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December 1–6 | McCormick Place, Chicago

SPOI11

Oncodiagnosis Panel: Renal Cell Carcinoma

Sunday, Dec. 1 10:45AM - 12:15PM Room: E353C

OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Anca L. Grosu, MD, Freiburg, Germany (*Moderator*) Nothing to Disclose
Simon S. Lo, MD, Seattle, WA (*Presenter*) Editor, Springer Nature; Member, ICON plc; Member, Elekta AB;
Robert Abouassaly, MD,MSc, Cleveland, OH (*Presenter*) Nothing to Disclose
Joseph I. Clark, MD, Maywood, IL (*Presenter*) Speakers Bureau, Bristol-Myers Squibb Company; Speakers Bureau, Merck & Co, Inc; Spouse, Employee, Bristol-Myers Squibb Company
Sandeep Vaidya, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Andrew D. Smith, MD, PhD, Birmingham, AL (*Presenter*) CEO, AI Metrics LLC ; Owner, AI Metrics LLC ; CEO, Radiostics LLC; Owner, Radiostics LLC; CEO, Liver Nodularity LLC ; Owner, Liver Nodularity LLC ; Research Grant, General Electric Company; Speaker, Canon Medical Systems Corporation; Speaker, AlgoMedica, Inc

For information about this presentation, contact:

andrewdennissmith@uabmc.edu

jclark@lumc.edu

LEARNING OBJECTIVES

1) Describe the diagnostic findings of renal cell carcinoma. 2) Describe the surgical options of renal cell carcinoma. 3) Describe the role of interventional radiology in renal cell carcinoma. 4) Describe the role of stereotactic body radiotherapy in primary and oligometastatic renal cell carcinoma. 5) Describe the role of systemic therapy in renal cell carcinoma.

ABSTRACT

Renal cell carcinoma (RCC) is one of the most common cancers in the developed world. Active surveillance is the standard of care but for patients who are not good surgical candidates, ablative therapies such as RFA and cryotherapy or stereotactic body radiotherapy can be offered. For patients with metastatic RCC, proper selection of systemic therapy and incorporate of focal therapy in appropriate clinical scenarios are crucial. To achieve the best treatment outcome, a multidisciplinary approach is paramount.

SSA07

Gastrointestinal (LIRADS)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S103AB

GI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Khaled M. Elsayes, MD, Pearland, TX (*Moderator*) Nothing to Disclose
Kathryn J. Fowler, MD, San Diego, CA (*Moderator*) Consultant, 12 Sigma Technologies; Researcher, Nuance Communications, Inc; Contractor, Midamerica Transplant Services; ;
Alexa G. Ortiz Escobar I, MD, Mexico City, Mexico (*Moderator*) Nothing to Disclose

Sub-Events

SSA07-01 Accuracy of Liver Imaging Reporting and Data System Category 4 or 5 for Diagnosing Hepatocellular Carcinoma: A Systematic Review and Meta-Analysis

Sunday, Dec. 1 10:45AM - 10:55AM Room: S103AB

Participants
Dong Hwan Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Hyun Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Central Medical Service Co, Ltd
Kyung Won Kim, 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
So Yeon Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyung Jin Won, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Pyo Nyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

edwardchoi83@gmail.com

PURPOSE

We aimed to systematically determine the accuracy of Liver Imaging Reporting and Data System (LI-RADS) for magnetic resonance imaging (MRI) diagnosis of hepatocellular carcinoma (HCC) and to determine the sources of heterogeneity between reported results.

METHOD AND MATERIALS

Original studies that reported the diagnostic accuracy of LI-RADS for HCC using MRI were identified in MEDLINE and EMBASE up to October 25, 2018. Study quality was assessed using QUADAS-2. We categorized studies into two groups, LR-5, and LR-4 or LR-5, criteria, and obtained the meta-analytic summary sensitivity and specificity of both criteria with a bivariate random-effects model. Subgroup analyses and meta-regression analysis were performed to further explore study heterogeneity.

RESULTS

Among the 157 articles screened, 18 studies covered LR-5 (3651 lesions), and 16 studies covered LR-4 or LR-5 (3182 lesions). For the LR-5 criterion, the meta-analytic summary sensitivity and specificity were 62.1% (95% CI [confidence interval], 53.9-69.7%; $I2$=91.6%) and 92.8% (95% CI, 89.9-94.9%; $I2$=66.8%), respectively (Fig. 1A). For the LR-4 or LR-5 criterion, the meta-analytic summary sensitivity and specificity were 88.4% (95% CI, 82.7-92.5%; $I2$=89.2%) and 81.7% (95% CI, 73.5-87.8%; $I2$=88.3%), respectively (Fig. 1B). For the LR-5 criterion, the three factors of subject enrollment, MRI scanner field strength, and type of reference standard were significantly associated with study heterogeneity (P <= 0.04). For the LR-4 or LR-5 category criterion, the three factors of subject enrollment, MRI contrast agent, and type of reference standard were significantly associated with study heterogeneity (P <= 0.03).

CONCLUSION

The LR-5 criterion was highly specific, but showed suboptimal sensitivity for diagnosing HCC in patients at risk of HCC. In comparison with the LR-5 criterion, the sensitivity of the LR-4 or LR-5 criterion increased, but the specificity decreased. Substantial study heterogeneity was noted, and four significant factors were identified: subject enrollment, the type of reference standard, MRI scanner field strength, and contrast agent type.

CLINICAL RELEVANCE/APPLICATION

The LR-5 criterion was highly specific, but had suboptimal sensitivity for diagnosing HCC. Substantial study heterogeneity was noted, and further randomized controlled studies are needed to validate the diagnostic performance of LI-RADS.

SSA07-02 Using Ancillary Features to Update Liver Imaging Reporting and Data System version 2018 on Gadobenate Dimeglumine-Enhanced MRI

Sunday, Dec. 1 10:55AM - 11:05AM Room: S103AB

Participants
Yao Zhang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jingbiao Chen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Sichi Kuang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Bingjun He, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Fowler, MD, San Diego, CA (*Abstract Co-Author*) Consultant, 12 Sigma Technologies; Researcher, Nuance Communications, Inc; Contractor, Midamerica Transplant Services; ;
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, Gilead Sciences, Inc; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV; Consultant, AMRA AB; Consultant, Fulcrum; Consultant, IBM Corporation; Consultant, Exact Sciences Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Arterys Inc; Consultant, Epigenomics; Author, Medscape, LLC; Lab service agreement, Gilead Sciences, Inc; Lab service agreement, ICON plc; Lab service agreement, Intercept Pharmaceuticals, Inc; Lab service agreement, Shire plc; Lab service agreement, Enanta; Lab service agreement, Takeda Pharmaceutical Company Limited; Lab service agreement, Alexion Pharmaceuticals, Inc; Lab service agreement, NuSirt Biopharma, Inc
Jin Wang, MD, Guangzhou, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

569874016@qq.com

PURPOSE

To evaluate whether ancillary features on gadobenate dimeglumine-enhanced MRI can be used to upgrade LI-RADS categories from LR-4 to LR-5.

METHOD AND MATERIALS

260 patients with chronic liver disease at high risk for HCC were retrospectively included. Hepatobiliary phase (HBP) was obtained 2 hours after gadobenate dimeglumine injection at 3.0T scanner, and all HBP images can be used to evaluate liver observations according to LI-RADS criteria. Blinded to the clinical and pathological data, two abdominal radiologists evaluated LI-RADS v2018 major and ancillary features for the largest observation in each patient on MR images in consensus. Observations were categorized according to LI-RADS version 2018 as well as various modifications to LI-RADS, in which LR-4 could be upgraded to LR-5 by the presence of ancillary features as listed in Table 1. Diagnostic sensitivity, specificity, accuracy, false negative rate (FNR), false positive rate (FPR), positive predictive value (PPV), negative predictive value (NPV) of category LR- 5 were calculated for LI-RADS v2018 and for each modified LI-RADS. Receiver operating characteristic (ROC) curves were generated and areas under the ROC curve (AUC) were computed.

RESULTS

Final diagnoses for the 260 observations included 216 HCCs, 5 intrahepatic cholangiocarcinomas, 5 combined hepatocellular-cholangiocarcinomas, 2 metastatic tumors, 2 focal nodular hyperplasias, 7 arterio-portal shunts, 20 hemangiomas, 1 abscess, 1 cyst, and 1 dysplastic nodule. Overall, 0% LR-1(0/2) and LR-2 (0/28), 90% (10/11) LR-3, 86% LR-4 (19/22), and 99% LR-5 (174/175) were HCCs according to LI-RADS v2018. The final LI-RADS categories, as well as the sensitivity, specificity, accuracy, FNR, FPR, PPV, NPV and AUC of LR-5 using v2018 and each modified LI-RADS are listed in table 1. Modified LI-RADS I (in which HBP hypointensity can be used to upgrade LR-4 to LR-5) showed higher sensitivity (94.4 vs 80.6%) and accuracy (93.5 vs 83.5%) than LI-RADS v2018 without significantly reducing specificity (88.6 vs 97.7%), PPV (97.6 vs 99.4%), or AUC (0.915 vs 0.891).

CONCLUSION

Modified LI-RADS I may improve sensitivity and accuracy for diagnosing HCC without impairing specificity or positive predictive value.

CLINICAL RELEVANCE/APPLICATION

HBP hypointensity may be used to upgrade LR-4 to LR-5 without impairing specificity or positive predictive value for a diagnosis of HCC on gadobenate dimeglumine-enhanced MRI in Chinese patients.

SSA07-03 Effect of Upgrading LR-4 Lesions to LR-5 Using HCC Favoring Ancillary Features on Diagnostic Performance of HCC

Sunday, Dec. 1 11:05AM - 11:15AM Room: S103AB

Participants
Jae Hyon Park, MD, Seoul, Korea, Republic Of (*Presenter*) 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
Mi-Suk Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research grant, Bayer Pharma AG; Honoraium, Guerbet SA, GE healthcare, Philips, and Siemens Healthineers

For information about this presentation, contact:

YELV@yuhs.ac

PURPOSE

To determine whether upgrading LR-4 lesion to LR-5 using ancillary features (AF) favoring HCC in LI-RADS version 2018 increases the diagnostic performance of HCC.

METHOD AND MATERIALS

112 patients with chronic B-, C- viral hepatitis or cirrhosis and surgically proven primary hepatic malignancy (98 HCC, 11 cHCC-CCC, 2 IHCC, 1 dysplastic nodule) were evaluated with gadoxetate-enhanced MRI in 2013. Two board-certified radiologists retrospectively assessed the presence of major features of HCC, imaging features of LR-M criteria, and HCC favoring ancillary features according to LI-RADS v2018 and assigned an LI-RADS category for each nodule in consensus. The diagnostic accuracy of

each LI-RADS category was described by sensitivity, specificity and positive and negative predictive values with 95% confidence interval. LR-4 lesions were then upgraded to LR-5 if (1) at least one HCC favoring AF was present and (2) lesion was not previously upgrade from LR-3 to LR-4. Diagnostic accuracy of this upgraded LR-5 was compared to initial LR-5 using McNemar X2-test. 5-year overall survival (OS) was evaluated via Kaplan-Meier method, log rank test and Cox proportional hazard model.

RESULTS

All three out of three LR-3 lesions, 18 (85%) out of 21 LR-4 lesions, 70 (98%) out of 71 LR-5 lesions and 7 (41%) out of 17 LR-M lesions were HCCs. As for non-HCC malignancy, except for 3 (27%) out of 11 cHCC-CCCs and 1 dysplastic nodule, all non-HCC malignancy were assigned as LR-M. 9 (42%) out of 21 initial LR-4 lesions were upgraded to LR-5 due to more than one HCC favoring AF. For HCC, initial LR-5 showed sensitivity and specificity of 71.4% and 92.8%, while HCC favoring AF-upgraded LR-5 showed sensitivity and specificity of 79.6% and 85.7%. Accuracy of upgraded LR-5 was 80.4% compared to 74.1% of initial LR-5. In McNemar X2-test, specificity of initial LR-5 was not significantly different from specificity of upgraded LR5 (P=0.317).

CONCLUSION

Upgrading LR-4 lesions to LR-5 increases accuracy without significantly decreasing HCC specificity; thus HCC favoring AF can be used to upgrade LR-4 to LR-5.

CLINICAL RELEVANCE/APPLICATION

Contrary to LI-RADS v2018, HCC favoring ancillary features should be used to upgrade LR-4 lesions to LR-5 because it increases accuracy of HCC without significantly decreasing HCC specificity.

SSA07-04 Assessing Accuracy of the LI-RADS v2017 Treatment Response Algorithm in Evaluating Ablated Hepatocellular Carcinoma

Sunday, Dec. 1 11:15AM - 11:25AM Room: S103AB

Participants
Mohammad Chaudhry, MBBS, Durham, NC (*Presenter*) Nothing to Disclose
Katrina A. McGinty, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Benjamin Mervak, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Erin Shropshire, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
James S. Ronald, MD, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Leah Commander, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Johann Hertel, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Reginald Lerebours, MA, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Cai Li, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Sheng Luo, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, NGM Biopharmaceuticals, Inc; Research Grant, Madrigal Pharmaceuticals, Inc; Research Grant, Metacrine, Inc; Research Grant, Pinnacle Clinical Research; Research Grant, ProSciento Inc; Research Grant, Carmot Therapeutics; Research Grant, 1Globe Health Institute; Research Consultant, ICON plc;
Lauren M. Burke, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mohammad.b.waseem@gmail.com

PURPOSE

To assess the performance of the LI-RADS v2017 Treatment Response Algorithm (TRA) in identifying viability of ablated hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

This was an Institutional Review Board approved and HIPAA compliant retrospective study. Patients who underwent ablation of HCC prior to liver transplantation between January 1, 2011, and December 31, 2015, at a single tertiary care center were identified. All patients underwent pretreatment abdominal MRI within 90 days of treatment and post-treatment MRI within 90 days of transplant. Based on transplant histopathology colocalized with imaging, lesions were categorized as completely (100%) or incompletely (<=99%) necrotic. Three radiologists classified each nodule into an LR-TR category (Viable/Non-Viable) according to imaging features. Final LR-TR categories were compared with histopathology and the correlation was calculated. Inter-reader agreement was assessed using Fleiss' Kappa.

RESULTS

36 patients with 53 lesions were included. 58% (31/53) of lesions were ablated using microwave ablation, and the remaining 42% (22/53) with radiofrequency ablation. TRA accuracy for predicting complete tumor necrosis at the time of transplant ranged from 0.75-0.78, with a negative predictive value ranging from 0.77-0.80. Accuracy for predicting incomplete tumor necrosis at the time of transplant ranged from 0.61-0.78, with a positive predictive value ranging from 0.68-0.89. 11% (6/53) of treated lesions were LR-TR Equivocal by consensus, with most (5/6) incompletely necrotic on histopathology. Inter-reader agreement for pre-treatment LI-RADS category was k=0.44 (95% CI 0.16-0.62), lower than agreement for TRA category, k=0.68 (95% CI 0.57-0.78).

CONCLUSION

The TRA is accurate in predicting viable or non-viable HCC after ablation. Of the ablated lesions rated as LR-TR Equivocal, many were incompletely necrotic nodules.

CLINICAL RELEVANCE/APPLICATION

The LI-RADS TRA's performance for predicting histopathological necrosis in HCC lesions following locoregional therapy has not been extensively assessed, and in this work is shown to be accurate.

SSA07-05 Ancillary Features in LI-RADS Version 2018: A Strategy to Improve Diagnostic Performance for HCC on Gadoxetate Disodium-enhanced MRI

Sunday, Dec. 1 11:25AM - 11:35AM Room: S103AB

Participants
Jihun Kang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Hyun Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong Hwan Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Jung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yeon 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
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Pyo Nyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jhbyun@amc.seoul.kr

PURPOSE

To determine the frequency of occurrence and strength of association with hepatocellular carcinoma (HCC) of each ancillary feature (AF) in the Liver Imaging Reporting and Data System (LI-RADS) version 2018, and to develop an appropriate strategy for applying the AFs to improve diagnostic performance on gadoxetate disodium-enhanced MRI.

METHOD AND MATERIALS

A total of 385 nodules (283 HCCs, 18 non-HCC malignancies, 84 benign nodules) of 3.0 cm or smaller in 266 patients at risk for HCC who underwent gadoxetate disodium-enhanced MRI in 2016 were retrospectively evaluated. Two radiologists independently assigned a LI-RADS category to each nodule. The frequency and diagnostic odds ratio of each AF were assessed. To improve the diagnostic performance for HCC, various criteria were developed based on the number of AFs detected favoring malignancy in general or HCC in particular. Generalized estimating equation models were used to compare the diagnostic performance of each criterion with that of the major features (MFs) only.

RESULTS

The AFs showing a significantly different frequency between HCC and non-HCC lesions were restricted diffusion, mild-moderate T2 hyperintensity, transitional-phase hypointensity, hepatobiliary-phase hypointensity, and hepatobiliary-phase isointensity. Of these AFs, hepatobiliary-phase hypointensity had the highest frequency and strongest association with HCC. When we applied AFs in addition to MFs, the new criterion (with a number of AFs >=4) had significantly higher sensitivity (80.6% vs. 70.0%; *P*<.001) than MFs only, without a significant lowering of specificity (85.3% vs. 90.2%; *P*=.060).

CONCLUSION

The AFs varied in the frequencies of occurrence and strengths of association with HCC. To improve the diagnostic performance for HCC, a new criterion of four or more AFs in addition to the MFs might be the best option.

CLINICAL RELEVANCE/APPLICATION

A criterion of four or more AFs in addition to MFs may be the best strategy to improve the diagnostic performance for HCC on gadoxetate disodium-enhanced MRI using LI-RADS, and is recommended in the evaluation of suspected HCC in patients at risk.

SSA07-06 LI-RADS v2018: Value of Quantitative Assessment of Arterial Phase Hyperenhancement and Washout with Extracellular MRI Contrast Agent

Sunday, Dec. 1 11:35AM - 11:45AM Room: S103AB

Participants
Daniel Stocker, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Anton S. Becker, MD,PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Borna Barth, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Stephan M. Skawran, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Malwina Kaniewska, MD, Baden, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Michael A. Fischer, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Olivio Donati, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Caecilia S. Reiner, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

daniel.stocker@usz.ch

PURPOSE

To assess the influence of quantitative arterial phase hyperenhancement (APHE) and washout (WO) of contrast enhanced MRI on LI-RADS v2018 categorization and compare the quantitative LI-RADS score with conventional qualitative reading.

METHOD AND MATERIALS

60 patients (19 female; mean age 56y) at risk for HCC with 71 liver lesions (28 hepatocellular carcinoma (HCC), 43 benign lesions) who underwent MRI with extracellular contrast agent were included in this HIPPA-compliant retrospective study. Four blinded radiologists independently reviewed all MRI and assigned a LI-RADS score per lesion. Two other radiologists drew regions of interests within the lesion and the adjacent liver parenchyma on pre- and post-contrast MR images. The percentage of arterial enhancement and the liver-to-lesion contrast ratio were calculated for quantification of APHE and WO. The presence or absence of APHE, WO or both was recorded according to the quantitative measurements. Using these quantitative parameters, a quantitative LI-RADS score was assigned in lesions classified as LR-3-5. The diagnostic accuracy was assessed with receiver-operating-characteristics (ROC) analysis and the DeLong test to compare for significant differences between the area under the curve (AUC).

RESULTS

The ROC analysis for the qualitative LI-RADS score showed an AUC of 0.869, 0.946, 0.940 and 0.919 for reader 1, 2, 3, and 4, respectively. The quantitative LI-RADS score where only APHE/WO/or both were replaced showed an AUC of 0.875/0.849/0.874, 0.942/0.924/0.914, 0.933/0.917/0.878 and 0.902/0.852/0.843 for readers 1, 2, 3 and 4, respectively. The AUC of the quantitative LI-RADS score was significantly lower than of the qualitative score only for reader 4 when quantitative WO (p=0.012) and both, quantitative APHE and WO (p=0.047) were used.

CONCLUSION

The qualitative LI-RADS score showed similar or higher diagnostic accuracy compared to the quantitative LI-RADS score. Therefore, qualitative visual assessment appears to be the better approach to scoring liver lesions according to LI-RADS v2018.

CLINICAL RELEVANCE/APPLICATION

A quantitative approach for LI-RADS scoring does not increase diagnostic accuracy; hence, visual assessment should be maintained to score liver lesions according to LI-RADS v2018.

SSA07-07 Hepatocellular Carcinoma Detection by Abbreviated-Protocol Dynamic Contrast-enhanced MRI in Patients with Cirrhosis Using LI-RADS v2018

Sunday, Dec. 1 11:45AM - 11:55AM Room: S103AB

Participants
Takeshi Yokoo, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD, Irving, TX (*Abstract Co-Author*) Nothing to Disclose
Alberto Diaz de Leon, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
David T. Fetzer, MD, Dallas, TX (*Abstract Co-Author*) Researcher, Koninklijke Philips NV; Researcher, Siemens AG; Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, Siemens AG ; ;
John R. Leyendecker, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Ivan Pedrosa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Gaurav Khatri, MD, Irving, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Determine the accuracy of abbreviated-protocol dynamic contrast enhanced MRI and complete-protocol MRI for detection of hepatocellular carcinoma (HCC) in cirrhosis patients

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant retrospective cohort study, 100 consecutive cirrhosis patients underwent standard complete-protocol MRI (cMRI) at 1.5T or 3T for workup for suspected HCC, using extracellular gadolinium contrast. Images of abbreviated-protocol MRI (aMRI; coronal T2-weighted and axial dynamic contrast-enhanced T1-weighted sequences) were extracted from cMRI (aMRI sequences + unenhanced axial T2-, T1-, and diffusion-weighted sequences). Both aMRI and cMRI images were independently read by 4 blinded fellowship-trained abdominal radiologists using Liver Imaging and Reporting Data System (LI-RADS) v2018. Each review (aMRI, cMRI) was scored as positive if any liver observation of LR-4, 5, or M was present, or negative otherwise. Each patient was followed from the time of index cMRI until final HCC status was determined using a composite reference standard of histopathlogy <=6 months, consensus expert panel review of index cMRI or followup-CT/MRI <=6 months (by two different senior abdominal radiologists), and clinic followup at >12 months (in those with negative index cMRI only). Patient-level HCC detection sensitivity and specificity were calculated for aMRI and cMRI with 95% confidence intervals, and compared by McNemar's test at a=0.05.

RESULTS

Mean age of the study cohort was 57.7 years (range 23-77). 14 patients were excluded due to non-diagnostic exam (5), prior HCC treatment (1), use of hepatobiliary contrast agent (1), loss to followup (3), and unable to determine final HCC diagnosis (4). Per-reader detection accuracy of aMRI and cMRI in remaining 86 cirrhosis patients are shown in Figure. No statistically significant differences were found by McNemar's test (p>0.05) between aMRI and cMRI, in sensitivity or specificity.

CONCLUSION

Abbreviated-protocol dynamic contrast enhanced MRI has sensitivity 89.3-96.4% and specificity 84.5-89.7% for HCC detection; no statistically significant difference was found compared to complete-protocol MRI. Further validation is needed in an asymptomatic cirrhosis population to support its use as a screening test.

CLINICAL RELEVANCE/APPLICATION

Abbreviated-protocol dynamic contrast enhanced MRI (a 15-min exam) offers high sensitivity and specificity for hepatocellular carcinoma (HCC) detection and has a potential as a screening test in cirrhosis patients at risk for HCC.

SSA07-08 Inter-reader Reproducibility and Overall Survival Predictability of LI-RADS Tumor Response Algorithm after Drug-eluting-Beads Transarterial Chemoembolization as an Initial Treatment Hepatocellular Carcinoma

Sunday, Dec. 1 11:55AM - 12:05PM Room: S103AB

Participants
Ali Pirasteh, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Endel A. Sorra II, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Hector J. Marquez, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Robert C. Sibley III, MD, Irving, TX (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yokoo, MD, PhD, Dallas, TX (*Presenter*) Nothing to Disclose

PURPOSE

LI-RADS (Liver Imaging and Reporting Data System) Tumor Response (LR-TR) algorithm standardizes the assessment of tumor

response to locoregional therapy in hepatocellular carcinoma (HCC). This study evaluated the inter-reader reproducibility of LR-TR categories (nonviable, equivocal, viable), and whether LR-TR categories predict survival in patients with HCC after first-time drug-eluting-beads transarterial chemoembolization (DEB-TACE).

METHOD AND MATERIALS

All DEB-TACE procedures from 2011 to 2015 at two hospitals affiliated with a liver transplant center were reviewed. Key exclusion criteria were prior HCC-related treatment and lack of pre- and post-treatment multiphasic abdominal MRI or CT within 3 months of DEB-TACE. Four readers (2 radiology residents and 2 fellowship-trained abdominal radiologists) independently reviewed the pre-and post-treatment exams, assigned LR-TR categories to up to two treated tumors per patient, and measured the size of the pre-treatment and the enhancing component of the treated tumor. Inter-reader agreement for LR-TR categories and tumor size were respectively assessed by Fleiss' kappa and intra-class correlation coefficient (ICC). Kaplan-Meier/Cox survival analysis for patient-level LR-TR category (the mode of all lesion LR-TR categories by all readers in a patient) was performed, before and after adjusting for Barcelona Clinic for Liver Cancer stage (BCLC A vs. >=B) and Child-Pugh-Turcott class (CPT A vs. >=B).

RESULTS

75 patients were included, yielding 108 lesions. Inter-reader agreement was moderate for the three LR-TR categories (κ=0.56 [0.55,0.58]). Inter-reader reproducibility for tumor size was excellent for untreated tumors (ICC=0.94 [0.92,0.95]) and good for treated tumors (ICC=0.83 [0.78,0.87]). No significant difference was detected in overall survival between LR-TR nonviable and viable groups (Fig. 1) before or after adjustment for BCLC stage/CPT class, respectively p=0.96 and 0.78.

CONCLUSION

LI-RADS tumor response algorithm for HCC after first-time DEB-TACE has moderate inter-reader reproducibility but may not predict overall survival. Further reader education/training is needed to improve reproducibility. Further research is needed to better translate LR-TR assessment to predict patient survival/guide therapy.

CLINICAL RELEVANCE/APPLICATION

LI-RADS tumor response algorithm for HCC requires reader education and may not predict survival in patients undergoing first-time DEB-TACE.

SSA07-09 Clinical Validation of CEUS LI-RADS in Prospective Multi-Center Study: Preliminary Results

Sunday, Dec. 1 12:05PM - 12:15PM Room: S103AB

Participants
Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Presenter*) Research support, Bracco Group; Advisory Board, Bracco Group; Research support, General Electric Company; Research support, Siemens AG; Research support, Canon Medical Systems Corporation; Speaker, SonoScape Co, Ltd
Yuko Kono, MD, PhD, San Diego, CA (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation Equipment support, General Electric Company Contrast agent support, Lantheus Medical Imaging, Inc Contrast agent support, Bracco Group
Fabio Piscaglia, Bologna, Italy (*Abstract Co-Author*) Research support, Esaote SpA; Speaker, Bayer AG; Speaker, Bracco Group; Speaker, Bristol-Myers Squibb Company; Speaker, Eisai Co, Ltd; Advisory Board, AstraZeneca PLC; Advisory Board, Bayer AG; Advisory Board, Eisai Co, Ltd; Advisory Board, General Electric Company; Advisory Board, Siemens AG; Advisory Board, Tiziana Life Sciences;
Shuchi K. Rodgers, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Geoffrey E. Wile, MD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Aya Kamaya, MD, Stanford, CA (*Abstract Co-Author*) Royalties, Reed Elsevier; Researcher, Koninklijke Philips NV; Researcher, Siemens AG
Alexandra Medellin, MD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Lisa Finch, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Stephanie R. Wilson, MD, Calgary, AB (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV; Equipment support, Siemens AG; Equipment support, Samsung Electronics Co, Ltd; Research support, LANDAUER, Inc; Research support, Samsung Electronics Co, Ltd; Speakers Bureau, Koninklijke Philips NV

PURPOSE

The American College of Radiology Contrast-Enhanced Ultrasound Liver Imaging Reporting and Data System (CEUS LI-RADS) is developed to classify focal liver observations in patients at risk of HCC. The aim of this prospective multicenter study is to validate the CEUS LI-RADS.

METHOD AND MATERIALS

A total of 273 nodules from 255 patients at risk of HCC are included in this ongoing study conducted at 8 centers (6 in the USA, 1 in Canada and 1 in Italy). Focal liver observations are classified as LR-5, (definitely HCC) if greater than 1 cm with arterial phase hyperenhancement, and late, mild washout. Rim enhancement and/or early washout and/or marked washout qualify as LR-M (malignant, but not specific for HCC). Other observations are classified as definitely benign (LR-1); probably benign (LR-2), intermediate malignancy probability (LR-3); probably HCC (LR-4). Tumor-in-Vein is characterized as LR-TIV. Definite HCC diagnosis on MRI, imaging follow-up or histology for MRI-indeterminate observations were used as reference standard.

RESULTS

The median focal liver observation size is 2.4cm. Of 273 nodules, 162 (59%) have confirmed diagnosis while 111 (41%) nodules remain indeterminate, currently undergoing imaging surveillance or awaiting histological confirmation. Of 162 confirmed nodules, 136 are HCC (82%), 6 (4%) other malignancies (2 ICC, 1 combined hepatocellular-cholangiocarcinoma, 3 metastasis) and 22 (14%) are benign. A total of 84 confirmed observations are characterized as LR-5 and 100% of them are HCC. The sensitivity of LR-5 for HCC is 63%. All 14 LR-1 and LR-2 observations are benign. All 11 LR-M observations are malignant (5 HCC, 4 metastasis, 2 ICC). 67% (14/21) of LR-3 observations and 92% (24/26) of LR-4 observations are HCC. 5% of nodules are not characterized on CEUS (LR-NC)

CONCLUSION

The CEUS LR-5 classification is 100% specific for HCC, confirming high clinical value of CEUS for noninvasive HCC diagnosis.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced ultrasound is a reliable method of focal liver observations classification in patients at risk for HCC

Printed on: 10/29/20

SSA09

Gastrointestinal (Rectal Cancer)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S103CD

GI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
David D. Bates, MD, Hastings On Hudson, NY (*Moderator*) Research support, General Electric Company
Viktoriya Paroder, MD,PhD, Bronx, NY (*Moderator*) Nothing to Disclose
Andrea Laghi, MD, Rome, Italy (*Moderator*) Speaker, General Electric Company; Speaker, Guerbet SA; Speaker, Bayer AG; Speaker, Bracco Group; Speaker, Merck & Co, Inc
Myles T. Taffel, MD, New York City, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSA09-02 Radiomic Shape Descriptors of Rectal Wall and Lumen on MRI are Associated with Low and High Pathologic Tumor Stages After Chemoradiation for Rectal Cancer

Sunday, Dec. 1 10:55AM - 11:05AM Room: S103CD

Participants
Charlems Alvarez-Jimenez, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jacob T. Antunes, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Amrish Selvam, Naperville, IL (*Abstract Co-Author*) Nothing to Disclose
Kaustav Bera, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Justin T. Brady, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Sharon Stein, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Kenneth Friedman, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Eduardo Romero, MD,PhD, Bogota, Colombia (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, Elucid Bioimaging Inc; Stockholder, Inspirata Inc; Consultant, Inspirata Inc; Scientific Advisory Board, Inspirata Inc; Scientific Advisory Board, AstraZeneca PLC; Scientific Advisory Board, Merck & Co, Inc; Researcher, Koninklijke Philips NV; Researcher, Inspirata Inc; License agreement, Elucid Bioimaging Inc; License agreement, Inspirata Inc; Grant, PathCore Inc; Grant, Inspirata Inc
Jaykrishna Gollamudi, MD, Beechwood, OH (*Abstract Co-Author*) Nothing to Disclose
Rajmohan Paspulati, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD, Westlake, OH (*Abstract Co-Author*) Nothing to Disclose
Satish Viswanath, Cleveland, OH (*Presenter*) Scientific Advisory Board, Virbio Inc

For information about this presentation, contact:

cxa220@case.edu

PURPOSE

The relatively poor expert restaging accuracy of MRI in rectal cancer after chemoradiation (sensitivity ~53%) may be due to difficulties in visual assessment of residual tumor. However, both the rectal wall and lumen may distort in shape due to tumor impact. While previous studies have examined radiomic appearance (texture) of rectal tumors on MRI, we evaluated whether radiomic shape features of the entire rectal wall and the lumen are associated with pathologic tumor stage after chemoradiation therapy (CRT).

METHOD AND MATERIALS

60 patients were retrospectively identified across 2 sites, from whom an axial 3T T2W MRI was available after standard-of-care chemoradiation but prior to excision surgery. The entire rectal wall (ERW) and the lumen were annotated by an expert radiologist on all MRIs. 96 shape descriptors (2D and 3D) were extracted from each of lumen and ERW separately, for each patient. Top 2 ranked radiomic shape features associated with pathologic tumor stage (evaluated on excised specimens) were identified via cross-validation on a training subset from Site 1 (n=33). These were evaluated using discriminant analysis on a hold-out validation set of 27 patients (n=13 from Site 1, n=14 from Site 2).

RESULTS

Top-ranked radiomic shape descriptors for distinguishing low (ypT0-2) and high (ypT3-4) stages after CRT were 2D shape change in ERW across rectal volume (p=0.0004) and 3D volumetric roundness of the lumen (p=0.0014). These features resulted in an AUC of 0.82 in the training set (n=33), and an AUC of 0.82 on hold-out validation (n=27, 2 sites). By contrast, ERW volume (p=0.0357) and lumen volume (p=0.8431) were not significantly different or discriminatory between pathologic stages in either cohort.

CONCLUSION

Radiomic shape features of the entire rectal wall and lumen are highly relevant for discriminating patients with low and high tumor stage after chemoradiation, likely capturing implicit effects of residual tumor expanding or contracting the rectum.

CLINICAL RELEVANCE/APPLICATION

First study of radiomic shape features of rectal structures on post-chemoradiation MRI reveal physiologically intuitive differences in low and high pathologic tumor stages, and could enable better evaluation of rectal cancer response to neoadjuvant CRT.

SSA09-03 Diagnostic Accuracy of Magnetic Resonance Tumor Regression Grade for Pathological Complete Response in Rectal Cancer Treated with Neoadjuvant Chemoradiotherapy: A Systematic Review and Meta-Analysis

Sunday, Dec. 1 11:05AM - 11:15AM Room: S103CD

Participants
Jong Keon Jang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Hyun Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Central Medical Service Co, Ltd
Kyung Won Kim, MD, 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

For information about this presentation, contact:

edwardchoi83@gmail.com

PURPOSE

We aimed to systematically evaluate and determine the diagnostic accuracy of the magnetic resonance tumor regression grade (mrTRG) for diagnosing pathological complete response (pCR) and pathological T1 or lower than T1 stage (<=ypT1) in rectal cancer patients treated with neoadjuvant chemoradiotherapy (CRT), with a focus on the selection of candidates for less aggressive treatments such as local excision or watch and wait approaches.

