assessment with 18F-FDG PET (PET Response Criteria in Solid Tumors (PERCIST)) in patients with NSCLC.

ABSTRACT

NSCLC commonly presents with advanced disease and chemotherapy is often an integral component in;treatment. However, following initiation of chemotherapy, tumor progression can occur in up to 33% of patients. Early determination of this therapeutic failure can be important in management and can assist clinical decisions concerning discontinuation of ineffective treatment and institution of alternative therapy. Additionally, an essential component of evaluating the results of cancer treatment in patients on clinical trials is the reporting of the response rate. Because small differences in the response rate can affect the outcome clinical trials, it is important that the criteria used to make this determination are meaningful and consistent. While the antitumor effect of a treatment in patients with solid tumors can be determined clinically or by surgical pathologic re-staging, image-based serial measurements based on WHO criteria or Response Evaluation Criteria in Solid Tumors (RECIST) provide uniform criteria for reporting response. However, morphological alterations detected by CT may not correlate with pathological response and tumor viability. Furthermore, the assessment of objective response has also been complicated by the development of treatment protocols that target tumor biology including tumor cell proliferation and invasion, angiogenesis and metastasis. Anti-tumor effect in many of these regimens is cytostatic and, unlike anticancer cytotoxic agents, may not cause regression in tumor size. FDG-PET may allow an early and sensitive assessment of the effectiveness of anticancer chemotherapy as FDG uptake is not only a function of proliferative activity but is also related to viable tumor cell number. This talk will review the status and limitations of anatomic and metabolic tumor response metrics in NSCLC including WHO criteria, RECIST 1.1 and PET Response Criteria in Solid Tumors (PERCIST).

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jeremy J. Erasmus, MD - 2015 Honored Educator

RC753

Computer Aided Diagnosis (Development and Clinical Applications)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E350

BR **CT** **OI** **IN**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Emanuele Neri, MD, Pisa, Italy (*Moderator*) Nothing to Disclose
Hiroyuki Yoshida, PhD, Boston, MA (*Moderator*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

LEARNING OBJECTIVES

1) Understand needs of CAD in radiologic image interpretation. 2) Understand basic concept of CAD in assisting radiologists' image reading. 3) Understand the usefulness of CAD in improving radiologists' performance. 4) Learn historical review of CAD developments. 5) Learn CAD for detection and differential diagnosis of common cancers. 6) Learn ROC analysis of radiologists' performance without and with CAD in observer studies.

ABSTRACT

Computer-aided diagnosis (CAD) has become one of the major topics in medical imaging and diagnostic radiology. In this refresher course, the principles of CAD will be presented, together with current developments as well as clinical applications of CAD.CAD aims at improving radiologists' diagnostic accuracy, and it can be used as primary, concurrent, or second reader. In principle, the CAD performs a morphological recognition of the pathology (nodule, focal lesion, polyp, etc.) combined with quantitative information (MR signal intensity, CT density, contrast enhancement, volume, etc.)Many different types of CAD schemes have been developed for detection and/or characterization of various lesions in different imaging modalities, including conventional projection radiography, CT, MRI, and ultrasound imaging. Organs that are subjected to research for CAD include the breast, lung, colon, brain, liver, kidney, and the vascular and skeletal systems.For detection of breast cancer on mammograms, more than 10,000 commercial CAD systems have been used clinically in assisting radiologists worldwide. For detection of lung cancer, CAD schemes have been developed for detection of pulmonary nodules on chest radiographs and CT images. In addition, CAD schemes have been developed for differential diagnosis of distinction between malignant and benign lesions. For colon cancer, CAD schemes have been developed for detection of polyps in CT colonography. Observer performance studies with use of ROC analysis indicated an improved performance in radiologists' task for detection and/or classification of these lesions.

URL

Sub-Events

RC753A   Development of a CAD: From Benchtop to Clinic

Participants
Ronald M. Summers, MD, PhD, Bethesda, MD, (rms@nih.gov) (*Presenter*) Royalties, iCAD, Inc; Research funded, iCAD, Inc;

LEARNING OBJECTIVES

1) To understand what radiology problems are amenable to computer aided detection. 2) To understand the steps required to develop and validate a radiology computer-aided detection product. 3) To understand the current performance and future trends in computer-aided detection with respect to indications, algorithms, sensitivity, false positive rates and pitfalls.

ABSTRACT

RC753B   CAD for CT Colonography: Where Do We Stand?

Participants
Daniele Regge, MD, Candiolo, Italy, (daniele.regge@ircc.it) (*Presenter*) Speakers Bureau, General Electric Company

LEARNING OBJECTIVES

1) Review interpretation pitfalls of CT colonography that could be overcome with CAD. 2) Present different reading paradigms of CAD for CT colonography and analyze their performances. 3) Summarize advantages and limitations of the use of CAD for CT colonography in different clinical settings.

RC753C   CAD for Breast Cancer Detection: Where Do We Stand?

Participants
Ulrich Bick, MD, Berlin, Germany, (Ulrich.Bick@charite.de) (*Presenter*) Equipment support, Hologic, Inc; License agreement, Hologic, Inc; Royalties, Hologic, Inc; Equipment support, Toshiba Corporation; Institutional research collaboration, Siemens AG

LEARNING OBJECTIVES

1) To learn about different applications of computer-aided diagnosis (CAD) in breast imaging. 2) To understand the potential and risks of using CAD in mammography screening. 3) To realize the impact of CAD on soft-copy reading and work-flow

RC753D   CAD for Lung Cancer Detection: Where Do We Stand?

Participants

Kunio Doi, PhD, Chicago, IL, (k-doi@uchicago.edu) (*Presenter*) Shareholder, Hologic, Inc; License agreement, Hologic, Inc; License agreement, Deus Technologies, LLC; License agreement, Riverain Technologies, LLC; License agreement, Mitsubishi Corporation; License agreement, MEDIAN Technologies; License agreement, General Electric Company; License agreement, Toshiba Corporation; Research support, Deus Technologies, LLC; Research support, E. I. du Pont de Nemours & Company; Research support, Elcint Medical Imaging Ltd; Research support, FUJIFILM Holdings Corporation; Research support, General Electric Company; Research support, Hitachi, Ltd; Research support, Eastman Kodak Company; Research support, Konica Minolta Group; Research support, Mitaya Manufacturing Co, Ltd; Research support, Mitsubishi Corporation; Research support, Koninklijke Philips NV; Research support, Hologic, Inc; Research support, Riverain Technologies, LLC; Research support, Seiko Corporation; Research support, Siemens AG; Research support, 3M Company; Research support, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Interventional Series: Complications in Interventional Oncology-Avoidance and Damage Control

Friday, Dec. 4 8:30AM - 12:00PM Location: N228

`GI` `VA` `IR` `OI` `RO`

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

`FDA` Discussions may include off-label uses.

Participants

Charles E. Ray JR, MD, PhD, Chicago, IL, (chary@uic.edu) (*Moderator*) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; ; ; ; ;
Robert J. Lewandowski, MD, Chicago, IL (*Moderator*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

1) List 2 important recent publications in interventional oncology. 2) Explain the mechanism of one complication related to thermal ablation. 3) Describe 1 pitfall of radioembolization. 4) Outline 3 complications in combination therapy for hepatocellular carcinoma. 5) List three complications of chemo-embolization.

ABSTRACT

Sub-Events

RC814-01 Chemoembolization Complications

Friday, Dec. 4 8:30AM - 8:45AM Location: N228

Participants

Charles E. Ray JR, MD, PhD, Chicago, IL (*Presenter*) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; ; ; ; ;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-02 DNA ChemoFilter: Novel Method to Prevent Toxicity from Intra-Arterial Administration of Chemotherapeutic

Friday, Dec. 4 8:45AM - 8:55AM Location: N228

Participants

Mariam S. Aboian, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Chia-Hung Sze, MS, San Francisco, CA (*Abstract Co-Author*) Researcher, ChemoFilter Inc
Jay F. Yu, MS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ayushi Gautam, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Prasheel Lillaney, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
David M. Wilson, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Anand S. Patel, MD, San Francisco, CA (*Abstract Co-Author*) Stockholder, ChemoFilter, Inc Officer, ChemoFilter, Inc
Mark W. Wilson, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Steven W. Hetts, MD, San Francisco, CA (*Abstract Co-Author*) Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation

PURPOSE

ChemoFilter is a novel medical device that limits systemic toxicity of chemotherapeutics by filtering non-target drug from blood that could be described as intra-vascular dialysis. This method has a potential to prevent toxicity associated with treatment of head and neck cancer, such as renal failure associated with cisplatin. We report a novel method to bind chemotherapeutics in blood that uses immobilized DNA as a platform for binding chemotherapeutics with intrinsic DNA binding activity.

METHOD AND MATERIALS

DNA binding experiments were carried out in vitro with doxorubicin in PBS solution. Genomic DNA was used to determine the concentration of DNA that shows optimum binding kinetics. Binding kinetics in nylon mesh of different pore size was evaluated.

RESULTS

DNA binding kinetics by doxorubicin is dose dependent and is very rapid with 94% decrease in drug concentration from solution within 1 minute of reaction time. DNA demonstrates faster binding kinetics by doxorubicin as compared to previously published polystyrene resin that uses ion exchange to filter doxorubicin out of the solution. DNA sequestered within the Nylon mesh demonstrates approximately 70% decrease in doxorubicin concentration from solution within 5 minutes.

CONCLUSION

DNA ChemoFilter demonstrates rapid binding of doxorubicin and is a model for filtration of DNA binding chemotherapeutics from the bloodstream.

CLINICAL RELEVANCE/APPLICATION

DNA ChemoFilter is optimized for DNA intercalating chemotherapeutics and minimizes their systemic toxicity after intra-arterial administration for treatment of liver and head and neck malignancies.

RC814-03   Repeated Transarterial Chemoocclusion with Degradable Starch Microspheres (DSMs-TACO) of Unresecable Hepatocellular Carcinoma: A Single Center Experience

Friday, Dec. 4 8:55AM - 9:05AM Location: N228

Participants
Fabrizio Chegai, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Antonio Orlacchio, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefano Merolla, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Greco, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Elisa Costanzo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Simonetti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of trans-arterialchemo-occlusion (TACO) using Degradable-Starch-Microspheres (DSMs) for unresectable hepatocellular carcinoma (HCC) treatment.

METHOD AND MATERIALS

We prospectively enrolled 28 HCC cirrhotic patients (23/5 M/F, mean age 66.3±10.5 years), to be treated with three repeated DSMs-TACO procedures (225 mg of DSMs, Embocept®S, PharmaCept and Doxorubicin Cloridrate, 50 mg/m2), performed at 4-6 week intervals. Patients were clinically evaluated before and after each procedure and disease severity scored according to Child Pugh and MELD scores. Treatment response was assessed by CT-scan 4 weeks after each procedure, according to mRECIST criteria.

RESULTS

Complete response (CR) was observed in 6 (20.8%), 11 (37.5%) and 14 (58.3%) patients after the first, second and third procedure, respectively. At the end of the treatment course all patients experienced at least a partial response. Patients with monolobar disease (16/28: 57.1%) showed higher CR rates after the first procedure compared to those with bilobar HCC (6 vs 0, p=0.017). No differences between mono or bi-lobar disease were observed in CR (64.2% vs 50%; p=ns). Eight patients (33.3%) did not complete the planned repeated procedures. In most cases treatment discontinuation was due to worsening liver function, mainly in patients with more advanced liver disease.

CONCLUSION

DSMs-TACO offers a valid therapeutic option in patients with unresecable HCC. A careful patients selection is required in order to avoid worsening liver function in patients with border-line liver compensation. Further investigations to establish the best treatment schedule and to define the effect of DSMs-TACO on survival are required.

CLINICAL RELEVANCE/APPLICATION

Temporary embolization of the hepatic artery using DSMs is feasible and safe in patients with HCC and an impaired liver function

RC814-04   Locoregional Treatment of Advanced HCC with Complete Portal Vein Thrombosis: The Impact of Radioembolization Using 90Y

Friday, Dec. 4 9:05AM - 9:15AM Location: N228

Participants
Francesco Somma, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
Roberto D'Angelo, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Gianluca Gatta, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Fiore, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Pecoraro, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Our purpose is to assess effectiveness and safety of Trans-arterial Radioembolization (TARE) using microspheres containing 90Y in case of advanced HCC with thrombosis of both portal branches.

METHOD AND MATERIALS

Between March 2010 and March 2013, 41 TARE were performed in 33 patients with unresectable HCC and bilirubine values up to 2.8 mg/dl. Among these, 23 had one portal branch thrombosis and 11 had thrombosis of both portal branches. Multislice Computed Tomography (MSCT) scans and angiography were used to assess the baseline burden and the follow-up studies according to the modified RECIST guideline. Some patients underwent the embolization of the Gastro-duodenal artery, using micro-coils. In these cases, a previous study was performed with the injection of TC-99MAA through a 3F microcatheter. Proton-Pump Inhibitors (PPI) were administered to prevent gastritis and ulcers.

RESULTS

The average dose administered was 1.8GBq. After the treatment, a post-embolization syndrome was found in 31/41 patients with no statistically significant difference between patients with portal thrombosis and those without. According to the RECIST guideline at least a partial response was found in 33/41 (79%) of cases three months after the procedure and in 35/41 (88%) at nine months. At two-year follow-up, patients with thrombosis of two portal branches presented survival rates similar to patients with one portal branch thrombosis, and only slightly inferior if compared to patients without thrombosis. Moreover, a retraction of portal vein thrombosis was registered in more than 60% of patients with thrombosis (21/34).

CONCLUSION

TARE showed to be a safe and effective locoregional treatment of locally advanced HCC, even in case of patients with portal vein thrombosis. Indeed, it does not worsen the post-embolization symptoms, while helping retracting portal vein thrombosis if present. Therefore, this condition not only has no impact on TARE, but represents an indication, even in case of thrombosis of both portal branches.

If compared to patients without thrombosis, TARE in patients with HCC and portal thrombosis does not reduce the post-treatment quality of life,Thrombosis of both portal branches does not interfere with TARE, and represents one of its major indication in case of locally advanced unresectable HCC, even in case of recurrence after other locoregional treatments.

RC814-05 Irreversible Electroporation (IRE) of Malignant Liver Tumors Close to Major Portal or Hepatic Veins Does not Influence Perfusion of Hepatic or Portal Veins but Can Result in Bile Duct Strictures

Friday, Dec. 4 9:15AM - 9:25AM Location: N228

Participants
Martina Distelmaier, Aachen, Germany (*Presenter*) Nothing to Disclose
Alexandra Barabasch, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heil, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

IRE has been proposed as a non-thermal ablation method that offers specific advantages over thermal ablation, notably absence of heat sink effect and preservation of both, blood vessels and bile ducts. The purpose of our study was to verify the theoretical advantages of IRE by systematically investigating clinical efficacy and complications of percutaneous IRE for hepatic malignancies located immediately adjacent to major portal and bile ducts or hepatic veins. We were specifically interested in the long-term patency of adjacent venous and biliary vessels.

METHOD AND MATERIALS

CT-guided percutaneous IRE of 37 primary or secondary liver malignancies (mean size 17 mm; range 7-44 mm) was performed in 27 patients (mean age 59 y; 13 men). All lesions were located immediately adjacent to major hepatic veins (n=16), portal vein branches or both (n=21) and therefore not suitable for RFA or MWA. Per standard IRE protocol, 3 to 5 probes (active tip length 1.5-2.5 cm) were placed strictly parallel under CT-guidance. All patients underwent systematic follow-up by CT or MRI.

RESULTS

No major procedure-related complications were observed. All adjacent major portal or hepatic veins remained perfused even at long term follow-up. Complete ablation of the target was achieved in 34/37 (92%) cases with a safety margin of 5-10 mm, confirmed by CT and MRI. In 9 cases (24%) local recurrences within or adjacent to the ablation zone were observed between 1-12 months after treatment. 5 patients with tumors located next to portal veins/ bile ducts (5/21=24%) developed mild to moderate segmental/lobar cholestasis, not requiring treatment. In one patient a clinically asymptomatic arterio-portal fistula developed.

CONCLUSION

IRE for primary and secondary liver malignancies located adjacent to large portal or hepatic veins proved to be safe and effective with regards to local control, and will leave venous blood vessels unaffected. Bile duct strictures may, however, occur, in up to 25% of lesions located close to portal structures.

CLINICAL RELEVANCE/APPLICATION

CT-guided IRE is a useful ablation method for primary and secondary liver tumors that are not amenable to thermal ablation (RFA, MWA). While blood vessels are preserved, bile duct stricutes do occur.

RC814-06 Y-90 Complications

Friday, Dec. 4 9:25AM - 9:40AM Location: N228

Participants
Robert J. Lewandowski, MD, Chicago, IL (*Presenter*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-07 Thermal Ablation Complications

Friday, Dec. 4 9:55AM - 10:10AM Location: N228

Participants
Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

RC814-08 Debate: IO: More than Radiologists?

Friday, Dec. 4 10:10AM - 10:25AM Location: N228

Participants
Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (*Presenter*) Nothing to Disclose
Robert J. Lewandowski, MD, Chicago, IL (*Presenter*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific

Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

RC814-09 Incidence of Tumor Seeding after Percutaneous Radiofrequency Ablation of Hepatocellular Carcinoma: A Six Year Experience in 581 Nodules in 305 Consecutive Patients

Friday, Dec. 4 10:25AM - 10:35AM Location: N228

Participants
Somrach Thamtorawat, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Justin P. McWilliams, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Michael L. Douek, MD, MBA, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Simin Bahrami, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David Y. Lu, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor seeding along the needle tract or peritoneum is dreaded complication of percutaneous liver ablation, especially in potential liver transplant patients with a reported incidence up to 4.4%. Therefore, the objective of our study was to determine the incidence of tumor seeding after percutaneous RF ablation of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, our institutional clinical database was queried to access all patients who had development of one or more extrahepatic recurrences in the skin, subcutaneous tissues, or peritoneum from March 2006 to December 2012. The study cohort consisted of 305 consecutive patients (217 men and 88 women) and a total of 498 RFA sessions. All lesions were treated with single, double or cluster internally cooled straight electrodes mated to a 200W generator and switching controller (Covidien, Boulder Co) by one of four experienced interventionalists. Tract ablation was used in almost all cases. Six patients were treated by using combined ethanol injection.

RESULTS

Over a 6 year period, 581 HCC nodules were treated by RF ablation with a mean follow up of 28±16 months (range from 3-66 months). Tumor seeding was evaluated by pathological report of explant liver in 96 patients and by imaging follow up in 209 patients. During this time in two patients, single chest wall nodules were detected in or near the needle tract (0.3% per nodule, 0.6% per patient) in the setting of extrahepatic metastases. One nodule was detected at 5.3 months post ablation concurrent with lymph node metastasis. The other nodule was detected at 18.3 month after liver transplantation in a patient with concurrent lung metastases. In both cases, the ablated nodules were subcapsular, poorly differentiated on concurrent biopsy with direct electrode insertion into the nodule. There was no further lesion treatment due to advanced metastatic disease.

CONCLUSION

In this series, no needle tract seeding was detected in patients without concurrent extrahepatic metastases. However, with two solitary chest wall nodules at or near the needle tract, the possible risk of tumor seeding after RF Ablation of HCC was 0.3% per nodule and 0.6% per patient. Both nodules were poorly differentiated and subcapsular.

CLINICAL RELEVANCE/APPLICATION

Using optimal technique, there is very low risk of possible tumor seeding after percutaneous radiofrequency ablation of hepatocellular carcinoma.

RC814-10 Utility and Safety of Radiofrequency Ablation for Focal Hepatic Lesions Adjacent to Gallbladder in Ablating between GB Fossa and Contralateral Safety Margin

Friday, Dec. 4 10:35AM - 10:45AM Location: N228

Participants
In Young Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Pyo Nyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyung Jin Won, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate safety and therapeutic efficacy of radiofrequency (RF) ablation for treatment of focal hepatic lesions (FHL) adjacent to gallbladder (GB) with reduction of ablation time and rearrangement of electrode.

METHOD AND MATERIALS

We restrospectively evaluated 36 patients who underwent RF ablation of FHL adjacent to GB(less than 10mm) from January 2011 to March 2014. Follow-up period was ranged from 9 to 50 months (mean, 25 months). The electrode was inserted parallel direction to GB. Patients were divided into two subgroups based on whether the lesion was abutting GB (less than 5mm, n=19) or not (more than 5mm, n=17). In abutting group, the electrode was inserted eccentrically after mesuring the diameter between GB fossa and contralateral safety margin and ablation time was decreased for reducing the diameter of ablated zone in horizontal axis to GB. Fourteen of abutting group were performed with artificial ascites (5% dextrose aqueous solution) and 8 of non-abutting group were performed with artificial ascites. A panel of radiologists blinded to the patients' clinical histories reviewed immediate follow up CT for complication and late follow up CT for local tumor progression. Statistical evaluation was performed with Chi-square test and

Fisher's exact test.

RESULTS

There were no major complications in both groups. Enhancing wall thickening of GB adjacent to RFA zone was noted in 19.4% (7/36, abutting group; 5, non-abutting group; 2) and it disappeared on subsequent follow-up imaging. There is no statistically significant difference between abutting group and non-abutting group (p >0.05). The technical success rate based on immediate follow-up and one-month follow-up CT was 94.4% (34/36) and two patients remained enhancing foci on immediate follow up (1 abutting group, 1 non-abutting group) and they were retreated sucessfully. Local tumor progression of completely ablated tumors during follow-up period less than 6 months was noted in two patients (2/34, 1 abutting group, 1 non-abutting group). Except these two patients, there was no local tumor progression during follow-up periods.