METHOD AND MATERIALS

Original studies that investigated the correlation of mrTRG with pathological tumor regression grade and pathological T stage were identified in MEDLINE and EMBASE up until August 31, 2018 according to PRISMA guidelines. The search terms included colorectal cancer, chemoradiation therapy, magnetic resonance imaging, and response or regression. A bivariate random effects model was used to for statistical analysis.

RESULTS

Six studies with 916 patients were included. The meta-analytic summary sensitivity and specificity of mrTRG 1 for pCR were 32.3% (95% CI, 18.2-50.6%) and 93.5% (95% CI, 91.5-95.1%) (Fig. 1A), while for <=ypT1 they were 31.8% (95% CI, 16.2-53.0%) and 94.7% (95% CI, 91.9-96.5%) (Fig.1B). On the contrary, sensitivity and specificity of mrTRG 1 or 2 for pCR were 69.9% (95% CI, 60.2-78.1%) and 62.2% (95% CI, 56.2-67.8%), while those for <=ypT1 were 71.4% (95% CI, 61.6-79.6%) and 67.7% (95% CI, 59.8-74.7%).

CONCLUSION

mrTRG 1 showed high specificity for pCR and <=ypT1, but suboptimal sensitivity. mrTRG 1 or 2 showed higher sensitivity for pCR and <=ypT1, but lower specificity. Because of the suboptimal sensitivity of mrTRG 1, it might be limited as a criterion for organ preservation after CRT.

CLINICAL RELEVANCE/APPLICATION

Good response of mrTRGs may be a limited criterion for diagnosing pCR or selecting patients for local excision or watch and wait approaches.

SSA09-04 Locally Advanced Rectal Cancer: The Value of Intravoxel Incoherent Motion Imaging and Diffusion Kurtosis Imaging in Evaluating Pathological Complete Response to Neoadjuvant Chemoradiotherapy

Sunday, Dec. 1 11:15AM - 11:25AM Room: S103CD

Participants
Lanqing Yang, Chengdu, China (*Presenter*) Nothing to Disclose
Bing Wu, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxin Liu, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lqyang95@163.com

PURPOSE

To investigate the role of intravoxel incoherent motion diffusion-weighted imaging (IVIM) and diffusion kurtosis imaging (DKI) in evaluating pathological complete response (pCR) to neoadjuvant chemoradiotherapy (CRT) in locally advanced rectal cancer (LARC).

METHOD AND MATERIALS

42 LARC patients (cT3/4 or N+) were consecutively enrolled in this prospective study, and underwent pre- and post-CRT rectal MRI on a 3.0 T MRI scanner, including IVIM and DKI sequences with 12 b values. They all received neoadjuvant CRT and subsequent surgery. Pathological tumor regression grade (TRG) of the surgical specimen served as the reference standard. Patients were divided into pCR (TRG0) and non-pCR group (TRG1-3). Slow diffusion coefficient (D) (.10-3 mm2/s), fast diffusion coefficient (D*) (.10-3 mm2/s), perfusion-related diffusion fraction (f), mean kurtosis (MK), mean diffusion (MD) (.10-3 mm2/s) and monoexponential ADC value (.10-3 mm2/s) were calculated by manually drawing ROIs on three representative slices of primary and residual tumor on pre- and post-CRT b=800 s/mm2 images. ROIs were then copied to images of IVIM and DKI parameters. Independent t test, Mann-Whitney U test, and ROC curves were used for statistical analyses.

RESULTS

The pCR group (n=7) had a significant higher post-CRT f (P=0.012), D*(P=0.027), MD (P=0.005) and ADC value (P=0.016) than non-pCR group (n=35). Also the percentage changes of f (P=0.034), MD (P=0.043) and ADC value (P=0.030) after CRT were significant higher in the pCR group. ROC curves showed that post-CRT f, D*, MD and ADC value presented AUCs of 0.739, 0.722, 0.788, and 0.767 in selecting pCR, and the post-CRT MD had a higher sensitivity (82.9% vs. 77.1%) and similar specificity (both 85.7%) than ADC value. Besides, percentage changes of f, MD, and ADC value after treatment presented AUCs of 0.755, 0.747, and 0.735 in identifying pCR, and the percentage f had a higher specificity (85.7% vs. 71.4%) and lower sensitivity(71.4% vs. 80%) than ADC value.

CONCLUSION

IVIM and DKI parameters, especially MD and f could help to differentiate pCR from non-pCR after nCRT in LARC.

CLINICAL RELEVANCE/APPLICATION

IVIM and DKI could help to more reliably select pCR in patients with LARC after CRT, thus could help individualized treatment in clinical. Complere responders may receive non-operative treatment instead of radical resection with reduced surgery related morbidities and improved life quality.

SSA09-05 The Additional Value of Post-nCRT MRI Characteristics for Predicting Locally Advanced Rectal Cancer Patients 3-year DFS

Sunday, Dec. 1 11:25AM - 11:35AM Room: S103CD

Participants
Yankai Meng, Beijing , China (*Presenter*) Nothing to Disclose
Chen Wang, MMed, Xuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Pei P. Dou, Xuzhou , China (*Abstract Co-Author*) Nothing to Disclose
Hongmei Zhang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kai Xu, MD, PhD, Xuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chunwu Zhou, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mengyankai@126.com

PURPOSE

The aim of this study was to investigate the additional value of post-nCRT MRI characteristics for predicting locally advanced rectal cancer patients 3-year DFS.

METHOD AND MATERIALS

In this retrospective study, pre- and post-neoadjuvant chemoradiotherapy (nCRT) MRI morphologic (e.g. pre-nCRT MRI-detected extramural venous invasion) and clinicopathologic variabilities (e.g. pathological complete response) were evaluated in all patients. 3-year DFS was estimated using Kaplan-Meier product-limit method, and Cox proportional hazards models were used to determine associations between morphologic or clinicopathologic variabilities and survival outcomes.

RESULTS

A total of 171 patients (median age of 55 years; age range, 27-82 years) were included in the study. 137 (80.1%) patients performed both pre- and post-nCRT MRI examination, while 34 (19.9%) patients did not perform post-nCRT MRI. Pathological type of tumor was an independent predictor for 3-year survival on pathologic variables. In univariate and multivariate analysis, non-adenocarcinoma was a significant factor for worse long-term survival outcomes with the DFS of 38.0 months (95% CI 25.1-51.0 months, P=0.022) in univariate and with the HR of 3.155 (95% CI 1.160-8.586) in multivariate analysis (P=0.024). Other pathologic characteristics subgroup (vascular tumor thrombus, dentate line involvement, CRM involvement and KRAS gene mutation) showed worse DFS compared to reference subgroup in Kaplan-Meier univariate analysis, but the difference were not significant in COX analysis.The 3-year DFS of patients with positive mrEMVI were 52.6 months in univariate analysis, while the negative patients were 65.1 months (P=0.003). Multivariate analysis result was not significantly different (P=0.563), but the HR in mrEMVI positivity patients was 1.270 .In univariate analysis, mrTRG was the independent predictor for 3-year survival on post-nCRT MRI variables (P=0.011) . Partial response patients showed worse DFS compared to those with complete response (HR=2.809, 95% CI 0.451-17.496), but the difference was not significant (P=0.268).

CONCLUSION

Pathological type was the independent risk factor for long-term outcomes in LARC patients; while the other morphologic and clinicopathologic characteristics were not significantly related to survival.

CLINICAL RELEVANCE/APPLICATION

Pre- and post-nCRT MRI characteristics provide more individualieze predicting information for LARC patients outcomes.

SSA09-06 MRI in Restaging Locally Advanced Rectal Cancer: Detailed Reasons of Discrepancy when Taking Pathology as Standard of Reference

Sunday, Dec. 1 11:35AM - 11:45AM Room: S103CD

Participants
Xiaoxuan Jia, MA, Beijing, China (*Presenter*) Nothing to Disclose
Yinli Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Caizhen Feng, MBChB, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Danhua Shen, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yingjiang Ye, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Nan Hong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jiaxiaoxuanfs@163.com

PURPOSE

To analyze the detailed reasons of discrepancy between restaging MRI and pathology in comprehensive morphologic indicators of tumor response

METHOD AND MATERIALS

The MRI and pathological data of 57 consecutive patients who received neoadjuvant treatment and curative surgery from August 2015 to July 2018 were prospectively collected and retrospectively analyzed. The sensitivity and specificity of restaging MRI in detecting tumor regression grade (TRG), T, N stage, circumferential resection margin (CRM), extramural vascular invasion (EMVI) were calculated when taking pathology as reference. One-by-one comparison between restaging MRI and pathology was conducted to analyze the detailed reasons of discrepancy.

RESULTS

The sensitivity of restaging MRI in detecting TRG3-5, T3-4, N+, CRM involvement and EMVI was 77.1%, 100.0%, 75.0%, 87.5% and 91.7%, respectively. Whereas the specificity was 72.7%, 62.5%, 70.7%, 85.7% and 64.4%, respectively. Perirectal irregular spiculation of fibrosis caused overstaging of T2 disease. Extramural infiltration depth of residual tumor in fibrotic area was not accurately identified, therefore accurate T3 staging was not obtained. Massive fibrosis mixed with tumor-like signal could stretch mesorectal fasica or adjacent organs, and be evaluated as persistent CRM involvement or T4b disease. Fibrosis could manifest as similar shape and signal intensity to invaded vessels shrinked after treatment, resulted in the overstaging of EMVI. Inflammatory cell infiltration in fibrotic area could demonstrate as high signal intensity on DWI, which was similar to residual tumor and resulted in the omission of pCR. Acellular mucin scattered in massive fibrosis could manifest as residual tumor. Edematous mucosa and submucosa, and muscularis propria could also be mistaken as residual tumor for the intermediate signal intensity on T2 weighted images.

CONCLUSION

MRI was prone to overstage the residual tumor. The discrepancy between MRI and pathology was mostly caused by the misinterpretation of fibrosis. Inflammation cell infiltration, acellular mucin, edematous mucosa and submucosa, and muscularis propria could also be mistaken as residual tumor.

CLINICAL RELEVANCE/APPLICATION

Preoperative prediction of tumor response is essential for treatment decision. Identification of what MRI features lead to misinterpretation could help improve selection of good responders.

SSA09-07 CT-derived Radiogenomic Signatures Predicting BRAF/KRAS Mutations and Overall Survival in Primary Colorectal Carcinoma Patients

Sunday, Dec. 1 11:45AM - 11:55AM Room: S103CD

Participants
Amy D. Metry, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose
Tagwa Idris, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Nabil A. Elshafeey, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ly Nguyen, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ganiraju Manyam, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Meiyue Hong, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jeniffer S. Davis, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Zhiqin Jiang, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David Menter, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Morris, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David Hong, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Scott Kopetz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rivka R. Colen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rrcolen@gmail.com

PURPOSE

To determine the ability of CT-derived radiogenomic signatures/models to predict between key mutation (BRAF/KRAS/other wild-type {WT}) of primary colorectal carcinoma (CRC) patients and their overall survival (OS).

METHOD AND MATERIALS

In this retrospective study, we evaluated 134 histopathological proven CRC patients with known genomic data, and available treatment naïve contrast-enhanced CT scans. Using 3D slicer, the entire primary tumor was semi-automatically segmented on the porto-venous phase, and the volume of interest (VOI) was extracted; subsequently, the VOI was imported into our in-house pipeline radiomic analysis to obtain 610 radiomic features per volume. For feature selection, classification model and validation, the least absolute shrinkage selection operator regression (LASSO), Xgboost, and leave-one-out-cross-validation were used, respectively.

RESULTS

Of 134 patients (male, 66; female, 68; average age, 57.9 years) with BRAF (N=47), KRAS (N=46), and WT (N=41); for mutation status, top 55 LASSO features were able to stratify the CRC patients, with an accuracy (99.3%), area under the curve (99.88%-100%), and *P*-value (2.2e-16). For overall survival 40 LASSO features were able to predict good versus poor OS (30 months), with sensitivity, specificity, and *P*-value of 100%, 97%, and 2e-16 respectively. Additional subgroup analysis revealed the ability of only 10 LASSO features to predict OS for BRAF, KRAS and WT with *P*-value of 3.049e-9, 9.19e-11, and 2.87e-7.

CONCLUSION

Our radiogenomic signatures were able robustly to stratify the CRC patients based on their molecular data, and to predict their OS status using pre-treatment CT scans.

CLINICAL RELEVANCE/APPLICATION

Radiogenomics is an emerging field that lends a non-invasive tool for quick CRC patients stratification based on their genomic/molecular profiles.

SSA09-08 Building of Comprehensive Prognostic Scoring System for Recurrence After Rectal Cancer Surgery: Based on Radiologic and Clinicopathologic Evaluation

Sunday, Dec. 1 11:55AM - 12:05PM Room: S103CD

Participants
Seo Yeon Youn, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soon Nam Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon Hyung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong Myung Yeo, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong-Taek Oh, Uijeongbu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Rha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate risk factors of rectal cancer and develop prognostic scoring system for individual recurrence risk assessment.

METHOD AND MATERIALS

Total 489 rectal cancer patients who underwent surgery from 2009 to 2013 were included in the study. Univariate and multivariate Cox proportional hazard model were used to determinate significant prognostic factors among clinical (age, sex, clinical stage, CEA level, anastomotic leak), radiological (anal verge, tumor length, peritoneal reflection, T-, N-stage, lateral LN involvement, threatened circumferential resection margin (CRM), T3 subclassification, extramural venous invasion (EMVI), mean apparent diffusion coefficient (ADC), diffusion volumetry), and pathologic variables (pCRM, lymphatic/venous/perineural invasion, pathologic subtype, immunohistochemistry markers, T-, N-stage). Individual prognostic scores were calculated from selected significant prognostic factors. Patients were divided into low, moderate, and high risk groups according to the prognostic scores. Recurrence rates of each risk groups were obtained. Recurrence free survivals were analyzed by Kaplan-Meier method with the log-rank test.

RESULTS

Distance from anal verge, presence of EMVI on MRI; perineural invasion, N stage on pathology were selected as significant prognostic factors in multivariate analysis. Pathologic T-stage was added to these factors to build prognostic scoring system. Risk coefficient of each 5 factor was assigned as 2, 3, 3, 3, 1, respectively, according to the beta coefficient (ß = 0.52, 0.65, 0.8, 0.31, 0.89). Total 489 patients were classified as low (score 0-1, n=172), intermediate (score 2-3, n=123), and high (score 4-11, n=194) risk groups, according to individual prognostic scores (0-11). Recurrence rates of low, intermediate, and high risk groups were 7.6%, 15.5%, 36.6%, respectively ($p<0.001$). The Kaplan-Meier curve for recurrence free survival showed the prognostic differences between the 3 risk groups.

CONCLUSION

Multifactorial prognostic scoring system based on radiologic and clinicopathologic variables correlated well with recurrence rate after rectal cancer surgery and could be a comprehensive approach to evaluate the prognosis of individuals.

CLINICAL RELEVANCE/APPLICATION

New prognostic scoring system, based on radiologic, and clinicopathologic factors, is useful for comprehensive assessment of individual recurrence risk in the post-operative rectal cancer patients.

SSA09-09 Scan Time Reduction in Rectal Diffusion-Weighted Imaging: Evaluation of the Simultaneous Multislice Acceleration Technique

Sunday, Dec. 1 12:05PM - 12:15PM Room: S103CD

Participants
Jae Hyon Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Nieun Seo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joonseok Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jongmoon Hahm, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research grant, Bayer Pharma AG; Honoraium, Guerbet SA, GE healthcare, Philips, and Siemens Healthineers

For information about this presentation, contact:

sldmsdl@yuhs.ac

PURPOSE

To assess the feasibility of simultaneous multislice-accelerated diffusion-weighted imaging (SMS-DWI) of the rectum compared to conventional DWI (C-DWI) for rectal cancer patients.

METHOD AND MATERIALS

DWI of the rectum was performed for 65 patients with initially diagnosed rectal cancer. All patients underwent C-DWI and SMS-DWI with acceleration factors of 2 and 3 (SMS2-DWI and SMS3-DWI, respectively) using a 3 T machine. Acquisition times of three DWI sequences were measured. Image quality among the three DWI sequences was reviewed by two independent radiologists using a 4-point Likert scale and subsequently compared using the Friedman test. Apparent diffusion coefficient (ADC) values for rectal cancer and normal rectal wall were compared among the three sequences using repeated measures analysis of variance.

RESULTS

Acquisition times using SMS2-DWI and SMS3-DWI were 38.2% and 55.5%, respectively, shorter than those with C-DWI. For all image quality ratings other than distortion (image sharpness, artifact, lesion conspicuity, and overall image quality), C-DWI and SMS2-DWI produced better image qualities than did SMS3-DWI ($P < 0.001$), with no significant differences observed between C-DWI and SMS2-DWI ($P >= 0.054$). ADC values of rectal cancer ($P = 0.943$) and normal rectal wall ($P = 0.360$) were not significantly different among C-DWI, SMS2-DWI, and SMS3-DWI.

CONCLUSION

SMS-DWI using an acceleration factor of 2 is feasible for rectal MRI, resulting in substantial reductions in acquisition time while maintaining diagnostic image quality and ADC values similar to those with C-DWI.

CLINICAL RELEVANCE/APPLICATION

SMS-DWI using an acceleration factor of 2 can be incorporated into routine rectal MRI protocol, with shorter scan time and similar image quality compared to conventional DWI.

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SSA16

Nuclear Medicine (Genitourinary Oncology Nuclear Medicine and PET)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S505AB

CT GU NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd
Sonya Y. Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

SSA16-01 AI Pipeline System for Detection of Bone Metastases on PET-CT

Sunday, Dec. 1 10:45AM - 10:55AM Room: S505AB

Participants
Saori Koshino, MD , Tokyo, Japan (*Presenter*) Nothing to Disclose
Naphur van Apeldoorn, MSc, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Antoine Choppin, MS, Chiyoda-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoko Maekawa, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kanako K. Kumamaru, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Akihiko Wada, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Abe, MD, PhD, Itabashi-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) GE, Toshiba/Canon, Fuji Film, Fuji RI/Toyama Kagaku, Eisai, Daiichi-Sankyo/GE pharma, Mediphysics, Siemens, Bayer, Guerbet, Bracco-Eisai, Shimazu

For information about this presentation, contact:

saori.koshino@gmail.com

PURPOSE

To develop a machine learning system for the detection of bone metastases from the data of CT based on ground truth generated from 18F-fluorodeoxyglucose (FDG) PET.

METHOD AND MATERIALS

In this study, 198 whole body PET-CT examinations (105 men and 93 women; mean age, 63.8 years ± 12.9 [standard deviation]) with one or more bone metastases were retrospectively evaluated. At first, an automated annotation generation tool for bone metastases was created to extract lesions from PET. A binary bone mask was obtained from CT and multiplied with the rescaled PET volume. This resulted in a PET volume with FDG uptake in bones only. A convolutional neural network (CNN), ResNet-50, was then used to discard high FDG uptake regions which did not correspond to bone metastases, such as brain or bladder. Each candidate of bone metastasis was assigned a unique lesion number before it was converted into slice-wise bounding boxes. Secondly, one of the authors labeled each automatically extracted lesion with osteoblastic metastasis, osteolytic metastasis, intertrabecular metastasis and other. The 198 examinations were split in 173 examinations for training and 25 examinations for validation. A Mask R-CNN model was trained on the training set using labeled bounding boxes as ground truth. Finally, prediction accuracy was measured on the validation set.

RESULTS

In a total of 198 examinations, 1263 lesions were detected with the annotation tool and composed of 364 osteoblastic metastases, 365 osteolytic metastases, 24 intertrabecular metastases, and 510 others such as normal lesions, postoperative lesions, degenerative changes, and inflammation. The sensitivity was 77.8% for osteoblastic metastases, 54.2% for osteolytic metastases, and 100% for penetrating metastases with a false positive per image of 0.701 in the validation datasets.

CONCLUSION

We successfully developed an AI pipeline system to detect bone metastases from the data of CT and FDG-PET. This is the first report on an AI-based automatic annotation system for PET-CT. Some limitations such as the low sensitivity for osteolytic metastases and too many false positives should be improved.

CLINICAL RELEVANCE/APPLICATION

Since the sensitivity for osteoblastic metastases was higher than that in the previous paper on human detection, our AI system can reduce the oversight of radiologists to detect bone metastases on CT.

SSA16-02 Detection of Seminal Vesicle Involvement and Extra-Prostatic Extension of Primary Prostate Cancer by Fluciclovine PET-CT

Sunday, Dec. 1 10:55AM - 11:05AM Room: S505AB

Participants
Oladunni O. Akin-Akintayo, MD,MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
Akinyemi A. Akintayo, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mehrdad Alemozaffar, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Dattatraya Patil, MBBS,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adeboye Osunkoya, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Martin J. Sanda, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

For information about this presentation, contact:

oakinak@emory.edu

PURPOSE

To evaluate the diagnostic performance of fluciclovine PET-CT in determining the extent of primary prostate cancer specifically seminal vesicle involvement (SVI) and extra-prostatic extension (EPE).

METHOD AND MATERIALS

51 patients with high risk primary prostate cancer, without conventional imaging findings of systemic metastasis, deemed eligible for potential curative surgery were recruited and underwent fluciclovine PET-CT after obtaining informed consent. Image interpretation was performed by a board-certified nuclear medicine physician blinded to other clinical and imaging data. Abnormal or absent uptake indicating the presence or absence of SVI and EPE was recorded. Histologic findings of SVI and EPE were compared with preoperative imaging results. Measures of diagnostic performance of fluciclovine PET-CT were assessed. Equivocal interpretations were analyzed as negative.

RESULTS

44/51 patients with a mean ± SD PSA of 25.8 ± 31.1 ng/ ml underwent radical prostatectomy and extended lymph node dissection within 11.8 ± 9.9 days of imaging. The remaining 7 were excluded from the final analysis as they were either still awaiting surgery or considered unsuitable for curative surgery. 28/44 and 20/44 patients were interpreted as positive for SVI and ECE respectively on fluciclovine PET-CT. On histology, 20/44 and 36/44 were positive for SVI and ECE respectively. Consequently, sensitivity, specificity and positive predictive value (PPV) of fluciclovine PET-CT for determination of SVI were: 80%, 50% and 57.1% respectively. For assessment of EPE, sensitivity, specificity and PPV of fluciclovine PET-CT were: 50%, 75% and 90% respectively.

CONCLUSION

Fluciclovine PET/CT showed high sensitivity and moderate PPV in the detection of SVI in primary prostate cancer. It also demonstrated high positive predictive value and moderate specificity in the detection of EPE.

CLINICAL RELEVANCE/APPLICATION

Fluciclovine PET/CT may be of use in preoperative determination of tumor extent in primary prostate cancer and consequently choice of therapy. Further studies with PET/MR with better anatomic definition may therefore be beneficial.

SSA16-03 Combined Hybrid Axumin (18F- Fluciclovine) PET/MRI Interpretation Compared to the Individual Interpretation of Axumin PET and Dedicated Prostate MRI in Evaluating for Prostate Cancer Local Recurrence

Sunday, Dec. 1 11:05AM - 11:15AM Room: S505AB

Participants
Sonam Jaglan, New York, NY (*Presenter*) Nothing to Disclose
Angela Tong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Shawn Karls, MD,BSC, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sonam.jaglan@nyulangone.org

PURPOSE

To determine if evaluation for prostate cancer local recurrence with a combined reading of hybrid Axumin PET/MRI leads to more confident interpretation with fewer indeterminate results when compared to separate reading of Axumin PET and multiparametric prostate MRI (mpMRI).

METHOD AND MATERIALS

This is a retrospective study of 60 patients with biopsy-proven prostate cancer who have had definitive therapy with concern for recurrence, who underwent a hybrid Axumin PET/MRI. PET and MRI images were reviewed separately by a nuclear medicine and an abdominal imaging specialist, respectively, each blinded to the other. Lesions were assigned a likelihood of local recurrence score. Axumin PET/MRI images were then jointly interpreted and a consensus likelihood of local recurrence score was assigned. The scores were based on qualitative 5-point scales outlined by each reader prior to the study. Scores were compared between individual PET or MRI and combined PET/MRI interpretations using Chi-Square and linear-by-linear association tests.

RESULTS

We evaluated 60 Axumin PET-MRI exams with a total of 68 lesions. 39 (65%) patients had radical prostatectomy while 21 (35%)

had local therapy only. The average patient age was 69 years old (range 45-85). There is a significant difference in the interpretation scores between individual mpMRI and combined Axumin PET/MRI interpretation (p=0.006). Of the 24 lesions with scores of 2-4 on MRI, 9 (38%) lesions were downgraded to a score of 1 and 10 (42%) lesions were upgraded to a score of 5 on combined interpretation. There is a trend toward a significant difference between individual PET and combined PET/MRI, with a linear-by-linear association of 1.1 (p = 0.139). Of the 17 lesions assigned scores of 2-4 on PET, 5 (29%) lesions were upgraded to a score of 5 and 4 out of 43 lesions (9%) with a PET score of 1 were upgraded to a score of 5 on combined interpretation.

CONCLUSION

The combined interpretation of Axumin PET/MRI showed significantly more confidence in assessing for locally recurrent prostate cancer over interpretation of MRI alone and a trend toward significance in confidence over interpretation of PET alone.

CLINICAL RELEVANCE/APPLICATION

Combined reading of Axumin PET/MRI increases confidence in local recurrence detection, facilitating management in prostate cancer patients with clinical concern for recurrent disease after treatment.

SSA16-04 Tumor Foci Size but Not Lymph Node Size Affects 18F-fluciclovine PET/CT Detection of Metastatic Lymph Nodes in Primary Prostate Cancer

Sunday, Dec. 1 11:15AM - 11:25AM Room: S505AB

Participants
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
Akinyemi A. Akintayo, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mehrdad Alemozaffar, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Faisal Saeed, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Oladunni O. Akin-Akintayo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Dattatraya Patil, MBBS,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adeboye Osunkoya, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Martin J. Sanda, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

For information about this presentation, contact:

oabiod2@emory.edu

PURPOSE

To determine the effect of sizes of lymph node (LN) and metastatic foci (MF) on the diagnostic performance of preoperative fluciclovine PET/CT for identifying LN metastasis (LNM) in patients with primary prostate cancer.

METHOD AND MATERIALS

51 patients with intermediate to high-risk prostate cancer underwent fluciclovine PET/CT (Dose: 366.3±22.2 MBq) prior to radical robotic prostatectomy (RP) with extended pelvic lymph node dissection (EPLND). LNs were excised according to 12 predefined templates and correlated to PET findings. Metastatic LNs and MF in LNs were measured bidimensionally by a board certified urologic pathologist. Sizes of metastatic LNs and MF in templates with positive and negative PET findings were compared using t-test. For every LN packet (LNP), the greatest long axis diameter of LN and MF were utilized as the most conservative surrogate for the LNP.

RESULTS

EPLND was performed in 45/51 patients with median PSA 18.0 ng/ml (range 0.58-147.03 ng/ml) and Gleason score (Grade group) 8 (4) within 7 days (range 1-41 days) after fluciclovine PET. Of these, 24/45 (53.3%) patients had histologically confirmed LNM. 508 LNPs (mean 11 packets per patient) were analyzed. LNM were detected in 82/508 (16.1%) LNPs on histology. Fluciclovine PET detected LNM in 36/82 (43.9%) LNPs (true positives) while 46/82 (56.1%) LNPs were either benign or not seen (false negatives) on fluciclovine PET. Of the remaining 426/508 LNPs, 3/426 (0.7%) were read as equivocal on PET but were benign on histology (false positives). There was no significant difference in the mean long axis diameters of true positives (15.1 mm [range 3.0-40.0 mm]) and false negatives (13.1 mm [range 3.0-52.0 mm]; p=0.13) LNPs. In contrast, the mean long axis diameters of MF within true positive LNPs (11.4 mm [range 1.0-40.0 mm]) were significantly higher than false negative LNPs (3.9 mm [range 0.4-14.0 mm]; p<0.01). 13/52 (25.0%) LNPs with MF <=7 mm were detected on fluciclovine PET while 23/30 (76.7%) LNPs with MF >7 mm were detected on fluciclovine PET.

CONCLUSION

Fluciclovine PET detection rate of LNM was influenced by the size of metastatic foci but not lymph node size. Metastatic foci >7 mm were more likely to be detected on fluciclovine PET than MF <=7 mm.

CLINICAL RELEVANCE/APPLICATION

The ability of preoperative fluciclovine PET/CT to detect lymph node metastasis in patients with primary prostate cancer is influenced by the size of the metastatic focus within the lymph node.

SSA16-05 Difference in the Spectrum of Metastatic Disease on 68Ga PSMA PET/CT after Radical Prostatectomy and after Radical Radiotherapy in Patients of Carcinoma Prostate with Biochemical Recurrence

Sunday, Dec. 1 11:25AM - 11:35AM Room: S505AB

Participants
Ritu Verma, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nikhil Seniaray, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ethel S. Belho, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Dharmender Malik, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Sudhir Khanna, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

Vanshika Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nitin Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Harsh Mahajan, MD,MBBS, New Delhi, India (*Presenter*) Director, Mahajan Imaging Pvt Ltd; Research collaboration, General Electric Company; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health
Vidur Mahajan, MBBS, New Delhi, India (*Abstract Co-Author*) Researcher, CARING; Associate Director, Mahajan Imaging; Research collaboration, General Electric Company ; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health; Research collaboration, Oxipit.ai; Research collaboration, Synapsica; Research collaboration, Quibim

For information about this presentation, contact:

drrituverma29@gmail.com

PURPOSE

To determine the pattern of metastatic disease with 68Ga PSMA PET/CT in patients with biochemical recurrence after definitive treatment

METHOD AND MATERIALS

A retrospective analysis of subjects with carcinoma prostate, who had undergone definitive treatment (Radical prostatectomy or Radiotherapy) and presented with biochemical recurrence, was done by 68Ga PSMA PET/CT. The data collected was analysed to establish temporal occurrence and patterns of regional and distant metastatic disease in both the groups and correlated with serum PSA levels.

RESULTS

The study included 200 subjects with history of adenocarcinoma prostate. In the post radical prostatectomy group (n=144), median serum PSA was 1.8 ng/ml, the overall metastatic detection rate was 39.3% for PSA 0.2 to < 0.5 ng/ml, 47.3% for PSA 0.5 to < 1 ng/ml, 68.4% for PSA 1 to < 2 ng/ml and 93.1% for PSA >=2 ng/ml. In this group local recurrence was identified in 28.73 % and lymph nodal metastases in 65.1%, with the pelvic lymph nodal metastases being the most common site of metastasis followed by bone metastases. The mean time for serum PSA recurrence in the radical prostatectomy group was 49.77±44.44 months (range 2-184 months). In the post radiotherapy group, median serum PSA was 5.2 ng/ml, the detection rate was 88.8 % for PSA 2 to < 4 ng/ml and 100 % for PSA >= 4 ng/ ml. Local recurrence after radiotherapy was present in 79.5 % of the group and 63.6 % had lymph nodal metastases. The mean time for serum PSA recurrence following radiotherapy was 49.15± 24.32 months, (range 12-111 months).

CONCLUSION

Radical prostatectomy and Radical radiotherapy are the two standard treatment options for localized carcinoma prostate. Although the extent and patterns of recurrence differed in the two groups, the temporal occurrence of metastatic disease remained comparable.

CLINICAL RELEVANCE/APPLICATION

68Ga-PSMA has been suggested as a novel tracer for detection of prostate cancer relapse and metastases with high specificity and sensitivity.

SSA16-06 Correlation of Findings on 18F-Fluciclovine PET/CT with Failure-Free Survival of Salvage Radiotherapy in Post-Prostatectomy Patients with Biochemical Recurrence

Sunday, Dec. 1 11:35AM - 11:45AM Room: S505AB

Participants
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
Ashesh B. Jani, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Akinyemi A. Akintayo, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mehrdad Alemozaffar, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Oladunni O. Akin-Akintayo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Funmilayo I. Tade, MD, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose
Viraj Master, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Pretesh Patel, Atlanta , GA (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Shelton, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Omer Kucuk, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Zhengjia Chen, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Bruce Hershatter, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Eduard Schreibman, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Bridget Fielder, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Raghuveer K. Halkar, MD, Atlanta, GA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Gilead Sciences, Inc Royalties, General Electric Company
David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

For information about this presentation, contact:

oabiod2@emory.edu

PURPOSE

To examine the impact of fluciclovine PET on failure-free survival (FFS) of radiotherapy (RT) ± androgen deprivation therapy (ADT) in recurrent prostate cancer patients post-prostatectomy.

METHOD AND MATERIALS

69 post-prostatectomy patients with biochemical recurrence in the experimental arm of a randomized controlled study (NCT01666808/NIH R01CA169188) underwent fluciclovine PET prior to RT±ADT. RT was based on PET and clinical findings: no

uptake/prostate bed only uptake - RT to prostate bed only, pelvic nodal uptake - RT to prostate bed+pelvis, extrapelvic nodal uptake - no RT. RT (median 66.6 Gy in 1.8 Gy fractions) was initiated 17±10 days after PET scan. 21 patients received RT+short course ADT. 8 patients at 12 months and 3 additional patients at 18 months post-RT were censored due to lack of follow-up. Treatment failure was defined as either serum prostate-specific antigen (PSA) >=0.2 ng/ml+post-RT nadir followed by another higher value, a continued rise in the serum PSA despite RT, initiation of systemic therapy after completion of RT, or clinical progression. FFS based on fluciclovine PET findings were compared using Fisher's exact test.

RESULTS

53/69 (76.8%) patients had positive fluciclovine PET findings. 4/69 patients were ineligible for RT due to systemic disease, hence, FFS was assessed in 65 patients (median PSA 0.32 [range 0.02-9.79] ng/ml). FFS at 6, 12 and 18 months was 63/65 (96.9%), 52/57 (91.2%), and 43/54 (79.6%), respectively. In patients with no uptake, FFS was 16/16 (100%), 15/15 (100%), 12/13 (92.3%) at 6, 12, and 18 months, respectively. In patients with uptake in the prostate bed only, FFS was 27/27 (100%), 21/22 (95.5%), 18/21 (85.7%) at 6, 12, and 18 months, respectively. In patients with pelvic±prostate bed uptake, FFS was 20/22 (90.9%), 16/20 (80.0%), 13/20 (65.0%) at 6, 12, and 18 months, respectively. FFS trends did not reach statistical significance at any timepoint.

CONCLUSION

Findings on fluciclovine PET/CT correlate with failure-free survival, potentially reflecting metabolic tumor burden and may have prognostic value. Longer follow-up duration and comparison to a control group not undergoing PET, are required to fully evaluate the value of fluciclovine PET based radiotherapy.

CLINICAL RELEVANCE/APPLICATION

Findings on fluciclovine PET/CT correlate with failure-free survival of salvage radiotherapy and may have prognostic value in post-prostatectomy patients with biochemical recurrence.

SSA16-08 Significant Interval Decrease in Bone Mineral Density in Osteopenic Patients: A Notable Limitation of FRAX Analysis in Dual-energy X-ray Absorptiometry

Sunday, Dec. 1 11:55AM - 12:05PM Room: S505AB

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Gabriela T. Bober, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Serge Jabbour, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Miller, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Intekhab Ahmed, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christine Wu, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Furlong, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Charles.Intenzo@jefferson.eduPhone:215-955-7871Fax:215-923-0268

PURPOSE

Bone mineral density (BMD) evaluation, considered to be the standard measure for the diagnosis of osteoporosis and fracture risk assessment, is most commonly measured by dual-energy x-ray absorptiometry (DXA). For patients diagnosed with osteopenia, the Fracture Risk Assessment Tool (FRAX) was developed, which incorporates clinical factors to aid the clinician in patient management. If the FRAX score in an osteopenic patient predicts a 10-year fracture risk of 20% or greater for a major osteoporotic fracture or 3% or greater for a hip fracture, therapy is warranted. However, any significant decline in BMD when compared to a prior DXA is not reflected in the FRAX analysis. Our goal was to determine the frequency with which there is a significant decline in BMD in patients diagnosed with osteopenia by DXA, but whose FRAX score predicts a fracture risk of less than 20% for a major osteoporotic fracture or less than 3% for a hip fracture.

METHOD AND MATERIALS

Over a period of 12 months, the number of patients diagnosed with osteopenia by DXA were counted, who (1) had a significant decrease in BMD when compared to a prior DXA and (2) the FRAX scores were both less than 20% for a major osteoporotic fracture and less than 3% for a hip fracture.

RESULTS

A total of 278 patients with osteopenia by DXA had a significant decrease in spine and/or hip BMD when compared to a previous DXA, yet the FRAX scores were both less than 20% for a major osteoporotic fracture and less than 3% for a hip fracture.

CONCLUSION

Fracture risk assessed by FRAX analysis is often underestimated in osteopenic patients whose BMD has significantly declined from a prior DXA. Therefore, in this clinical setting, a low FRAX score should not influence the therapeutic decision.

CLINICAL RELEVANCE/APPLICATION

The following sentence should be added to the DXA scan report in the above clinical scenario: "It should be noted that a significant decrease in BMD from a prior DXA is not reflected in FRAX analysis."

SSA16-09 Effect of Tumor Histology on Detection of Pelvic and Para-Aortic Nodal Metastasis with FDG-PET in Stage IB Cervical Cancer

Sunday, Dec. 1 12:05PM - 12:15PM Room: S505AB

Participants
Alexander J. Lin, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Jason Wright, New York, NY (*Abstract Co-Author*) Personal fee, Clovis Oncology, Inc; Personal fee, Tesaro

Farrokh Dehdashti, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Barry A. Siegel, MD, Saint Louis, MO (*Abstract Co-Author*) Advisory Board, Blue Earth Diagnostics Ltd; Advisory Board, General Electric Company; Consultant, Curium, Inc; Consultant, ImaginAb, Inc; Consultant, Progenics Pharmaceuticals, Inc; Spouse, Speakers Bureau, Siemens AG
Stephanie Markovina, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Julie K. Schwarz, MD,PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Premal Thaker, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
David J. Mutch, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Matthew Powell, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Perry W. Grigsby, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

alexanderlin@wustl.edu

PURPOSE

To determine if the detection of FDG-avid pelvic and para-aortic lymph nodes in early stage cervical cancer patients is dependent on tumor histology.

METHOD AND MATERIALS

Patients with IB1-2 cervical cancer who underwent pre-surgical FDG-PET between 1997-2018 were identified in a tertiary academic center database. All patients had radical hysterectomy with pelvic and para-aortic lymph node dissection. The detection of pelvic and para-aortic lymph nodes by FDG-PET vs. surgical dissection was compared. FDG-PET sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined and stratified by tumor histology. Freedom from relapse (FFR) was analyzed with Kaplan-Meier analysis and Cox proportional hazards models.

RESULTS

We identified 212 patients with early-stage cervical cancer (84% FIGO IB1, 16% IB2) who underwent pre-surgical FDG-PET; 137(65%) had squamous carcinoma and 75(35%) had adenocarcinoma. PET/CT was performed in 189(89%) patients and 23(11%) had PET only. Surgical dissection revealed positive pelvic and para-aortic lymph nodes in 25% and 3.3% of patients, respectively. For squamous carcinoma, the sensitivity, specificity, PPV and NPV of FDG-PET for pelvic nodal metastasis were 44%, 99%, 95% and 78%, respectively. For adenocarcinoma, the corresponding results for pelvic nodal metastasis were 25%, 99%, 67% and 92%, respectively. The overall sensitivity, specificity, PPV and NPV of FDG-PET for para-aortic nodal metastasis was 29%, 99%, 67%, and 98%, respectively. With a median follow up of 9.3 years, the 5-year FFR for squamous carcinoma and adenocarcinoma was 83% vs. 96% (p=0.008), respectively.

CONCLUSION

Pelvic nodal metastasis was less likely to be detected by FDG-PET in patients with early-stage adenocarcinoma than with squamous carcinoma. Patients with adenocarcinoma had a better prognosis than those with squamous carcinoma.

CLINICAL RELEVANCE/APPLICATION

FDG-PET was half as sensitive for detecting pelvic lymph nodes in adenocarcinoma vs. squamous carcinoma.

Printed on: 10/29/20

VSIO11

Interventional Oncology Series: Interventional Therapies for Primary and Metastatic Lung Tumors

Sunday, Dec. 1 1:00PM - 3:00PM Room: S405AB

CH IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

Participants
Florian J. Fintelmann, MD, Boston, MA (*Moderator*) Consultant, Jounce Therapeutics, Inc; Research support, BTG International Ltd
Afshin Gangi, MD,PhD, Strasbourg, France (*Moderator*) Consultant, AprioMed AB

For information about this presentation, contact:

fintelmann@mgh.harvard.edu

LEARNING OBJECTIVES

1) Review recent advances pertaining to microwave and cryoablation in the thorax. 2) Discuss data supporting thermal ablation of lung cancer and thoracic metastases. 3) Learn how to integrate thermal ablation into the interdisciplinary management of thoracic neoplasms.

Sub-Events

VSIO11-01 The Role of RFA for Lung Ablation in the Era of Microwave

Sunday, Dec. 1 1:00PM - 1:15PM Room: S405AB

Participants
Jean Palussiere, MD, Bordeaux, France (*Presenter*) Speaker, Boston Scientific Corporation

LEARNING OBJECTIVES

1) To develop specificities of lung tissue following heating. 2) To specify technical differences between Radiofrequency ablation and microwave ablation applied to lung tumors. 3) To define the best indications for each technique. 4) To list the limits, indications and contraindications for each technique. 5) To identify whether some development are awaited and might increase indications.

VSIO11-02 Thoracic Cryoablation

Sunday, Dec. 1 1:15PM - 1:30PM Room: S405AB

Participants
William H. Moore, MD, Port Washington, NY (*Presenter*) Consultant, Merck & Co, Inc Consultant, BTG International Ltd

LEARNING OBJECTIVES

1) Highlight the results of Cryoablation and the potential role for ablation in primary lung cancer and metastatic diseases. 2) Identify the Strength of Cryoablation in the lung. 3) Compare Ablative Technique in the Lung.

VSIO11-03 Transarterial Chemoperfusion (TACP) And Transpulmonary Chemoembolization (TPCE) for the Treatment of Lung Metastases: Palliative Treatment Approach

Sunday, Dec. 1 1:30PM - 1:40PM Room: S405AB

Participants
Thomas J. Vogl, MD, PhD, Frankfurt , Germany (*Presenter*) Nothing to Disclose
Ahmed I. Ahmed, MBCHB, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Duaa B. Thabet, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Mostafa A. El-Sharkaway, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Hossam M. Kamel, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Nour-eldin A. Nour-Eldin, MD,PhD, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Afaf A. Hassan, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

T.Vogl@em.uni-frankfurt.de

PURPOSE

To evaluate tumor response, local tumor control and patient survival after the treatment of secondary lung malignancies using transpulmonary chemoemboilzation (TPCE) and transarterial chemoperfusion (TACP) in a palliative indication.

METHOD AND MATERIALS

±In this retrospective study 161 patients (mean 55.3±13.8 years; 82 females/79 males) who had failied previous systemic chemotherapy were treated with either repetitive TPCE (n=92) or TACP (n=69) between August 2004 and April 2017 for

unresectable pulmonary metastases. The median number of sessions was 5 per patient, the median number of nodules 16 and bilateral lung involvement 85.1%. The chemotherapeutic agents used were Mitomycin C, Cisplatin, Gemcitabine and/or Irinotecan. Nine patients received other combinations according to their physicians' recommendations. Either the tumor-supplying pulmonary arteries were catheterized followed by injection of the chemotherapeutic agents, iodized oil and microspheres (TPCE group) or the chemotherapy was non-selectively injected intra-arterielly opposite the orifices of the main tumor-supplying arteries (TACP group). The response was assessed using the revised RECIST criteria.

RESULTS

After evaluation of the tumor response partial response (PR) was achieved in 8.7% (n=14), stable disease (SD) in 65.2% (n=105) and progressive disease (PD) in 26.1% (n=42). The estimated mean survival time and time to progression were 19.7±2 and 7.1±0.7 for the TPCE group and 15.6±1.6 and 6.5±0.6 for the TACP group, respectively. Patients who underwent TPCE had a non significantly longer mean survival time than the TACP group. Patients with PR and SD had a significantly ($p<0.05$) better survival (mean: 25±4.4 and 19±1.8 months, respectively) than those with PD (mean 14±2.3 months).

CONCLUSION

Both TPCE and TACP are feasible treatment options for patients with secondary lung malignancies with acceptable local control and survival rates. A more favorable initial response to the locoregionally delivered chemotherapy might be a positive predictor for survival.

CLINICAL RELEVANCE/APPLICATION

TACP and TPCE improve local tumor control and prolong survival in patients with pulmonary metastases

VSIO11-04 Ablation versus Radiation versus Surgery for Lung Cancer

Sunday, Dec. 1 1:40PM - 1:55PM Room: S405AB

Participants
Stephen B. Solomon, MD, New York, NY (*Presenter*) Consultant, BTG International Ltd ; Consultant, Johnson & Johnson; Consultant, XACT Robotics; Consultant, Endoways; Consultant, Aperture Medical Technology; Researcher, General Electric Company; Researcher, Johnson & Johnson; Researcher, AngioDynamics, Inc; Stockholder, Aspire Bariatrics; Stockholder, Johnson & Johnson; Stockholder, Immunomedics, Inc; Stockholder, Strongbridge; Stockholder, Progenics Pharmaceuticals, Inc; Stockholder, Aperture Medical Technology; Stockholder, Innoblative; Stockholder, Surefire Medical, Inc

LEARNING OBJECTIVES

1) Understand the difference in treatment options for lung cancer.

VSIO11-05 Ablation versus Radiation versus Surgery for Lung Metastases

Sunday, Dec. 1 1:55PM - 2:10PM Room: S405AB

Participants
Ashok Muniappan, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the surgical technique of pulmonary metastasectomy. 2) Compare efficacy and utility of surgical metastasectomy to that of ablation and radiation. 3) Discuss the strategy of combining surgical metastasectomy and ablation to manage pulmonary metastases.

VSIO11-06 Effectiveness of Local Therapy for the Treatment of Lung Carcinoid Tumors

Sunday, Dec. 1 2:10PM - 2:20PM Room: S405AB

Participants
Meaghan Dendy Case, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Johannes Uhlig, Goettingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hyun S. Kim, MD, New Haven, CT (*Abstract Co-Author*) Boston Scientific Corporation; Galil Medical Ltd ; Sirtex Medical Ltd

PURPOSE

To determine the potential benefit of local and systemic therapy in lung carcinoid tumors.

METHOD AND MATERIALS

Data from lung carcinoid patients receiving surgical resection, external beam radiation therapy, thermal ablation or systemic therapy alone was acquired from the 2004-2015 National Cancer Database (NCDB). Patient and tumor characteristics across different treatment strategies were compared using univariate Wilcoxon test. Overall survival (OS) was evaluated via multivariable Cox proportional hazards models. Comparison was made between SBRT, thermal ablation, surgical resection and compared with systemic therapy alone.

RESULTS

34,205 patients from the NCDB database fulfilled inclusion criteria (SBRT n = 5,489; surgery n= 9,025; TA n = 67; systemic therapy alone n = 19,624.) Treatments differed across patient demographics and disease characteristics, with higher likelihood of TA in older male Caucasians with high comorbidities, and late-stage disease with small diameter. Prior to multivariable adjustment, SBRT, surgical resection, and thermal ablation all demonstrated superior OS compared to systemic therapy alone (compared to systemic therapy alone: SBRT HR = 0.56, 95% CI: 0.54-0.58, $p < 0.001$; surgical resection HR = 0.19, 95% CI: 0.18-0.20, $p < 0.001$; TA HR = 0.58, 95% CI: 0.44-0.76, $p < 0.001$). SBRT and surgical resection treatment demonstrated superior survival compared to systemic therapy alone after multivariable adjustment (SBRT HR = 0.74, 95% CI: 0.70-0.77, $p < 0.001$; surgical resection HR = 0.39, 95% CI: 0.37-0.41). Additional independent predictors of survival (p-values of <0.05) were patients with one or more comorbidities, male gender, Caucasian race, age, low cancer stage and grade, small tumor diameter, and type of treatment facility.

CONCLUSION

Patients with lung carcinoid tumor who received SBRT, surgical resection or TA demonstrated prolonged survival when compared to those patients who received systemic therapy only. The limited number of patients receiving TA limits the ability to determine survival significance after multivariable analysis, and more research in this area is required to determine its utility in prolonging survival in these patients.

CLINICAL RELEVANCE/APPLICATION

Locoregional therapies demonstrate increased survival benefits when used in patients with carcinoid lung tumors. TA and SBRT demonstrate similar effectiveness in prolonging overall survival in patients with carcinoid lung cancer.

VSIO11-07 Ablation and Immune Modulation

Sunday, Dec. 1 2:20PM - 2:35PM Room: S405AB

Participants
Joseph P. Erinjeri, MD,PhD, New York, NY (*Presenter*) Advisory Board, AstraZeneca PLC; Advisory Board, BTG International Ltd; Consultant, Jounce Therapeutics, Inc; Consultant, Canon Medical Systems Corporation

VSIO11-08 Starting and Developing a Lung Ablation Program

Sunday, Dec. 1 2:35PM - 2:50PM Room: S405AB

Participants
Florian J. Fintelmann, MD, Boston, MA (*Presenter*) Consultant, Jounce Therapeutics, Inc; Research support, BTG International Ltd

For information about this presentation, contact:

fintelmann@mgh.harvard.edu

LEARNING OBJECTIVES

1) Discuss strategies to start and grow a lung ablation program at your institution. 2) Outline a path to move from lung biopsy and fiducial placement to thermal ablation. 3) Discuss the role of interdisciplinary collaboration, case selection and patient management.

VSIO11-09 Panel Discussion

Sunday, Dec. 1 2:50PM - 3:00PM Room: S405AB

RC109

Abbreviated/Faster MRI Abdominal Pelvic Protocols

Sunday, Dec. 1 2:00PM - 3:30PM Room: E450B

GI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, Gilead Sciences, Inc; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV; Consultant, AMRA AB; Consultant, Fulcrum; Consultant, IBM Corporation; Consultant, Exact Sciences Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Arterys Inc; Consultant, Epigenomics; Author, Medscape, LLC; Lab service agreement, Gilead Sciences, Inc; Lab service agreement, ICON plc; Lab service agreement, Intercept Pharmaceuticals, Inc; Lab service agreement, Shire plc; Lab service agreement, Enanta; Lab service agreement, Takeda Pharmaceutical Company Limited; Lab service agreement, Alexion Pharmaceuticals, Inc; Lab service agreement, NuSirt Biopharma, Inc

Sub-Events

RC109A Hepatocellular Carcinoma Screening

Participants
Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, Gilead Sciences, Inc; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV; Consultant, AMRA AB; Consultant, Fulcrum; Consultant, IBM Corporation; Consultant, Exact Sciences Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Arterys Inc; Consultant, Epigenomics; Author, Medscape, LLC; Lab service agreement, Gilead Sciences, Inc; Lab service agreement, ICON plc; Lab service agreement, Intercept Pharmaceuticals, Inc; Lab service agreement, Shire plc; Lab service agreement, Enanta; Lab service agreement, Takeda Pharmaceutical Company Limited; Lab service agreement, Alexion Pharmaceuticals, Inc; Lab service agreement, NuSirt Biopharma, Inc

For information about this presentation, contact:

csirlin@ucsd.edu

LEARNING OBJECTIVES

1) Explain the need for HCC screening in adults with cirrhosis. 2) Explain the limitations of ultrasound for HCC screening in adults with cirrhosis, in particular adults with overweight or obesity. 3) Explain one approach for abbreviated MRI for HCC screening as a potential alternative to ultrasound.

RC109B Pancreatic Tumor Evaluation and Follow-up

Participants
Kumaresan Sandrasegaran, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sandrasegaran.kumaresan@mayo.edu

LEARNING OBJECTIVES

1) Understand pitfalls in diagnosing, staging and post-therapy assessment of pancreatic ductal adenocarcinoma (PDAC). 2) Understand what the surgeon and oncologist want from a staging CT/MRI report. 3) Learn to use standardized reporting template for staging PDAC.

ABSTRACT

This presentation covers the diagnosis and staging of pancreas cancer (pancreatic ductal adenocarcinoma). There are multiple pitfalls in the diagnosis of pancreas cancer and these are highlighted. The staging of pancreas cancer has changed in recent years because of advances in surgical and oncologic therapy. Radiologists need to be aware of these developments, so that accurate information may be reported. The value of standardized reporting is discussed.

RC109C Faster MR Enterography

Participants
Michael S. Gee, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To comprehend the indications for MR enterography. 2) To apply structured interpretation and reporting of MR enterography studies. 3) To apply new techniques for decreasing MR enterography scan time.

ABSTRACT

None.

RC109D Participants Rectal Cancer Staging

Michael H. Rosenthal, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand best practices for MR imaging of rectal cancer at diagnosis. 2) Learn and apply diagnostic criteria to accurately stage rectal adenocarcinomas using MRI. 3) Understand common pitfalls in the interpretation of rectal MRI.

Printed on: 10/29/20

RC118

Interactive Game: Cases in Body Oncologic Imaging that I Have Learned the Most From (Interactive Session)

Sunday, Dec. 1 2:00PM - 3:30PM Room: S102CD

CT MR OI US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Deborah J. Rubens, MD, Rochester, NY (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

Deborah_rubens@urmc.rochester.edu

Special Information

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC118A Ultrasound

Participants
Deborah J. Rubens, MD, Rochester, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

deborah_rubens@urmc.rochester.edu

LEARNING OBJECTIVES

1) Review some commonly performed examinations where US leads to oncologic diagnosis. 2) Identify those technical parameters which are critical to accurate ultrasound performance, especially color and spectral Doppler, as exemplified by pitfalls and 'missed' cases. 3) Explore the role of US in management of oncologic patients, including contrast enhanced ultrasound.

RC118B Computed Tomography

Participants
Christine O. Menias, MD, Chicago, IL (*Presenter*) Royalties, Reed Elsevier

For information about this presentation, contact:

menias.christine@mayo.edu

LEARNING OBJECTIVES

1) Review CT imaging features of challenging abdominal and pelvic oncologic cases encountered in clinical practice using case-based examples. 2) Highlight the imaging pearls and pitfalls that may impact diagnosis and treatment. 3) Discuss potential differential diagnoses and mimics of oncologic abdominal and pelvic cases.

RC118C Magnetic Resonance Imaging

Participants
Richard Kinh Gian Do, MD,PhD, New York, NY (*Presenter*) Consultant, Bayer AG; Author, Reed Elsevier; Spouse, Author, Wolters Kluwer nv; Spouse, Data Monitoring Committee, Alk Abello

For information about this presentation, contact:

dok@mskcc.org

LEARNING OBJECTIVES

1) Assess the role of diffusion weighted imaging in oncology. 2) Explain the presence of susceptibility artifacts on different MRI sequences. 3) Compare the use of extracellular and hepatobiliary contrast agents for liver MRI.

RC118D PET/CT

Participants
Luigi Aloj, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

la398@cam.ac.uk

LEARNING OBJECTIVES

1) Biochemical characterisation of cancer through PET imaging.2) How combinations of radiopharmaceuticals may be relevant to diagnosis.3) Tumour heterogeneity as detected by PET and implications for patient management.4) The role of PET/CT in theragnostics

Printed on: 10/29/20

RC120

What's New in the Treatment of Brain Metastases?

Sunday, Dec. 1 2:00PM - 3:30PM Room: S501ABC

NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Timothy J. Kruser, MD, Chicago, IL (*Moderator*) Speakers Bureau, AstraZeneca PLC

For information about this presentation, contact:

tkruser@nm.org

Sub-Events

RC120A Role of Hippocampal Sparing WBRT

Participants
Vinai Gondi, MD, Warrenville, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the biology, radiation sensitivity, and cognition specificity of hippocampal neurogenesis. 2) Examine practice-changing data supporting the use of hippocampal sparing during whole-brain radiotherapy for brain metastases. 3) Identify clinical scenarios that may favor adoption of hippocampal sparing whole brain radiotherapy.

RC120B Role of SRS Treatment

Participants
Timothy J. Kruser, MD, Chicago, IL (*Presenter*) Speakers Bureau, AstraZeneca PLC

For information about this presentation, contact:

tkruser@nm.org

LEARNING OBJECTIVES

1) Identify clinical factors that may favor radiosurgery versus whole brain RT. 2) Examine the impact of combining radiosurgery with targeted medical therapies on local control. 3) Estimate the likelihood of radiation necrosis and local failure following SRS +/- immunotherapy.

RC120C MR Imaging for Brain Metastases

Participants
Timothy J. Kaufmann, MD, Rochester, MN (*Presenter*) Consultant, SpineThera

For information about this presentation, contact:

kaufmann.timothy@mayo.edu

LEARNING OBJECTIVES

1) Review current Response Assessment in Neuro-Oncology Brain Metastases guidelines. 2) Examine common MRI patterns of radionecrosis, tumor progression, and pseudoprogression after radiosurgery. 3) Review imaging changes of brain metastases treated with immunotherapy. 4) Appraise the value and limitations of special imaging modalities (perfusion, permeability, DWI, spectroscopy, SPECT) on differentiating tumor progression from radionecrosis.

RC120D PET Imaging for Brain Metastases

Participants
Norbert Galldiks, MD, Cologne, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the most important PET tracers for imaging of brain metastases. 2) Review the value of PET for the differentiation of treatment-related changes related to radiotherapy, immunotherapy and combinations thereof from brain metastases recurrence. 3) Review the potential of PET for treatment response assessment.

VSIO12

Interventional Oncology Series: Novel Targets for Interventional Oncologists

Sunday, Dec. 1 3:15PM - 5:15PM Room: S405AB

IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Luigi Solbiati, MD, Pieve Emanuele (milano), Italy (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

LEARNING OBJECTIVES

1) List more recent, non conventional applications of image-guided percutaneous ablation for thyroid, parathyroids, adrenals, prostate, breast and pancreas. 2) Learn technological and technical aspects and clinical indications of these mini-invasive treatments. 3) Identify how and in which clinical situations these recent ablative treatments can replace conventional therapies.

Sub-Events

VSIO12-01 Different Ablative Techniques for Benign Thyroid Nodules

Sunday, Dec. 1 3:15PM - 3:30PM Room: S405AB

Participants
Giovanni Mauri, MD, Milan, Italy (*Presenter*) Consultant, Elesta Srl

For information about this presentation, contact:

vanni.mauri@gmail.com

LEARNING OBJECTIVES

1) Describe and compare various ablative techniques available for the treatment of benign thyroid nodules. 2) Recommend appropriate indication for various ablative techniques of benign thyroid nodules. 3) Assess clinical results of ablative techniques of benign thyroid nodules.

ABSTRACT

Image-guided ablations are gaining an increasingly important role in the treatment of patients with benign thyroid nodules. Some different techniques have been succesfully applyied in the treatment of benign thyroid nodules, including laser ablation, radiofrequency ablation, microwaves ablation and high intensity focused ultrasound. In this course, the different techniques for ablation of benign thyroid nodules will be presented and compared. Furthermore, clinical indications and results of image guided ablation of benign thyroid nodules will be presented and discussed.

VSIO12-02 Percutaneous Ablation for Thyroid Malignancies

Sunday, Dec. 1 3:30PM - 3:45PM Room: S405AB

Participants
Ji-hoon Kim, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jihnkim@gmail.com

LEARNING OBJECTIVES

1) To understand the current issues with regard to the management of primary and recurrent thyroid cancers. 2) To learn outcome and complication of percutaneous ablation for primary and recurrent thyroid cancers. 3) To suggest indication of percutaneous ablation for primary and recurrent thyroid cancers over other treatment modalities.

VSIO12-04 Percutaneous Ablation of Parathyroid Adenoma

Sunday, Dec. 1 3:55PM - 4:10PM Room: S405AB

Participants
Luigi Solbiati, MD, Pieve Emanuele (milano), Italy (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

LEARNING OBJECTIVES

1) To learn what instrumentation can be used for ablation of parathyroid adenomas and how to use them. 2) To understand what complications can be caused by ablation of parathyroid adenomas and what procedures can be followed to avoid them. 3) To learn indications and contraindications of thermal ablation of parathyroid adenomas.

VSIO12-05 Percutaneous Ablation of Adrenal Tumors and Retroperitoneal Adenopathies

Sunday, Dec. 1 4:10PM - 4:25PM Room: S405AB

Participants
Paul B. Shyn, MD, Boston, MA (*Presenter*) Research Grant, Siemens AG

For information about this presentation, contact:

pshyn@bwh.harvard.edu

LEARNING OBJECTIVES

1) Assess the appropriateness of clinical indications for adrenal and retroperitoneal tumor ablation. 2) Compare the advantages and disadvantages of various adrenal and retroperitoneal tumor ablation technologies. 3) Appraise and manage the risks of adrenal and retroperitoneal tumor ablation.

VSIO12-06 Percutaneous Image-guided Prostate Interventions

Sunday, Dec. 1 4:25PM - 4:40PM Room: S405AB

Participants
Eric M. Walser, MD, Galveston, TX (*Presenter*) Nothing to Disclose

VSIO12-07 Percutaneous Image-guided Ablation of Breast Cancer

Sunday, Dec. 1 4:40PM - 4:55PM Room: S405AB

Participants
Jean Palussiere, MD, Bordeaux, France (*Presenter*) Speaker, Boston Scientific Corporation

LEARNING OBJECTIVES

1) To describe the different methods of thermal ablation applied to breast cancer. 2) To develop specificities of breast tissue following heating, freezing. 3) To specify technical skills with protection measures of vulnerable structures. 4) To define the best indications : for which patients ? which tumor ? (size, location, type). 5) To list the limits, indications and contraindications. 6) To identify which techniques are under development and might increase indications.

VSIO12-08 Percutaneous Ablation of Pancreatic Adenocarcinoma

Sunday, Dec. 1 4:55PM - 5:10PM Room: S405AB

Participants
Giovanni Mauri, MD, Milan, Italy (*Presenter*) Consultant, Elesta Srl

VSIO12-09 Panel Discussion

Sunday, Dec. 1 5:10PM - 5:15PM Room: S405AB

MSRO25

BOOST: Breast-Case-based Multidisciplinary Review (Interactive Session)

Monday, Dec. 2 8:30AM - 10:00AM Room: S103CD

BR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jonathan B. Strauss, MD, Chicago, IL (*Presenter*) Reviewer, WellPoint, Inc
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Cesar A. Santa-Maria, MD, Baltimore, MD (*Presenter*) Research funded, AstraZeneca PLC; Research funded, Pfizer Inc; Research funded, Tesaro; Advisory Board, Polyphor; Advisory Board, Halozyme Therapeutics, Inc; Advisory Board, Genomic Health, Inc
Brian J. Czerniecki, MD, PhD, Tampa, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Jonathan1804@gmail.com

bethany.niell@moffitt.org

LEARNING OBJECTIVES

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.

RC207

Novel Anti-cancer Agents in Genitourinary Malignancies: What Your Reports Should Include

Monday, Dec. 2 8:30AM - 10:00AM Room: S102CD

GU OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Priya R. Bhosale, MD, Bellaire, TX (*Presenter*) Nothing to Disclose
Andrew D. Smith, MD, PhD, Birmingham, AL (*Presenter*) CEO, AI Metrics LLC ; Owner, AI Metrics LLC ; CEO, Radiostics LLC; Owner, Radiostics LLC; CEO, Liver Nodularity LLC ; Owner, Liver Nodularity LLC ; Research Grant, General Electric Company; Speaker, Canon Medical Systems Corporation; Speaker, AlgoMedica, Inc
Atul B. Shinagare, MD, Boston, MA (*Presenter*) Consultant, Arog Pharmaceuticals, Inc; Consultant, VirtualScopics, Inc

For information about this presentation, contact:

ashinagare@bwh.harvard.edu

LEARNING OBJECTIVES

1) Know the mechanisms of action and rationale behind use of various novel anticancer agents available to treat advanced renal, bladder, prostate and gynecologic malignancies. 2) Identify the typical and atypical patterns of tumor response with the novel anticancer agents using a combination of size-based, morphologic and immune-response criteria, and avoid common pitfalls in response assessment. 3) Detect adverse events and complications associated with the novel anticancer agents including immune-related adverse events, and understand the role of certain adverse events as imaging biomarkers.

ABSTRACT

Molecular targeted therapies, immune checkpoint inhibitors and hormonal therapies represent three classes of novel anticancer agents with distinct mechanisms of action, response patterns and toxicities. With the burgeoning use of these agents to treat advanced GU malignancies, the role of the radiologist as a key member of the treatment team has evolved. After attending this course, attendees will know how novel anticancer agents change the radiologic assessment of advanced genitourinary cancers, including their typical and atypical response patterns and common toxicities seen on imaging. This knowledge will inform the radiologists how to render appropriate reports of imaging exams and conduct an effective dialogue with the referring physicians about the management of genitourinary cancers.

RC218

Whole Body MRI for Precision Oncology in Malignant Bone Disease

Monday, Dec. 2 8:30AM - 10:00AM Room: S103AB

BQ MR MK OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Moderator*) Co-founder, Cambridge AI Health; Speakers Bureau, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Describe the limitations of current imaging modalities in evaluation of metastatic bone disease. 2) Learn the added value of whole body MRI in evaluation of metastatic bone disease in various malignancies including prostate cancer and multiple myeloma. 3) Understand the role of quantitative whole body MRI in delivering precision medicine in oncology.

Sub-Events

RC218A Imaging of Metastatic Bone Disease: Current Limitations

Participants
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the challenges associated with the diagnosis and interpretation of bone findings in patients with metastatic disease.

ABSTRACT

Conventional imaging of metastatic disease to the bone is notoriously difficult. Unlike soft tissue metastases, significant cortical disruption is required before a bone metastases is visible on CT, and bone scan demonstrates the effect of the metastases on bone, rather than the metastases themselves. MR partially overcomes these limitations, as early bone metastases can be detected. However, even after bone metastases are apparent on imaging, it is difficult to assess their evolution with regards to therapy response.

RC218B WB-MRI of Multiple Myeloma: My-RADS

Participants
Christina Messiou, MD, BMBS, London, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Christina.Messiou@icr.ac.uk

LEARNING OBJECTIVES

1) List indications for WB-MRI in multiple myeloma. 2) Describe the core and comprehensive protocols for WB-MRI in multiple myeloma. 3) Apply a systematic approach to reporting WB-MRI in multiple myeloma as outlined in MY-RADS. 4) Review the MY-RADS criteria for assessing disease phenotype, burden and response assessment with case examples.

ABSTRACT

Acknowledging the increasingly important role of WB-MRI for directing myeloma patient care, a multidisciplinary international expert panel of radiologists, medical physicists and haematologists convened to discuss the performance standards, merits and limitations of WB-MRI in myeloma. The MY-RADS imaging recommendations are designed to promote standardization and diminish variations in the acquisition, interpretation, and reporting of WB-MRI in myeloma both in the clinical setting and within clinical trials. MY-RADS comprehensive disease classification requires validation within clinical trials including assessments of reproducibility.

Active Handout:Christina Messiou

http://abstract.rsna.org/uploads/2019/18001096/Messiou Final RSNA 2019 WB MRI in multiple myeloma.pdf

RC218C WB-MRI of Metastatic Bone: MET-RADS

Participants
Anwar R. Padhani, MD,FRCR, Northwood, United Kingdom (*Presenter*) Advisory Board, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, sanofi-aventis Group; Speakers Bureau, Johnson & Johnson; Speakers Bureau, Astellas Group

For information about this presentation, contact:

anwar.padhani@stricklandscanner.org.uk

LEARNING OBJECTIVES

1) MET-RADS measurement protocols distinguishing between tumor detection (core) and response (comprehensive) assessments.

2) To highlight and review the MET-RADS response assessment criteria and their application. 3) To illustrate MET-RADS usage with case examples and to provide efficacy data on MET-RADS use in clinical practise. 4) Outline development steps for MET-RADS.

ABSTRACT

MET-RADS provides the minimum standards for whole body MRI with DWI regarding image acquisitions, interpretation, and reporting of both baseline and follow-up monitoring examinations of patients with advanced, metastatic cancers. MET-RADS is suitable for guiding patient care in practice (using the regional and overall assessment criteria), but can also be incorporated into clinical trials when accurate lesion size and ADC measurements become more important (the recording of measurements is not mandated for clinical practice). MET-RADS enables the evaluation of the benefits of continuing therapy to be assessed, when there are signs that the disease is progressing (discordant responses). MET-RAD requires validation within clinical trials initially in studies that assess the effects of known efficacious treatments. METRADS measures should be correlated to other tumor response biomarkers, quality of life measures, rates of skeletal events, radiographic progression free survival and overall survival. The latter will be needed for the introduction of WB-MRI into longer term follow-up studies, that will allow objective assessments of whether WB-MRI is effective in supporting patient care

RC218D Quantitative WB-MRI for Promoting Precision Oncology

Participants
Dow-Mu Koh, MD,FRCR, Sutton, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the quantitative parameters that can be derived from WB-MRI studies. 2) To understand the evolving role of quantitative WB-MRI for the evaluation of metastatic bone disease. 3) To appreciate the application of quantitative WB-MRI for precision oncology in assessing tumour treatment response and disease heterogeneity.