CONCLUSION

RF ablation can be a safe and effective treatment for FHL adjacent to GB with rearrangement of electrode and reduction of ablation time.

CLINICAL RELEVANCE/APPLICATION

The treatment of FHL adjacent to GB is challenging issue. RF ablation may be a safe and effective treatment option even though the lesion is located right beside GB.

RC814-11   Combination Therapy Complications

Friday, Dec. 4 10:45AM - 11:00AM Location: N228

Participants
Thuong G. Van Ha, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-12   Complications due to Imaging Errors

Friday, Dec. 4 11:00AM - 11:15AM Location: N228

Participants
Aradhana M. Venkatesan, MD, Houston, TX, (avenkatesan@mdanderson.org) (*Presenter*) Institutional research agreement, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RC814-13   Tumor Board-Ask the Experts

Friday, Dec. 4 11:15AM - 11:30AM Location: N228

Participants
Charles T. Burke, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-14   Literature Review: The Most Important IO Papers from the Past 5 Years that Everyone Should Know

Friday, Dec. 4 11:30AM - 11:45AM Location: N228

Participants
Ryan Hickey, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Handout:Ryan Hickey

http://abstract.rsna.org/uploads/2015/15002217/The Most Important IO Papers from the Past 5 years that Everyone Should Know.docx

RC814-15   Questions and Wrap-up

Friday, Dec. 4 11:45AM - 12:00PM Location: N228

Participants

Molecular Imaging Beyond PET: MRI and Ultrasound/Photoacoustic Molecular Imaging

Friday, Dec. 4 8:30AM - 10:00AM Location: S504CD

`MI` `MR` `OI` `US`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

`FDA` Discussions may include off-label uses.

Participants
Fabian Kiessling, MD, Aachen, Germany, (fkiessling@ukaachen.de) (*Moderator*) Advisor, invivoContrast GmbH; Co-owner, invivoContrast GmbH; Advisor, Molecular Targeting Technologies, Inc; Cooperation, Bayer AG; Cooperation, Bracco Group; Cooperation, Merck KgaA; Cooperation, AstraZeneca PLC; Cooperation, Koninklijke Philips NV; Cooperation, FUJIFILM Holdings Corporation

LEARNING OBJECTIVES

1) Attendees will learn the principles and applications of molecular imaging using ultrasound and photoacoustic imaging techniques. 2) Principles and applications of ultrasound molecular imaging will be reviewed. 3) Principles and applications of molecular imaging using photoacoustic imaging techniques will be presented. 4) Ultrasound guided drug delivery approaches will be reviewed. 5) At the end of this course, the attendees will understand the principles and potential clinical applications of ultrasound and optoacoustic molecular imaging as well as of ultrasound guided drug delivery.

Sub-Events

RC817A   Photoacoustic Imaging

Participants
Stanislav Emelianov, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the fundamental principles of photoacoustic imaging and major components of photoacoustic imaging system. 2) Knowing how photoacoustic images are formed and how to interpret photoacoustic images. 3) Understand how imaging contrast agents or imaging probes affect contrast, penetration depth and specificity in photoacoustic imaging. 4) Understand the ability of photoacoustic imaging system to visualize anatomical, functional and molecular properties of imaged tissue. 5) Identify the role of photoacoustic imaging in pre-clinical and clinical applications.

ABSTRACT

Photoacoustic imaging or tomography - a non-ionizing, non-invasive, real-time imaging technique capable of visualizing optical absorption properties of tissue at reasonable depth and high spatial resolution, is a rapidly emerging biomedical and clinical imaging modality. Photoacoustic imaging is regarded for its ability to provide in-vivo morphological and functional information about the tissue. With the recent advent of targeted contrast agents, photoacoustics is capable of in-vivo molecular imaging, thus facilitating further molecular and cellular characterization of tissue. This presentation is designed to provide both a broad overview and a comprehensive understanding of photoacoustic imaging. With a brief historical introduction, we will examine the foundations of photoacoustics, including relevant governing equations, optical/acoustic properties of the tissues, laser-tissue interaction, system hardware and signal/image processing algorithms. Specifically, penetration depth and spatial/temporal resolution of photoacoustic imaging will be anlyzed. Integration of photoacoustic and ultrasound imaging systems will be discussed. Techniques to increase contrast and to differentiate various tissues in photoacoustic imaging will be presented. Furthermore, design, synthesis and optimization of imaging probes (typically, nanoconstructs or dyes) to enable molecular/cellular photoacoustic imaging will be presented. Special emphasis will be placed on contrast agents capable of multiplexed imaging, multi-modal imaging and image-guided therapy including drug delivery and release. The presentation will continue with an overview of several commercially available and clinically-relevant systems capable of photoacoustic imaging. Regulatory aspects of photoacoustic imaging systems and imaging contrast agents will be presented. Finally, current and potential biomedical and clinical applications of photoacoustics will be discussed.

RC817B   Ultrasound Molecular Imaging

Participants
Juergen K. Willmann, MD, Stanford, CA (*Presenter*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To understand the acquisition and quantification principles of ultrasound molecular imaging. 2) To understand the characteristics and biodistribution of molecularly targeted ultrasound contrast agents. 3) To understand the role of ultrasound molecular imaging in preclinical and clinical applications.

ABSTRACT

Ultrasound imaging is a widely available, relatively inexpensive, and real-time imaging modality that does not expose patients to radiation and which is the first-line imaging modality for assessment of many organs. Through the introduction of ultrasound contrast agents, the sensitivity and specificity of ultrasound for detection and characterization of focal lesions has been substantially improved. Recently, targeted contrast-enhanced ultrasound imaging (ultrasound molecular imaging) has gained great momentum in preclinical research by the introduction of ultrasound contrast agents that are targeted at molecular markers over-expressed on the vasculature of certain diseases. By combining the advantages of ultrasound with the ability to image molecular

signatures of diseases, ultrasound molecular imaging has great potential as a highly sensitive and quantitative method that could be used for various clinical applications, including screening for early stage disease (such as cancer); characterization of focal lesions; quantitative monitoring of disease processes at the molecular level; assisting in image-guided procedures; and, confirming target expression for treatment planning and monitoring. In this refresher course the concepts of ultrasound molecular imaging are reviewed along with a discussion on current applications in preclinical and clinical research.

RC817C   Sonographically-guided Drug Therapy

Participants
Alexander L. Klibanov, PhD, Charlottesville, VA, (sasha@virginia.edu) (*Presenter*) Co-founder, Targeson, Inc; Stockholder, Targeson, Inc; Institutional research collaboration, AstraZeneca PLC;

LEARNING OBJECTIVES

1) To identify the basic principles of ultrasound energy deposition as applied to molecular imaging and image-guided therapeutic interventions. 2) To combine the general physical principles of ultrasound-microbubble interaction, drug-carrier systems pharmacokinetics and ultrasound contrast imaging, apply this knowledge for the development of triggered delivery approaches in the setting of personalized medicine. 3) To understand advantages and disadvantages of ultrasound application in the potential image-guided intervention designs. 4) To identify and compare potential clinical applications of ultrasound-guided drug delivery.

ABSTRACT

The reason of ultrasound use in drug delivery is to enhance drug action specifically in the area of disease. The design of such therapeutic intervention should assure that drug deposition or action enhancement take place only in the disease site, with the general goal to improve the therapeutic index. There are several approaches to ultrasound-assisted drug delivery. The first approach, closest to clinical practice, takes advantage of existing ultrasound contrast agents (intravenous gas microbubbles approved in US for cardiac imaging). When these bubbles are co-injected intravenously with the drugs, and ultrasound energy applied to the areas of disease, localized energy deposition leads to endothelium activation or transient "softening" of blood brain barrier (BBB). Drugs (including antibodies or liposomes) can thus transit BBB and achieve therapeutic action. Ultrasound imaging can be used for targeted focusing of ultrasound energy in the areas of disease. Second approach suggests attaching microbubbles to the drug or a drug carrier (including nucleic acid drugs). Microbubbles can be complexed with drug or gene carrier nanoparticles, so that local action of ultrasound would result in triggered drug release/deposit or transfection in the ultrasound-treated area. Third approach involves targeted microbubble design, as in ultrasound molecular imaging. Combination of targeted microbubbles with drug carrier makes possible unfocused ultrasound use, to act only in the areas of the target receptor expression, where microbubbles adhere and ultrasound energy is then deposited. Lately, formulation moved from microbubbles to smaller nanodroplet drug carriers, to reach interstitium, where drug release could take place upon ultrasound treatment. Overall, combination of ultrasound imaging, including contrast (molecular) imaging, focused ultrasound, and drug carrier systems will lead to novel image-guided therapies, especially applicable in the era of personalized medicine.

RC817D   Magnetic Resonance Molecular Imaging

Participants
Moritz F. Kircher, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To receive a structured overview of the fundamental principles of generating molecular information with MRI. 2) To understand how each of these principles functions and what unique information it can provide. 3) To understand the current role of molecular MRI in preclinical and clinical applications. 4) To understand what the challenges of new molecular MRI approaches towards translation into humans will be.

ABSTRACT

The field of molecular MRI has exploded in the last decade, with hundreds of different concepts and probe designs developed and tested in vitro and in vivo. This talk will attempt at giving a structured overview over this vast arsenal of potentially useful approaches by focusing on those that have the highest potential for clinical translation. The approaches will be grouped into 6 major categories and their principles explained and illustrated with key examples: 1) Multimodal nanoparticles; 2) Activatable MRI probes; 3) Targeted superparamagnetic iron oxide nanoparticles; 4) non-targeted superparamagnetic iron oxide nanoparticles; 5) MRI-based Radiogenomics; and 6) Hyperpolarized magnetic resonance spectroscopic imaging.

Global Cancer Imaging-Insights from Overseas

Friday, Dec. 4 8:30AM - 10:00AM Location: E261

GU **MI** **MR** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC818A   Functional and Molecular Imaging at Oxford University

Participants
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Presenter*) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

LEARNING OBJECTIVES

1) To learn about the functional and molecular imaging research being conducted within the Radiology Department of Oxford University Hospitals NHS Trust.

ABSTRACT

There is increasing functional and molecular imaging being performed in medicine. The Radiology department at the Churchill Hospital in Oxford is conducting a number of trials in these areas, and has designed these trials around interventions to measure the effect of these new techniques. It has also taken the opportunity to raise the profile of Radiology within the University, to promote greater collaboration with basic scientists, attracting increased funding, and opportunities for scientists and physicians.