MSMI22

Molecular Imaging Symposium: Oncologic MI Applications

Monday, Dec. 2 10:30AM - 12:00PM Room: S405AB

BQ GU MR MI OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD (*Moderator*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;
Vikas Kundra, MD, PhD, Houston, TX (*Moderator*) Institutional license agreement, Introgen Therapeutics, Inc; Research Grant, General Electric Company

For information about this presentation, contact:

pchoyke@mail.nih.gov

vkundra@mdanderson.org

LEARNING OBJECTIVES

1) To understand current advances in PET molecular imaging and clinical applications. 2) To understand new applications of advanced MRI techniques. 3) To improve understanding of theranostic agents based on targeted imaging agents. 4) To improve understanding of imaging delivered gene expression.

Sub-Events

MSMI22A Hyperpolarized MRI of Cancer

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

For information about this presentation, contact:

dan.vigneron@ucsf.edu

MSMI22B Imaging of Delivered Gene Expression

Participants
Vikas Kundra, MD, PhD, Houston, TX (*Presenter*) Institutional license agreement, Introgen Therapeutics, Inc; Research Grant, General Electric Company

For information about this presentation, contact:

vkundra@mdanderson.org

LEARNING OBJECTIVES

1) To improve understanding of imaging of delivered gene expression. 2) Multiple modalities and reporter systems will be discussed.

MSMI22C PSMA Imaging in Prostate Cancer

Participants
Peter L. Choyke, MD, Rockville, MD (*Presenter*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;

For information about this presentation, contact:

pchoyke@mail.nih.gov

LEARNING OBJECTIVES

1) To understand the basic biology of PSMA and its role in prostate cancer. 2) To describe the sensitivity of PSMA PET with regard to other PET agents for prostate cancer. 3) To demonstrate potential pitfalls and unexpected findings with PSMA PET imaging.

ABSTRACT

PSMA PET imaging is a highly sensitive method of detecting prostate cancer. It can be used in the initial diagnosis and staging, for recurrence and to assess metastatic disease. PSMA is expressed in aggressive cancers but not in low grade or highly undifferentiated cancers. It is superior to all other PET agents in terms of sensitivity especially in the recurrence setting. It can be used to determine if lesions seen on CT or MRI are related to prostate cancer. Pitfalls include false negatives in highly aggressive disease, the diagnosis of additional malignancies and false positives in the cisterna chyli and fibrous dysplasia. PSMA PET will have a

profound impact on the management of prostate cancer.

MSMI22D Gastrin Releasing Peptide Receptors: When in the Course of Prostate Cancer Will They Be Useful?

Participants
Andrei Iagaru, MD, Emerald Hills, CA (*Presenter*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

LEARNING OBJECTIVES

1) List some of the radiopharmaceuticals targeting gastrin-releasing peptide receptors that are used in prostate cancer. 2) Understand underlying biology and mechanism of action for the radiopharmaceuticals targeting gastrin-releasing peptide receptors in prostate cancer. 3) Discuss patterns of prostate cancer appearance when using the radiopharmaceuticals targeting gastrin-releasing peptide receptors.

ABSTRACT

Various radiopharmaceuticals targeting different molecules have been studied in prostate cancer (PC). One recent class of tracers are the gastrin releasing peptide (GRP) analogs. Bombesin (BBN) is analog to the mammalian GRP, and it binds with high affinity to its transmembrane receptors, the GRP receptors (GRPR). Preclinical evaluation in PC cells and animal models have reported encouraging results; therefore, they are currently investigated as targets both for PC imaging and therapy. Increases in GRPR expression have been shown in 63-100% of intraprostatic PC, and 50-80% of nodal and osseous metastases. High density expression of GRPR has been reported in primary PC in contrast to surrounding healthy tissues and hyperplastic prostate, allowing for detection of early neoplastic events in the prostate with high specificity.

MSMI22E Iron Oxide Enhanced MR Imaging in GU Malignancies

Participants
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Research support, Koninklijke Philips NV; Royalties, Invivo Corporation; Investigator, NVIDIA Corporation

For information about this presentation, contact:

turkbeyi@mail.nih.gov

LEARNING OBJECTIVES

1) Understand mechanism of iron-oxide enhanced MRI. 2) Understand imaging findings of iron-oxide enhanced MRI. 3) Understand pitfalls and limitations of iron-oxide enhanced MRI.

ABSTRACT

n/a

MSRO22

BOOST: CNS-Case-based Multidisciplinary Review (Interactive Session)

Monday, Dec. 2 10:30AM - 12:00PM Room: S103AB

NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

LEARNING OBJECTIVES

1) Review latest advances in imaging for assessment of gliomas before, during, and after therapy in the context of WHO 2016 molecular/genetic classification gliomas. 2) Discuss challenges and strategies for accurate imaging characterization of gliomas following therapy in a case based format. 3) Recognize the need to incorporate molecular/genetic features and types of therapy in imaging assessment of gliomas.

Sub-Events

MSRO22A Rapid Fire Tumor Board Case Review

Participants
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Simulate a tumor board environment by presenting ten cases of patients with brain tumor and present important elements of discussion relevant to patient care in each case. 2) Discuss latest advances in brain tumor therapy including immunotherapy, convection-enhanced delivery, and molecularly targeted agents and their implications for post-therapy imaging interpretation. 3) Apply structural and advanced imaging methods to differentiate active tumor growth and treatment related changes and recognize imaging pitfalls and limitations.

MSRO22B Updates in Primary and Recurrent GBM

Participants
Roger Stupp, MD, Chicago, IL (*Presenter*) Spouse, Employee, Novartis AG; Research Consultant, Celgene Corporation; Research Consultant, AbbVie Inc; Research Consultant, Boehringer Ingelheim GmbH

For information about this presentation, contact:

roger.stupp@northwestern.edu

MSRO22C Role of Immunotherapy in GBM

Participants
Clark C. Chen, MD,PhD, Minneapolis, MN (*Presenter*) Nothing to Disclose

MSRO22D Updates in Diffuse Gliomas

Participants
Christina I. Tsien, MD, Washington, DC (*Presenter*) Advisory Board, Blue Earth Diagnostics Ltd; Advisory Board, NovoCure Ltd; Speakers Bureau, Varian, Inc; Speakers Bureau, Merck & Co, Inc

MSRO26

BOOST: Gynecologic-Anatomy and Treatment Planning (Interactive Session)

Monday, Dec. 2 10:30AM - 12:00PM Room: S103CD

GU OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Stephanie Markovina, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Author, Wolters Kluwer nv
Marcela G. del Carmen, MD, Boston , MA (*Presenter*) Nothing to Disclose
Wui-Jin Koh, MD, Plymouth Meeting, PA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

smarkovina@wustl.edu

LEARNING OBJECTIVES

1) Describe the appropriate indication and use of pre treatment imaging in the management of patients with endometrial, cervical and vulvar cancer. 2) Describe updates in the primary surgical treatment of patients with endometrial and cervical cancer. 3) Describe the appropriate use of radiation therapy in the treatment of patients with uterine, cervical and vulvar cancer.

ABSTRACT

At the conclusion of this session, attendees will be able to describe updates in the pre treatment imaging of patients with endometrial, cervical and vulvar cancer. Participants will also be able to describe updates in the surgical and radiation treatment of patients with endometrial, cervical and vulvar cancer.

Printed on: 10/29/20

RCC22

Novel Discoveries Using the NCI's Cancer Imaging Archive (TCIA) Public Data Sets

Monday, Dec. 2 10:30AM - 12:00PM Room: E353A

AI IN OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants
Justin Kirby, Rockville, MD (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain a general understanding about the scope and mission of The Cancer Imaging Archive (TCIA). 2) Obtain a detailed understanding of how to leverage several of TCIA's most popular data sets. 3) Learn about some of the major scientific discoveries which have resulted from these data.

ABSTRACT

This didactic session will highlight popular data sets and major projects utilizing TCIA with presentations from leading researchers and data contributors. Attendees will also learn about a number of new, major NIH data collection initiatives that are ongoing or coming in the near future which they can leverage in their own research.

Sub-Events

RCC22A An Introduction to the Cancer Imaging Archive

Participants
Justin Kirby, Rockville, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the scope and mission of The Cancer Imaging Archive. 2) Gain a high level understanding of TCIA services and functionality. 3) Learn about new NIH data collection initiatives that will be generating high-value research resources for the imaging community.

ABSTRACT

This session will provide a brief introduction to The Cancer Imaging Archive (TCIA) to set the stage for more detailed presentations from the remaining speakers about popular data sets stored in TCIA and the novel discoveries that have resulted from them.

RCC22B ECOG-ACRIN Clinical Trial Data Sharing

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Learn about the image and meta data sets acquired by ECOG-ACRIN collected during clinical trials. 2) Gain a general understanding about the methods and constraints in collecting and disseminating archived images and meta data sets from clinical trials. 3) Learn about the specific ECOG-ACRIN data sets transferred to TCIA.

RCC22C Imaging Proteogenomics in Ovarian Cancer

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Presenter*) Co-founder, Cambridge AI Health; Speakers Bureau, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Learn how quantitative imaging can unravel tumour heterogeneity in ovarian cancer. 2) Understand how tumour heterogeneity on imaging may relate to biological heterogeneity. 3) Discuss the added value of integrating imaging with proteogenomics in ovarian cancer for better outcome prediction.

RCC22D Crowds Cure Cancer

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Portland, OR (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd;

For information about this presentation, contact:

kalpathy@nmr.mgh.harvard.edu

LEARNING OBJECTIVES

1) Learn about the crowds cure cancer crowdsourcing activity. 2) Learn how annotations from the crowds cure cancer effort can be used to develop machine learning algorithms.

RCC22E Registration of CT and Digitalized Pathology Images in Lung Cancer

Participants
Mirabela Rusu, DPhil, MENG, Stanford, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mirabela.rusu@stanford.edu

LEARNING OBJECTIVES

1) General principles for image registration for multi-modal alignment. 2) Challenges in registering radiology and pathology images. 3) Approaches for registering multi-modal data. 4) Evaluation of registration methods. 5) Case study: Radiology Pathology fusion in pulmonary ground glass nodules.

Printed on: 10/29/20

SSC03

Chest (Radiomics - Malignancy)

Monday, Dec. 2 10:30AM - 12:00PM Room: E451A

AI CH CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Mark L. Schiebler, MD, Madison, WI (*Moderator*) Stockholder, Stemina Biomarker Discovery, Inc; Stockholder, HealthMyne, Inc;
John P. Lichtenberger III, MD, Bethesda, MD (*Moderator*) Author, Reed Elsevier

Sub-Events

SSC03-01 Impact of Interobserver Variability in Manual Segmentation of Non-Small Cell Lung Cancer (NSCLC) on Computed Tomography

Monday, Dec. 2 10:30AM - 10:40AM Room: E451A

Participants
Michelle L. Hershman, MD, Tucson, AZ (*Presenter*) Nothing to Disclose
Bardia Yousefi, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Maya Galperin-Aizenberg, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Leonid Roshkovan, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jose M. Luna Castaneda, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey C. Thompson, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael J. LaRiviere, MD, Philadelphia , PA (*Abstract Co-Author*) Nothing to Disclose
Charu Aggarwal, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Erica Carpenter, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sharyn I. Katz, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Trizell LTD
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc

For information about this presentation, contact:

sharyn.katz@pennmedicine.upenn.edu

PURPOSE

Discovery of predictive and prognostic radiomic features in cancer is currently of great interest to the radiologic community. Since there is no reliable automated means of segmenting lung cancer, tumor labeling is typically performed by imaging analysts, physician trainees and attending physicians. Here we examine the impact of level of specialty training on interobserver variability in manual segmentation of non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

A public dataset of computed tomography (CT) imaging (NSCLC-Radiomics-Genomics- LUNG3) which contains 88 patients (61 males and 28 females) with NSCLC (adenocarcinoma (n=42), squamous cell carcinoma (n=32), and other NSCLC (n=12). For each CT, tumors were labeled in 3D using ITkSnap (ver 3.6.0). Segmentation was performed by three raters with differing levels of radiologic experience: an imaging analyst (BY;no formal experience), a radiology trainee (MH;5 yrs.) and a specialty-trained thoracic radiologist (SK;18 yrs.). For each tumor segmentation, 429 radiomic features (including grey-level intensity, co-occurrence, run-length, binary patterns, and wavelet features) were extracted. Principal component analysis was further performed on the extracted features. Interoberver variability in radiologic features between the 3 raters was then examined using the senior radiologist as the ground truth (GT). The Sørensen-Dice (SD) coefficient was used to evaluate spatial agreement of segmentations and the Pearson correlation was estimated between the first principal components of the extracted features from each rater's segmentations.

RESULTS

The SD coefficient between the BY-SK(GT) and MH-SK(GT) segmentations was indicated 0.894 (STD: ±0.25) and 0.839 (STD: ±0.20), respectively, showing high agreement. The corresponding PCs were also highly correlated with Pearson's correlations of 0.88 and 0.92, respectively.

CONCLUSION

Routine interobserver variability in tumor segmentation may not result in substantial spatial disagreement of 3D tumor delineation, while subsequently extracted radiomic features are also highly correlated.

CLINICAL RELEVANCE/APPLICATION

Radiomic feature extraction may be robust to interobserver variability in tumor segmentation from lung CT data, resulting in robust prognostic and predictive biomarkers of NSCLC.

SSC03-02 Deep Learning Algorithm for Reducing CT Slice Thickness: Effect on Reproducibility of Radiomics in Lung Cancer

Monday, Dec. 2 10:40AM - 10:50AM Room: E451A

Participants
Sohee Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyu-Hwan Jung, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Hyunho Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Woong Bae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sangmin.lee.md@gmail.com

PURPOSE

To retrospectively assess the effect of CT slice thickness on the reproducibility of radiomic features (RFs) of lung cancer, and to investigate if convolutional neural network (CNN)-based super-resolution (SR) algorithms can improve the reproducibility of RFs obtained from different slice thicknesses.

METHOD AND MATERIALS

CT images from 100 pathologically proven lung cancers acquired between July 2017 and December 2017 were evaluated, including 1, 3, and 5 mm slice thicknesses. CNN-based SR algorithms using residual learning were developed to convert thick-slice images into 1 mm slices. Lung cancers were semi-automatically segmented and a total of 702 RFs (tumor intensity, texture, and wavelet features) were extracted from 1, 3, and 5 mm slices, as well as the 1 mm slices generated from the 3 and 5 mm images. The stabilities of the RFs were evaluated using concordance correlation coefficients (CCCs).

RESULTS

All CT scans were successfully converted to 1 mm slice images at a rate of 2.5 s/slice. The mean CCCs for the comparisons of original 1 vs 3 mm, 1 vs 5 mm, and 3 vs 5 mm images were 0.41, 0.27, and 0.65, respectively (all, $P<0.001$). Tumor intensity features showed the best reproducibility and wavelets the lowest. The majority of RFs failed to reach reproducibility (CCC>=0.85; 3.6%, 1.0%, and 21.5%, respectively). In terms of nodule type, GGNs had better reproducibility than solid nodules in all RF classes and in all slice-thickness pairings ($P < 0.001$ for 1 vs 3 mm and 1 vs 5 mm, and $P = 0.002$ for 3 vs 5 mm). After applying CNN-based SR algorithms, the reproducibility significantly improved in all three pairings (mean CCCs: 0.58, 0.45, and 0.72; all, $P<0.001$). This improvement was also observed in the subgroupings based on the classes of RFs and nodule types. The reproducible RFs also increased (36.3%, 17.4%, and 36.9%, respectively).

CONCLUSION

The reproducibility of RFs in lung cancer is significantly influenced by CT slice thickness, which can be improved by the CNN-based SR algorithms.

CLINICAL RELEVANCE/APPLICATION

On the basis of the findings of our study, the comparisons of radiomics results derived from CT images with different slice thicknesses may be unreliable. As our convolutional neural network-based image conversion algorithm is easily applicable and reliable, this algorithm may be used for enhancing reproducibility of radiomic features when the CT slice-thicknesses are different.

SSC03-03 Correlation-Incorporated Hierarchical Clustering of High-Dimensional Radiomic Features for Prognostic Phenotype Identification of EGFR-Mutated Non-Small Cell Lung Cancer

Monday, Dec. 2 10:50AM - 11:00AM Room: E451A

Participants
Bardia Yousefi, Philadelphia, PA (*Presenter*) Nothing to Disclose
Nariman Jahani, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael J. LaRiviere, MD, Philadelphia , PA (*Abstract Co-Author*) Nothing to Disclose
Jose M. Luna Castaneda, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey C. Thompson, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charu Aggarwal, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Erica Carpenter, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sharyn I. Katz, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Trizell LTD
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc

For information about this presentation, contact:

Bardia.Yousefi@uphs.upenn.edu

PURPOSE

We propose a correlation-incorporated unsupervised hierarchical clustering algorithm and evaluate it in identifying computed tomography (CT) radiomic phenotypes of EGFR-mutated non-small cell lung cancer (NSCLC) in association with patient overall survival.

METHOD AND MATERIALS

The NSCLC-*radiogenomic* dataset publicly available from the National Cancer Institute's Cancer Imaging Archive (TCIA) was analyzed, including 204 patients (age range: 69 [±11], male/female: 132/72, event: death [41], adenocarcinoma/squamous cell carcinoma/unspecified: 166/34/4, EGFR mutation status: wild-type/mutant/unknown: 125/42/37). Tumor regions were verified by an experienced radiologist and segmented in 3D using the *ITKSnap* semi-automated toolkit. A total of 429 radiomic features were extracted (grey-level intensity, co-occurrence, run-length, binary patterns, and wavelets) using the *pyRadiomics* toolkit. An unsupervised method was applied based on a correlation-incorporated hierarchical clustering algorithm (CHCA) to determine the truncation distance in the resulting dendrogram and assign features to robust cluster groups. Low-rank dimensionality reduction

was further performed by principal component analysis (PCA) to estimate the first principal component (PC) of each feature cluster and create a radiomic signature for each tumor. Differences between radiomic signature scores and EGFR mutation status was evaluated using Student's t-test. Survival probabilities across the extracted PCs were evaluated using Kaplan-Meier curves, and a Cox proportional hazards (CPH) model was fitted based on the estimated PCs.

RESULTS

Using CHCA, dimensionality was reduced from 429 to 67 PCs for a dendrogram truncation distance of 0.1. Three significant radiomic phenotypes were identified, which were associated with EGFR mutation status (p-value < 0.05). The best multivariable CPH model had a C-statistic of 0.71 based on the 67 PCs. Combining radiomic signatures with all available clinical covariates (age, sex, histology, EGFR mutation) yielded a C-statistic of 0.78.

CONCLUSION

CHCA effectively reduces the high dimensionality of radiomic features while allowing for robust identification of CT-based phenotypes of EGFR-mutated NSCLC that are associated with patient survival.

CLINICAL RELEVANCE/APPLICATION

Radiomic phenotypes of EGFR-mutated NSCLC, efficiently extracted by CHCA, could aid in identifying NSCLC patients likely to benefit from targeted EGFR inhibitor therapy.

SSC03-04 Radiomics-Based Prognostic Nomogram for the Prediction of Progression-Free Survival in Stage IV Non-Small Cell Lung Cancer Treated with Platinum-Based Chemotherapy

Monday, Dec. 2 11:00AM - 11:10AM Room: E451A

Participants
Lan He, Guangzhou, China (*Presenter*) Nothing to Disclose
Zaiyi Liu, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

helan0811@126.com

PURPOSE

We aimed to establish an effective radiomics-based prognostic nomogram for the prediction of progress-free survival (PFS) in stage IV non-small cell lung cancer (NSCLC) treated with platinum-based chemotherapy.

METHOD AND MATERIALS

A total of 308 stage IV NSCLC patients without an EGFR-sensitizing mutation or ALK gene rearrangement were enrolled and divided into a discovery cohort (n=159) and a validation cohort (n=149). All patients had received at least 2 cycles of platinum-based chemotherapy as first-line treatment. 1182 radiomics features were extracted from pre-treatment CT images of each patient. Then, radiomics signature was constructed using LASSO Cox regression analysis based on discovery cohort, and was validated in validation cohort. Furthermore, an individualized prognostic nomogram incorporating the radiomics signature and clinicopathologic risk factors was proposed.

RESULTS

The established signature consisted of 14 features showed good discrimination for classify patients with high-risk and low-risk progression treated by platinum-based chemotherapy. On the multivariable Cox regression, independent factors for PFS were radiomics signature, PS, and N stage, which were all selected into the nomogram. The calibration curve for probability of PFS showed good satisfactory. The C-index of the nomogram for predicting PFS was 0.721(95%CI:0.713-0.729), which was statistically higher than clinicopathologic-based model (C-index: 0.641, 95%CI:0.631-0.651). Decision curve analysis revealed that the nomogram significantly outperformed the clinicopathologic-based model in terms of clinical usefulness.

CONCLUSION

This study establishes a radiomics-based prognostic nomogram that can be conveniently used to achieve individualized prediction of PFS probability for stage IV NSCLC patients treated with platinum-based chemotherapy, which holds promise of guiding the personalized pre-therapy of stage IV NSCLC.

CLINICAL RELEVANCE/APPLICATION

The developed radiomics-based prognostic nomogram could be conveniently used to achieve individualized prediction of PFS probability for stage IV NSCLC patients treated with platinum-based chemotherapy.

SSC03-05 A Primary Study of Predicting Spread through Air Space in Lung Adenocarcinoma Using a CT-Base Radiomics Model

Monday, Dec. 2 11:10AM - 11:20AM Room: E451A

Participants
Jingshan Gong, MD, Shenzhen, China (*Presenter*) Nothing to Disclose
Changsi Jiang, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose
Yan Luo, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose
Dongdong Mei, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose
Mingxiang Wu, MD, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose
Guijing Jia, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose
Rennan Ling, Shenzhen, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jshgong@sina.com

PURPOSE

Spread through air space (STAS), a novel invasive pattern of lung adenocarcinoma, is a risk factor for recurrence and worse prognosis of patients with early stage adenocarcinoma who underwent limited resection. Therefore, preoperative prediction of STAS in lung adenocarcinoma can facilitate surgeons' treatment decision making. The aim of this study is to develop and validate a CT-based radiomics model for preoperative prediction of STAS in lung adenocarcinoma.

METHOD AND MATERIALS

This retrospective study was approved by institutional review board and included 437 patients with pathological confirmed lung adenocarcinoma, which consisted of 186 males and 251 females with a mean age of 58.2 years. Two experienced radiologists retrospectively reviewed the tissue sample slices in consensus to determine whether there was STAS in lung adenocarcinomas. Two experienced radiologists segmented and extracted radiomics features on preoperative thin-slice CT images using the 3D Slicer with Pyradiomics extention (www.slicer.org) independently. Intra-class correlation coefficients (ICC) and Pearson's correlation were used to roll out those low reliability (ICC<0.76) and redundant (r>0.9) features. Univariate logistic regression was used to select radiomics features and clinical metrics which were associated with STAS. Multivariate logistic regression analysis was used to develop a predictive model. The diagnostic performance of the model was measured by area under curve (AUC) of recerver operating characteristic (ROC) and calibrated with five-fold cross-validation.

RESULTS

STAS was identified by the pathologists in 85 patients (19.5%). At univariate analysis, 26 radiomics features and age were found to be associated with STAS. Multivariate logistic regression showed that age and one radiomics feature (Skewness) were independent predictors for STAS. The CT-base radiomics model achieved a AUC of 0.81 with a sensitivity of 0.737 and a specificity of 0.838 for predicting SATS (Figure. 1).

CONCLUSION

CT-base radiomics model can preoperatively predict STAS in lung adenocarcinoma with high diagnosis performance, which provide guides for patients therapeutic decision making.

CLINICAL RELEVANCE/APPLICATION

The result of present study showed CT-based radiomics model could preoperatively predict STAS in lung adenocarcinomas with high diagnosis performance which could facilitate surgeons' operation decision making.

SSC03-06 Can DECT Quantitative and Radiomics Features Differentiate Benign and Malignant Lymphadenopathy?

Monday, Dec. 2 11:20AM - 11:30AM Room: E451A

Participants
Riddhi M. Borse, MD, Boston, MA (*Presenter*) Nothing to Disclose
Fatemeh Homayounieh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ruhani Doda Khera, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Chayanin Nitiwarangkul, MD, Bangkok, Thailand (*Abstract Co-Author*) Nothing to Disclose
Felix Lades, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Andrew Primak, PhD, Cleveland, OH (*Abstract Co-Author*) Employee, Siemens AG
Ramandeep Singh, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Clinical Bay; Researcher, Zai Lab
Mannudeep K. Kalra, MD, Lexington, MA (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Riverain Technologies, LLC;

For information about this presentation, contact:

borseriddhi@gmail.com

PURPOSE

Dual Energy CT tumor analysis prototype (DE-TA, eXamine, Siemens) was developed to evaluate DECT quantitative and DECT radiomics features. We assessed the accuracy of these features for differentiating benign and malignant lymph nodes on DECT of the chest and abdomen using histology as reference.

METHOD AND MATERIALS

With IRB approval, we identified 80 adult patients (mean age 62 ± 15 years; 42 men, 38 women) from our Radiology Information System who had lymph nodes > 1 cm in short axis and had a tissue biopsy of the lymph nodes. All patients had contrast enhanced, dual-source DECT (SOMATOM Flash or Force, Siemens) of the chest (n = 70) and abdomen (n= 10). DECT images were de-identified and exported to the DE-TA. Lymph nodes were identified and delineated and segmented into 4 inner peels and 4 outer rims. For each segment, DECT quantitative metrics and 585 radiomics features (including first and higher order statistics) were derived. Logistic regression, receiver operating characteristics and random forest classification were performed.

RESULTS

We observed a significantly higher volume, RECIST diameter and WHO area for the malignant nodes (13.9± 12.5 ml, 25.3± 9.4 mm, 500.9± 469.0 mm2) as compared to the benign nodes (mean values-2.3± 3.0, 18.8± 6.3 mm, 271.7+/-177.0 mm2) (p< 0.02). Malignant nodes had a greater iodine uptake and concentration as compared to the benign nodes (AUC 0.83 ; p=0.001). A total of 1643 radiomics parameters were significantly different between benign and malignant nodes (AUC=0.87 ; p=0.00008-0.04). Rim 3 (the peel before the outermost segment) showed the largest number of statistically significant radiomics parameters for differentiating benign and malignant lesions (p<0.02). Random forest classification revealed an AUC of 0.85 (p = 0.002) for differentiating benign and malignant lymph nodes.

CONCLUSION

Dual-energy quantitative and radiomics features enable accurate differentiation of benign and malignant lymph nodes on contrast-enhanced chest and abdomen CT.

CLINICAL RELEVANCE/APPLICATION

DECT quantitative and radiomics features can help in accurate lymph nodal staging for neoplastic diseases of chest and abdomen.

SSC03-07 Development of Predictive Models for Lymph Node Metastasis in Pre-Surgical Stage IA Patients with Non-Small Cell Lung Cancer

Monday, Dec. 2 11:30AM - 11:40AM Room: E451A

Participants
Mengdi Cong, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Gaofeng Shi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Feng Li, MD,PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jia-Liang Ren, MD, Beijing, China (*Presenter*) Nothing to Disclose
Haoyue Yao, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and validate predictive models by use of clinical/CT findings, radiomics features and combination of the both for lymph node metastasis (LNM) in pre-surgical stage IA patients with a non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

This retrospective study included 649 pre-surgical stage IA patients with NSCLC from September 2017 to January 2019 in our hospital. All patients had a thin-section venous CT scan before surgery. There were 138 (21%) of the 649 patients who had LNM after surgery. A training group included 455 patients (97 with and 358 without LNM) and a test group included 194 patients (41 and 153, respectively). Clinical/CT features (such as age, gender, smoking status, size, vacuole sign, marginal spiculation, marginal lobulation, and pleural indentation) were identified by a study radiologist, selected by Mann-Whitney U test and $\chi 2$ test, and used to develop a clinical model. A total of 396 radiomics features were extracted from venous CT scans. Mann-Whitney U test and univariate analysis of variance were used for radiomics feature dimension reduction. The least absolute shrinkage and selection operator (LASSO) algorithm was used for radiomics feature selection. Three models (a clinical model, a radiomics model, and a combined model) were developed to predict LNM in the early-stage NSCLC. The receiver operating characteristic (ROC) curve was used to evaluate the performance in LNM classification by use of the three models.

RESULTS

The area under the curve (AUC) value of radiomics model based on seven best features in predicting LNM was 0.898 (95% CI, 0.890-0.906) in the training group, compared with 0.851 in the test group. The AUC values of the clinical model (main based on size and spiculation) were 0.739 (95% CI, 0.725-0.753) and 0.614, respectively, in the training and test group. The AUC values of the radiomic-clinical model were 0.911 (95% CI, 0.904-0.918) and 0.860, respectively, in the two groups.

CONCLUSION

A radiomics-clinical model in venous CT was superior for predicting LNM in pre-surgical Stage IA patients with NSCLC than that models developed by radiomics and clinical features only.

CLINICAL RELEVANCE/APPLICATION

Approximately 20% of pre-surgical Stage IA patients with NSCLC may have LNM; a radiomics-clinical model has the potential to predict the LNM and may help to improve treatment plans.

SSC03-08 CT-Derived Prognostic Radiomics Phenotype of Tumor Habitat is Closely Associated with Interaction of Tumor Infiltrating Lymphocytes (TILs) and Cancer Nuclei on H&E Tissue as Well as PD-L1 Expression in NSCLC

Monday, Dec. 2 11:40AM - 11:50AM Room: E451A

Participants
Pranjal Vaidya, Cleveland , OH (*Presenter*) Nothing to Disclose
Kaustav Bera, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Xiangxue Wang, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
German Corredor, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Braman, Cleveland, OH (*Abstract Co-Author*) Intern, IBM Corporation
Amit Gupta, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Vamsidhar Velcheti, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, Elucid Bioimaging Inc; Stockholder, Inspirata Inc; Consultant, Inspirata Inc; Scientific Advisory Board, Inspirata Inc; Scientific Advisory Board, AstraZeneca PLC; Scientific Advisory Board, Merck & Co, Inc; Researcher, Koninklijke Philips NV; Researcher, Inspirata Inc; License agreement, Elucid Bioimaging Inc; License agreement, Inspirata Inc; Grant, PathCore Inc; Grant, Inspirata Inc

For information about this presentation, contact:

pvv3@case.edu

PURPOSE

While radiomic analysis of lung nodules to predict outcome has been increasingly prevalent, the underlying tumor morphology that these features highlight is often not understood or explored. In this multi-modality analysis, we discovered unique radiomic-histologic-molecular phenotypes for early-stage non-small cell lung cancer(ES-NSCLC) patients which could successfully stratify patients based on their disease-free survival(DFS).

METHOD AND MATERIALS

After retrospective chart review, we trained a radiomic model to predict recurrence for 316 ES-NSCLC pts. using 124 radiomic textural features from the Gabor, Laws, Laplace, Haralick, and Collage feature families extracted from a 0-3 mm annular ring immediately adjacent to the nodule-Peritumoral(PT) features. The radiomics model had an AUC=0.74($p<0.01$) in predicting recurrence. Among 70 pts in this cohort, we had available tissue derived PD-L1 expression as well as H&E stained Whole slide images (WSIs). In order to build the radiomic-histologic-molecular phenotype of the tumor habitat, we also extracted 242 Quantitative Histomorphometric (QH) features related to the nuclear shape, texture, orientation, spatial architecture of TILs and features quantifying TI-cancer nuclei interaction. Unsupervised clustering of the top 20 most discriminative features from 0-3mm outside the tumor was done, and correlations of the clusters were calculated for QH and PDL-1 expression.

RESULTS

We obtained two significant clusters corresponding to high-risk and low-risk patients based on their risk of recurrence. The two clusters had significant disease-free survival(DFS) differences based on Kaplan-Meier analysis($p<0.05$). The two clusters were also correlated with nuclear morphology features($p<0.05$) and spatial architecture of TIL patterns ($p<0.05$) as well as PD-L1 expression($p<0.001$). We found that the high-risk cluster had increased PD-L1 expression and increased intensity of the QH features

CONCLUSION

We built a radio-histo-molecular phenotype of the tumor habitat stratified according to the risk of recurrence in ES-NSCLC. We found that radiomic tumor habitat features were strongly correlated with TIL-cancer nuclei interaction and PD-L1 expression.

CLINICAL RELEVANCE/APPLICATION

The prognostic usefulness of radiomics of the tumor habitat can be complemented by understanding the underlying morphology in the tissue patterns which lead to the expression of these features, which we have shown in this work.

SSC03-09 CT-Based Analysis Using Radiomics for Predicting Pathological Response after Preoperative Chemotherapy in Patients with Locally Advanced Esophageal Cancer

Monday, Dec. 2 11:50AM - 12:00PM Room: E451A

Participants
Shioto Oda, MD, Kashiwa, Japan (*Presenter*) Nothing to Disclose
Hirofumi Kuno, MD, PhD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Hiyama, MD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsushi Kobayashi, MD, Kashiwa, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

alpenglow00@gmail.com

PURPOSE

To investigate the application of radiomics in a group of patients with locally advanced esophageal cancer (LAEC) and distinguish those who will respond to preoperative chemotherapy from those who will not, using histopathologic results as the reference standard.

METHOD AND MATERIALS

For this retrospective study, a radiomics model was developed based on a primary cohort of 133 patients with LAEC, who underwent contrast-enhanced CT from October 2013 to November 2018, followed by preoperative chemotherapy. All patients underwent surgery after chemotherapy and were divided into two groups based on the pathological evaluation of surgically resected specimens; a poor response group (Grade 0/1) and a good response group (Grade 2/3). A total of 1409 quantitative imaging features were extracted from the CT images using Radcloud platform. We used variance threshold, SelectKBest and LASSO algorithm methods to gradually select the most optimal features and reduce their dimensionality. Six machine learning algorithms (KNN, SVM, XGBoost, RF, LR, DT) were adopted to establish a radiomics nomogram. The predictive performances of the radiomics signature were evaluated by ROC curve analysis in both cohorts: training (n=99 VOIs) and validation (n=41 VOIs).

RESULTS

Out of 1409 features, 6 optimal ones were selected using the LASSO method. The area under the ROC curve (AUC) of the XGBoost model used for predicting the good response in a group was 0.893 (95% CI; 0.79 - 0.99) in the training cohort and 0.761 (95% CI; 0.65 - 0.87) in the validation cohort.

CONCLUSION

A radiomics model derived from CT imaging could be potentially useful for predicting the effect of preoperative chemotherapy in patients with LAEC.

CLINICAL RELEVANCE/APPLICATION

CT-based radiomics features could provide additional quantitative information on disease progression and may help to improve clinical decision making for the preoperative management of LAEC patients.