RC818B   Lessons Learned from the National Irish Breast Screening Program: The First 12 years-One Million Mammograms On

Participants
Michelle M. McNicholas, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the results of the Irish National Breast Screening Program following 12 years of screening with over 1,000,000 mammograms performed. 2) To understand the essential components of setting up and maintaining a national breast screening program in Ireland. This includes the rationale for the decisions made at the outset, such as age range, frequency of screens, centralisation of service and responsibility of the screening process to the end of primary surgery. 3) To understand the need for and the mechanism of developing a national registry of eligible women in the absence of a national unique identifier. 4) To understand the need for a client charter which sets out client guarantees, objectives and goals around issues of consent, timeliness of screening results and recall to assessment, biopsy results and admission for surgery and further treatment where indicated. 5) To understand the necessity of national guidelines, annual reports and external accreditation. 6) To demonstrate the essential need for ongoing review of key performance indicators (recall rate, biopsy rate, cancer detection rate, DCIS rate, open biopsy rate, false negative rate, interval cancer rate) as surrogates of program success. 7) To understand the importance of communication and feedback to clients, units, practitioners and media in maintaining uptake. 8) To understand the reporting structure and the composition of various roles within the multidisciplinary medical and surgical teams. 9) To understand the requirements for ongoing training and education of all staff - physicians, technologists, nurses, physicists, administrative staff. 10) To understand the factors affecting radiation dose to the screened population and the over-riding responsibility of the ALARA principle, such as: role of physics team, mammographic technique, equipment choice, technologist expertise and training, quality assessment. 11) To understand the operational issues of different screening units, double reading, discrepancy cases, dealing with interval cancers, dealing with outliers in key performance parameters. 12) To understand the positive spinoff s from the program including increased awareness, improving national standards in the screening and the symptomatic population and the contribution to improved diagnostic and treatment options. 13) To understand how the program achieved, maintained, and monitored performance and how it adapted to changes in practice as issues or controversies arose. 14) To discuss whether this population screening program has been a successful and cost effective health care initiative for Ireland. 15) Ultimately, to understand whether the Irish National Breast Screening Program has led to improved survival in women with breast cancer in Ireland.

RC818C   MRI of Pelvic Malignancy-The View from Down Under

Participants
Nicholas J. Ferris, MBBS, Clayton, Australia, (nicholas.ferris@monashhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about the local availability and funding of MRI in investigating pelvic malignancy that is unique to Australia.2) To understand the current usage of Pelvic MRI in investigating pelvic malignancy in the Australian population.3) To review some typical examples of Pelvic MRI in Oncology that illustrate the advantages of MRI in the assessment of pelvic malignancies and impact MRI has on patient management in the multidisciplinary setting.

ABSTRACT

Most medical imaging tests in Australia are heavily subsidized by the Federal government as part of the 'Medicare' national health

insurance system.Prostate cancer is a common problem in Australian men, and MRI appears to be a very useful tool in its assessment and management, however it remains unfunded in the Medicare system. To remedy this, a group of clinicians has made application to the Medicare Services Advisory Committee (MSAC) for inclusion of the test on the Medicare Benefits Schedule. Steps in the recently revised MSAC procedure will be reviewed, with reference to the current application for prostate MRI.The impact of its current unfunded status on the uptake of prostate MRI will be briefly reviewed.Despite the lack of government support, there has been considerable experience with the technique 'Down Under', leading to some important publications in the international literature about the role of MRI in selection of patients for biopsy, and the choice of biopsy target.

RC818D   Imaging of HCC-A Korean Perspective

Participants
Byung Ihn Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn recent imaging techniques for the qualitative and quantitative diagnosis, selection of treatment methods, and evaluation of monitoring after treatment for HCC. 2) To understand the imaging findings of hepatocarcinogenesis from regenerate nodule going through low and high grade dysplastic nodule, early HCC and finally to advanced HCC. 3) To review current clinical practice guidelines including role of imaging for the diagnosis and treatment for HCC with focus on recent change of guidelines by rapid progression of imaging biomarkers.

ABSTRACT

Body MRI: Clinical Challenges (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E450A

GI **GU** **MR** **OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC829A   Imaging Perianal Fistulae

Participants
Damian J. Tolan, MBBCh, FRCR, Leeds, United Kingdom, (damian.tolan@nhs.net) (*Presenter*) Speaker, Bracco Group; Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) To understand how to describe the different types of fistula. 2) To learn how to perform, interpret and report MRI for the initial assessment of fistula in ano. 3) To learn the implications of MR findings in planning surgical treatment.

RC829B   Pelvic Endometriosis

Participants
Evan S. Siegelman, MD, Philadelphia, PA (*Presenter*) Consultant, BioClinica, Inc; Consultant, ICON plc; Consultant, ACR Image Metrix

LEARNING OBJECTIVES

1) Review the theories concerning the pathogenesis of endometriosis. 2) Discuss the clincial indications that may indicate the use of pelvis imaging to diagnose endometriosis. 3) Assess the current MR techniques used in the detection and characterization of endometriosis. 4) Describe the imaging features of endometriomas and deeply infiltrative endometriosis.

ABSTRACT

Endometriosis is defined as the presence of ectopic endometrial glands and stroma outside the uterus. Endometriosis is a common cause of pelvic pain and infertility, affecting as many as 10% of premenopausal women. Radiologists should be familiar with the various imaging manifestations of endometriosis, especially those that allow its differentiation from other pelvic lesions. The MR 'pearls' offered here apply to the detection and characterization of pelvic endometriosis. The inclusion of T1-weighted fat-suppressed sequences is recommended for all MR examinations of the female pelvis because such sequences facilitate the detection of small endometriomas and aid in their differentiation from mature cystic teratomas. Benign endometriomas can exhibit restricted diffusion and should not be confused with ovarian cancer. Although women with endometriosis are at risk for developing clear cell and endometrioid epithelial ovarian cancers (ie, endometriosis-associated ovarian cancers), imaging findings such as enhancing mural nodules should be confirmed before a diagnosis of ovarian malignancy is suggested. The presence of a dilated fallopian tube, especially one containing hemorrhagic content, is often associated with pelvic endometriosis. Deep (solid infiltrating) endometriosis can involve the pelvic ligaments, anterior rectosigmoid colon, bladder, uterus, and cul-de-sac, as well as surgical scars; the lesions often have poorly defined margins and T2 signal hypointensity as a result of fibrosis. The presence of subcentimeter foci with T2 hyperintensity representing ectopic endometrial glands within these infiltrating fibrotic masses may help establish the diagnosis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Evan S. Siegelman, MD - 2013 Honored Educator

RC829C   Cholangiocarcinoma Diagnosis and Staging: What the Surgeon Needs to Know

Participants
Eduard E. De Lange, MD, Charlottesville, VA, (delange@virginia.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about staging cholangiocarcinoma. 2) To understand how the tumor is classified surgically. 3) To get insight into the various surgical procedures for tumor resection. 4) To understand the importance of vascular involvement for determining tumor resectability.

ABSTRACT

Active Handout:Eduard E. De Lange

http://abstract.rsna.org/uploads/2015/15002799/RC829C.pdf

Handout:Eduard E. De Lange

http://abstract.rsna.org/uploads/2015/15002799/Course RC829C- de Lange EE - Cholangiocarcinoma - What the surgeon needs to

know.xps

Theranostics: Contributions of Diagnostic Nuclear Medicine and Targeted Radionuclide Therapy in Clinical Oncology (In Conjunction with SNMMI)

Friday, Dec. 4 8:30AM - 12:00PM Location: S504AB

GI **HN** **MK** **NR** **CT** **MR** **NM** **OI** **RO**

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

1) An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and beta (or alpha) emitters (for therapy), allowing for the targeted treatment of lesions. This is an expression of theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient's disease. This proposed session will provide several examples of such paired diagnostic studies and treatements using Nuclear Medicine methods.

Sub-Events

SPNM61A   Radioactive Iodine and Thyroid Cancer - Current Use and Controversies

Participants
Douglas Van Nostrand, MD, Washington, DC, (douglas.van.nostrand@medstar.net) (*Presenter*) Speakers Bureau, sanofi-aventis Group

LEARNING OBJECTIVES

1) Define remnant ablation, adjuvant treatment, and treatment of locoregional/distant metastases. 2) Discuss the indications and controversies of 131I for each. 3) Discuss the range of prescribed activity of 131I for each.

SPNM61B   Bone Scintigraphy and the Use of Radionuclides in the Management of Patients with Metastatic Castrate-Resistant Prostate Cancer

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review bone scintigraphy with single photon and PET radiotracers in the imaging evaluation of patients with prostate cancer. 2) To summarize the results of the ALSYMPCA clinical trial for 223Ra dichloride therapy in patients with castrate resistant metastatic prostate cancer.

SPNM61C   Updates on the Use of PET/CT (and PET/MRI) and Radioimmunotherapy in NHL

Participants
Erik S. Mittra, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPNM61D   Peptide Receptor Radionuclide Imaging and Therapy: Where Are We in Europe and What Shall the US Do to Catch Up?

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of theragnostic. 2) Identify promising candidates for PRRT. 3) Challenges and limitations of PRRT. 4) Future perspective using alpha-emitters.

ABSTRACT

Well-differentiated neuroendocrine tumors (NETs) demonstrate modest responses to conventional chemotherapy due to their slow proliferation rate. However, the expression of somatosatin receptors by NET enables targeting with high affinity peptides. When these octreotide analgue peptides are labelled with beta emitters such as 90Y or 177Lu promising anti-tumor effects have been observed. The presentation will introduce the concept of theragnostic (68Ga-DOTATOC and 90Y/177Lu-DOTATOC) for improved patient stratefication. Today, PRRT is well established for a long time in NET-patients. However challenges and limitations will be discussed in regard to other systemic therapies such as everolimus or sunitinib. Finally, outlook will be given in regard to the novel of targeted alpha therapy in NET-patients and its implication to other tumor entities.

URL

SPNM61E   Selective Internal Radiation Therapy for Hepatic Malignant Lesions

Ghassan El-Haddad, MD, Tampa, FL, (ghassan.elhaddad@moffitt.org) (*Presenter*) Speaker Bureau, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Chest (Thoracic Malignancy)

Friday, Dec. 4 10:30AM - 12:00PM Location: E451B

`CH` `CT` `OI`

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Patricia M. de Groot, MD, Houston, TX (*Moderator*) Nothing to Disclose
James G. Ravenel, MD, Charleston, SC (*Moderator*) Nothing to Disclose

Sub-Events

SST03-01   Radiogenomic Evaluation of Lung Cancer-Are There Imaging Characteristics Associated with Lung Adenocarcinomas Harboring BRAF Mutations?

Friday, Dec. 4 10:30AM - 10:40AM Location: E451B

Participants
Darragh Halpenny, MBBCh, MRCPI, New York, NY (*Presenter*) Nothing to Disclose
Gregory J. Riely, New York, NY (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH Consultant, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd
Andrew J. Plodkowski, MD, Syracuse, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Litvak, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Junting Zheng, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chaya Moskowitz, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michelle S. Ginsberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

BRAF mutations are found in 2% of non-small cell lung cancers (NSCLC) and are associated with responsiveness to treatment with targeted medical therapy. The purpose of this study is to identify computed tomography (CT) imaging features associated with BRAF mutation in lung cancer.