SSC06

Gastrointestinal (Advanced Response Evaluation)

Monday, Dec. 2 10:30AM - 12:00PM Room: N230B

BQ GI OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Daniele Marin, MD, Durham, NC (*Moderator*) Research support, General Electric Company
Priya R. Bhosale, MD, Bellaire, TX (*Moderator*) Nothing to Disclose
Nelly Tan, MD, Phoenix, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SSC06-01 Immunotherapy Response Evaluation with Magnetic Resonance Elastography (MRE) in Advanced HCC

Monday, Dec. 2 10:30AM - 10:40AM Room: N230B

Participants
Aliya Qayyum, MD,MBBS, Houston, TX (*Presenter*) Nothing to Disclose
Rony Avritscher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ajaykumar C. Morani, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rizwan Aslam, MBBCh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jia Sun, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Roberto Carmagnani, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ken-Pin Hwang, PHD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Manal Hassan, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Asif Rashid, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jingfei Ma, PhD, Houston, TX (*Abstract Co-Author*) Royalties, Siemens AG; Royalties, General Electric Company; Consultant, C4 Imaging
Richard L. Ehman, MD, Rochester, MN (*Abstract Co-Author*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;
Ahmed Kaseb, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

AQayyum@mdanderson.org

PURPOSE

To determine whether stiffness change on magnetic resonance elastography (MRE) can detect immunotherapy response in advanced HCC.

METHOD AND MATERIALS

This was a prospective study of 15 patients with advanced HCC who were treated with anti-PD-1 therapy, (Pembrolizumab). All patients had a standard of care liver MRI with MRE, and liver biopsy at baseline and after 6 weeks of therapy. HCC stiffness was measured on MRE elastograms. Increase in HCC stiffness was compared with a decrease in HCC ADC, size and enhancement on MRI. Change in HCC stiffness was compared with the time to disease progression, overall survival, and the total number of intratumoral T lymphocytes (CD3+ positive by immunohistochemistry) on targeted liver biopsy. Analysis was performed using descriptive statistics and Spearman correlation (R); p-value <0.05 was considered statistically significant.

RESULTS

Nine evaluable patients (6 men; 3 women) were analyzed. Median age was 71 years (range, 54-78). Etiology of liver disease was HCV (n=4), HBV (n=1) and NASH (n=4). HCC was well-differentiated in 2 of 9 patients, moderately differentiated in 6 and poorly differentiated in 1. Average HCC size was 4 cm (range, 1.5 - 8.5), and change in size at 6 weeks was -0.32 (range, - 2.2 - 0.4). Median time to progression (TTP) was 13 weeks (range, 9-48) and overall survival (OS) was 44 weeks (range, 16-70). Average baseline HCC stiffness and change in HCC stiffness were 5.0 kPa (range, 2.4 -9.1) and 0.12 kPa (range, [-2.1] - 2.8), respectively. Increase in HCC stiffness on MRE correlated significantly with a decrease in ADC (p=0), but there was no correlation with change in HCC size (p=0.5) or enhancement (p=1). HCC stiffness correlated significantly with intratumoral T lymphocytes on biopsy (R = 0.79, p = 0.007). Change in HCC stiffness at 6 weeks correlated significantly with TTP (R = 0.88 and OS (R = 0.81), p <0.01. Baseline non-tumor liver stiffness and HCC size tended toward inverse correlation with overall survival (p < 0.055).

CONCLUSION

Increased HCC stiffness on MRE was associated with longer time to disease progression and survival in advanced HCC and may be useful as a biomarker of early immunotherapy response.

CLINICAL RELEVANCE/APPLICATION

Development of noninvasive functional MRI biomarkers of early immunotherapy response would improve therapeutic management in advanced hepatocellular carcinoma.

SSC06-02 Role of Tumor Morphology and ADC Change in Defining the Need for Additional TACE after Initial

Treatment in Patients with Unresectable HCC

Monday, Dec. 2 10:40AM - 10:50AM Room: N230B

Participants
Mohammadreza Shaghaghi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Mounes Aliyari Ghasabeh, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Ameli, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Pegah Khoshpouri, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Ghadimi, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Roya Rezvani Habibabadi, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Bita Hazhirkarzar, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Pallavi Pandey, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ankur Pandey, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG

For information about this presentation, contact:

mshagha1@jhmi.edu

PURPOSE

To evaluate the survival benefit of sequential transarterial chemoembolization in different subgroups of patients with unresected hepatocellular carcinoma

METHOD AND MATERIALS

For this IRB approved, HIPPA compliant retrospective cohort study, our institutional database was searched for patients with hepatocellular carcinoma diagnosed during 2005-2016. Patients who had MR imaging, received transarterial chemoembolization (TACE), and did not undergo liver resection or transplantation were included. Data on baseline liver function, number of TACE, and survival status was retrieved from our clinical database. Lesions were categorized to well-defined or ill-defined for subgroup analysis. Baseline tumor volume and volumetric apparent diffusion coefficient (ADC) of tumors at baseline and after first TACE were measured. After adjustment for demographics, baseline liver function, and tumor volume, the correlation between number of TACE and OS was tested using multiple Cox regression in different subgroups of patients.

RESULTS

A total of 159 patients met the inclusion criteria. 52 patients had well-defined and 107 patients had ill-defined HCC tumors. The median number of TACE sessions was comparable between groups (p=0.35). Tumor volume was larger in patients with ill-defined lesions, as compared to well-defined lesions (p=0.001). The median OS was 340 days for all patients, 663 days for those with well-defined lesions, and 257 days for those with ill-defined lesions (HR=1.64, p<0.001). After adjusting for confounders including the tumor size, Cox model showed that patients with ill-defined lesions take survival benefit from an increase in number of TACE sessions (HR=0.86, p=0.020). Higher number of TACE did not improve OS in patients with well-defined lesions (HR=0.91, p=0.173). In patients with well-defined tumors, a cutoff value of >=25% increase in ADC after first TACE was shown to predict better OS (p= 0.023). When categorizing these patients based on this cutoff value, a higher number of TACE did not show any survival benefit (HR=1.12, p=0.422) in patients with >=25% ADC increase (responders). In patients with <25% ADC increase (non-responder to first TACE), an increase in the number of subsequent TACE sessions was shown to significantly improve patients' OS (HR=0.73, p=0.031).

CONCLUSION

Survival benefit of sequential TACE is different for ill- vs well-defined HCC. This benefit is limited in lesions that respond well to first treatment by >=25% increase in ADC. Patients with ill-defined or non-responding well-defined lesions would benefit from additional TACE.

CLINICAL RELEVANCE/APPLICATION

Patients with ill-defined HCC or well-defined lesions with <25% ADC-increase after first TACE will benefit from additional TACE. This benefit is limited in those with adequate response to first TACE.

SSC06-03 Early Survival Prediction Using 3D Quantitative Tumor Response Analysis on MRI in Patients with Advanced Stage Hepatocellular Carcinoma Undergoing Systemic Therapy with Sorafenib

Monday, Dec. 2 10:50AM - 11:00AM Room: N230B

Participants
Luzie A. Doemel, New Haven, CT (*Presenter*) Nothing to Disclose
Julius Chapiro, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Research Grant, Boston Scientific Corporation;
Fabian Laage-Gaupp, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Lynn J. Savic, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ahmet S. Kuecuekkaya, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Alexandra Petukhova, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Bing Liu, MD,PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jonathan Tefera, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming de Lin, PhD, North Haven , CT (*Abstract Co-Author*) Employee, Visage Imaging, Inc; Former Employee, Koninklijke Philips NV
Todd Schlachter, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Guerbet SA
Mario Strazzabosco, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Timil Patel, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Stacey M. Stein, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

julius.chapiro@yale.edu

PURPOSE

To compare uni- (1D) and three-dimensional (3D) quantitative tumor response criteria on multi-parametric magnetic resonance imaging (mpMRI) in patients with hepatocellular carcinoma (HCC) that underwent systemic therapy with sorafenib and to evaluate their ability to predict overall survival (OS) outcomes.

METHOD AND MATERIALS

This IRB-approved retrospective, single-institution analysis included twenty-three patients with advanced stage HCC who received sorafenib for at least 60 days. All patients underwent baseline (BL) and Follow-Up (FU) MRI 19-140 days after initiation of therapy (median 65 days, standard deviation ±33.58). Response to sorafenib was assessed in 37 target lesions using 1D criteria such as Response Evaluation Criteria in Solid Tumors (RECIST) and modified RECIST (mRECIST). In addition, a segmentation-based 3D quantification of enhancing lesion volume (volumetric quantitative European Association for the Study of the Liver, vqEASL) was performed on arterial-phase MRI, and the enhancement fraction of total tumor volume (percentage-based qEASL, pqEASL) was calculated. Accordingly, patients were stratified into groups of Disease Control (DC, which included Complete Response, Partial Response, and Stable Disease) and Disease Progression (DP, included Progressive Disease). Overall survival was evaluated using Kaplan-Meier curves with log-rank test.

RESULTS

The survival analysis showed that stratification of patients in DC vs. DP according to vqEASL was successfully predicted (DC n=22, DP n=15) and stratified overall survival (median OS of 15.4 months for DC, 10.7 months for DP; p=0.01, see Figure 1). Stratification according to RECIST (DC n=20, DP n=17), mRECIST (DC n=27, DP n=10) and pqEASL (DC n=36, DP n=1) did not correlate with OS (p=0.2416, p=0.6945 and p=0.8055, respectively).

CONCLUSION

The study identified vqEASL as an accurate predictor of overall survival early after initiation of sorafenib treatment. This data provides early evidence for potential advantages of 3D quantitative tumor response analysis over conventional techniques regarding early identification of response to or failure of sorafenib.

CLINICAL RELEVANCE/APPLICATION

The use of 3D quantitative vqEASL may optimize clinical decision making and provide more personalized therapeutic algorithms in patients undergoing systemic therapy of advanced stage HCC.

SSC06-04 Multi-Parametric DECT Assessment of Therapeutic Response to Neo-Adjuvant Chemoradiation in Pancreatic Cancer Patients to Determine Surgical Resectability

Monday, Dec. 2 11:00AM - 11:10AM Room: N230B

Participants
Avinash R. Kambadakone, MD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Research Grant, Koninklijke Philips NV
Vinit Baliyan, MBBS, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hamed Kordbacheh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Theodore S. Hong, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Carlos Fernandez-Del Castillo, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant Sahani, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Medical Advisory Board, Allena Pharmaceuticals, Inc

For information about this presentation, contact:

AKAMBADAKONE@mgh.harvard.edu

PURPOSE

To study if iodine quantification and CTTA can detect histologic response in pancreatic cancer following neoadjuvant chemoradiation

METHOD AND MATERIALS

This IRB approved study prospectively included patients with borderline resectable or locally advanced pancreatic ductal adenocarcinoma (PDAC) undergoing neo-adjuvant chemoradiation (NACT/RT) prior to surgical resection. Patients underwent multiphase abdominal dual energy (DECT) at baseline and a presurgical DECT within 2 weeks of completion of NACT/RT. Based on post-surgical pathology the patients were divided into good histologic response and poor histologic response. The tumor morphology (RECIST 1.1), Iodine quantification and CT texture analysis (CTTA) were compared between these two groups using student t-test and Mann Whitney U test. Multiple regression was used to identify the strongest independent predictor of histological response.

RESULTS

Final patient cohort included 25 patients of which 13 had good histologic response and 12 had poor histologic response. Morphological response by RECIST 1.1 was associated with good histologic response (5/13 vs 0/12 respectively, p=0.039). CTTA parameters were significantly different between the good and poor histologic response groups at baseline, but more frequently after NACT/RT (Figure). On multivariate analysis, CTTA was a strong (rpartial=0.68; p=0.007) and independent predictor of histological response after NACT/RT. There was no significant difference in the quantitative iodine values at baseline, early treatment and after completion of chemoradiation both in the arterial/pancreatic phase and portal venous phase.

CONCLUSION

CT texture analysis performed on post processed DECT images is a strong marker for assessing and predicting histologic response after neoadjuvant chemoradiation in pancreatic and outperforms morphologic features of tumor size and vascular involvement.

CLINICAL RELEVANCE/APPLICATION

The detection of post NACT/RT treatment effects in PDAC is very challenging and can not be reliably assessed on conventional imaging. This study shows that CTTA can reliably predict and assess the histologic response.

SSC06-05 Yttrium-90 Radioembolization for Hepatocellular Carcinoma: Outcome Prediction with MRI Derived Fat-Free Muscle Area

Monday, Dec. 2 11:10AM - 11:20AM Room: N230B

Participants
Anton Faron, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
Martin A. Sprinkart, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Nowak, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claus C. Pieper, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Rolf Fimmers, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Block, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Carsten Meyer, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Anton.Faron@ukbonn.de

PURPOSE

Sarcopenia is associated with adverse outcomes in gastrointestinal malignancies and liver cirrhosis. We aimed at investigating the utility of magnetic resonance imaging (MRI) derived fat-free muscle area (FFMA) to predict clinical outcome in patients receiving yttrium-90 radioembolization (RE) for treatment of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

Consecutive patients with unresectable HCC and pre-interventional liver MRI undergoing salvage RE between December 2007 and October 2014 were retrospectively evaluated. Using axial T2-weighted turbo spin echo sequences, FFMA was calculated by subtraction of the intramuscular adipose tissue area from the total cross-sectional area of paraspinal skeletal muscles at the superior mesenteric artery level. FFMA values lower than 3582 mm2 in male and 2301 mm2 in female patients were defined as low FFMA. Main outcomes were progression-free survival (PFS) and overall survival (OS). For outcome analysis, the Kaplan-Meier method with log rank test and multivariate cox regression analysis were used.

RESULTS

Fifty-eight patients (13 female, mean age 68+-12 years) were included. Mean time from pre-interventional MRI to RE was 27 ± 20 days. Median OS and PFS after RE were 250 (range: 21-1230 days) and 156 days (range: 21-674 days), respectively. Patients with low FFMA showed significantly reduced OS (197 vs. 294 days, P=0.024) and tended to have shortened PFS (109 vs. 185 days, P=0.068). Low FFMA (HR 2.675; P=0.011), estimated liver tumor burden (HR 4.058; P=0.001), and Eastern Cooperative Oncology Group (ECOG) performance status (1.763; P=0.009) were independent predictors of OS on multivariate analysis.

CONCLUSION

FFMA might represent a promising new biomarker for survival prognosis in patients undergoing RE for treatment of unresectable HCC.

CLINICAL RELEVANCE/APPLICATION

In this study, we offer an easy applicable MRI-based measurement of lean muscle mass as a measure of sarcopenia which is capable to predict outcome in patients receiving RE for treatment of unresectable HCC.

SSC06-06 Early Tumor Viability Prediction Following Y90 Radioembolization Segmentectomy for Hepatocellular Carcinoma Using Automated 3D Tumor Sub-Volume Segmentation and Texture Analysis

Monday, Dec. 2 11:20AM - 11:30AM Room: N230B

Participants
Brett Marinelli, MD,MS, New York, NY (*Presenter*) Speaker, Siemens AG; Research Consultant, Cibiem Inc
Daniel Stocker, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Dudley Charles, New York , NY (*Abstract Co-Author*) Nothing to Disclose
Sara D. Pasik, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Young Joon Kwon, BS, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Rahul S. Patel, MD, New York, NY (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd Research Consultant, Medtronic plc Consultant, Penumbra, Inc Consultant, Terumo Corporation
Aaron M. Fischman, MD, New York, NY (*Abstract Co-Author*) Advisory Board, Terumo Corporation Consultant, Terumo Corporation Advisory Board, Embolx, Inc Consultant, Embolx, Inc Speakers Bureau, Boston Scientfic Corporation Speakers Bureau, BTG International Ltd Royalties, Merit Medical Systems, Inc Investor, Adient Medical Inc
Vivian L. Bishay, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mona B. Ranade, MD, Brookfield, WI (*Abstract Co-Author*) Nothing to Disclose
Scott Nowakowski, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Robert A. Lookstein, MD, New York, NY (*Abstract Co-Author*) Consultant, Boston Scientific Corporation Consultant, Medtronic plc
Bachir Taouli, MD, New York, NY (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Regeneron Pharmaceuticals, Inc; Consultant, Alexion Pharmaceuticals, Inc; Consultant, Bayer AG; ;
Edward Kim, MD, New York, NY (*Abstract Co-Author*) Consultant, Koninklijke Philips NV Advisory Board, Onyx Pharmaceuticals, Inc Advisory Board, Sterigenics International LLC

For information about this presentation, contact:

brett.marinelli@mountsinai.org

PURPOSE

Tumor viability (TV) after radioembolization segmentectomy (RS) is often not definitive on follow-up MRI until several months later.

Given an array of available treatment options for early and advanced HCC, sooner determination of RS efficacy is needed to facilitate optimal disease management.

METHOD AND MATERIALS

83 patients with initial RS 1/1/14 - 12/31/17 were retrospectively reviewed. Patients with prior TACE, TARE, systemic therapy or target lesion (TL) retreatment after first follow-up (FU1) and before second follow-up (FU2) were excluded. All FU MRIs were assessed using mRECIST criteria. Tumor viability (TV) was defined as PR, SD or PD. Using Slicer's GrowCut tool duplicate tumor and normal parenchymal segmentations were made on T1 arterial phase (T1 AP) and ADC on pre-RS and FU1 MRI. Automated calculation of 3D hypo- and hyperintense sub-volumes and first order texture features were performed using SimpleITK, Numpy and PyRadiomics. Segmentation time and intraclass correlation (ICC) of segmentations was assessed. Metrics were compared to TV at FU2 and time to TL TV. Univariate Mantel-Cox time to event, logistic regression and ROC analysis were performed using R and Prism.

RESULTS

47 patients were selected with a mean age of 70 (66% male). 5, 27, 10 and 5 were BCLC 0, A, B, and C. Mean TL size (mm) and dose (mCi) were 26 (SD19) and 49 (SD27), respectively. Pre-RS MRI was performed a mean 44 (SD 13) days before treatment. FU1 and FU2 MRIs were performed a mean 51 (SD 15) and 136 (SD 38) days after intervention. 373 tumor segmentations were made taking a mean 3.4 (SD 2.1) minutes each with ICC of 0.83 (95CI 0.78-0.88). At FU2 36 and 11 had CR and tumor viability, respectively. Median overall survival was 30 months. On logistic regression analysis, difference in T1 AP and ADC kurtosis between pre-RS and FU1 were significantly predictive of TV on FU2 with AUC 0.77 ($p<0.05$) and 0.76 ($p<0.05$). There were no significant differences on median-split, univariate time to TV for all measures.

CONCLUSION

On early follow-up MRI after RS hyper- and hypointense sub-volume sizes do not appear correlated with TV, however, 3D tumor texture analysis do appear to be predictive of TV.

CLINICAL RELEVANCE/APPLICATION

Texture analysis may provide insight into tumor viability earlier than mRECIST. If validated prospectively, adoption of routine tumor segmentation and MR-based quantitative analyses may hasten and improve HCC treatment decision making.

SSC06-07 Dual-Energy CT Vital Iodine Tumor Burden as a Quantitative Response Parameter in Patients with GIST Undergoing Tyrosine-Kinase-Inhibitor Therapy - A Comparison to Standard CT and FDG-PET Criteria

Monday, Dec. 2 11:30AM - 11:40AM Room: N230B

Participants
Mathias Meyer, Mannheim, Germany (*Presenter*) Researcher, Siemens AG; Researcher, Bracco Group
Daniel Overhoff, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Anna Bartsch, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Haubenreisser, Stuttgart, Germany (*Abstract Co-Author*) Speaker, Siemens AG Speaker, Bayer AG Speaker, Bracco Group
Peter Hohenberger, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Hideki Ota, MD,PhD, Sendai, Japan (*Abstract Co-Author*) Grant, Canon Medical Systems Corporation
Christina Messiou, MD, BMBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Nothing to Disclose
Daniele Marin, MD, Durham, NC (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

o determine whether dual-energy CT (DECT) vital iodine tumor burden (VITB) allows reliable response assessment in patients with a Gastrointestinal Stromal Tumor (GIST) undergoing Tyrosine-Kinase Inhibitor therapy (TKI), compared to established CT and [18F] fluorodeoxyglucose (FDG) positron emission tomography (PET) criteria.

METHOD AND MATERIALS

An anthropomorphic phantom equipped with spherical GIST lesions of 3 different iodine concentrations (1, 2 and 5mg/mL) and a non-enhancing central necrotic core (40HU at 120kVp) was scanned on a second generation dual-source DECT platform. 40 patients with 155 metastatic GIST lesions underwent a portal phase DECT on the same platform. Each patient had a pre-treatment and a 3-4-months follow-up DECT and FDG-PET after TKI-treatment. Up to 5 target lesions were selected using mRECIST 1.1 guidelines. Tumor burden was assessed using different tumor response criteria, including mRECIST 1.1, mChoi, VTB, and VITB. Standardized uptake value (SUVmax) on the FDG-PET datasets, which is the current reference standard for metabolic response assessment in patients with GIST. Progression-free survival (PFS) in responders (complete, partial response and stable disease) and non-responders (progressive disease) according to each response criteria was compared by using the Cox proportional hazard ratio (HR).

RESULTS

The anthropomorphic phantom revealed a cut-off of 0.5mg/mL (15HU on the iodine image) to differentiate necrotic from vital tumor tissue. The median PFS was significantly different between non-responders and responders and comparable among the SUVmax criteria (632days; HR=4.6; 95%CI:2.2-10.1; $p<.001$), the VITB criteria (521days; HR=28.4; 95%CI:7.8-184.9; $p<0.001$) and VTB criteria (501days; HR=8.1; 95%CI:3.4-21.2; $p<.001$). VITB allowed a significant better differentiation between non-responders and responders compared to mRECIST 1.1 (414days; HR=2.5; 95%CI:1.3-5.0; $p<.010$). and mChoi criteria (151days; HR=1.1; 95%CI:0.5-2.1; $p<.001$).

CONCLUSION

The VITB criteria showed comparable performance to FDG-PET criteria for response assessment of patient with GIST under TKIs while outperforming mRECIST 1.1 and mChoi criteria.

CLINICAL RELEVANCE/APPLICATION

VITB is a quantitative DECT imaging biomarker that captures the effects of TKI therapy and predicts tumor response (PFS) in

patients with GIST and could be used to guide treatment management.

SSC06-08 Dynamic Control of Chelation Therapy in Transfusion Dependent and Non-Transfusion Dependent Patients Using Hepatic MRI and DECT

Monday, Dec. 2 11:40AM - 11:50AM Room: N230B

Participants
Anna M. Titova, Saint Petersburg, Russia (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

anisa33@mail.ru

PURPOSE

To show the possibilities of DECT as well as MRI in the diagnostic of iron overload (IOL) and monitoring of chelation therapy. To determine sufficient time intervals between dynamic hepatic DECT and MRI in controlling of chelation therapy results in Transfusion Dependent (TD) and Non-Transfusion Dependent (NTD) patients with IOL.

METHOD AND MATERIALS

We examined 75 patients with suspected IOL. 14 of them were NTD, the other 61 - TD. We conducted T2* MRI study of the liver by 1.5T scanner for assessment of liver iron concentration (LIC) and performed DECT procedures with 80kV and 140kV on the limited area of the liver of the same patients with the slice thickness of 5mm and calculation of Dual Energy indicators. Chelation therapy was prescribed for all examined patients in doses depending on body weight. 6 and 12 months later, we repeated the same procedures to the earlier examined patients who received iron chelators. For various reasons, only 26 of them were able to undergo CT and MRI studies at appointed times.

RESULTS

We calculated IOL severity for the examined patients. Using correlation and regression analysis, it was found that the calculation of the dual-energy difference (HU) gives high correlation coefficient (r=0.93) with IOL severity, it means that the predicted values of IOL by CT fall into all ranges of IOL according to MRI. Using the data of 26 patients after 6 and 12 months chelation, in all DECT-results we also established the conformity of our findings to the MRI data. In both control CT and MRI study of NTD patients with HH (n=9), degree of LIC decrease significant - average 12% in 6 months, and 33% in a year. When analyzing similar control MRI data in TD patients (n=17), we had extremely slow dynamics of reducing the LIC (average 2,75% in 6 months, 7% in a year). MRI data show that there is some dynamic, while DECT data demonstrate no significant dynamic either in 6 or in 12 months of treatment (less than 1% decreasing).

CONCLUSION

DECT, like MRI, is a useful technique for controlling chelation therapy. However, such studies in NTD patients should be more frequent to avoid hyper-chelation. The use of DECT for the annual control of chelation therapy in TD patients is not justified.

CLINICAL RELEVANCE/APPLICATION

Recommended to undergo hepatic MRI or DECT for NTD patients no less than every 6 months to control chelation therapy results, especially with light or moderate IOL severity, to avoid over-chelation.

SSC06-09 Post-TACE Changes in the Mean Value and Kurtosis of Apparent Diffusion Coefficient Histograms are Independent Predictors of Overall Survival in Patients with Hepatocellular Carcinoma

Monday, Dec. 2 11:50AM - 12:00PM Room: N230B

Participants
Mohammadreza Shaghaghi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Mounes Aliyari Ghasabeh, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Ameli, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Bita Hazhirkarzar, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Pegah Khoshpouri, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Roya Rezvani Habibabadi, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Ghadimi, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Pallavi Pandey, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ankur Pandey, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG

For information about this presentation, contact:

mshagha1@jhmi.edu

PURPOSE

To identify MR imaging parameters that can be used for evaluating early tumor response and overall survival (OS) after transarterial chemoembolization in patients with hepatocellular carcinoma

METHOD AND MATERIALS

In this IRB approved, HIPAA compliant retrospective cohort study, our institutional database was searched for patients with confirmed HCC, diagnosed during 2005-2016. Imaging data were reviewed by a radiologist and patients with well-defined tumors were recruited initially (n=151). Patients with available apparent diffusion coefficient (ADC) map at baseline and 3-4 weeks after first TACE were included (n=99). Demographic data, HCC etiology, baseline Child score, treatment modalities, and survival status were retrieved from clinical database. Volumetric MRI metrics including tumor volume, mean ADC, skewness and kurtosis of ADC were measured at baseline and 1 month post-TACE. Change in variables was calculated by subtracting baseline values from post-TACE measures. Univariate and multiple Cox models were used to test the independent role of change in imaging parameters to predict OS. $p<0.05$ was considered significant.

RESULTS

In unadjusted survival model, baseline tumor volume, changes in ADC and ADC-kurtosis were potential imaging predictors of survival. After adjusting for baseline liver function, tumor volume, number of TACE sessions, and treatment modality, incremental percent change in ADC was an independent predictor of better OS (HR=0.98, p=0.020). In overall, a decremental change in ADC-kurtosis (increase in heterogeneity) showed a strong trend in predicting better prognosis (HR=0.92, p=0.051). Categorizing patients to responders (>=25% ADC increase) and non-responders (<25% ADC increase) based on change in mean ADC provided a good prediction of OS (c-index: 0.791). Responders had the best survival profile (HR=0.42, p=0.021). Subgroup analysis showed that in non-responders, change in ADC-kurtosis (Δ kADC) as an indicator of change in tissue homogeneity, could distinguish between poor and fair prognosis (cutoff=0.5). It was not a measure of difference among responders (p=0.86). Non-responder patients with Δ kADC >=0.5 (homogeneous post-TACE tumor) had the worst prognosis (HR=3.03, p=0.007), as compared to responders and those of non-responders who had Δ kADC <0.5 (log-rank p=0203).

CONCLUSION

A >=25% increase in ADC demonstrated favorable response to TACE in patients with HCC. In non-responder patients, an increase in tumor heterogeneity, as measured by ADC-kurtosis, could distinguish patients with relatively better prognosis from those with the worst survival profile.

CLINICAL RELEVANCE/APPLICATION

Change in mean ADC and ADC-kurtosis, as a measure of change in tissue heterogeneity, can be used to monitor early response to TACE in well-defined HCC and to identify patients with treatment failure and poor prognosis

Printed on: 10/29/20

SSC07

Science Session with Keynote: Genitourinary (Prostate MRI in Biopsy, Therapy, and Surveillance)

Monday, Dec. 2 10:30AM - 12:00PM Room: E260

GU MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Aytekin Oto, MD, Chicago, IL (*Moderator*) Research Grant, Koninklijke Philips NV; Research Grant, Guerbet SA; Research Grant, Profound Medical Inc; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; ; ;
Vinay A. Duddalwar, MD,FRCR, Los Angeles, CA (*Moderator*) Research Grant, Samsung Electronics Co, Ltd Advisory Board, DeepTek Consultant, Radmetrix
Ronaldo H. Baroni, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Sub-Events

SSC07-01 Genitourinary Keynote Speaker: Next Generation Prostate Imaging

Monday, Dec. 2 10:30AM - 10:40AM Room: E260

Participants
Daniel J. Margolis, MD, New York, NY (*Presenter*) Consultant, Blue Earth Diagnostics Ltd

PURPOSE

Prostate imaging has transformed over the past decade, with the advent of iterations on multiparametric MRI in addition to small-molecule PET agents targeting the extracellular domain of prostate specific membrane antigen (PSMA) and high-resolution ultrasound. These innovative magnetic resonance imaging techniques both facilitate new treatment methods, and more importantly, allow for assessment of the efficacy of these new treatments. From MRI-ultrasound image fusion targeted biopsy and ablation to quantitative assessment of treatment response of medical and ablative therapies, the field of prostate imaging is rife with novel applications. These techniques individualize patient care through more accurate identification of the location and stage of prostate cancer so that only significant cancers receive treatment, and then monitor the response to directed therapies. Perhaps most intriguing is the application of artificial intelligence, which augments the radiologist's acumen, improving the value we deliver to our patients. We stand on the cusp of the age of radiologist-driven prostate cancer management.

SSC07-02 MR-US Fusion Prostate Biopsy: The Added Value of Systematic Core Biopsy to MR-Targeted Cores for Prostate Cancer Grading

Monday, Dec. 2 10:40AM - 10:50AM Room: E260

Participants
Sohrab Afshari Mirak, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Amirhossein Mohammadian Bajgiran, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Anthony Sisk, DO, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Consultant, Johnson & Johnson; Consultant, Bayer AG; Consultant, Merck & Co, Inc; Consultant, Amgen Inc; Consultant, Profound Medical Inc

For information about this presentation, contact:

safsharimirak@mednet.ucla.edu

PURPOSE

To investigate the value of the systematic core biopsy (S-Bx) to MR-US fusion targeted core biopsy (MR-F Bx) for detection and grading of prostate cancer (PCa) using whole mount histopathology (WMHP) as reference.

METHOD AND MATERIALS

This IRB approved, HIPAA compliant observational study cohort comprises 295 patients with 716 pathology PCa lesions, who underwent MR-F bx prior to radical prostatectomy, between 7/2010-2/2019. All patients had MR-F Bx and S-Bx. The pathology reports of all of the cores were evaluated and the characteristics of patients with higher reported Gleason score (GS) for S-Bx as compared to MR-F bx were assessed.

RESULTS

Mean patient age and PSA were 62.9±6.3 years and 8.9±10.5 ng/ml, respectively. Mean PCa lesion number on WMHP was 2.4 (1-6). Mean S-Bx and MR-F bx cores were 11.4 (6-16) and 5.3 (1-10), respectively. Mean positive cores for S-Bx was 3 (0-12) and for MR-F Bx was 3.3 (0-10). The per-patient performance of S-Bx and MR-F Bx for PCa detection were 82.4% (243/295) and 95.6% (282/295), respectively. Overall, 37.6% (111/295), 48.8% (144/295) and 13.6% (40/295) of cases had similar GS in S-Bx and MR-F Bx, higher GS in MR-F Bx and higher GS in the S-Bx, respectively. In 4.1% (12/295) of all cases, S-Bx cores upgraded PCa from GS 6 to GS>6. Among cases with higher GS in S-Bx, 32.5% (13/40) cases had benign findings on MR-F bx. 82.5% (33/40) of the higher GS cases in S-Bx were taken from the same lesion as MR-F Bx as a result of wider sampling and the characteristics of these lesions

were as follows: 51.5% (17/33) PIRADSv2 score 3, 33.3% (11/33) score 4 and 15.2% (5/33) score 5; 14.5% (15/33) in apex, 33.3% (11/33) in midgland and 21.2% (7/33) in base; 42.4% (14/33) in a different sextant for the same lesion in contralateral side (3/14) or a different level (11/14). In 22.5% (9/40) of all cases with higher GS in S-Bx and in 8.3% (1/12) of upgraded cases from GS 6 to >6 in S-Bx, the report of the higher GS was false considering WMHP.

CONCLUSION

Although S-Bx at the time of MR-F Bx can slightly improve PCa grading, however, in almost one quarter of the cases, we found false upgrading. The true rate of upgrading with S-Bx is minimal and significant portion of the upgraded lesions are ipsilateral to the target.

CLINICAL RELEVANCE/APPLICATION

PCa treatment selection depends on the results of the prostate biopsy. S-Bx improves diagnostic yield only slightly for clinically significant disease over MR-F Bx.

SSC07-03 Manual Adjustment in mpMRI-Guided Prostate Biopsy Significantly Improves the Detection Rate of Prostate Cancer: Experience in 400 Patients

Monday, Dec. 2 10:50AM - 11:00AM Room: E260

Participants
Sarah Alessi, MD, Milano, Italy (*Presenter*) Nothing to Disclose
Paola Pricolo, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Paul E. Summers, Milan, Italy (*Abstract Co-Author*) Stockholder, QMRI Tech iSrl
Giuseppe Renne, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Gennaro Musi, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Bianchi, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Barbara Jereczek-Fossa, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Bellomi, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Ottavio de Cobelli, Milano , Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Petralia, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to compare the results of software-guided sampling with those obtained after manual adjustment in multiparametric MRI-guided prostate biopsy (mpMRI-PB) and to evaluate whether manual adjustment improves the detection rate of prostate cancer (PCa).

METHOD AND MATERIALS

We enrolled 400 consecutive patients between November 2014 and February 2018, who underwent mpMRI-PB of the target lesion visible on previous mpMRI (average 11.6 mm, range 4-40mm). All mpMRI-PBs were performed on a 1.5T MR scanner (Magnetom Avanto, Siemens Healthineers, Germany) using a commercially available MR transrectal biopsy device (DynaTRIM, Invivo, USA). After calibration of the biopsy device, the first sample was obtained using the coordinates provided by the device software to guide the needle along a trajectory to the target lesion. The trajectory was then manually adjusted to improve localization to the target lesion for further biopsy samples.