METHOD AND MATERIALS

The institutional review board approved this study. Patients presenting from 4/2/2004 - 6/3/2013 with BRAF mutated NSCLC were studied. Stage matched patients with NSCLC without BRAF mutation were used as controls. Thoracic CTs, performed at diagnosis, were retrospectively reviewed by 2 radiologists in consensus. Features assessed included: size, contour, consistency of the primary tumor, adjacent parenchymal changes (peri-lesional halo, obstructive changes, pleural tail); presence of thoracic lymphadenopathy, pleural effusion, pleural metastases and lymphangitic spread.

RESULTS

188 patients with NSCLC were included: 47 (25%) patients had a BRAF mutation. 141(75%) had non-BRAF mutated NSCLC: 47 EGFR mutations, 47 KRAS mutations, and 47 lesions without documented mutation. In each group, 30% patients were stage 1, 6% were stage 2, 26% were stage 3 and 38% were stage 4. BRAF patients were more likely to be older (p= 0.014), male (p=0.011) and have a smoking history (p<0.001) when compared to EGFR patients. There were no other demographic differences between the groups.BRAF lesions were most frequently solid: 37(79%), spiculated 22(47%) and peripheral 37(79%), however no imaging feature of the primary tumor was significantly different between BRAF and non-BRAF groups. Some ancillary imaging features were significantly associated with BRAF mutations when the BRAF group was compared to patients with KRAS mutations. BRAF patients were more likely to have a pleural effusion than KRAS patients 11(23%) vs 3(6%) p= 0.033. In addition, BRAF patients were more likely to have pleural metastases than KRAS patients 5(11%) vs 0(0%), p=0.045.

CONCLUSION

On CT evaluation, NSCLC with BRAF mutation is most frequently solid, spiculated and peripheral. No feature of the primary tumor can be used to differentiate BRAF lesions from other genetically distinct forms of NSCLC.

CLINICAL RELEVANCE/APPLICATION

The results provide the first description of the radiologic characteristics of BRAF mutated lung cancer, detection of which is important to identify patients who may benefit from targeted therapy.

SST03-02   Radiogenomic Detection of EGFR and KRAS Mutations in NSCLC Using CT Texture Analysis

Friday, Dec. 4 10:40AM - 10:50AM Location: E451B

Participants
James Sorensen, MBBCh, Houston, TX (*Presenter*) Nothing to Disclose
Jeremy J. Erasmus, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Shekhar S. Patil, MD, MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Laurence E. Court, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Arvind Rao, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Myrna C. Godoy, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (*Abstract Co-Author*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;
J J. Lee, PhD,DDS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kathryn A. Gold, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen G. Swisher, MD, Houston, TX (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc

John V. Heymach, MD,PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To perform CT texture analysis on contrast enhanced chest CT images to detect EGFR and KRAS mutations in non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

We retrospectively evaluated NSCLC patients from the MD Anderson Cancer Center GEMINI (Genomic Marker-Guided Therapy Initiative) cohort who had contrast-enhanced chest CT imaging within 90 days prior to biopsy, and who also had genetic testing for EGFR or KRAS mutations. Tumor segmentation was done semi-automatically using 3DSlicer (Harvard University, Cambridge MA). Textural features were calculated using IBEX (MDACC, Houston TX). On the basis of existing literature, and prior experience, 30 image features were selected, including GreyLevel Cooccurrence Matrix, Run-Length Matrix, intensity histogram, and geometric properties (ie shape and size) of the tumor. Feature sets were generated from CT images without filtering, as well as following application of either a Laplacian of Gaussian filter or Gaussian smoothing filter. The resulting features were used to train a Random Forest machine learning classifier, which yielded a prediction for the EGFR and/or KRAS mutation status of each patient.

RESULTS

Of 115 patients, 107 were tested for KRAS mutation (81 -ve, 26 +ve) and 113 tested for EGFR mutation (85 -ve, 28 +ve). CTs were from a variety of scanners, but all were contrast-enhanced, with soft-tissue reconstructions, and slice-thickness of 1.25 - 5 mm. Mean tumor diameter was 5.7cm (range 1.2 - 14.9cm) and mean volume was 44.9 cm3 (range 0.4 - 338 cm3). No single feature was found to be strongly predictive for either mutation, but when collected in a Random Forest classifier these features predicted the presence of KRAS mutations with a sensitivity and specificity of 42% and 89%, respectively, with a PPV of 55% and NPV of 83%. For EGFR mutation, sensitivity and specificity were 50% and 76%, with a PPV of 41% and NPV of 82%. In total, KRAS and EGFR mutation status was correctly assessed in 76% and 70% of cases, respectively.

CONCLUSION

Texture analysis was able to correctly identify EGFR and KRAS mutation status in the majority of patients. Given the limitations of obtaining histologic samples in patients with multiple lesions or tumor heterogeneity, texture analysis may improve genotyping accuracy in these patients.

CLINICAL RELEVANCE/APPLICATION

Non-invasive genotyping with texture analysis may be of particular benefit to patients with NSCLC being considered for targeted therapy.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jeremy J. Erasmus, MD - 2015 Honored Educator
Brett W. Carter, MD - 2015 Honored Educator

SST03-03 **Decoding Tumor Phenotype for ALK, ROS1, and RET Fusions in Lung Adenocarcinoma Using a Radiomics Approach**

Friday, Dec. 4 10:50AM - 11:00AM Location: E451B

Participants
Hyun Jung Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Insuk Sohn, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ho Yun Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae-Hun Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon-La Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyeseung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jhingook Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify the clinicoradiologic predictors of tumors for ALK (anaplastic lymphoma kinase), or ROS1 (c-ros oncogene 1), or RET (rearranged during transfection) fusion-positive in patients with lung adenocarcinoma.

METHOD AND MATERIALS

A total of 539 pathologically confirmed lung adenocarcinomas were included this retrospective study. Baseline clinicopathologic characteristics were retrieved from the patients' medical records. ALK/ROS1/RET fusion status was also reviewed. Qualitative and quantitative CT and PET imaging characteristics were evaluated. Of all clinicoradiologic features, significant features for ALK/ROS1/RET fusion-positive prediction model were extracted, and sensitivity, specificity, positive and negative predictive value were calculated for each of two discrimination tasks such as fusion-positive vs. fusion-negative tumor. We further performed comparison task between ALK vs. ROS1/RET fusion-positive tumors in clinicoradiologic features to identify clinicoradiologic similarity between the two groups.

RESULTS

Of 539 patients, 47 were ALK + lung cancers (47/539, 8.7%), 17 were ROS1/RET fusion-positive (17/539, 3.2%), and 475 were fusion-negative for those genes (475/539, 88.1%). ALK/ROS1/RET fusion status was mutually exclusive. ALK ROS1/RET fusion-positive predicting model was combination of age, tumor stage, solidity, SUVmax, mass, kurtosis, inverse variance on 3-voxel distance with a sensitivity, specificity, positive and negative predictive value of 0.73, 0.70, 0.71 and 0.69, respectively. In comparison task between ALK vs. ROS1/RET fusion-positive, all clinicoradiologic features were not significantly different except

tumor stage, central location, SUVmax, homogeneity on 1-, 2- and 3-voxel distance, and sum mean on 2-voxel distance.

CONCLUSION

ALK/ROS1/RET fusion-positive lung adenocarcinomas possess certain clinical and imaging features, enabling good discrimination of fusion-positive from fusion-negative lung adenocarcinomas. ROS1/RET fusion-positive tumors share most clinicoradiologic features with ALK fusion-positive tumors.

CLINICAL RELEVANCE/APPLICATION

ROS1/RET + lung adenocarcinomas share clinicoradiologic characteristics with ALK + tumor and it may help to identify cases for ROS1/RET testing targeted Crizotinib even in case of ALK - condition.

SST03-04   Pseudo-progression in NSCLC with anti-PD-1/PD-L1 Antibodies: An Early Onset Event

Friday, Dec. 4 11:00AM - 11:10AM Location: E451B

Participants
Caroline Caramella, MD, Villejuif, France (*Presenter*) Nothing to Disclose
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Jean-Charles Soria, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Benjamin Besse, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Immune-checkpoint inhibitors directed against PD-1 (PD-1i) or PD-L1 (PD-L1i) are emerging as a standard of care for non-small cell lung cancer (NSCLC). Radiological and clinical evaluation of their activity is still challenging. In particular, signs of disease progression can be followed by long-term disease control.

METHOD AND MATERIALS

Data from advanced NSCLC patients included in phase I-II clinical trials were retrospectively collected in a single center. CT-scans were performed every 6 weeks and at 4 weeks if progression was suspected. All CT-scans were centrally reviewed by two senior radiologists. A pseudo-progression (pseudo-PD) was defined as a Disease Progression that was not confirmed at 4 weeks evaluation (i.e. tumoral stabilization or regression).

RESULTS

From 12/2012 to 12/2014, 44 patients were included in 3 phase I (n=13) and 2 phase II (n=31) clinical trials evaluating 2 PD-1i and 2 PD-L1i. 38 patients (86%) had a stage IV NSCLC, 6 (14%) local recurrences. There were 14 Squamous Cell Carcinomas, 27 Adenocarcinomas (ADC) and 3 other histologies. PD-1i and PD-L1i were administered to 18 and 26 patients respectively. At 3 months, 20 patients had a PD confirmed at 4 weeks, 9 a Stable Disease (SD), 9 a Partial Response (PR), 2 a Complete Response (CR) and 4 a pseudo-PD. All pseudo-PD patients received a PD-L1i and had PD-L1 positive ADC. Median time to radiological or clinical PD was 33 days (range 7-81), and subsequent response was 84 days (range 40-125). Signs of PD were: 1) appearance of pre-vascular lymph nodes, 2) increase of subcutaneous lesions, 3) significant increase of lung and pleural lesions and new contralateral carcinomatous lymphangitis 4) new pulmonary lesion. Of note, either PR or CR was later achieved for all lesions but the pre-vascular lymph nodes, which remained stable. For case 3), radiological behavior was accompanied by early-onset (7 days after the first infusion) worsening of dyspnea and asthenia, followed by clinical improvement. All 4 patients are still treated, with a median time of 169 days.

CONCLUSION

Pseudo-progression during immunotherapy is frequent (9%) and has to be individualized since these patients may derive a significant benefit, despite initial radiological and sometimes clinical worsening.

CLINICAL RELEVANCE/APPLICATION

The emergence of immunotherapy leads to a new radiological paradigm in tumoral evaluation, the concept of pseudoprogression being a frequent event.