RESULTS

225 out of 400 patients were positive for PCa after mpMRI-PB, with PCa diagnosed in 55/62 PI-RADS 5 (88.7%), 136/188 PI-RADS 4 (72.3%), 33/127 PI-RADS 3 (25.9%) and 1/23 PIRADS 2 lesions (4.3%). The first sample was positive for PCa in just 117 cases. After manual adjustment, an additional 108 positive biopsies were obtained, corresponding to an increase in the detection rate of 92.3% ($p < 0.0001$; McNemar's Test). The core involvement averaged 50.3% (range 1-100%). To date, 101 of the 225 PCa patients have undergone surgery, with an average lesion diameter in the surgical specimen of 15.7 mm (range 5-40mm).

CONCLUSION

Manual adjustment of needle trajectory significantly improves the detection rate of PCa when performing mpMRI-PB.

CLINICAL RELEVANCE/APPLICATION

mpMRI guided prostate biopsy is associated with an improvement of detection rate of prostate cancer after manual adjustment of needle trajectory.

SSC07-04 Deep Learning-Based Automated Segmentation of Prostate Cancer on Multiparametric MRI: Comparison with Experienced Uroradiologists

Monday, Dec. 2 11:00AM - 11:10AM Room: E260

Participants
Wonmo Jung, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung Il Hwang, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sejin Park, MS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Kyeong Sung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Kyu-Hwan Jung, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Hyungwoo Ahn, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Jong Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Youn Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myoung Seok Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Younggi Kim, Seongnam , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

wm.jung@vuno.co

PURPOSE

To compare the performance of deep learning based prostate cancer (PCa) segmentation with manual segmentation of experienced uroradiologists.

METHOD AND MATERIALS

From 2011 Jan to 2018 Apr, 350 patients who underwent prostatectomy for prostate cancer were enrolled retrospectively. To collect histopathological ground truth, pathologic slides of whole resected prostate were scanned and PCa lesions were drawn by a uropathologist with 25 years' experience. With reference to the histopathological lesion, radiological ground truth of PCa was drawn on the T2 weighted image by a uroradiologist with 19 years' experience. A U-Net type deep neural network, in which the encoder part has more convolution blocks than the decoder, was trained for segmentation. Four different MR sequences including T2 weighted images, diffusion weighted images (b = 0, 1000), and apparent diffusion coefficient (ADC) images, were used as input images after affine registration. Besides the automatic segmentation by the deep neural network, two experienced uroradiologists marked suspected sectors of PCa among 39 sectors provided by PIRADS-v2 after reviewing same images of four MR sequences. The manual segmentation performance of uroradiologists was measured using the number of sectors that coincided with the ground truth PCa lesion.

RESULTS

The dice coefficient scores (DCSs) achieved by two uroradiologists were 0.490 and 0.310 respectively. The DCS was calculated based on the number of sectors. The DCS of automatic segmentation by a deep neural network was 0.558 (calculated by the number of pixels) which is slightly better than the average (0.40) DCSs of uroradiologists.

CONCLUSION

Automated segmentation of PCa on multiparametric MR based on histopathologically confirmed lesion label achieved comparable performance with experienced uroradiologist.

CLINICAL RELEVANCE/APPLICATION

The automated segmentation of prostate cancer using a deep neural network not only reduce time consuming work but also provide reliable location and size information required for treatment decision.

SSC07-05 Multiparametric MRI Can Exclude Prostate Cancer Progression in Patients Under Active Surveillance

Monday, Dec. 2 11:10AM - 11:20AM Room: E260

Participants
Lars Schimmoeller, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Tim Ullrich, Duesseldorf, Germany (*Presenter*) Nothing to Disclose
Fabian Mones, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Arsov, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Robert Rabenalt, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Lars.schimmoeller@med.uni-duesseldorf.de

PURPOSE

To assess the ability of multiparametric MRI (mp-MRI) of the prostate to exclude prostate cancer (PCa) progression in patients under active surveillance.

METHOD AND MATERIALS

One hundred and forty-seven consecutive patients under active surveillance with known PCa with a Gleason score of 3+3=6 or 3+4=7a were initially enrolled and received mp-MRI (T2WI, DWI, DCE-MRI) of the prostate at 3T. Of these patients, fifty-five received follow-up MRI after a minimum interval of 12 months with subsequent targeted MR/US fusion-guided (FUS-GB) plus systematic transrectal ultrasound-guided (TRUS-GB) biopsy. Primary endpoint was negative predictive value (NPV) of the follow-up mp-MRI to exclude tumor progression. Secondary endpoints were positive predictive value (PPV), sensitivity, specificity, and cancer upgrade after initial mp-MRI.

RESULTS

Of 55 patients 28 (51%) had a Gleason score upgrade in the re-biopsy. All of the 28 patients showed findings in the follow-up mp-MRI that were suspicious of tumor progress. 16 of 55 patients (29%) showed signs of tumor progress in the follow-up MRI but had a stable re-biopsy. 11 of 55 patients (20%) showed no signs of progress in follow-up MRI and none of these patients had a Gleason score upgrade in the re-biopsy. NPV was 100%. PPV was 64%. Sensitivity was 100% and specificity 59%.

CONCLUSION

MP-MRI can reliably exclude PCa progression in patients under active surveillance. Over 60% of the patients with signs of tumor progress in follow-up mp-MRI had a Gleason score upgrade in repeat biopsy.

CLINICAL RELEVANCE/APPLICATION

Patients under active surveillance should receive follow-up MRI to monitor tumor progress. Standard re-biopsy protocols might be waived if follow-up mp-MRI is stable.

SSC07-06 Post-ablation Prostate Imaging Reporting and Data System (PAPI-RADS): Preliminary Results at 12 Months After Whole-Gland MRI-Guided Transurethral Ultrasound Ablation (TULSA)

Monday, Dec. 2 11:20AM - 11:30AM Room: E260

Participants
Temel Tirkes, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Consultant, Johnson & Johnson; Consultant, Bayer AG; Consultant, Merck & Co, Inc; Consultant, Amgen Inc; Consultant, Profound Medical Inc
Sandeep S. Arora, MBBS, Nashville, TN (*Abstract Co-Author*) Speaker, Profound Medical Inc Researcher, Profound Medical Inc
Derek W. Cool, MD,PhD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD, Westlake, OH (*Abstract Co-Author*) Nothing to Disclose
Daniel N. Costa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Joyce G. Bomers, Arnhem, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Siemens AG
Carlos Nicolau, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Thorsten Persigehl, MD, Koeln, Germany (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Bloomfield Hills, MI (*Abstract Co-Author*) Nothing to Disclose
Robert Staruch, Mississauga, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Mathieu Burtnyk, DIPLPHYS, Toronto, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
David Bonekamp, MD, PhD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Profound Medical Inc
Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Katarzyna J. Macura, MD,PhD, Catonsville , MD (*Abstract Co-Author*) Author with royalties, Reed Elsevier; Research Grant, Profound Medical Inc; Research Grant, GlaxoSmithKline plc; Research Grant, Siemens AG
Aytekin Oto, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, Guerbet SA; Research Grant, Profound Medical Inc; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; ; ;

For information about this presentation, contact:

atirkes@iu.edu

PURPOSE

PI-RADS v2 criteria do not specifically address evaluation of the prostate gland after non-surgical treatment. We present a modified scoring system for MRI detection of prostate cancer (PCa) in the post-ablation setting (PAPI-RADS), comparing the preliminary diagnostic performance of PAPI-RADS and PI-RADS v2 against histopathology.

METHOD AND MATERIALS

PAPI-RADS was defined by consensus among radiologists participating in an IRB-approved, HIPAA-compliant 13-center pivotal trial of whole-gland MRI-guided transurethral ultrasound ablation (TULSA) in 115 men with PCa. The proposed system uses a 5-point likelihood score for residual/recurrent PCa, with the same MRI acquisition parameters recommended by PI-RADS v2. PAPI-RADS criteria give emphasis to focal early enhancement on dynamic contrast-enhanced images, over abnormal T2-weighted hypointensity or diffusion restriction. We present the interpretation by 13 on-site radiologists, in addition to a separate blinded central radiologist who scored all 12-month MRIs according to PI-RADS v2 and PAPI-RADS. Diagnostic accuracy was assessed against histopathology obtained at 12-month post-ablation 10-core biopsy.

RESULTS

At time of this submission, local PI-RADS v2 was available for 111/111 men with 12-month MRI and biopsy, central PI-RADS v2 for 76/111. At 12 months, local and central radiologists identified PI-RADS v2 score >=3 and >=4 lesions in 28/111 (25%) and 13/111 (12%) men, vs. 23/76 (30%) and 15/76 (20%) men, respectively. Local and central PAPI-RADS was available for 55/111 and 29/55 men, with score >=3 and >=4 lesions identified in 12/55 (22%) and 9/55 (16%) of men, vs. 7/29 (24%) and 5/29 (17%). Preliminary diagnostic performance of both criteria against 10-core biopsy (median sampling density 1.0 cores/cc) are listed in Table 1, with higher negative predictive values for PAPI-RADS (local: 96% vs. 89% for score >=4, central: 92% vs. 90%). Results from all patients will be available in December.

CONCLUSION

Preliminary results of 12-month post-ablation mpMRI with the proposed PAPI-RADS scoring system provided improved diagnostic performance for detection of prostate cancer over PI-RADS v2.

CLINICAL RELEVANCE/APPLICATION

PI-RADS v2 was designed for treatment-naïve prostates. The proposed modified post-ablation MRI criteria improves accuracy by addressing prostate tissue changes following ablative therapy for PCa.

SSC07-07 Pivotal Trial of MRI-Guided Transurethral Ultrasound Ablation (TULSA) in Patients with Localized Prostate Cancer

Monday, Dec. 2 11:30AM - 11:40AM Room: E260

Participants
Steven S. Raman, MD, Santa Monica, CA (*Presenter*) Consultant, Johnson & Johnson; Consultant, Bayer AG; Consultant, Merck & Co, Inc; Consultant, Amgen Inc; Consultant, Profound Medical Inc
Aytekin Oto, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, Guerbet SA; Research Grant, Profound Medical Inc; Medical Advisory Board, Profound Medical Inc; Consultant, IBM Corporation; ; ;
Katarzyna J. Macura, MD,PhD, Catonsville , MD (*Abstract Co-Author*) Author with royalties, Reed Elsevier; Research Grant, Profound Medical Inc; Research Grant, GlaxoSmithKline plc; Research Grant, Siemens AG
Sandeep S. Arora, MBBS, Nashville, TN (*Abstract Co-Author*) Speaker, Profound Medical Inc Researcher, Profound Medical Inc
Temel Tirkes, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Siemens AG
Daniel N. Costa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
David Bonekamp, MD, PhD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Profound Medical Inc
Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Derek W. Cool, MD,PhD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Carlos Nicolau, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Thorsten Persigehl, MD, Koeln, Germany (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Bloomfield Hills, MI (*Abstract Co-Author*) Nothing to Disclose
Robert Staruch, Mississauga, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Mathieu Burtnyk, DIPLPHYS, Toronto, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Marc Serrallach, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

Gregory Zagaja, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
James D. Relle, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Allan Pantuck, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Yair Lotan, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Axel Heidenreich, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Michiel Sedelaar, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Michael Koch, Bloomington, IN (*Abstract Co-Author*) Nothing to Disclose
Christian Pavlovich, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
David Penson, MD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Laurence Klotz, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Scott Eggener, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

SRaman@mednet.ucla.edu

PURPOSE

MRI-guided transurethral ultrasound ablation (TULSA) is an incision-free method for customized prostate ablation using directional ultrasound under MRI thermometry feedback control. We report 12-month (12mo) outcomes from the TULSA-PRO Ablation Clinical Trial (TACT) Pivotal study.

METHOD AND MATERIALS

TACT enrolled 115 men with localized prostate cancer at 13 sites. Treatment intent was whole-gland ablation sparing the urethra and urinary sphincter. Primary endpoints were adverse events and proportion of men with PSA reduction >=75%. Secondary endpoints included 12mo 10-core biopsy, mpMRI, prostate volume reduction, and quality of life.

RESULTS

Median (IQR) age was 65 (59-69) years and PSA 6.3 (4.6-7.9) ng/ml. Pre-treatment, 72/115 (63%) men had Grade Group 2 (GG2) disease. PI-RADSv2 score >=3 lesions were present in 98/115 (85%) men, >=4 in 77 (67%). Ablation times were 51 (39-66) min for targeted prostate volumes of 40 (32-50) cc. MRI thermometry during treatment indicated 98% (95-99%) thermal coverage with ablation precision of ±1.4 mm, confirmed qualitatively by post-treatment CE-MRI. Grade 3 adverse events occurred in 8% of men (all resolved), with no rectal injuries or Grade >=4 events. At 12mo, 1% of men were incontinent (>1 pad/day), and 69/92 (75%) maintained erections sufficient for penetration (IIEF Q2 >=2). PSA reduction >=75% was achieved in 110/115 (96%), with median reduction of 95% and nadir of 0.34 ng/ml. Median perfused prostate volume decreased from 41 to 4 cc at 12mo MRI. Of 68 men with baseline GG2 disease, 54 (79%) were free of GG2 on 12mo biopsy. Overall, 72/111 (65%) had no evidence of any cancer. Of 98 men with PI-RADSv2 >=3 at baseline, 26 had MRI lesions at 12mo, 11/26 with biopsy-confirmed GG2 (negative predictive value, NPV 93%). Multivariate predictors of residual GG2 included intraprostatic calcifications at screening, MRI thermal coverage of target volume, and PI-RADSv2 >=3 at 12mo ($p<0.05$).

CONCLUSION

The TACT Pivotal study of MRI-guided TULSA for whole-gland ablation in men with localized prostate cancer met its primary PSA endpoint in 96% of patients, with low rates of severe toxicity and residual GG2 disease. MRI at 12mo detected residual disease with NPV of 93%.

CLINICAL RELEVANCE/APPLICATION

Whole-gland ablation using MRI-guided TULSA achieves predictable PSA and prostate volume reduction. Multiparametric MRI is promising for post-TULSA follow-up.

SSC07-08 Early Diffusion and Perfusion Changes of Prostate Cancer on IVIM MR Imaging after ADT Therapy

Monday, Dec. 2 11:40AM - 11:50AM Room: E260

Participants
Yu Guo, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Hui Li, Tianjin, China (*Presenter*) Nothing to Disclose
Penghui Wang, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yu Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhaoyang Fan, West Hollywood, CA (*Abstract Co-Author*) Nothing to Disclose
Wen Shen, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

shenwen66happy@163.comzhaoyang.fan@csmc.edu

PURPOSE

To investigate the usefulness of intravoxel incoherent motion (IVIM) MR in early detection of therapeutic changes from androgen deprivation therapy (ADT) in prostate cancer patients.

METHOD AND MATERIALS

MR examinations in 22 patients with advanced prostate cancer were performed before and three months after ADT treatment, using a 3.0T system (Ingenia, Philips Healthcare) equipped with a 16-channel body coil. The imaging protocol included axial T1WI ,axial T2WI , coronal T2WI and axial IVIM. The IVIM was performed at 11 b values of 0, 10, 20, 30, 50, 75, 100, 250, 500, 750 and 1000s/mm2. T2WI and IVIM images were qualitatively reviewed by an experienced radiologist. The prostate-specific antigen (PSA) levels were also assessed. The diffusion coefficients (D), perfusion fractions (f) and the perfusion-related diffusion Coefficient (D*) values were quantitatively measured in the prostate cancer area and bone metastasis. Changes in these IVIM measurements between pre- and post-treatment timepoints were evaluated using a paired Student t test. $P<0.05$ indicated a significant difference.

RESULTS

Prostate and tumor volume of the patients showed different degrees of reduction after ADT therapy except for 3 patients. T2-weighted images signal was diffusely reduced after therapy. The signal intensities of most cancerous and non-cancer areas were visually similar. The mean PSA level was significantly reduced. At 3 months after treatment, the D value of cancer area ((0.902±0.118)×10-3mm2/s) was significantly increased as compared with the pretreatment value ((0.585±0.142)×10-3 mm2/s), ($p < 0.001$). The f value of cancer area (0.299±0.074) was significantly increased compared with the pretreatment one (0.254±0.064) ($P < 0.05$). The D and f value of bone metastases was significantly increased after treatment ($P < 0.05$). D* showed no significant changes before and after treatment.

CONCLUSION

T2WI images after ADT therapy are of little value for determining the location and boundary of the tumor. The IVIM MR allows non-invasive quantitative characterization of biological changes (both diffusion and perfusion fraction) of prostate cancer after treatment. This technique may potentially be useful for the evaluation of therapeutic effect and risk for recurrence.

CLINICAL RELEVANCE/APPLICATION

It may have potential technique in the evaluation of therapeutic effect and early prediction of efficacy.

SSC07-09 Baseline Multiparametric MRI Characteristics of Exceptional Pathologic Response to Neoadjuvant Enzalutamide for High-Risk, Localized Prostate Cancer

Monday, Dec. 2 11:50AM - 12:00PM Room: E260

Participants
Stephanie A. Harmon, PhD , Bethesda, MD (*Presenter*) Research funded, NCI
Scott Wilkinson, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Huihui Ye, MD, Boston , MA (*Abstract Co-Author*) Nothing to Disclose
Fatima Karzai, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole L. Carrabba, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas L. Terrigino, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Rayann Atway, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
John Bright, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie M. Walker, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Lake L. Ross, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
David J. Vanderweele, MD,PhD, Bethesda , MD (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD, Rockville, MD (*Abstract Co-Author*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;
Peter Pinto, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
William Dahut, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Adam G. Sowalsky, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Research support, Koninklijke Philips NV; Royalties, Invivo Corporation; Investigator, NVIDIA Corporation

PURPOSE

To assess multiparametric MRI (mpMRI) characteristics of high-risk prostate cancer patients demonstrating minimal residual disease (MRD) at radical prostatectomy (RP) after neoadjuvant androgen deprivation therapy (ADT) + enzalutamide.

METHOD AND MATERIALS

Patients with untreated high risk prostate cancer enrolled on a clinical trial evaluating neoadjuvant ADT + enzalutamide (160mg/day), receiving mpMRIat baseline and 6-months post-treatment followed by RP. RP specimens were sectioned in same plane as MR using a patient-specific 3D printed mold. Fixed tissue sections of baseline biopsy and tumor on RP specimens were stained, laser capture microdissected, and analyzed using whole exome sequencing to define clonally independent tumors. Non-responding tumors were pathologically defined by residual tumor burden >0.05 cc, measured by an expert GU pathologist. All mpMRI imaging was interpreted by a single expert radiologist. Regions encompassing suspected lesions were contoured at baseline and follow-up. Quantitative characteristics including volume, Apparent Diffusion Coefficients (ADC), and perfusion (Ktrans; calculated using a two compartment Tofts model with standardized arterial input function) were collected. Association between metrics and residual disease was evaluated using appropriate nonparametric statistical testing.

RESULTS

31 patients completed all imaging and RP, with 49 lesions detected on baseline mpMRI, of which 39 remained measurable at 6-mo. follow-up imaging. Two patients had at least 2 clonally independent lesions distinguishable on baseline imaging showing differential response at RP assessment. Lesion burden at both mpMRI timepoints was strongly associated with residual cancer (N=16) on pathology (p=0.002 vs p=0.003, respectively). Baseline summary diffusion (ADC) and perfusion (Ktrans) characteristics showed modest association to residual disease, further enhanced when assessing heterogeneity of signal intensity (ADCentropy 0.003, Ktrans,entropy 0.056).

CONCLUSION

While quantitative mpMRI metrics have shown correlation to Gleason grading and disease burden in untreated cases, distinct features also correlate with likelihood of residual cancer burden after intensive neoadjuvant therapy.

CLINICAL RELEVANCE/APPLICATION

Selection of patients based on these parameters may improve overall responses to treatment in subsequent clinical trials.

VSIO21

Interventional Oncology Series: Interventional Oncology Basic Science-Progress, Challenges, and Opportunities

Monday, Dec. 2 1:00PM - 3:00PM Room: E450B

IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
S. Nahum Goldberg, MD, Efrat, Israel (*Moderator*) Consultant, AngioDynamics, Inc; Consultant, Cosman Medical, Inc; Consultant, XACT Robotics;

LEARNING OBJECTIVES

1) Characterize the most important cutting-edge advances of interventional oncologic techniques. 2) Gain a better understanding of new intraprocedural and follow-up imaging techniques that facilitate successful state of the art interventional oncologic practice.

ABSTRACT

This session has been organized into a thematic unit thatwill provide a series of six lectures by leaders in the field each dedicated to discussing advances in the key aspects that comprise robust interventional oncologic practice. These include lectures on four aspects of tumor eradication thermal and non-thermal ablation devices, and transcatheter and injection therapies, supplemented by presentations highlighting two cutting edge areas that are rapidly being incorporated into treatment algorithms: Robotics and Virtual Navigation and Artificial Intelligence algorithms. The session will further include selected complementary abstract presentations that highlight innovative research in these thematic areas.

Sub-Events

VSIO21-01 Thermal Ablation Devices and Physics

Monday, Dec. 2 1:00PM - 1:15PM Room: E450B

Participants
Alison R. Gillams, MBChB, London, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

alliesorting@gmail.com

LEARNING OBJECTIVES

1) To understand the most commonly used ablation devices and the physics underlying their usage. 2) To understand the positives and downsides of each technology. 3) To understand which are the optimal devices to use in various common clinical scenarios.

VSIO21-02 Combining Shear Wave Ultrasound Elastography and Single Cell Biophysical Analysis to Highlight Differences in Tumor Phenotype and Heterogeneity

Monday, Dec. 2 1:15PM - 1:25PM Room: E450B

Participants
Michael D. Beland, MD, Providence, RI (*Presenter*) Nothing to Disclose
Deepraj Ghosh, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Michelle Dawson, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mbeland@lifespan.org

PURPOSE

The purpose of this study was to determine if tissue stiffness is related to tumor invasiveness. We describe a novel 3D organoid culture model using 18 gauge core biopsy samples of soft tissue tumors with ultrasound shear wave elastography (SWE) prior to biopsy to characterize tissue stiffness.

METHOD AND MATERIALS

This prospective study was performed with IRB approval. Ten consenting adult patients underwent biopsy of a superficial soft tissue mass with US guidance. Prior to obtaining 18g core biopsy, multiple SWE images of the mass were obtained. The samples were then monitored using time-lapsed microscopy to study cell interactions with the extracellular matrix, along with single cell morphology and motility parameters. We used this approach to characterize single cell biophysical properties for dissociated cells cultured on 2D polyacrylamide substrates, as well as cells migrating from tumor organoids in our 3D model. The gels were then dissociated and cells isolated from the gels for further biophysical or phenotypical analysis to study intratumor heterogeneity in a controlled way.

RESULTS

We observed increased variation in tissue stiffness (SWE measurements) correlated with increased heterogeneity in nuclear morphology and cell motility, which appeared to be related to increased incidence of cells with larger nuclei. Based on flow cytometry analysis of multiple markers we suspect these larger nucleated cells are fibroblasts, which may contribute to the increased tissue stiffness through matrix remodeling. Stiffer tumors required more time for cells to invade the surrounding collagen gel than softer lymphomas or benign lymphoid tissue. Lymphomas also contained small round lymphocyte-like cells that rapidly invade the surrounding gel moving randomly; these tumors also contain larger spindle-shaped cells that invade at a later time point, which were more likely fibroblasts.

CONCLUSION

Early data suggests that combining high content single cell biophysical analysis with in vivo ultrasound SWE shows cells isolated from stiffest regions of malignant tumors have abnormal mechanical signatures, which may be directly related to their invasive behavior.

CLINICAL RELEVANCE/APPLICATION

Stiffer portions of tumors may behave in a more invasive pattern. SWE may be useful in selecting sites for tumor biopsy or treatment monitoring. There may be future role for therapeutic modification of tumor extracellular environments to alter invasiveness.

VSIO21-03 Non-thermal Ablation (IRE)

Monday, Dec. 2 1:25PM - 1:40PM Room: E450B

Participants
Martijn R. Meijerink, MD, Amsterdam, Netherlands (*Presenter*) Research Grant, AngioDynamics, Inc

For information about this presentation, contact:

mr.meijerink@amsterdamumc.nl

LEARNING OBJECTIVES

1) To understand the basic physical concept of electroporation. 2) To understand the current and potential future indications of irreversible electroporation. 3) To better understand the immunomodulatory effect of irreversible electroporation and electro-immunotherapy

ABSTRACT

Irreversible electroporation (IRE) is a predominantly non-thermal ablation technique for the treatment of malignancies considered unsuitable for surgery and thermal ablation. By creating nanopores the cells will loose their homeostasis and go into apoptosis, pyknosis and delayed necrosis, contrary to coagulative necrosis with thermal ablation. The potential to eradicate tumors in the vicinity of critical structures such as bile ducts, intestines, urinary tracts and important blood vessels has slowly led to the adoption of IRE in the treatment of locally advanced pancreatic cancer, perihilar cholangiocarcinoma and central liver tumors, central renal cancers and prostate cancer. In pancreatic cancer a systemic immune-response targeted against tumor-specifc antigens, together with a reduction in immune-suppression and increase in cytotoxic and helper T-cell populations have now focused research on combining IRE with local and/or systemic immune-modulatory drugs such as checkpoint inhibitors.

VSIO21-04 Transcatheter Therapies

Monday, Dec. 2 1:40PM - 1:55PM Room: E450B

Participants
Stephen J. Hunt, MD,PhD, Philadelphia, PA (*Presenter*) Consultant, Amgen Inc; Research Consultant, BTG International Ltd; Speakers Bureau, Galil Medical Ltd; Research Grant, BTG International Ltd; Research Grant, Geurbet SA

For information about this presentation, contact:

stephen.hunt@uphs.upenn.edu

LEARNING OBJECTIVES

1) Be able to provide an overview of the different types of transcatheter therapies, their mechanisms of action, their indications for use, their side effects, and their role in clinical management of solid malignancies.

ABSTRACT

This lecture provides an overview of transcatheter therapies, with updates on the latest therapies in both research and clinical development. The objective of this course is to review the current state of transcatheter therapies in interventional oncology, and provide an introduction to emerging technologies in the field. At the conclusion, participants in this course will be able to provide a broad overview of transcatheter therapies in interventional oncology as well as the advantages and limitations of individual modalities.

VSIO21-05 Molecular Imaging of Tumor pH to Monitor Loco-Regional Therapy Effects on Liver Cancer

Monday, Dec. 2 1:55PM - 2:05PM Room: E450B

Participants
Lynn J. Savic, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Isabel T. Schobert, BS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Dana C. Peters, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
John J. Walsh, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Fabian Laage-Gaupp, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Charlie Hamm, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

Nina M. Tritz, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Luzie A. Doemel, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming de Lin, PhD, North Haven , CT (*Abstract Co-Author*) Employee, Visage Imaging, Inc; Former Employee, Koninklijke Philips NV
Albert Sinusas, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Lantheus Medical Imaging, Inc; Research Consultant, Astellas Group; Research Consultant, Bayer AG
Todd Schlachter, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Guerbet SA
James S. Duncan, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Fahmeed Hyder, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Daniel Coman, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Julius Chapiro, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Research Grant, Boston Scientific Corporation;

For information about this presentation, contact:

lynn.savic@yale.edu

PURPOSE

To establish extracellular pH (pHe) mapping for the non-invasive molecular monitoring of the liver tumor microenvironment and changes induced by loco-regional therapy.

METHOD AND MATERIALS

Thirty-two VX2 tumor-bearing rabbits were assigned to non-invasive pHe mapping on human-size 3T MRI-scanners before and up to 2 weeks after complete conventional transarterial chemoembolization (cTACE) using ethiodized oil (Lipiodol, Guerbet) and doxorubicin. Additionally, intentional incomplete cTACE was performed to mimic unsuccessful treatment and employ pHe imaging to detect viable tumor residuals. pHe mapping utilized chemical shift imaging. Additionally, multiparametric MRI and CT were performed before and at several timepoints after cTACE for the quantification of tumor enhancement, diffusion, and Lipiodol coverage. Imaging findings were correlated with histopathology using a panel of metabolic (HIF-1a, GLUT-1, LAMP-2) and viability markers (PCNA, TUNEL).

RESULTS

Untreated VX2 tumors demonstrated a significantly lower pHe (6.80±0.09) than liver parenchyma (7.19±0.03, $p<0.001$). Upregulation of HIF-1a, GLUT-1, and LAMP-2 histologically confirmed a hyperglycolytic phenotype and tumor acidosis. A gradual increase over time toward pHe normalization was revealed after complete cTACE supported by decreasing detectability of the metabolic histological markers. Additionally, pHe 2 weeks after incomplete cTACE indicated both acidosis of viable residuals and increased pHe of treated regions in the same tumor. Multimodal imaging revealed durable devascularization immediately after complete cTACE and gradually increasing necrosis whilst sustained Lipiodol coverage of the tumor.

CONCLUSION

In this study, spectroscopic pHe mapping was established as a new non-invasive monitoring tool for therapeutic efficacy in a translational liver tumor model. As most liver tumors are hyperglycolytic and create an acidified microenvironment, normalization of tumor pHe may serve as a functional biomarker for positive therapeutic outcome.

CLINICAL RELEVANCE/APPLICATION

In addition to tumor detection, pHe can be used as a functional biomarker for liver cancer to inform personalized treatment decisions and to monitor therapeutic efficacy of loco-regional therapies.

VSIO21-06 Direct Intra-tumoral Delivery: Drugs and Beyond

Monday, Dec. 2 2:05PM - 2:20PM Room: E450B

Participants
Rahul A. Sheth, MD, Houston, TX (*Presenter*) Nothing to Disclose

VSIO21-07 Robotics and Virtual Navigation

Monday, Dec. 2 2:20PM - 2:35PM Room: E450B

Participants
Luigi Solbiati, MD, Pieve Emanuele (milano), Italy (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lusolbia@tin.it

VSIO21-08 Artificial Intelligence: Nuts, Bolts and Clinical Applications

Monday, Dec. 2 2:35PM - 2:50PM Room: E450B

Participants
Julius Chapiro, MD, New Haven, CT (*Presenter*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Research Grant, Boston Scientific Corporation;

For information about this presentation, contact:

julius.chapiro@yale.edu

ABSTRACT

This talk will introduce the 'hot topic' of machine learning to interventional oncology and discuss how machine learning applications for image guidance, big data analysis and clinical decision support may change IO practice and research.

VSIO21-09 Panel Discussion

Monday, Dec. 2 2:50PM - 3:00PM Room: E450B

Printed on: 10/29/20

MSRO24

BOOST: Head and Neck-Case-based Multidisciplinary Review (Interactive Session)

Monday, Dec. 2 3:00PM - 4:15PM Room: S103AB

HN NR OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Consultant, Nanobiotix
Suresh K. Mukherji, MD, Carmel, IN (*Presenter*) Nothing to Disclose
Francis P. Worden, MD, Ann Arbor, MI (*Presenter*) Grant, Bayer AG Grant, Eisai Co, Ltd Grant, AstraZeneca PLC Grant, IRX Therapeutics Grant, Galera Therapeutics Grant, Bristol-Myers Squibb Company Grant, Merck & Co, Inc Consultant, Merck & Co, Inc
Chad Zender, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Expose to audience to the experience of a multidisciplinary tumor board. 2) Discuss specific imaging findings that directly affect staging, treatment and management. 3) Review the optimum modalities to detect cartilage invasion and perineural spread.

ABSTRACT

The intent of this session is to expose to audience to the experience of a multidisciplinary tumor board. Specific cases will be presented that will discuss specific imaging findings that directly afftect staging, treatment and management. The session will also review the optimum modalities to detect important imaging findings such as cartilage invasion and perineural spread.

Printed on: 10/29/20

MSRO28

BOOST: Gynecologic-Case-based Multidisciplinary Review (Interactive Session)

Monday, Dec. 2 3:00PM - 4:15PM Room: S103CD

GU OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Aoife Kilcoyne, MBBCh, Boston, MA (*Moderator*) Author, Wolters Kluwer nv
Susanna I. Lee, MD,PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv; Royalties, Springer Nature
Lilie Lin, MD, Houston, TX (*Presenter*) Investigator, AstraZeneca PLC

For information about this presentation, contact:

slee0@mgh.harvard.edu

LEARNING OBJECTIVES

1) Describe the surgical treatment and systemic therapies for gynecologic cancers based on standard of care current treatment strategies. 2) Describe the use of radiotherapy techniques used for the adjuvant and definitive treatment of gynecologic cancers. 3) Identify key imaging findings and avoid pitfalls when reading MRI and PET CT for gynecologic cancers.

ABSTRACT

This is a case based, multidisciplinary review of gynecologic malignancies including uterine cervical and endometrial cancer, vulvar cancer, and ovarian cancer.

VSIO22

Interventional Oncology Series: Primary Liver Cancer-Update on Therapeutic Options and Future Outlook

Monday, Dec. 2 3:15PM - 5:15PM Room: E450B

GI IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Anne M. Covey, MD, New York, NY (*Moderator*) Stockholder, Amgen Inc; Advisory Board, Accurate Medical
Nadine Abi-Jaoudeh, MD, Orange, CA (*Moderator*) Research collaboration, Koninklijke Philips NV; Research collaboration, Teclison Cherry Pharma Inc; Research support, SillaJen, Inc; Intellectual property and Owner, Bruin Biosciences Inc

For information about this presentation, contact:

coveya@mskcc.org

LEARNING OBJECTIVES

1) Learn which patients are most likely to benefit from locoregional treatment of hepatocellular carcinoma. 2) Understand how locoregional therapies fit into the overall treatment plan of patients with hepatocellular carcinoma and how systemic treatments may affect patient selection. 3) Describe the rational and potential therapeutic combinations of locoregional and systemic therapy for patients with hepatocellular carcinoma.

Sub-Events

VSIO22-01 Transplant/Resection for HCC

Monday, Dec. 2 3:15PM - 3:30PM Room: E450B

Participants
Parissa Tabrizian, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Parissa.tabrizian@mountsinai.org

LEARNING OBJECTIVES

1) Review the role of liver resection and transplantation for patients with HCC. 2) Discuss outcomes in patients with HCC undergoing liver resection or transplantation. 3) Describe the impact of locoregional therapy on a surgical practice.

VSIO22-02 Ablation for HCC

Monday, Dec. 2 3:30PM - 3:45PM Room: E450B

Participants
Bernhard Gebauer, MD, Berlin, Germany (*Presenter*) Speaker, PAREXEL International Corporation; Speaker, ICON plc; Speaker, BAYER AG; Speaker, F. Hoffmann-La Roche Ltd; Speaker, Pfizer Inc; Speaker, Guerbet SA; Speaker, Sirtex Medical Ltd

For information about this presentation, contact:

bernhard.gebauer@charite.de

LEARNING OBJECTIVES

1) Compare different techniques of ablation in HCC. 2) Identify patients profit from ablation. 3) Describe complications of ablation. 4) Identify complete ablation and local recurrence in follow-up.

VSIO22-03 Microwave Ablation versus Radiation Segmentectomy for Treatment-Naïve Early-Stage Hepatocellular Carcinoma

Monday, Dec. 2 3:45PM - 3:55PM Room: E450B

Participants
Mohamed Soliman, New York City, NY (*Presenter*) Nothing to Disclose
Madhu R. Joshi, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
Maria Mitry, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Caroline C. Chung, NYC, NY (*Abstract Co-Author*) Nothing to Disclose
Russell Rosenblatt, MD, NYC, NY (*Abstract Co-Author*) Nothing to Disclose
Resmi Charalel, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rac9069@med.cornell.edu

PURPOSE

To compare treatment efficacy of microwave ablation (MWA) and radiation segmentectomy (RS) in treatment of solitary hepatocellular carcinoma (HCC) less than 3 cm.

METHOD AND MATERIALS

Following IRB approval, all patients with cirrhosis who underwent locoregional treatment (LRT) for HCC at a single academic institution between 2005-2018 were reviewed. Patients who had prior HCC treatment, multifocal HCC or HCC larger than 3cm in maximum axial diameter were excluded. A total of 26 treatment-naïve patients were identified and reviewed. The primary endpoint is median overall survival (OS), analyzed via Kaplan-Meier method. Patients were censored at time of surgery, transplantation, or last known follow-up. The secondary endpoint is progression-free survival (PFS) following LRT. Baseline patient demographics and characteristics were compared between the two groups using a non-paired t-test. Treatment toxicities were assessed by measuring changes in liver function tests pre- and 1-month post LRT, from which MELD-Na scores were calculated and compared.

RESULTS

A total of 17/26 (65%) patients received MWA, while 9/26 (35%) received RS. There was no statistically significant differences between the groups in age (71 vs. 73, p=0.53), gender (64% vs. 72% male, p=0.492), cirrhosis etiology, presence of major medical comorbidities (DM, CAD, COPD), or tumor size (1.7cm vs. 2.4cm, p=0.5). In terms of treatment safety, RS was associated with higher 1-month post-treatment elevation in AST and ALT (p=0.034) compared to MWA. There was no statistically significant difference (p=0.50) in median PFS between the two groups (1289 days (95% CI = 828-NA) for the MWA group and 1029 days (95% CI = 620-NA) for the RS group). The median OS in the RS group was 1879 days, while median OS in the MWA group could not be estimated because only 2 mortality events were recorded over 20 months median follow-up period.

CONCLUSION

There was no significant difference in median PFS between RS and MWA for early-stage HCC; however, RS is associated with higher rates of hepatoxicity at 1 month. Larger, prospective studies are needed to further assess differences in treatment efficacy and toxicity.

CLINICAL RELEVANCE/APPLICATION

RS is a safe and efficacious treatment option for treatment-naïve patients with early-stage HCC, with similar local tumor control rate as MWA. Clinical judgement is imperative in choosing the theraputic intervention.

VSIO22-04 Update on Transarterial Therapies for HCC

Monday, Dec. 2 3:55PM - 4:10PM Room: E450B

Participants
Gregory J. Nadolski II, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review BCLC Tx recommendations for HCC. 2) Examine some issues with BCLC recommendations as compared to clinical practice and experience. 3) Discuss data on response to different embolization treatments.

ABSTRACT

N/A

VSIO22-05 Preoperative Transcatheter Arterial Chemoembolization for Surgical Resection of Huge Hepatocellular Carcinoma (>= 10 cm): A Multicenter Propensity Matching Analysis

Monday, Dec. 2 4:10PM - 4:20PM Room: E450B

Participants
Yang Tian, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Chao Li, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Wang Xinrong, Shanghai , China (*Presenter*) Nothing to Disclose
Mingda Wang, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Han Wu, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Jiongjie Yu, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Pawlik, Columbus , OH (*Abstract Co-Author*) Nothing to Disclose
Jun Han, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Hao Xing, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Zhenli Li, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Wanyee Lau, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Mengchao Wu, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Feng Shen, Shanghai , China (*Abstract Co-Author*) Nothing to Disclose
Yahao Zhou, Yunnan , China (*Abstract Co-Author*) Nothing to Disclose
Tinghao Chen, Sichuan , China (*Abstract Co-Author*) Nothing to Disclose
Hong Wang, Hunan, China (*Abstract Co-Author*) Nothing to Disclose
Weimin Gu, Heilongjiang, China (*Abstract Co-Author*) Nothing to Disclose
Yaoming Zhang, Meizhou, China (*Abstract Co-Author*) Nothing to Disclose
Wanguang Zhang, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yangtianehbh@smmu.edu.cn

PURPOSE

Surgical resection for hepatocellular carcinoma (HCC) is potentially curative, but long-term survival remains unsatisfactory. There is currently no effective neoadjuvant or adjuvant therapy for HCC. We sought to evaluate the impact of preoperative transcatheter

arterial chemoembolization (TACE) on long-term prognosis after surgical resection of huge HCCs (>= 10 cm).

METHOD AND MATERIALS

Using a multicenter database, consecutive patients who underwent curative-intent resection for huge HCC without macrovascular invasion between 2004 and 2014 were identified. The association between preoperative TACE with perioperative outcomes, long-term overall survival (OS) and recurrence-free survival (RFS) was assessed before and after propensity score matching (PSM).

RESULTS

Among the 377 enrolled patients, 88 patients (23.3%) received preoperative TACE. The incidence of perioperative mortality and morbidity was comparable among patients who did and did not undergo preoperative TACE (3.4% vs. 2.4%, P=0.704, and 33.0% vs. 31.1%, P=0.749, respectively). PSM analysis created 84 matched pairs of patients. In examining the entire cohort as well as the PSM cohort, median OS (overall cohort: 32.8 vs. 22.3 months, P=0.035, and PSM only: 32.8 vs. 18.1 months, P=0.023, respectively) and RFS (12.9 vs. 6.4 months, P=0.016, and 12.9 vs. 4.1 months, P=0.009, respectively) were better among patients who underwent preoperative TACE versus patients who did not. After adjustment for other confounding factors on multivariable analyses, preoperative TACE remained independently associated with a favorable OS and RFS after resection of huge HCC.

CONCLUSION

Preoperative TACE did not increase perioperative morbidity or mortality, yet was associated with an improved OS and RFS after liver resection of huge HCC.

CLINICAL RELEVANCE/APPLICATION

Preoperative TACE did not increase perioperative morbidity or mortality, yet was associated with an improved OS and RFS and is recommended before liver resection of huge HCC.

VSIO22-06 New Systemic Therapies for HCC and Combination Locoregional and Systemic Therapies

Monday, Dec. 2 4:20PM - 4:35PM Room: E450B

Participants
Farshid Dayyani, MD, Orange, CA (*Presenter*) Speakers Bureau, Amgen Inc; Speakers Bureau, F. Hoffmann-La Roche Ltd ; Speakers Bureau, Ipsen SA; Speakers Bureau, Sirtex Medical Ltd; Speakers Bureau, Exelixis, Inc; Speakers Bureau, Eisai Co, Ltd; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Exelixis, Inc; Consultant, Eisai Co, Ltd; Research support, F. Hoffmann-La Roche Ltd; Research support, Bristol-Myers Squibb Company; Spouse, Employee, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Describe available systemic treatment options for advanced hepatocellular carcinoma. 2) Differentiate available systemic treatment options for advanced hepatocellular carcinoma based on mechanism of action. 3) Recommend appropriate treatment for advanced unresectable hepatocellular carcinoma based on level 1 evidence.

VSIO22-07 Debate: Transarterial Therapy versus Systemic Therapy for BCLC C

Monday, Dec. 2 4:35PM - 4:45PM Room: E450B

Participants
Farshid Dayyani, MD, Orange, CA (*Presenter*) Speakers Bureau, Amgen Inc; Speakers Bureau, F. Hoffmann-La Roche Ltd ; Speakers Bureau, Ipsen SA; Speakers Bureau, Sirtex Medical Ltd; Speakers Bureau, Exelixis, Inc; Speakers Bureau, Eisai Co, Ltd; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Exelixis, Inc; Consultant, Eisai Co, Ltd; Research support, F. Hoffmann-La Roche Ltd; Research support, Bristol-Myers Squibb Company; Spouse, Employee, F. Hoffmann-La Roche Ltd
Gregory J. Nadolski II, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe available systemic treatment options for advanced hepatocellular carcinoma. 2) Differentiate treatment options based on mechanism of action. 3) Recommend appropriate treatments based on Level 1 evidence.

VSIO22-08 Cholangiocarcinoma: Classification and Treatment

Monday, Dec. 2 4:45PM - 5:00PM Room: E450B

Participants
William S. Rilling, MD, Milwaukee, WI (*Presenter*) Consultant, BTG International Ltd; Consultant, Terumo Corporation; Consultant, C. R. Bard, Inc; Research support, Guerbet SA

VSIO22-09 New Kids on the Block: SBRT and Other Options for Primary Liver Cancer

Monday, Dec. 2 5:00PM - 5:15PM Room: E450B

Participants
Alexander H. Lam, MD, Orange, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Discuss loco-regional modalities separate from traditional ablative or transarterial therapies 2. Understand the potential benefits and drawbacks associated with each modality 3. Recognize how these new techniques may fit into the current treatment paradigm

MSRO29

BOOST: Head and Neck-eContouring

Monday, Dec. 2 4:30PM - 5:30PM Room: S104B

HN NR OI RO

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

Participants
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Consultant, Nanobiotix
Suresh K. Mukherji, MD, Carmel, IN (*Presenter*) Nothing to Disclose

Special Information

The e-contouring sessions may be used by participating radiation oncologists to fulfill a PQI (practice quality improvement) requirement for ABR (American Board of Radiology) MOC (Maintenance of Certification). Interested radiation oncologist can download a e-contouring PQI template here: https://academy.astro.org/content/econtouring-pqi-template and handouts directing users to the same website will be available at the actual session.

LEARNING OBJECTIVES

1) Expose the audience to head and neck radiation therapy contouring. 2) Describe the concepts of CTV, GTV and PTV. 3) Demonstrate the complementary nature of different imaging techniques for tumor contouring.

ABSTRACT

The goal of this session is to expose the audience to head and neck radiation therapy contouring. The session will introduce the audience to concepts such as CTV, GTV and PTV. We will also demonstrate the important complementary nature of different imaging techniques for tumor contouring. This activity may also fulfill the ABR's Part 4: Practice Quality Improvement (PQI) requirement for Maintenance of Certification (MOC). Please refer to the ABR website for details.

Printed on: 10/29/20

MSRO31

BOOST: Gastrointestinal-Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Dec. 3 8:30AM - 10:00AM Room: S103AB

GI OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Abraham J. Wu, MD, New York, NY (*Presenter*) Research Grant, CivaTech Oncology, Inc
David D. Bates, MD, Hastings On Hudson, NY (*Presenter*) Research support, General Electric Company
Mukta Krane, MD, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

wua@mskcc.org

LEARNING OBJECTIVES

1) Review anatomy relevant to local staging of rectal cancer. 2) Review the role of MRI in staging and treatment planning. 3) Discuss features of structured reporting in rectal MRI.

ABSTRACT

This lecture will focus on the role of MRI in local staging of rectal cancer, including discussion of relevant anatomy and the benefits of structured reporting.

MSRO35

BOOST: Musculoskeletal-Sarcoma Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Dec. 3 8:30AM - 10:00AM Room: S103CD

MK OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Edward Y. Kim, MD, Seattle, WA (*Presenter*) Nothing to Disclose
F. Joseph Simeone, MD, Boston, MA (*Presenter*) Nothing to Disclose
Seth Pollack, MD, Seattle, WA (*Presenter*) Consultant, Back Bay Consulting; Consultant, Bayer AG; Consultant, Eli Lilly and Company; Consultant, Puretech; Consultant, Seattle Genetics, Inc; Consultant, DAIICHI SANKYO Group; Consultant, Blueprint Medicines Corporation
Kevin Raskin, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To better understand standard of care management relevant to radiation management of musculoskeletal tumors. 2) To understand best imaging practices with respect to bone and soft tissue tumors.

ABSTRACT

This session will review the multidisciplinary evaluation and treatment of musculoskeletal tumors (sarcomas and other soft tissue tumors) with discussion provided by diagnostic radiology, orthopedic oncology, medical oncology, and radiation oncology panelists.

Printed on: 10/29/20

RC305

Neuroradiology Series: Brain Tumors

Tuesday, Dec. 3 8:30AM - 12:00PM Room: S406B

NR OI

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Soonmee Cha, MD, San Francisco, CA (*Moderator*) Nothing to Disclose
Ji-hoon Kim, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

RC305-01 Integrated Next-Generation Sequencing for Glioma Diagnosis and Treatment: What is it and Where Does Imaging Fit In?

Tuesday, Dec. 3 8:30AM - 9:00AM Room: S406B

Participants
David Solomon, MD,PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

david.solomon@ucsf.edu

LEARNING OBJECTIVES

1) Comprehend the basic principles of next-generation sequencing. 2) Recognize the role of genetic characterization using NGS for diagnostic classification of CNS tumors. 3) Appreciate that an 'integrated diagnosis' for CNS tumors requires integration of radiographic, histologic, and molecular findings.

RC305-02 Interrater Agreement Using a Brain Tumor MRI Structured Reporting System in a Tumor Board Setting

Tuesday, Dec. 3 9:00AM - 9:10AM Room: S406B

Participants
Maxwell Cooper, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Michael J. Hoch, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Syed A. Abidi, BS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Ranliang Hu, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Brent D. Weinberg, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

brent.d.weinberg@emory.edu

PURPOSE

Longitudinal imaging evaluation of brain tumor patients with MRI is a challenging endeavor, as there is considerable overlap between imaging findings of tumor progression and treatment related changes, including radiation necrosis. Additionally, there is felt to be a high degree of variation between individual interpreters, particularly in complex cases such as those presented at multidisciplinary tumor board (TB). Structured reporting systems, such as the recently described brain tumor reporting and data system (BT-RADS), attempt to maximize consistency between reading radiologists, although how successful they are at achieving this is unknown.

METHOD AND MATERIALS

Patients with a diagnosis of a primary brain tumor with imaging presented at adult brain tumor board between October 2017 and March 2019 were reviewed. The most recent follow-up MRI was scored on an 8-point scale as described by BT-RADS, ranging from 0 to 4 with increasing suspicion for worsening disease, as described in the original radiologist report. Secondary review of MRI was performed by one of three neuroradiologists participating in brain tumor conference. Interrater agreement between primary and secondary review were calculated using rates of exact agreement and linear weighted kappa.

RESULTS

Of studies reviewed, 270 out of 275 had imaging and reports suitable for repeat structured scoring. Grade 4 astrocytoma (glioblastoma) was the most common diagnosis, followed by grade 2 oligodendroglioma and grade 2 astrocytoma (Figure 1A). The overall agreement rate between initial and secondary review was 83.0% with kappa of 0.89 +/- .05. There was perfect agreement on studies with improvement (1a or 1b) with lower levels of agreement (63.6-82.4%) for studies with worsening imaging findings (3a-4) (Figure 1B).

CONCLUSION

Using a structured reporting system to categorize MRIs in brain tumor patients presented at tumor board allows for precise

characterization of variation between report conclusions on primary and secondary review. Overall agreement is good, but variation rates increase with worsening findings which may be harder to correctly interpret.

CLINICAL RELEVANCE/APPLICATION

Structured reporting system of MRIs in brain tumor patients allows quantitation of report variation between readers, with further study needed to understand the impact on patient care.

RC305-03 Metabolic Characterization of Human Glioma Subtypes Using pH-Weighted Amine Chemical Exchange Saturation Transfer Echoplanar Imaging (CEST-EPI) at 3T

Tuesday, Dec. 3 9:10AM - 9:20AM Room: S406B

Participants
Jingwen Yao, MBBS,MS, Los Angeles, CA (*Presenter*) Nothing to Disclose
Chencai Wang, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Joseph Tsung, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David A. Nathanson, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
William H. Yong, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Noriko Salamon, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Albert Lai, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd Research Grant, Millennium Health Partners, Inc
Phioanh L. Nghiemphu, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Robert M. Prins, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Whitney B. Pope, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Speaker, Guerbet SA; Research funded, Guerbet SA; Speaker, Bracco Group
Richard G. Everson, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Linda M. Liao, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Timothy F. Cloughesy, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Tocagen Inc; Consultant, Karyopharm Therapeutics, Inc; Consultant, GW Pharma; Consultant, Kiyatec; Consultant, AbbVie Inc; Consultant, Boehinger Ingelheim GmbH; Consultant, VBI Vaccines Inc; Consultant, Deciphera Pharmaceuticals, LLC; Consultant, VBL; Consultant, Agios Pharmaceuticals, Inc; Consultant, Merck & Co, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Genocea; Consultant, Celgene Corporation; Consultant, Puma; Consultant, Eli Lilly and Company; Consultant, Bristol-Myers Squibb Company; Consultant, Cortice Biosciences, Inc; Consultant, Wellcome Trust; Consultant, NovoCure Ltd; Consultant, Novogen; Consultant, Sumitomo Dainippon Pharma Co, Ltd; Consultant, Human Longevity; Consultant, Insys; Consultant, ProNai; Consultant, Pfizer Inc; Consultant, Notable Labs; Consultant, MedQIA Imaging Core Laboratory; Grant, Amgen Inc; Grant, AbbVie Inc; Grant, DNAtrix; Grant, Bristol-Myers Squibb Company; Grant, AstraZeneca PLC; Grant, Kazia; Grant, Agios Pharmaceuticals, Inc; Grant, Sumitomo Dainippon Pharma Co, Ltd; Grant, Deciphera Pharmaceuticals, LLC; Grant, Tocagen Inc; Grant, OrbusNeich; Grant, Karyopharm Therapeutics, Inc; Stock options, Notable Labs; Board Member, 501c3 Global Coalition for Adaptive Research;
Benjamin M. Ellingson, MS, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Consultant, MedQIA Imaging Core Laboratory Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Boston Scientific Corporation Research Consultant, Amgen Inc Research Grant, Siemens AG Research Grant, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:

BEllingson@mednet.ucla.edu

PURPOSE

Isocitrate dehydrogenase (IDH) mutant and chromosome 1p/19q co-deleted gliomas may have distinct metabolic characteristics, which may explain their sensitivity to therapy and slow growth rates. We hypothesized a new pH-sensitive molecular MRI technique could be used to non-invasive quantify abnormal metabolic behavior in glioma subtypes.

METHOD AND MATERIALS

pH-weighted MRI was obtained at 3T using amine chemical exchange saturation transfer echoplanar imaging (CEST-EPI). The pH-dependent measure of MTRasym at 3ppm along with an estimate of acidic tumor volume were quantified in 136 patients with gliomas. Acidic tumor volume was defined by tissue with MTRasym at 3ppm>99% confidence interval of normal measurements on a voxel-wise basis in a set of 20 healthy volunteers.

RESULTS

MTRasym at 3ppm (acidity) and acidic tumor volume fraction within T2 hyperintense areas (excluding necrosis) increased with increasing WHO grade (*MTRasym: P=0.0189, Acidic Volume: P=0.0050*). In untreated tumors (pre-operative, post-operative, or not on active therapy for at least 1 year (N=89)), MTRasym at 3ppm (acidity) and acidic tumor volume fraction were significantly higher in IDH wild-type compared to mutant gliomas (*MTRasym: P=0.0399, Acidic Volume: P=0.0219*). In untreated patients with 1p/19q status available (N=58), MTRasym at 3ppm (acidity) was significantly lower in 1p/19q co-deleted compared to non-co-deleted gliomas (*P=0.0246*). Acidic tumor volume fraction was slightly lower in 1p/19q co-deleted gliomas (*P=0.1535*). In patients with complete molecular data, untreated and on active therapy, 1p/19q co-deleted tumors were significantly less acidic than 1p/19q non-co-deleted tumors when accounting for IDH status (*P=0.00038*), with significant interaction effects between 1p/19q and IDH status (*P=0.00088*). Acidic volume fraction was lower in 1p/19q co-deleted compared with non-co-deleted gliomas when accounting for IDH status (*P=0.00916*).

CONCLUSION

IDH mutant and 1p/19q co-deleted gliomas have distinct metabolic characteristics as measured using pH-weighted amine CEST-EPI at 3T.

CLINICAL RELEVANCE/APPLICATION

pH-weighted molecular MRI suggests IDH mutant and 1p/19q co-deleted gliomas (oligodendrogliomas) have unique metabolic characteristics that may be useful for as a therapeutic targeting.

RC305-05 Molecularly Defined CNS Tumors (IDH, 1p19q, CDK, BRAF, RELA)-What All Radiologists Who Read Brain Tumor Imaging Must Know

Tuesday, Dec. 3 9:30AM - 10:00AM Room: S406B

Participants
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List several CNS tumors that are newly classified based on molecular and genetic markers in the 2016 CNS Tumor Classification of World Health Organization. 2) Describe salient imaging features associated with the molecularly and genetically defined CNS tumors. 3) Explain the importance of molecular/genetic features of CNS tumors in interpreting imaging before, during, and after targeted therapy.

RC305-06 Hot Topic Panel: What's Next for Brain Tumor Imaging in the Era of 2016 CNS WHO?

Tuesday, Dec. 3 10:10AM - 10:40AM Room: S406B

Participants
David Solomon, MD,PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Michael Lim, Baltimore, MD (*Presenter*) Research Support, Arbor; Research Support, Aegenus; Research Support, Altor; Research Support, Bristol-Myers Squibb Company; Research Support, Accuray Incorporated; Research Support, DNAtrix; Consultant, Tocagen Inc; Consultant, SQZ Technologies; Consultant, VBI Vaccines Inc; Consultant, Stryker Corporation; Consultant, Baxter International Inc
Susan L. McGovern, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

RC305-07 Immunotherapy: Where is this Going and What Does Imaging Look Like Post Therapy?

Tuesday, Dec. 3 10:40AM - 11:10AM Room: S406B

Participants
Michael Lim, Baltimore, MD (*Presenter*) Research Support, Arbor; Research Support, Aegenus; Research Support, Altor; Research Support, Bristol-Myers Squibb Company; Research Support, Accuray Incorporated; Research Support, DNAtrix; Consultant, Tocagen Inc; Consultant, SQZ Technologies; Consultant, VBI Vaccines Inc; Consultant, Stryker Corporation; Consultant, Baxter International Inc

LEARNING OBJECTIVES

1) To understand the current state of immunotherapy for brain tumors. 2) To understand the challenges of radiographic endpoints in brain tumor immunotherapy trials. 3) Identify obstacles for effective immunotherapy in brain tumors.

RC305-08 Prognostic Value of Deep-Learning-Based Quantitative MRI Analysis in Diffuse Glioma

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S406B

Participants
Xue Feng, Charlottesville, VA (*Presenter*) Nothing to Disclose
Prem P. Batchala, MD, Shillong, India (*Abstract Co-Author*) Nothing to Disclose
Craig Meyer, Charlottesville, VA (*Abstract Co-Author*) Research Grant, Siemens AG
Nick Tustison, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
David Schiff, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Camilo E. Fadul, MD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
Pasha Darvishi, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Sohil H. Patel, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xf4j@virginia.edu

PURPOSE

Diffuse gliomas exhibit highly variable prognosis due to heterogeneous molecular and genetic characteristics. Pre-operative MRI provides important diagnostic information, but its prognostic value is less well understood. The purpose was to use a deep-learning-based method to automatically extract quantitative imaging features and study their prognostic value for overall survival.

METHOD AND MATERIALS

Data from a total of 140 diffuse glioma patients with pre-operative MR using pre- and post-contrast T1, T2, FLAIR was obtained from a local clinical database. Age at diagnosis, gender, tumor grade, IDH status as well as the overall survival in days was determined for each patient. The tumor region was first automatically segmented using a deep convolutional neural network. After segmentation, the whole tumor volume and surface area were obtained as well as the sphericity, which measures how closely the shape approaches a sphere. The overall survival was classified as < 5 and > 5 years. First, the age, gender, tumor grade and IDH status were used as non-imaging features to predict the overall survival class. The volume, area and sphericity were then combined with age and gender for the same task to evaluate the classification accuracy with only pre-operative information. Finally, all features were used in the classifier. 5-fold cross validation was performed and the average accuracy and area-under-the-curve (AUC) were calculated. Logistic regression models were trained on 4/5 of the data and tested on the remaining 1/5 at each fold.

RESULTS

Statistical significance was observed between each of the three imaging features (volume, surface area, sphericity) and patient overall survival (Fig 1), with sphericity showing highly significant differences ($p=1e-6$), indicating that larger and irregular tumors tend to have shorter survival. Survival prediction accuracy using pre-operative information was 0.836 with AUC of 0.905. The combined non-imaging features obtained an accuracy of 0.921 and AUC of 0.947; adding the imaging features slightly reduced the accuracy to 0.907 but the AUC increased to 0.958.

CONCLUSION

Quantitative information extracted from multi-contrast MRI using deep-learning-based segmentation provides prognostic value in the pre-surgical setting for diffuse glioma patients.

CLINICAL RELEVANCE/APPLICATION

For diffuse glioma patients, deep-learning-based segmentation of pre-operative MRI provides prognostic value.

RC305-09 Assessment of Safety Profile of Tumor Treating Fields on Normal Brain in Glioblastoma Patients Using Diffusion Tensor Imaging

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S406B

Participants
Sanjeev Chawla, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sumei Wang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Shadi Asadollahi, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
MacLean Nasrallah, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Stephen Bagley, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Arati Desai, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lisa M. Desiderio, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Steven Brem, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Harish Poptani, PhD, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (*Presenter*) Grant, NovoCure Ltd Grant, Galileo CDS, Inc

For information about this presentation, contact:

Sanjeev.Chawla@uphs.upenn.edu

PURPOSE

Tumor treating fields (TTFields) is a novel therapeutic modality recently approved for the management of patients with glioblastoma (GBM). No quantitative evidence of safety profile of TTFields on normal brain parenchyma in patients with GBM is available. The purpose of present study was to assess whether TTFields induce any tissue damage to normal brain regions in patients with GBM by using diffusion tensor imaging (DTI).

METHOD AND MATERIALS

Twelve patients GBM previously treated with surgery and chemo-radiation therapy received TTFields. Patients underwent anatomical imaging and DTI on a 3T MR system at baseline (prior to TTFields) and at two-month following initiation of TTFields. DTI data were acquired using a single-shot spin-echo EPI sequence (30 directions). After motion and eddy current correction of raw DTI data, parametric maps [mean diffusivity (MD), fractional anisotropy (FA), coefficient of linear (CL), planar (CP) and spherical anisotropy (CS)] were computed. DTI maps at two time points were co-registered. Mean values of MD, FA, CL, CP and CS were computed from different normal appearing gray-matter, and white-matter regions bilaterally by drawing circular regions of interests (ROIs, 20pixels). Adequate care was taken to avoid different tissue compartments with infiltrating neoplasms while drawing these ROIs. Paired t-tests were performed with an assumption that significant differences ($p<0.05$) in DTI parameters from baseline to post-TTFields would reflect adverse effects.

RESULTS

No significant differences ($p>0.05$) in DTI parameters (MD, FA, CL, CP and CS) were observed from different brain regions at a post-TTFields period relative to baseline. The average values of MD and FA from white-matter regions [frontal (FWM), occipital (OWM), centrum semiovale (CS), genu, splenium (spl) and body of corpus callosum) and gray-matter regions (basal ganglia (BG), thalamus (Th), caudate nucleus (CN) and hippocampus (Hip) are shown as bar-diagrams (Figure).

CONCLUSION

Our preliminary findings provide objective and quantitative measures of evaluating safety profile of TTFields. DTI analyses support the notion that TTFields therapy does not induce any tissue injury to normal brain regions in patients with GBM.

CLINICAL RELEVANCE/APPLICATION

Favorable safety profile of TTFields makes this therapy as an attractive choice for treating GBM patients. This information will help in enhancing compliance rate and thus efficacy of TTFields.

RC305-10 Proton Beam Therapy for CNS Tumors: Reinventing the Wheel or Fresh New Start-Imaging Changes Post Therapy

Tuesday, Dec. 3 11:30AM - 12:00PM Room: S406B

Participants
Susan L. McGovern, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

slmcgove@mdanderson.org

LEARNING OBJECTIVES

1) Understand how proton therapy differs from photon therapy for brain tumors. 2) Identify risk factors for imaging changes after proton therapy for brain tumors. 3) Describe the incidence and types of imaging changes that may develop after proton therapy for brain tumors.

RC307

Genitourinary Series: Imaging with Impact in Gynecologic Oncology

Tuesday, Dec. 3 8:30AM - 12:00PM Room: E353B

GU OI

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Katherine E. Maturen, MD, Ann Arbor, MI (*Moderator*) Royalties, Reed Elsevier; Royalties, Wolters Kluwer nv; ;
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

kmaturen@umich.edu

LEARNING OBJECTIVES

1) Recognize stages in the diagnosis and treatment process for gynecologic cancers where imaging changes management. 2) Identify key sequences for MR imaging in the female pelvis. 3) Understand fundamentals of adnexal mass characterization with US and MRI. 4) Describe important staging considerations in endometrial and cervical cancer. 5) Appreciate the important role of radiotherapy in gynecologic oncology.

Sub-Events

RC307-01 Global Scope and Morbidity of Gynecologic Cancers

Tuesday, Dec. 3 8:30AM - 8:45AM Room: E353B

Participants
Carolyn M. Johnston, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

johnstob@umich.edu

LEARNING OBJECTIVES

1) Learn how to do more with less. 2) Develop an awareness of the existing challenges for cancer care in Ghana and Ethiopia. 3) Understand what you can do and how those in the developing world can help.

RC307-02 Imaging and the FIGO Staging Paradigm: Gaps and Opportunities

Tuesday, Dec. 3 8:45AM - 9:00AM Room: E353B

Participants
Stephanie Nougaret, MD, Montpellier, France (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To present the difficulties with the current FIGO staging in female pelvic malignancy. 2) To discuss the gap between FIGO staging and imaging in female pelvic malignancy. 3) To present the need of a staging system incorporating advanced imaging.

RC307-03 Fundamentals of Imaging in Endometrial Cancer

Tuesday, Dec. 3 9:00AM - 9:15AM Room: E353B

Participants
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

esadowski@uwhealth.org

LEARNING OBJECTIVES

1) Understand the current staging and treatment of endometrial cancer. 2) Review the MRI protocol for imaging endometrial cancer. 3) Recognize MRI findings in endometrial cancer which alter treatment.

RC307-04 MRI-Assessed Tumor-Free Distance to Serosa Predicts Deep Myometrial Invasion and Poor Prognosis in Endometrial Cancer

Tuesday, Dec. 3 9:15AM - 9:25AM Room: E353B

Participants

Julie Andrea Dybvik, MD, Bergen, Norway (*Presenter*) Nothing to Disclose
Kristine E. Fasmer, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Jone Trovik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Camilla Krakstad, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingfrid H. Haldorsen, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

julie.andrea.dybvik@helse-bergen.no

PURPOSE

The aim of this study was to explore the diagnostic accuracy of preoperative magnetic resonance imaging (MRI) and MRI-based tumor measurements for prediction of pathological deep (>=50%) myometrial invasion (pDMI) and for prognostication in endometrial carcinomas (EC).

METHOD AND MATERIALS

Preoperative pelvic MRI scans of 357 prospectively included patients with histologically confirmed EC were read independently by three radiologists blinded to clinical information. The radiologists recorded the following imaging data in a standardized registration form: findings suggesting deep (>=50%) myometrial invasion (iDMI) and the tumor measurements: axial anteroposterior tumor diameter (APD), depth of myometrial tumor invasion (DOI) and tumor free distance to serosa (TFD). Receiver operating characteristic (ROC) curves for prediction of pDMI (in 38.1% of the patients) using hysterectomy specimen as reference standard, were plotted for the different tumor measurements and optimal cut-off values were determined. The predictive and prognostic value of the tumor measurements were analyzed using binary logistic regression and Cox proportional hazard model, respectively. Interobserver agreement was assessed using Fleiss' kappa (κ).

RESULTS

TFD yielded the highest area under the ROC-curve (AUC) for prediction of pDMI with an AUC of 0.83 whereas DOI, APD and iDMI yielded AUCs of 0.72, 0.81 and 0.74, respectively. Multivariate analysis (including cut-off based imaging variables and preoperative histological risk-status) for predicting pDMI yielded highest predictive value of TFD<6 mm with OR of 6.1 (p<0.001) and lower figures for DOI >=5mm (OR=2.2; p=0.04), APD >=17mm (OR=3.1, p<0.001) and iDMI (OR=1.1 (p=0.76). Patients with TFD<6 mm also had significantly reduced survival with hazard ratio of 1.9; p=0.01. The interobserver agreement was good for APD>=17mm (κ=0.70) and moderate for TFD<6 mm (κ=0.52), but only fair for DOI >=5mm (κ=0.25) and iDMI (κ=0.36)

CONCLUSION

At preoperative MRI TFD<6 mm was the strongest predictor of pDMI and was associated with poor survival. TFD<6 mm outperforms iDMI for prediction of pDMI and could aid in identifying high-risk disease in endometrial carcinomas.

CLINICAL RELEVANCE/APPLICATION

Preoperative TFD at MRI using cut-off value <6 mm, represents a promising imaging biomarker that could aid in prediction of pDMI and high-risk disease in endometrial cancer.

RC307-05 Integrated Clinical Parameters and Diffusion-weighted Imaging Radiomics for Predicting Lymph Node Metastasis in Endometrial Cancer: Added Values of Computer-Aided Segmentation and Machine Learning

Tuesday, Dec. 3 9:25AM - 9:35AM Room: E353B

Participants
Gigin Lin, MD, Taoyuan, Taiwan (*Presenter*) Nothing to Disclose
Tiing Yee Siow, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Lan-Yan Yang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Chun Lin, MSC, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chyong-Huey Lai, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

giginlin@cgmh.org.tw

PURPOSE

Precise risk stratification in lymphadenectomy is important for patients with endometrial cancer, to balance the therapeutic benefit against perioperative morbidity and mortality. We aim to investigate added values of computer-aided segmentation and machine learning based on clinical parameters and diffusion-weighted imaging radiomics for predicting nodal metastasis in endometrial cancer.

METHOD AND MATERIALS

This prospective study included 119 women with endometrial cancer who underwent magnetic resonance (MR) before surgery during July 2010-June 2015. Decision-tree machine learning comprised the apparent diffusion coefficient (ADC) of whole tumor volumetric and lymph nodes (LNs) segmentations, MR morphological measurement, and relevant clinical parameters. Areas under the receiver operating characteristics curve (AUCs) were used to compare diagnostic performances of the decision-tree model, mean ADC model, and LN short-axis diameter criteria.