SST03-05   Benefit of Motion Correction for Blood Flow Estimates in CT Perfusion Imaging of Lung Cancer

Friday, Dec. 4 11:10AM - 11:20AM Location: E451B

Participants
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Jonathan Santos, BS, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Ramsey Badawi, PhD, Sacramento, CA (*Abstract Co-Author*) Stockholder, Johnson & Johnson Consultant, Toshiba Corporation
David Gandara, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Friedrich D. Knollmann, MD, PhD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT perfusion imaging to assess the treatment response in advanced lung cancer can be compromised by respiratory motion during image acquisition. The purpose of this study was to determine whether the use of an original motion correction method can improve the reproducibility of blood flow measurements in CT perfusion imaging.

METHOD AND MATERIALS

The institutional review board approved this dual-institution prospective study. Twenty random adult patients with non-resectable

pathologically proven non-small cell lung cancer treated with systemic therapy gave written informed consent to undergo CT perfusion of their tumor over a period of 50 seconds after intravenous contrast injection. A motion correction method which consisted of manually outlining the tumor margins and then applying a rigid manual landmark registration algorithm followed by the non-rigid Diffeomorphic Demons algorithm was applied on all CT perfusion images. The non-motion-corrected and motion-corrected images were then analyzed with commercially available perfusion analysis software which accounted for tumor dual blood supply. Two observers each performed the analysis twice, and the intra-observer and inter-observer variability of each method was assessed with Bland-Altman statistics.

RESULTS

The 95% limits of agreement of intra-observer reproducibility for observer 1 improved from -84.4%; 65.3% before motion correction to -33.8%; 30.3% after motion correction (r = 0.86 and 0.97, before and after motion correction, respectively, p < 0.0001 for both). The 95% limits of agreement of intra-observer reproducibility for observer 2 improved from -151.1%; 95.7% before motion correction to 48.5%; 36.0% after motion correction (r = 0.87 and 0.95, before and after motion correction, respectively, p < 0.0001 for both). The 95% limits of agreement of inter-observer reproducibility improved from -168.2%; 153.8% before motion correction to -17.3; 25.3% after motion correction (r = 0.65 and 0.97, before and after motion correction, respectively, p < 0.0001 for both).

CONCLUSION

The use of a motion correction method significantly improves the reproducibility of CTP estimates of tumor blood flow in lung cancer.

CLINICAL RELEVANCE/APPLICATION

Respiratory motion is an important compromising factor in measuring lung tumor blood flow. Use of an original motion correction method significantly improves reproducibility of blood flow measurements in lung cancer at perfusion CT.

SST03-06 The Value of Diffusion-weighted Imaging in differentiating Metastatic from Non-metastatic Lymph Nodes in Patients with Lung Cancer: A Meta-analysis

Friday, Dec. 4 11:20AM - 11:30AM Location: E451B

Participants
Guangxiang Chen, Luzhou, China (*Presenter*) Nothing to Disclose
Maohua Wang, Luzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ting Zheng, Luzhou, China (*Abstract Co-Author*) Nothing to Disclose
Guangcai Tang, Luzhou, China (*Abstract Co-Author*) Nothing to Disclose
Fugang Han, Luzhou, China (*Abstract Co-Author*) Nothing to Disclose
Guojian Tu, Luzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To perform a meta-analysis to evaluate the diagnostic performance of the diffusion-weighted imaging(DWI) in differentiating metastatic from non-metastatic lymph nodes in patients with lung cancer.

METHOD AND MATERIALS

Systematic and comprehensive literature searches of the PubMed, Embase, Web of Science, Cochrane Library, China Biomedicine(CBM), China National Knowledge Infrastructure(CNKI) and Wanfang databases were performed to identify eligible original studies. Methodological quality of included studies was assessed by QUADAS-2(Quality Assessment of Diagnostic Accuracy Studies). Meta-analysis were performed to pool sensitivity and specificity, calculate positive likelihood ratio(PLR),negative likelihood ratio(NLR), diagnostic odds ratios(DORs) and construct summary receiver operating characteristic(SROC) curve. Homogeneity of included studies,potential threshold effect and publication bias were investigated.

RESULTS

A total of 10 studies with 11 datasets met the inclusion criterion, including 796 patients with a total of 2,433 lymph nodes. The pooled diagnostic sensitivity was 0.78(95% CI: 0.74-0.81) and the pooled diagnostic specificity was 0.88 (95% CI: 0.86-0.89). The PLR, NLR, and DOR were 7.11 (95% CI: 4.39-11.52), 0.24 (95% CI: 0.18-0.33), and 31.14 (95% CI: 17.32-55.98), respectively. The overall area under the curve (AUC) was 0.90. The Deeks' funnel plot symmetry tests revealed that no publication bias was found (bias = -0.15, P = 0.887). A notable heterogeneity was observed and patient selection, type of lung cancer, number of enrolled lymph nodes, reference standard, b value and type of scanner were the sources of heterogeneity. There was no significant threshold effect.

CONCLUSION

DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer.

CLINICAL RELEVANCE/APPLICATION

Our meta-analysis revealed that DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer. In the future, larger-scale prospective studies with respect to DWI for the diagnosis of lymph node metastasis are still necessary to evaluate and confirm its clinical value. Furthermore, the optimization of DWI acquisition protocol, standard image processing and analysis are crucial to routine clinical application of DWI in detecting lymph node metastasis in patients with lung cancer.

SST03-07 Clinical Outcome of Stereotactic Body Radiotherapy (SBRT) of Lung Metastases - A Single Center Study

Friday, Dec. 4 11:30AM - 11:40AM Location: E451B

Participants
Natalie D. Klass, MD, Bern, Switzerland (*Presenter*) Nothing to Disclose
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A Geretschlaeger, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Kathrin Zaugg, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Michael W. Schmuecking, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It is hypothesized that oligometastatic disease represents a potentially curable disease. Stereotactic body radiation therapy (SBRT) is an option for patients who are not amenable to or do not want resection. We present a single center study to evaluate the outcome of SBRT in oligometastatic patients with lung lesions.

METHOD AND MATERIALS

Patients: between 07/2009 and 08/2014 oligometastatic patients (n = 24) with 34 lung lesions of various histology were treated with SBRT. 16.7% of the patients had a solitary lung metastasis. In 14 patients (pts.) we treated 1 pulmonary lesion, in 9 pts. 2 lesions and in 1 patient 3 lesions. 19 lesions were located peripherally, 15 centrally. Radiation Therapy: After stereotactic positioning using a Bodyfix®, every patient received a 4D-CT followed by 18F-FDG-PET/CT in radiation treatment planning position (except patients with renal cell cancer). Dose calculation was done with the pencil beam (PB) algorithm in iPlan, IGRT by daily pre-treatment and post-treatment CBCT. Standard fractionation for peripheral lesions was 5x10-12Gy, for very central lesions 11x4.5Gy or 10x5-6Gy, if tolerable according to the RTOG constraints. The dose was prescribed to the isodose line covering at least 95% of the PTV (median prescription isodose line 80%, mean 82%, range 76%-86%; median coverage of the PTV D98, range D94-D100).

RESULTS

Median follow-up was 13.9 months (range 0-48 months). Actuarial local control (Kaplan-Meier-Plot) after 1, 2, 3, 4 years was 94%, 91%, 91%, 87%, respectively. Actuarial progression free survival after 1, 2, 3, 4 years was 73%, 62%, 45%, 29%, respectively. Local relapse / tumor persistence as detected by CT or 18F-FDG-PET/CT was found in 4 patients: directly after SBRT in one patient (sarcoma), 5, 8 and 31 months after SBRT in the other patients. Regional and/or distant out of volume progression was found in 9 patients (in 4/8 pts. with NSCLC): 0, 0, 1, 1, 3, 8, 14, 28 und 31 months after SBRT. 2 patients died during follow-up, 1 due to tumor progression (NSCLC), 1 due to pulmonary embolism (head and neck cancer). Clinical asymptomatic pneumonitis 12.5%. Grade 2 toxicity 8%.

CONCLUSION

Our preliminary data show a long term local control of 87% in the treated pulmonary lesions without severe side effects. Systemic progression is a major challenge, especially in patients with NSCLC.

CLINICAL RELEVANCE/APPLICATION

Critical is the correct patient selection for this treatment option.

SST03-08   Diagnostic Accuracy of PET/MR in Comparison to PET/CT in Local Thoracic Staging of Malignant Pleural Mesothelioma

Friday, Dec. 4 11:40AM - 11:50AM Location: E451B

Participants
Katharina Martini, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Andreas A. Meier, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Isabelle Schmitt-Opitz, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Walter Weder, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company
Rolf A. Stahel, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Thomas Frauenfelder, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the diagnostic accuracy of PET/MR for local staging of malignant pleural mesothelioma (MPM) compared to PET/CT.

METHOD AND MATERIALS

In a prospective clinical trial 22 consecutive patients (median age 66 years; range 40-76 years; 1 female, 21 male) with known MPM, who underwent PET/CT and PET/MR exams for either staging or re-staging/follow-up were evaluated. Imaging was conducted using a tri-modality PET/CT-MR set-up (Discovery PET/CT 690, 3T Discovery MR 750w, both GE Healthcare, Waukesha, WI, USA). Two independent readers evaluated images for T and N stage, confidence level (sure to unsure; 1-3) and subjective overall image quality (very good to non-diagnostic; 1-4). Inter-observer agreement of T and N stages (Cohen's kappa) and interclass correlation coefficient (ICC) between PET/CT vs. PET/MR was calculated.

RESULTS

Inter observer agreement for evaluation of T and N stage in PET/CT images was excellent (k=0.871 and k= 0.869, respectively), whereas PET/MR imaging showed substantial agreement in T and N staging (k=0.744 and k= 0.749, respectively). The ICC of PET/CT vs. PET/MR was excellent for the evaluation of T as well as N stage (ICC=0.974 and ICC= 0.963, respectively). Diagnostic confidence was scored significantly higher in PET/MR compared to PET/CT (mean score = 1.16 and 1.48, respectively; p<0.001). Image quality was diagnostic for all image series.

CONCLUSION

Our findings suggest that diagnostic accuracy of PET/MR is comparable to PET/CT in T and N staging of MPM but has significant higher diagnostic confidence due to better soft tissue contrast of PET/MR compared to PET/CT.

SST03-09 Locally Advanced Esophageal Squamous Cell Carcinoma: Multidetector CT for Restaging and Assessment of Treatment Response after Neoadjuvant Therapy

Friday, Dec. 4 11:50AM - 12:00PM Location: E451B

Participants
Shi Yanjie, MD, Beijing, China (*Presenter*) Nothing to Disclose
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Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhilong Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess the diagnostic accuracy of multidetector CT (MDCT) for restaging and determine the feasibility of CT for assessment of treatment response in esophageal squamous cell carcinoma after neoadjuvant therapy.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board, and a waiver of informed consent was remitted. We studied 135 consecutive patients with esophageal squamous cell carcinoma who had pre-resection CT after neoadjuvant treatment. The CT staging of the patients was either T1-2 with N1-3 or T3-4 with N0-N3 without metastases before therapy according to the 7th edition of the AJCC/TNM classification. Results of CT restaging after therapy were compared with the final pathological staging. Tumor regression grade (TRG) from CT was determined by two radiologists using the Response Evaluation Criteria in Solid Tumors (RECIST) method. According to CT restaging, the patients with T0-2 and N0 (cohort 1) were defined as response, T3-4 and N1-3 (cohort 2) were defined as non-response and the response of patients with T3-4 and N0 or T0-2 and N1-3 (cohort 3) was not determined.

RESULTS

The accuracy of CT for T stage of patients with esophageal cancer after neoadjuvant therapy was 45% (61/135) and 47% (64/135), respectively by two radiologists (kappa value=0.718). Sensitivity and specificity were as follows: Observer 1, T0 21%/100%, T1-2 42%/96%, T3 69%/46%, T4 50%/84%; Observer 2, T0 42%/100%, T1-2 55%/93%, T3 54%/54%, T4 57%/85%. Accurate N stage were noted 59% and 56%, by two radiologists (kappa value=0.753). TRG from CT was predicted correctly in only 27% (37/135). There were no significant trends toward better survival for lower TRG (P=0.286). There was significant difference in survival among cohort 1(19 patients), cohort 2 (46) and cohort 3 (70). The survival of responding patients was better than that of non-responders.

CONCLUSION

Restaging by CT did not accurately predict pathological stage in esophageal squamous cell carcinoma after neoadjuvant treatment. Comparing with TN stage before and after therapy, CT can evaluate the response in about one half of patients, but the treatment response of the remaining half of patients was not determined using CT.

CLINICAL RELEVANCE/APPLICATION

The TNM staging of esophageal carcinoma will directly affect overall treatment options and their prognosis.Currently, chest CT is still routinely applied for restaging and monitoring treatment therapy.

Gastrointestinal (Stomach Cancer and Masses)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353B

| GI | CT | MR | OI |

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose
Douglas R. Kitchin, MD, Middleton, WI (*Moderator*) Nothing to Disclose

Sub-Events

SST05-01   Chemotherapy Response Evaluation for Late-stage Gastric Cancer by Spectral CT Imaging: Correlation with RECIST Criteria

Friday, Dec. 4 10:30AM - 10:40AM Location: E353B

Participants
Yong Yu, Xianyang City, China (*Presenter*) Nothing to Disclose
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Feng Jing I, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yang Chuangbo, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Zhang Xirong, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the clinical value of using the iodine content in tumors obtained in Spectral CT imaging for chemotherapy response evaluation of late-stage gastric cancer in correlation with the RECIST criteria.

METHOD AND MATERIALS

A total of 18 patients (11 women, mean age of 60y) with pathologically proved gastric cancer by endoscopy were prospectively enrolled in our study. All patients were certified as having un-resectable gastric cancers and received three months of chemotherapy. Contrast-enhanced spectral CT scans were performed before and after the 3 months chemotherapy. Patients were classified into a good response group or poor response group according to the RECIST criteria (tumor volume reduction exceeds 30% is considered having good response). The iodine concentration (IC) values from the iodine-based material decomposition images of spectral CT for the tumors were measured before and after the chemotherapy. IC reduction ratio was calculated as: (IC(before) - IC(after))/IC(before). The iodine concentration value before the chemotherapy and the IC reduction ratio after the chemotherapy between the good- and poor- response groups were analyzed statistically by independent-samples t test. The correlation between the IC reduction ratio and response was calculated using spearman correlation test.

RESULTS

The iodine concentration values (figure) of the tumors before chemotherapy were significantly different between the good-response group (2.44±0.83mg/ml) and poor-response group (1.65±0.64mg/ml) in the arterial phase (P<0.05). The good-response group had a higher IC reduction ratio of 0.42±0.23 in the tumor than that in the poor-response group (0.29±0.17). Significant correlation was seen between IC reduction ratio and responses with correlation coefficient of r =-0.73 (P=0.007).

CONCLUSION

The iodine content in tumors and its reduction ratio after chemotherapy measured in Spectral CT has significant correlation with the treatment responses defined by RECIST criteria, and may be used as good indications for the chemotherapy prognosis of late-stage gastric cancers.

CLINICAL RELEVANCE/APPLICATION

Spectral CT may provide a new imaging method for evaluating the chemotherapy response for late-stage gastric cancers.

SST05-02   'Gastric Comb Sign' for Prediction of Lymphovascular Invasion in Gastric Cancer on Contrast-Enhanced CT

Friday, Dec. 4 10:40AM - 10:50AM Location: E353B

Participants
Hyun-Jung Baek, Yang-San, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Tae Un Kim, MD, Yangsan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nam Kyung Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Jin Han, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Gastric cancer is the fourth most common cancer and the second leading cause of cancer-related death worldwide. Although the depth of invasion and lymph node are independent prognostic factors for gastric cancer and associated with patient survival, several studies have reported that lymphovascular invasion (LVI) by cancer cells are associated with poor survival or early recurrence in gastric cancer. The role of CT for predicting LVI remains controversial.The purpose of our study was to evaluate CT findings for predicting LVI in gastric cancer.

METHOD AND MATERIALS

We retrospectively reviewed 194 patients with gastric cancer who underwent contrast-enhanced CT within 6 weeks before the operation between January 2012 to December 2012. The degree of contrast enhancement, location, gastric comb sign (multiple engorged tubular, tortuous opacities radiating from the thickened gastric wall), and ulceration were assessed on CT. Histopathologic analysis was performed for size of the tumor and T stage.The relationship between gastric cancer with LVI and the CT and histopathologic findings was statistically analyzed. Multivariate logistic regression was used to identify independent imaging variables.

RESULTS

Gastric cancer with LVI demonstrated stronger enhancement (80.4%) more often than that without LVI (19.6%) (p= 0.0001). There was a statistically significant difference regarding the presence of gastric comb sign between both groups; gastric cancer with LVI (94.3%) and gastric cancer without LVI (5.7%) (p= 0.0001). There was a statistically significant difference in the presence of ulceration between both groups; 77.6% vs 22.4% (p=0.014). The statistically significant histopathologic feature was T stage (p= 0.0001). In multivariate logistic analysis, the gastric comb sign and T stage were the most significant findings in differentiation between gastric cancer with LVI and those without LVI. The strongest imaging predictor for LVI in the gastric cancer was gastric comb sign (p= 0.026).

CONCLUSION

Our findings suggest that CT can provide valuable information for prediction of LVI in patients with gastric cancer.

CLINICAL RELEVANCE/APPLICATION

Gastric comb sign may be useful in predicting LVI in gastric cancer and used to stratify patients with gastric cancer who will benefit from adjuvant systemic therapy.

SST05-03   Gastrointestinal Stromal Tumours (GIST): A CT Proposal for Predicting the Risk of Malignancy

Friday, Dec. 4 10:50AM - 11:00AM Location: E353B

Participants
Maria A. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
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Carla Vindigni, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Sadotti, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Paola Mercuri, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Righi, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Susanna Guerrini, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Gentili, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco G. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Volterrani, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to identify the predictors of malignancy on CT for the evaluation of gastrointestinal stromal tumours of the stomach (GIST), correlating CT findings with the mitotic index.

METHOD AND MATERIALS

The medical records at our institution of 42 patients (mean age 68 years, range 26-91 y) with a histologic diagnosis of GIST were reviewed. One radiologist and one resident in radiology with 10 and 4 years experience in oncological field, retrospectively and blindly reviewed the CT findings by consensus with respect to location, lesion size, contour, tumour growth pattern, enhancing pattern, degree of enhancement of tumour, percentage of CT tumour hypodensity, mesenteric fat infiltration, ulceration, calcification, regional lymphadenopathy, direct invasion to adjacent organ, and distant metastasis. All parameters were correlated with the mitotic index evaluated at histopathological analysis following surgery. Normality of variables was evaluated using Shapiro-Wilk test. Pearson's correlation test was used to test the interaction between variables. The diagnostic accuracy of percentage of CT tumour hypodensity in detecting if the number of mitosis per 50 high-power fields was >5 was measured by using receiver operating characteristic (ROC) analysis.

RESULTS

A significant statistical correlation was found between percentage of CT tumour hypodensity and the mitotic index (p<0,005), dimension and location of the tumour. Using a percentage of CT hypodensity major than 20% as the CT feature to compare with the mitotic index in creating a "modified Miettinen CT index" for evaluating the malignancy risk of GISTs we obtained a Cohen's weighted k of 0.80 (95% CI 0.66-0.92) between Miettinen risk assessment and "modified Miettinen CT index".

CONCLUSION

MDCT could be an accurate technique in the prediction of malignancy of GIST in a CT risk assesment system, based on the location of the tumour, its size and the percentage of intralesional CT hypodensity.

CLINICAL RELEVANCE/APPLICATION

The primary aim of this project is to find a modified Miettinen CT index useful to predict the malignancy of GIST, in order to tailor the treatment in elderly or complex patients.

SST05-04   Neuroendocrine Carcinomas of the Stomach: CT, Clinical and Pathologic Findings in 32 Patients

Friday, Dec. 4 11:00AM - 11:10AM Location: E353B

Participants
Kyeong Ah Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Jae Woong Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jong Mee Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang Shin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Cheol Min Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the computed tomographic (CT) findings and the clinicopathologic features of neuroendocrine carcinomas (NECs) of the stomach.

METHOD AND MATERIALS

The CT examinations of 32 patients with gastric NECs were reviewed retrospectively for the morphology, size, CT attenuation of the tumor, CT attenuation of the lymph node, associated findings such as peritumoral infiltration, liver metastasis and peritoneal carcinomatosis. The ages of patients ranged from 45 to 79 years (mean: 62 years). 27 patients (84%) were men. Pathologic diagnosis was made by gastrectomy (n=28) and endoscopic biopsy (n=4). 19 patients underwent Multidetector CT with water as an oral contrast agent, 12 patients underwent helical CT with water, and one underwent non-helical CT with water-soluble contrast material.

RESULTS

Among the three CT morphologic types (polypoid, ulcerofungating, ulceroinfiltrative), 63% of the gastric NECs were ulcerofungating (n=20), 37% were ulceroinfiltrative and none were polypoid. All were larger than 5 cm in the greatest dimension (mean size: 7.8 centimeter). The characteristic features were focal (n=3) or diffuse (n=15) low attenuation within mass, extensive large necrotic lymphadenopathy (n=13), and liver metastasis (n=6) at presentation. Preoperatively, CT findings were interpreted as gastric adenocarcinoma (n=29) or lymphoma (n=3).

CONCLUSION

Although differential diagnosis between gastric adenocarcinoma and gastric NEC is difficult, gastric NEC should be considered in the differential diagnosis when CT shows a large ulcerofungating tumor with low attenuation areas, especially combined with extensive necrotic lymphadenopathy, and frequent hepatic metastasis.

CLINICAL RELEVANCE/APPLICATION

Gastric NEC should be considered in the differential diagnosis when CT shows a large ulcerofungating tumor with low attenuation areas, especially combined with extensive necrotic lymphadenopathy, and frequent hepatic metastasis.

SST05-05 Preoperative Whole-tumor Texture Analysis by Contrast Enhanced CT in Gastric Cancer: Correlations with Post-operative T Staging

Friday, Dec. 4 11:10AM - 11:20AM Location: E353B

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Annalaura Salerno, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Computed tomography texture analysis (CTTA) is an emerging tool to assess and quantify tumor heterogeneity, that is strictly related to cancer aggressiveness. Many quantitative features can be obtained from CTTA. We investigated the correlation of some of these parameters with postoperative T staging in gastric cancer.

RESULTS

Among all parameters, the following showed significant correlations ($p<0.01$): energy (without and with all filters, r ranging from 0.43 to 0.59), entropy (filtered, r ranging from -0.52 to -0.36) and uniformity (filtered, r ranging from 0.34 to 0.50). Mean values were significantly different ($p<0.05$) between the two groups (pT1-3 vs pT4) for the following: energy (with and without filtered image), entropy and uniformity.

CONCLUSION

CTTA features can help to predict T staging. Uniformity is directly correlated to pT stages: our hypothesis is that the increased vascularity - characteristic of more aggressive tumors - leads to greater parenchymal enhancement and lower contrast resolution, resulting in higher uniformity during CTTA. All the aforementioned parameters could represent promising, non-invasive and easily applicable diagnostic tools to evaluate the aggressiveness of gastric cancer.

CLINICAL RELEVANCE/APPLICATION

CTTA can quantify the heterogeneity of gastric cancer, opening a new window for the evaluation and treatment planning of this type of tumor.

SST05-06 Diffusion-weighted Magnetic Resonance Imaging in Submucosal Tumors of the Stomach: Preliminary Results

Friday, Dec. 4 11:20AM - 11:30AM Location: E353B

Participants
Atsushi Tani, MD, PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose
Yoriko Kajiya, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Shinohara, MD, Kagoshima City, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the appearance of submucosal tumors of the stomach on diffusion-weighted magnetic resonance imaging (DWI).

METHOD AND MATERIALS

Ten consecutive patients (5 males and 5 females: age range, 32 to 84 years) with a submucosal tumor of the stomach were included in this retrospective study. Pathological diagnosis was confirmed in all patients either by surgery (8 patients) or biopsy (2 patients). DWI with b values of 0 and 800 s/mm2 was performed using a 1.5T system. Visual evaluation of DWI was independently performed by two radiologists and the signal intensity (SI) of each lesion was evaluated using a five-point scale (1, unrecognizable; 2, recognizable but SI lower than muscle; 3, SI equal to or higher than muscle but lower than kidney; 4, SI equal to or higher than kidney but lower than spleen; 5, SI equal to or higher than spleen). Interobserver agreement of visual scores was evaluated using the weighted kappa statistics. Apparent diffusion coefficient (ADC) values, which were available in 8 patients, were also recorded.

RESULTS

The pathological diagnoses were gastrointestinal stromal tumor (GIST) (n=7), leiomyosarcoma (n=1), malignant lymphoma (n=1) and ectopic pancreas (n=1). All lesions except an ectopic pancreas showed a conspicuous high SI on DWI and the mean of visual scores was 4.5 for both readers. Interobserver agreement in visual analysis was good (weighted kappa=0.78). ADC values for 6 patients with GIST ranged from 1.35x10-3 to 2.11x10-3 mm2/s (mean: 1.52x10-3 mm2/s), which were higher than that of a malignant lymphoma (1.18 x10-3 mm2/s).

CONCLUSION

The majority of gastric submucosal tumors show conspicuous high SI on DWI. DWI may be helpful in the preoperative evaluation of the tumor extent in these patients.

CLINICAL RELEVANCE/APPLICATION

DWI can visualize the majority of submucosal tumors of the stomach and may help us evaluate the extent of these lesions.

SST05-07   Dynamic Contrast-enhanced Computed Tomography (DCE-CT) as a Prognostic Marker for Overall Survival in Gastroesophageal Junctional Cancer and Gastric Cancer after Preoperative Chemotherapy

Friday, Dec. 4 11:30AM - 11:40AM Location: E353B

Participants
Martin Lundsgaard, MD, Kobenhavn, Denmark (*Presenter*) Nothing to Disclose
Eva Fallentin, MD, Kobenhavn, Denmark (*Abstract Co-Author*) Nothing to Disclose
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Birgitte Federspiel, MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Lars Bo Svendsen, DSc,MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Michael B. Nielsen, MD, PhD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether changes in DCE-CT parameters during pre-operative chemotherapy predict overall survival in patients with gastro-esophageal junction (GEJ) cancer and gastric cancer.

METHOD AND MATERIALS

Twenty-eight patients with adenocarcinoma of the gastro-esophageal junction (GEJ) and stomach were followed for a minimum of 2 years after completed surgery. All patient had received three series of chemotherapy before surgery, and were all evaluated with a DCE-CT scan prior to chemotherapy, after the first series of chemotherapy, and after three series of chemotherapy. The DCE-CT scans were performed using a 320-detector row scanner covering 12 - 16 cm in the z-axis. The total scan duration was 55-60 seconds with a variable scan delay determined by a test bolus. Analyses of the DCE-CT scans were done in consensus between two radiologists. Maximum slope model and Patlak analysis were used to calculate the following DCE-CT parameters: tissue perfusion (ml/min/100ml), blood volume (ml/100ml) and permeability (ml/min/100ml). Changes in DCE-CT parameters during pre-operative chemotherapy were calculated. Data on death were collected from the Electronic Patient Record. Patients who were not resected due to tumour invasion (n=1) or died caused by severe complications after surgery (within 30 days) (n=1), were excluded from the survival analysis. Survival analysis was done using Log Rank Test and Kaplan-Meier plot.The protocol was approved by the Committees on Biomedical Research for [BLINDED] with oral and written consent from patients.

RESULTS

Minimum follow-up time was 885 days after inclusion in the study. Surgery was performed at a median of 88 days (range 66-119) after enrolment. Changes in permeability after the first series of chemotherapy ranged from -51% to 86% (median:-19.3%; 25th percentile:-38.1%, 75th percentile:6.6%). Patients with the largest decrease in permeability (using the median as cut-off) had a significant longer overall survival (p=0.03). Changes in tissue perfusion and blood volume were not a significant prognostic factor.

CONCLUSION

Changes in permeability measured with DCE-CT during pre-operative chemotherapy may have a predictive value on overall survival after preoperative chemotherapy and surgery in GEJ cancer and gastric cancer.

CLINICAL RELEVANCE/APPLICATION

DCE-CT may have a role in patient stratification in the management of preoperative chemotherapy for GEJ cancer and gastric cancer.

SST05-08   Hydro-Multidetector CT in the Staging of Gastric Adenocarcinoma. A Comparative Study with Surgical and Histopathological Specimen

Friday, Dec. 4 11:40AM - 11:50AM Location: E353B

Participants
Marco Di Girolamo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Francesco Carbonetti, MD, Rome-Roma, Italy (*Abstract Co-Author*) Nothing to Disclose

Cristiano Cantone, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Bucciarelli, Rome-Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Linda Stefanetti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo David, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the accuracy of hydro-MDCT in the evaluation of gastric adenocarcinoma with subsequent surgical and histo-pathological specimen.

METHOD AND MATERIALS

65 patients with gastric adenocarcinoma diagnosed by endoscopy and biopsy, underwent hydro-MDCT (16 detectors).The distension of the gastric lumen was obtained after the oral administration of 500ml of water and i.v. injection of spasmolytic agent. The dynamic study was performed during arterial and portal phase.

RESULTS

Contrast-enhanced Hydro-MDCT always detected the gastric cancer as a focal or diffuse gastric wall thickening with or without abnormal enhancement. The tumor was pre-operatively classified as T1 stage in 11 cases, T2 in 21, T3 in 25 and T4 stage in 8. In 49/65 patients the assessment of local tumor extension on hydro-MDCT was identical to the histopathological results in defining the T category according TNM classification, with overall accuracy of 75%. We found overstaging in 12 and understaging in 4 cases. The local enlarged lymphnodes were always identified but MDCT results in the N stage were in agreement with histo-pathological samples in 69% of cases. For the evaluation of metastatic disease hydro-MDCT had an accuracy of 99%.

CONCLUSION

Hydro-MDCT is a reliable technique in the preoperative staging of gastric adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

Hydro-MDCT is a reliable technique in the preoperative staging of gastric adenocarcinoma.

SST05-09 Is CT Surveillance Necessary in Patients who Undergo Curative Endoscopic Submucosal Dissection for Early Gastric Cancers Based on Expanded Indications?

Friday, Dec. 4 11:50AM - 12:00PM Location: E353B

Participants
Kyusung -. Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Cheong-Il Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Gyun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the role of follow-up abdominopelvic CT in detecting extragastric recurrence in patients who had undergone curative endoscopic submucosal dissection (ESD) for early gastric cancers (EGCs) based on expanded indications.

METHOD AND MATERIALS

This retrospective study was institutional review board approved with waiver of patients' informed consent. Patients who underwent curative ESD for EGCs based on expanded indications between November 2005 and December 2009 as well as post-ESD CT and endoscopy comprised our study population. The primary outcome was post-ESD CT discovery of extragastric recurrence (i.e., lymph nodes or distant metastases) not detected by endoscopy. The incidence of gastric recurrence detected by endoscopy and/or CT was also analyzed. The cumulative incidence of gastric recurrence over the post-ESD follow-up period was analyzed using the Kaplan-Meier method.

RESULTS

The final cohort included 652 patients (297 based on absolute indications [234 men and 63 women; mean age, 64 years] and 390 patients based on expanded indications [311 men and 79 women; mean age, 63 years]). In a total of 611 post-ESD CTs performed over a mean follow-up of 59.1 months (Total 3013 CT scans; range, 4-113 months), extragastric recurrence (lymph node metastasis) was detected in only 2 patients (1 meeting absolute indications and 2 meeting expanded indications). Among the 8 local recurrences and 3 synchronous and 18 metachronous gastric cancers detected by endoscopy, 11 gastric recurrences were also detected on CT. Cumulative incidence of gastric recurrence 1, 3, and 5 years after ESD was 1.6%, 2.8%, and 7.1%, respectively.

CONCLUSION

When EGC meets expanded indications, surveillance CT following curative ESD rarely detects extragastric recurrence during 5-year post-ESD follow-up. However, owing to the high incidence of gastric recurrence, endoscopy surveillance is strongly warranted during this period.

CLINICAL RELEVANCE/APPLICATION

The role of CT surveillance is limited in patients who undergo curative ESD for early gastric cancers based on expanded indications as extragastric recurrence is rare.