RESULTS

For decision-tree modeling, 106 MR imaging features and 7 clinical factors were extracted. A decision-tree model was constructed based on grade (1 vs 2 and 3), CA125 level (cutoff, 190 U/mL), short-axis diameter of LN (cutoff, 2.2 mm), 75th percentile and minimum ADC of tumor (cutoff, 0.8 × 10-3 and 0.4 × 10-3 mm2/s, respectively), and difference of LN ADC skewness to tumor ADC skewness (cutoff, 1.3). The sensitivity, specificity, accuracy, positive predictive value, and negative predictive value for the decision-tree model were 100%, 91.1%, 92.0%, 56.8%, and 100%, respectively. The AUC of the decision-tree model was 0.96-significantly higher than the mean ADC model (AUC = 0.59) and LN short-axis diameter criteria (AUC = 0.68) (both P < .0001).

CONCLUSION

A combination of clinical and MR radiomics generates a prediction model for LN metastasis in endometrial cancer, with diagnostic performance surpassing the conventional ADC and size criteria.

CLINICAL RELEVANCE/APPLICATION

Computer-aided segmentation and machine learning added values of clinical parameters and diffusion-weighted imaging radiomics for predicting nodal metastasis in endometrial cancer, with a diagnostic performance superior to criteria based on lymph node size or apparent diffusion coefficient.

RC307-06 Preoperative 3D Tumor Texture Features from MRI Predict Aggressive Disease in Endometrial Cancer

Tuesday, Dec. 3 9:35AM - 9:45AM Room: E353B

Participants
Kristine E. Fasmer, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Erlend Hodneland, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Julie Andrea Dybvik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Camilla Krakstad, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingfrid H. Haldorsen, MD, Bergen, Norway (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ingfrid.haldorsen@helse-bergen.no

PURPOSE

To extract whole-volume texture features in primary tumor based on preoperative MRI and explore whether 3D image features relate to stage and outcome in endometrial cancer (EC).

METHOD AND MATERIALS

Preoperative pelvic MRI including contrast-enhanced T1-weighted (T1+c), T2-weighted and diffusion-weighted imaging (DWI) were performed in 99 EC patients. 3D tumor volumes were manually delineated on axial oblique T1+c and the corresponding T2, b1000 and apparent diffusion coefficient (ADC) maps were co-registered to the T1+c images. Grey level histogram features (kurtosis, skewness, entropy), gray level co-occurrence matrix (GLCM) features (energy, homogeneity, contrast, correlation) and tumor cluster analyses (cluster-size and -index) were computed for each of the sequences. Associations between image texture and surgicopathological features were assessed by Mann-Whitney U-tests and controlled for false discovery rates (alpha=0.01). Receiver-operating-characteristics (ROC) curves were used for the three top-ranked significant texture features for prediction of staging parameters and high-risk histology (endometrioid grade 3 and non-endometrioid). Kaplan-Meier, uni- and multivariable Cox regression analyses were applied for survival analysis.

RESULTS

Top-ranked tumor texture features significantly predicting advanced stage were high correlation T1+c (AUC=0.85), homogeneity T1+c (AUC=0.81) and entropy ADC (AUC=0.81) predicting deep myometrial invasion; and high tumor cluster-index T2 (AUC=0.84), entropy ADC (AUC=0.82) and entropy T1+c (AUC=0.82) predicting lymph node metastases. Features predicting high-risk histology were high correlation ADC (AUC=0.76), clustersize b1000 (AUC=0.75) and correlation T1+c (AUC=0.73). High tumor entropy on ADC, b1000 and T1+c all predicted reduced recurrence- and progression-free survival (HR=2.0, p<=0.014 for all).

CONCLUSION

3D tumor texture features derived from MRI, significantly predict deep myometrial invasion, lymph node metastases, high-risk histological subtype and reduced survival in endometrial cancer.

CLINICAL RELEVANCE/APPLICATION

3D MRI tumor texture analyses yield markers that can be utilized for preoperative risk assessment and may ultimately enable more tailored treatment strategies in endometrial carcinomas.

RC307-07 Cervical Cancer Imaging Essentials

Tuesday, Dec. 3 9:45AM - 10:00AM Room: E353B

Participants
Evan S. Siegelman, MD, Media, PA (*Presenter*) Advisory Board, Spreemo Health; Consultant, BioClinica, Inc; Consultant, ICON plc; Consultant, inviCRO, LLC

For information about this presentation, contact:

evan.siegelman@uphs.upenn.edu

LEARNING OBJECTIVES

1) Describe the role of human papilloma virus in the development of cervical cancer and critique the ability of an HPV vaccine to prevent the development of cervical cancer. 2) Apply the FIGO classification system of cervical cancer and explain what imaging features are not incorporated in the FIGO system. 3) Identify the essential MR pulse sequences and imaging findings to accurately stage women with cervical cancer. 4) Assess the utility of PET imaging in the staging of cervical cancer.

RC307-08 MRI-Assessed Tumor Size Parameters Predict Survival in Uterine Cervical Cancer

Tuesday, Dec. 3 10:00AM - 10:10AM Room: E353B

Participants
Njal G. Lura, MD, Bergen, Norway (*Presenter*) Nothing to Disclose
Kari Wagner-Larsen, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

Mari Halle, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Julie Andrea Dybvik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Jone Trovik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Camilla Krakstad, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingfrid H. Haldorsen, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

njal.lura@gmail.com

PURPOSE

The aim of this study was to compare the value of different tumor size measurements at magnetic resonance imaging (MRI) for predicting disease specific survival in patients with uterine cervical cancer

METHOD AND MATERIALS

A total of 421 patients with histologically confirmed uterine cervical cancer who had a pelvic MRI at primary diagnostic work-up were reviewed. Maximum tumor diameters were measured in three orthogonal planes; anteroposterior (AP), transverse (TV), and craniocaudal planes (CC); maximum diameter irrespective of plane (MAX), and tumor volumes (TVOL) were estimated. Tumor size parameters were analyzed in relation to disease-specific survival and clinical FIGO stage. Kaplan-Meier survival analyses and uni- and multivariate Cox regression analyses were performed. Receiver operating characteristics (ROC) curves for the different tumor measurements were calculated and optimal cut-off values were determined.

RESULTS

All tumor size parameters yielded high area under the ROC curve (AUC) (range of 0.82-0.84 for all), for predicting disease-specific death. All size parameters were significant predictors of disease specific survival in univariate analyses (hazard ratios (HR) ranging from 1.025-1.053; p<0.001 for all); when including all size parameters in a multivariate model, only TV had an independent impact on survival (HR of 1.04; p=0.002). The optimal cut of value for TV was >= 31 mm yielding a sensitivity and specificity of 82 % and 73%, respectively, for predicting disease specific death. TV>=31 mm yielded a HR of 6.9; p<0.001; when adjusting for clinical FIGO stage (4 categories) TV>=31 mm had an independent prognostic impact with HR of 4.0; p<0.001 for TV>=31 mm and HR of 2.1; p<0.001 for FIGO stage.

CONCLUSION

All tumor size parameters from pelvic MRI predict disease-specific survival. TV was the only independent predictor of poor survival amongst the tumor size parameters, and TV>31 mm was a significant predictor of poor survival also when adjusting for clinical FIGO stage. Thus, preoperative tumor measurements including assessment of TV may yield prognostic information in uterine cervical cancer potentially relevant for therapy.

CLINICAL RELEVANCE/APPLICATION

Transverse tumor diameter measurements based on MRI using cut-off of >=31 mm represents a promising imaging marker that may aid in the prediction of aggressive disease in uterine cervical cancer.

RC307-09 Cervical Carcinoma Post-Treatment Neoplasm or Post-Treatment Sequalae: Can Diffusion-Weighted Imaging (DWI) with ADC Mapping Solve the Ongoing Dilemma?

Tuesday, Dec. 3 10:10AM - 10:20AM Room: E353B

Participants
Samar A. Hussein, MSc, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Eman F. Kamal, MBChB, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Rasha M. Kamal, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

samar.ahmad@nci.cu.edu.eg

PURPOSE

To assess the value of each of the applicable MRI pulse sequences include diffusion weighted imaging with ADC mapping in the evaluation of tumor residual, recurrence or post-treatment complications after tumor resection and/or chemotherapy/radiotherapy on cervical cancer. We also aim to assess the possibility of using DW imaging instead of contrast studies especially in patients with impaired renal functions and trying to define cut off ADC values of residual/recurrent lesions.

METHOD AND MATERIALS

The study included 61 patients with pathologically proven cancer cervix and a control group of 60 patients. All patients underwent post treatment Contrast Enhanced and Diffusion weighted MRI examinations to assess, confirm or exclude the presence of residual/recurrence mass lesions or post therapy complications.The reported MRI findings of both studies were correlated with histopathology results and/or with follow -up imaging.

RESULTS

In post-treatment cervical cancer malignant lesions detection and differentiation from benign post treatment changes, contrast enhanced MRI calculated sensitivity and specificity of 86% and 88% respectively. The inclusion of CE MRI resulted in statistically a non-significant improvement of the diagnostic accuracy in post-treatment malignant lesions detection compared to conventional non-enhanced sequences as both had low specificity (88%) with a high false-positive rate. The addition of DW imaging and ADC mapping provided 100 % specificity in post-treatment malignant lesions detection and raised the sensitivity to 97.2%. Mean ADC values of malignant post-treatment lesions (1.019±0.15 x10-3 mm2/sec) were significantly different than those of benign post -treatment changes (1.5482± 0.07 x10-3 mm2/sec) (P < 0.001).The cut off average ADC value for detecting post-treatment malignant lesions was found to be <= 1.2 x10-3 mm2/sec with 100% specificity and 97.2% sensitivity. Patients with lower baseline mean ADC values (<= 0.8 ± 0.024 x10-3 mm2/sec) are more likely to have post-treatment complete response than patients with higher baseline mean ADC values (>= 0.96± 0.045 x10-3 mm2/sec) (P < 0.001).

CONCLUSION

The use of contrast-enhanced MR imaging does not improve the accurate assessment of post-treatment cancer cervix with a high probability of false negative and false positive results . The use of DW imaging with ADC mapping provide added value with improved sensitivity and specificity in detection of cancer cervix post-treatment malignant lesions and differentiating them from post-treatment benign changes.

CLINICAL RELEVANCE/APPLICATION

Addition of DW imaging with ADC mapping further improve detection of post-treatment residual/recurrent lesions in cancer cervix patients and differentiating them form post -treatment sequalae.

RC307-10 Image Based Radiotherapy in Gynecologic Oncology: Radiologists as Partners in Treatment Planning

Tuesday, Dec. 3 10:20AM - 10:35AM Room: E353B

Participants
Aradhana M. Venkatesan, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

avenkatesan@mdanderson.org

LEARNING OBJECTIVES

1) Provide an overview of the contemporary role for MRI for radiotherapy (RT) planning and management of gynecologic cancer patients, with an emphasis on HPV-associated gynecologic malignancies. 2) Summarize technical requirements, patient preparation and image acquisition protocols. 3) Describe fundamental radiotherapy concepts and asociated radiologic findings pertinent to management, illustrative of the team-based approach between radiologists and radiation oncologists.

RC307-11 Ultrasound of Adnexal Lesions and Introduction to ACR O-RADS US

Tuesday, Dec. 3 10:45AM - 11:00AM Room: E353B

Participants
Phyllis Glanc, MD, Toronto, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Phyllis.Glanc@sunnybrook.ca

LEARNING OBJECTIVES

1) Discuss the emerging role of ultrasound in the evaluation of adnexal lesions. 2) Review the ACR Ovarian-Adnexal Reporting Lexicon. 3) Evaluate the new O-RADS Ultrasound Risk Stratification and Management System.

ABSTRACT

Over the last 2 decades there has been an evolution in the approach to incidentally detected ovarian lesions. We will review the key changes which incorporate more conservative therapy for benign lesions and appropriate triage to gynecological oncologists for malignant lesions. We will discuss the recently published O-RADS (Ovarian and Adnexal) lexicon and highlight key features approach to it's use. Finally, we will evaluate the O-RADS Ultrasound risk stratification and mangement system, an international consensus guideline from the O-RADS committee which incorporated the international ovarian tumor analysis (IOTA) group data with other published data to provide a useful risk stratification and management system for patients with ovarian lesions.

Active Handout:Phyllis Glanc

http://abstract.rsna.org/uploads/2019/19000195/Active RC307-11.pdf

RC307-12 MRI Characterization of Adnexal Lesions and Introduction to ACR O-RADS MRI

Tuesday, Dec. 3 11:00AM - 11:15AM Room: E353B

Participants
Andrea G. Rockall, FRCR,MRCP, London, United Kingdom (*Presenter*) Speaker and Chairman, Guerbet SA

LEARNING OBJECTIVES

1) To know the indications of MRI for adnexal mass characterisation. 2) To be familiar with MRI protocol used. 3) To be familiar with the O-RADS MR lexicon. 4) To know how to apply the O-RADS MR score.

ABSTRACT

In this lecture, the indication for MRI characterisation of adnexal masses will be reviewed and the protocol will be described. The key lexicon terms will be presented and a link to the full lexicon will be provided. A systematic approach to applying the O-RADS MR score will be described, with case examples.

RC307-13 Contrast-Enhanced SHI Imaging for Characterization of Adnexal Masses

Tuesday, Dec. 3 11:15AM - 11:25AM Room: E353B

Participants
Priscilla Machado, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Lauren J. DeLaney, PhD, Philadelphia , PA (*Abstract Co-Author*) Nothing to Disclose
Mehnoosh Torkzaban, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrej Lyshchik, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Research support, Bracco Group; Advisory Board, Bracco Group; Research support, General Electric Company; Research support, Siemens AG; Research support, Canon Medical Systems

Corporation; Speaker, SonoScape Co, Ltd
Corinne Wessner, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Norman G. Rosenblum, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, General Electric Company
Christine Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Scott Richard, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Kirk Wallace, PhD, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Flemming Forsberg, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Lantheus Medical Imaging, Inc

For information about this presentation, contact:

Priscilla.Machado@jefferson.edu

PURPOSE

To evaluate the use of contrast-enhanced subharmonic ultrasound imaging (SHI) to characterize adnexal masses prior to surgical intervention.

METHOD AND MATERIALS

Ten women scheduled to undergo surgery for adnexal masses underwent a SHI examination of their adnexal region using a modified Logiq E9 scanner (GE, Waukesha, WI). Baseline images were acquired using B-mode and color Doppler using both curvilinear and endocavitary probes. After the baseline imaging, which was also used to locate the region of interest, SHI imaging was done using the endocavitary probe following both bolus and infusion of the ultrasound contrast agent Definity® (Lantheus Medical Imaging, N Billerica, MA). Subjects first received a 1.5 ml Definity bolus injection and, digital clips were acquired up to 5 minutes after injection (time of wash-out). After a 10 minute interval, subjects received an infusion consisting of 1.5 ml of Definity in 25.0 ml of saline over 5 minutes, digital clips were acquired using pulse destruction/replenishment SHI imaging across the lesion. Time intensity curves were created off-line to quantitatively evaluate SHI parameters. These parameters were compared to the pathological findings.

RESULTS

The 10 subjects had a total of 12 adnexal masses, as 2 subjects had bilateral adnexal masses. The final pathological diagnosis determined that 8adnexal masses were benign and 4 were malignant. Qualitative analysis of the CEUS SHI images by an experienced radiologist resulted in a diagnostic accuracy of 70%, compared to 56% without contrast, demonstrating the benefit of SHI. Quantitative analysis of CEUS SHI parameters produced diagnostic accuracy as high as 81%. Peak contrast intensity was significantly greater in malignant than benign masses (0.109 ± 0.088 vs. 0.046 ± 0.030, p = 0.046). Malignant masses also demonstrated significantly greater perfusion than benign masses (24.79 ± 25.34% vs. 7.62 ± 6.50%, p = 0.045).

CONCLUSION

The use of SHI for characterization of adnexal masses may improve the determination of malignancy, reducing cost and risk to patients, while improving diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

SHI characterization of ovarian masses is a noninvasive and safe method that could be used in the future to differentiate benign from malignant lesions.

RC307-14 Non-Invasive Prediction of Laparoscopy-Based Score System Using Preoperative CT in Advanced Ovarian Cancer Patients

Tuesday, Dec. 3 11:25AM - 11:35AM Room: E353B

Participants
Nayoung Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dae Chul Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyunghwa Han, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeon Jong Seob, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Taik Oh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

knynk1107@yuhs.ac

PURPOSE

To construct a CT based Fagotti scoring system without staging laparoscopy by analyzing correlation between the laparoscopic findings and the corresponding CT findings in advanced ovarian cancer patients.

METHOD AND MATERIALS

The pre-operative CT and staging laparoscopic records based on Fagotti score system of 157 patients with stage III/IV ovarian cancer were reviewed, who underwent debulking surgery between 2010 and 2018. Ten CT features known as predictor of sub-optimal resection were evaluated by two independent radiologists who were blinded to the laparoscopy and the surgical outcome. Each imaging features were matched with relevant laparoscopic parameters by Spearman correlation between them. Variable selection and Model construction was performed by logistic regression with a least absolute shrinkage and selection operator (LASSO) method. Final CT-based scoring system was internally validated using 5-fold cross validation.

RESULTS

Among the 157 patients, 120 (76.4%) was rated predictive index value (PIV, sum of scores) >= 8 on staging laparoscopy, who assigned to non-resectable group initially. Complete/optimal cytoreduction was achieved in 23 (63.5%)/37(100%) among the remaining 37 patients (PIV < 8), respectively. Table 1 shows regression coefficient between CT features and laparoscopic parameters as result of LASSO regression modeling. The ROC analysis showed that the area under the curve(AUC) was 0.7234 (95% CI 0.6225~0.8243) (Fig.2).

CONCLUSION

Central tumor burden such as mesenteric diseases and paraaortic lymphadenopathy and upper abdominal spread including diaphragm and gastro-transverse-splenic (GTS) space involvement on preoperative CT was identified distinct prediction factor for high PIV. The CT based PIV prediction model may be useful for patient stratification in the era of staging laparoscopy.

CLINICAL RELEVANCE/APPLICATION

Although the achievement of complete cytoreduction was known as the important prognostic factor of advanced ovarian cancer, there is no standardized model for predicting surgical outcome.

RC307-15 Deep Learning in the Differentiation of Benign and Malignant Ovarian Lesions Based on Routine Magnetic Resonance Imaging

Tuesday, Dec. 3 11:35AM - 11:45AM Room: E353B

Participants
Yeyu Cai, MD, Changsha, China (*Abstract Co-Author*) Nothing to Disclose
Robin Wang, BA, Philadelphia, PA (*Presenter*) Nothing to Disclose
Iris Lee, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Hui Liu, Changsha, China (*Abstract Co-Author*) Nothing to Disclose
Jing Wu, Changsha, China (*Abstract Co-Author*) Nothing to Disclose
Ting Huang, Changsha, China (*Abstract Co-Author*) Nothing to Disclose
Harrison X. Bai, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Zishu Zhang, MD, PhD, Changsha, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

caiyeyu001@csu.edu.cn

PURPOSE

Ovarian cancer is one of the most common causes of cancer death among women. However, definite diagnosis of benign versus malignant ovarian lesion is difficult based on pre-operative imaging. We proposed using deep learning based on routine MR imaging to distinguish the two using routine MR imaging and compare performance with expert radiologists.

METHOD AND MATERIALS

A total of 335 ovarian lesions were identified from the institution's database with definitive pathology and pre-operative MR imaging. Preprocessing of the images involved n4 bias correction, intensity normalization, and registration. The images were divided into training, validation, and test sets in a 7:2:1 split. Individual models were trained on T2-weighted (T2WI) and T1-contrast enhanced (T1C) sequences independently, using the ResNet50 architecture. A stochastic gradient descent optimizer was used with Nesterov momentum. The training involved 500 epochs with a batch size of 16 and early stopping (patience=300 epochs). An ensemble model was created by combining clinical variables (age and volume), T2WI and T1C sequences with a bagging classifier to predict ovarian tumor outcomes. Final performance was compared with two experts' interpretation (two radiologists with 23 and 10 years of experience reading pelvic MR, respectively).

RESULTS

Among all 335 lesions, the mean age is 51.33 years old ranging from 13 to 90, and there was no significant difference in age (50.9 ± 15.5 vs 53.1±14.9, p=0.425) and tumor location(p=0.966) between benign and malignant group. The final ensemble model achieved a test accuracy of 85.3% with 33.3% sensitivity and 96.4% specificity. In comparison, expert 1 achieved an accuracy of 67.6% with a sensitivity of 100% and specificity of 60.7%. Expert 2 achieved an accuracy of 64.7% with a sensitivity of 66.7% and 64.3% specificity.

CONCLUSION

Deep learning can distinguish benign from malignant ovarian lesions with high accuracy when compared to experts. Further work on optimization of algorithm and incorporation of a larger, more diverse input cohort will boost performance.

CLINICAL RELEVANCE/APPLICATION

Definite diagnosis of benign from malignant ovarian lesions is difficult based on preoperative imaging. A deep learning algorithm based on routine MRI that can distinguish the two with high accuracy can potentially save patients from unnecessary surgeries/biopsies and guide treatment decisions.

RC307-16 Essential and Emerging MRI Techniques for Gynecologic Cancer Diagnosis and Staging

Tuesday, Dec. 3 11:45AM - 12:00PM Room: E353B

Participants
Caroline Reinhold, MD, MSc, Montreal, QC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To outline patient preparation that will allow the optimization of the MR imaging acquisition. 2) To determine the essential MR pulse sequences to accurately stage women with gynaecological malignancies. 3) To review emerging MR technologies for staging gynaecological cancers.

RC318

An Integrated Approach to Tumor Heterogeneity Using Imaging

Tuesday, Dec. 3 8:30AM - 10:00AM Room: S502AB

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (*Moderator*) Co-founder, Cambridge AI Health; Speakers Bureau, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Review the results of the massively parallel sequencing studies of human cancers. 2) Assess the inter- and intra-tumor genetic heterogeneity found in human cancers. 3) Define the implications of genetic heterogeneity on tumor evolution and treatment. 4) Identify potential multi-omics data sets in medicine 5) Identify and compare different integration strategies 3) identify challenges of multi-omics data integration. 6) Explain the basic concepts of Radiomics. 7) Describe methods, challenges, and solutions on small data sets. 8) Discuss early clinical results in Oncologic Imaging with a critical eye.

Sub-Events

RC318A Genetic Heterogeneity in Cancer: Overview and Implications

Participants
Britta Weigelt, New York, NY (*Presenter*) Spouse, Advisor, Goldman Sachs; Spouse, Scientific Advisory Board, VolitionRx; Spouse, Scientific Advisory Board, Page.AI; Spouse, Scientific Advisory Board, Grail; Spouse, Scientific Advisory Board, F. Hoffmann-La Roche Ltd; Spouse, Scientific Advisory Board, inviCRO, LLC; ;

LEARNING OBJECTIVES

1) Review the results of the massively parallel sequencing studies of human cancers. 2) Assess the inter- and intra-tumor genetic heterogeneity found in human cancers. 3) Define the implications of genetic heterogeneity on tumor evolution and treatment.

RC318B Integrating Multiomics: New Frontiers Ahead

Participants
Ramona Woitek, MD, Vienna, Austria (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rw585@cam.ac.uk

LEARNING OBJECTIVES

1) Identify potential multi-omics data sets in medicine 2) Identify and compare different integration strategies 3) identify challenges of multi-omics data integration

RC318C Radiomics on Small Datasets: Techniques and Strategies to Enhance Performance

Participants
Nickolas Papanikolaou, PhD, Lisbon, Portugal (*Presenter*) Stockholder, MRIcons LTD; Stockholder, Advantis Medical Imaging

For information about this presentation, contact:

nickolas.papanikolaou@research.fchampalimaud.org

LEARNING OBJECTIVES

1) Explain the basic concepts of Radiomics. 2) Describe methods, challenges, and solutions on small data sets. 3) Focus on the critical appraisal of radiomics in Oncologic Imaging

MSRO32

BOOST: Genitourinary-Anatomy and Treatment Planning (Interactive Session)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S103AB

GU OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Rohit Mehra, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Tristan Barrett, MBBS, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Nicole Curci, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn current data on effectiveness of prostate MRI. 2) Understand inter-rater challenges with prostate MRI. 3) Gain awareness of how analytics can be used to improve quality of care.

MSRO36

BOOST: Lung, Mediastinum, Pleura-Anatomy and Treatment Planning (Interactive Session)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Meng X. Welliver, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Mizuki Nishino, MD, Newton, MA (*Presenter*) Institutional Research Grant, Merck & Co, Inc; Institutional Research Grant, Canon Medical Systems Corporation; Institutional Research Grant, AstraZeneca PLC; Consultant, DAIICHI SANKYO Group; Research Grant, DAIICHI SANKYO Group; Consultant, AstraZeneca PLC
Alexander Louie, MD, FRCPC, Toronto, ON (*Presenter*) Speaker, AstraZeneca PLC; Speaker, Varian Medical Systems, Inc;
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Clinical Bay; Researcher, Zai Lab
Melin J. Khandekar, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mizuki_nishino@dfci.harvard.edu

meng.welliver@osumc.edu

LEARNING OBJECTIVES

1) Describe the lung, mediastinal, and pleural anatomy on imaging for treatment planning and monitoring for thoracic malignancy, with a focus on lung cancer, thymic tumors, and mesothelioma. 2) Discuss the cutting-edge strategies and pitfalls for treatment planning and disease surveillance for lung cancer, thymic tumors, and mesothelioma. 3) Understand the importance of multidisciplinary approaches to thoracic malignancy involving lung, mediastinum, and pleura.

ABSTRACT

The purpose of this course is to provide attendees with a practical knowledge of the lung, mediastinal, and pleural anatomy and the understanding of the treatment planning strategies and pitfalls for thoracic malignancy with a focus on lung cancer, thymic tumors, and mesothelioma, highlighting the importance of multidisciplinary approaches to these tumors.

SSG09

Nuclear Medicine (Lymphoma PET)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S504CD

NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Helen R. Nadel, MD, Palo Alto, CA (*Moderator*) Consultant, ICON plc
Don C. Yoo, MD, Lexington, MA (*Moderator*) Consultant, inviCRO, LLC

Sub-Events

SSG09-01 Impact of PET/CT on Clinical Management in Patients with Cancer of Unknown Primary

Tuesday, Dec. 3 10:30AM - 10:40AM Room: S504CD

Participants
Christian P. Reinert, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Julia Sekler, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian La Fougere, Tubingen , Germany (*Abstract Co-Author*) Nothing to Disclose
Christina Pfannenberg, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

christian.reinert@med.uni-tuebingen.de

PURPOSE

To evaluate the impact of PET/CT on clinical management decisions in patients with Cancer of Unknown Primary (CUP).

METHOD AND MATERIALS

A cohort of patients with CUP undergoing clinically indicated PET/CT was prospectively enrolled in a local PET/CT registry study between 01/2013 to 06/2018. Questionnaire data from referring physicians on intended patient management before and after PET/CT were recorded. The questionnaire included items on PET/CT indication (primary staging, re-staging, lesion characterization), intended diagnostic procedures (biopsy, additional imaging), and intended treatment concept (no treatment plan, curative treatment, palliative treatment, watchful waiting). Changes in management before and after PET/CT were analyzed. Patient outcome was measured as overall survival from initial diagnosis and drawn from available patient records.

RESULTS

155 patients (53 female; 63.4±12.1y) with CUP were included. PET/CT detected the primary in 36 patients (23.7%). Intended treatment concepts were changed in 74 patients (47.7%) on the basis of PET/CT results. The treatment plan changed from 'curative' or 'no treatment plan' before PET/CT to 'palliative' in 28 patients (18.1%) and from 'no treatment plan' to a 'curative' concept in 15 patients (9.7%). Minor therapy adjustments without change of treatment goal were documented in 30 patients (19.4%). Additional invasive procedures and imaging (CT, MRI) were intended in 40 (25.8%) and 98 (63.2%) patients before PET/CT and in 21 (13.5%) and 10 (6.5%) patients after PET/CT. Overall patient survival was significantly longer in patients with one CUP manifestation (4.6±0.4y) compared to patients with 2-3 (2.8±0.4y) or more than 3 manifestations (2.4±.4y)(p=.001). Patients with cervical CUP manifestations showed a significantly longer survival (4.3±0.3y) than patients with extracervical manifestations (3.5±0.5y)(p=.01), as well as patients with intended curative (4.0±3.6y) compared to palliative treatment (2.7±0.6y) after PET/CT (p=.001).

CONCLUSION

PET/CT significantly influences clinical management in patients with CUP. It helps referring physicians to select a more appropriate and individualized treatment and to avoid unnecessary additional diagnostics.

CLINICAL RELEVANCE/APPLICATION

PET/CT has a high impact on clinical management of CUP patients due to its potential as a method for detection of the primary and distant metastases that directly influences overall patient survival.

SSG09-03 Characterization of Interim Residual Lymphoma Masses Using Diffusion-Weighted MRI with Apparent Diffusion Coefficient Mapping: FDG-PET as the Reference Standard

Tuesday, Dec. 3 10:50AM - 11:00AM Room: S504CD

Participants
Chieh Lin, MD,PhD, Taoyuan, Taiwan (*Presenter*) Nothing to Disclose
Sebastien Mule, MD,PhD, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Pierre Zerbib, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Nicolas Louarn, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Romain Ricci, Creteil, France (*Abstract Co-Author*) Nothing to Disclose

Karim Belhadj, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Tzu-Chen Yen, MD, PHD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Corinne Haioun, MD, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Alain Rahmouni, MD, Nogent Sur Marne, France (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Itti, MD, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Alain Luciani, MD,PhD, Creteil CEDEX, France (*Abstract Co-Author*) Research Consultant, Bracco Group Research Grant, Bracco Group Research Consultant, General Electric Company Research Consultant, Siemens AG

For information about this presentation, contact:

sophieclin@gmail.com

PURPOSE

To assess the value of diffusion-weighted MRI in characterizing residual lymphoma masses early during first-line chemotherapy, compared with FDG-PET as the reference standard.

METHOD AND MATERIALS

Our two-nation and two-institutional prospective study included 133 patients with bulky disease (at least one mass >7cm in diameter) at diagnosis. Whole-body diffusion-weighted MRI at 3.0-T (b = 50, 400, 800 sec/mm2) and FDG-PET/CT were performed within a week from each other, or simultaneously using FDG-PET/MRI in the later patients, before initiation in all and after 2 chemotherapy cycles (interim) in 126 patients. Volume-of-interest encompassing the entire bulky mass before and after treatment was drawn semi-automatically to obtain the mean apparent diffusion coefficient values (ADCmean). The 2014 Lugano classification was used for PET response interpretation and a Deauville score of 4 or 5 was considered positive.

RESULTS

There were 64 diffuse large B-cell (DLBCL), 45 Hodgkin (HL) and 24 follicular (FL) lymphoma patients with a total 157 bulky masses at diagnosis. Before treatment, ADCmean of these masses was 1.071 ± 0.352 x10-3 mm2/sec (range, 0.415-2.400). They were all FDG-avid with a maximum SUV of 17.0 ± 8.1 (range, 4.0-43.3). ADCmean values were comparable between two institutions for each histology subtype (P = .621-.769). Among three lymphoma subtypes, HL (52 masses) had significantly higher ADCmean values than either DLBCL (75 masses) or FL (30 masses), 1.321 v. 0.976 or 0.873 x10-3 mm2/sec, respectively (P < .0001), while only marginal difference was found between DLBCL and FL (P = .048). At interim, ADCmean values were lower in PET-positive (poor response, 50 masses) than in PET-negative (good response, 100 masses) residual masses, 1.442 ± 0.486 v. 1.865 ± 0.559 x10-3 mm2/sec (P < .0001).

CONCLUSION

Diffusion-weighted MRI with ADC mapping demonstrated in lymphoma patients with bulky disease at diagnosis different features between HL and the other two major histology subtypes. In addition, interim residual masses with good response on FDG-PET showed higher ADCmean values than those with poor response (NCT02300402).

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted MRI with ADC mapping seems useful in characterizing residual masses in lymphomas, by providing quantitative information of lesion cellularity.

SSG09-04 Comparison of FDG PET/CT-Guided Percutaneous Metabolic Bone Marrow Biopsy and Conventional Trephine Bone Marrow Biopsy for the Assessment of Lymphomatous Bone Marrow Infiltration in Newly Diagnosed Lymphoma

Tuesday, Dec. 3 11:00AM - 11:10AM Room: S504CD

Participants
Rajender Kumar, MBBS, Chandigarh, India (*Presenter*) Nothing to Disclose
Bhagwant R. Mittal, MD, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Harmandeep Singh, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Gaurav Prakash, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
Anish Bhattacharya, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

drrajender2010@gmail.com

PURPOSE

To compare the diagnostic-values of PET/CT-guided targeted metabolic bone marrow (BM) biopsy and trephine bone marrow-biopsy (TBMB) to assess lymphomatous infiltration in newly diagnosed lymphoma.

METHOD AND MATERIALS

Newly diagnosed patients of lymphoma were recruited for FDG PET/CT. FDG uptake in the marrow was classified as focal, multifocal, diffuse and negative and PET/CT guided BM biopsy was done from focal or multifocal marrow lesion. The PET-guided biopsies were done using a dedicated automated-robotic-arm assisted device on the same day of diagnostic PET/CT. The real-time tissue sample was retrieved after confirming the needle tip to the target lesion. All the patients underwent TBMB from bilateral posterior superior iliac spine as a routine staging work-up. The reference standard was histopathology results of the biopsies. The diagnostic values of PET/CT-guided BM-biopsy with TBMB was compared for assessment of BM infiltration. The PET/CT-guided procedure related complications and radiation exposure to the interventionist were also recorded.

RESULTS

From January 2017 to December 2018, 167 patients of lymphoma were recruited for baseline FDG PET/CT staging. The FDG uptake in bone marrow was classified as focal (n=8), multifocal (n=25), diffuse (n=32) and negative (n=102). Of these 33/167 patients underwent both, PET/CT guided targeted BM biopsies and TBMB. Of these 33 patients, PET-guided-biopsy revealed 30 true-positive (TP), no false-positive (FP), two true-negative (TN), and one false-negative (FN). The sensitivity, specificity, positive predictive

values, NPV and accuracy of 96.7%, 100%, 100%, 66.7%, 96.9 % respectively. TBMB revealed TP-18, FN-12, FP-0 and TN-3 with sensitivity, specificity, positive predictive values, NPV and accuracy of 60.0%, 100%, 100%, 20%, 63.6% respectively. No procedure related complications were encountered in the present study. The estimated absorbed radiation dose was 566.7 µSv/year for the interventionist.

CONCLUSION

PET/CT-guided targeted BM biopsy has shown a higher diagnostic performance as compared to routine TBMB from iliac spine. It is highly practical and useful in characterization of focal FDG avid lesion and negates the false negative results.

CLINICAL RELEVANCE/APPLICATION

TBMB is established method for evaluation of BM involvement in lymphoma but only a fraction of the BM is sampled leading to a FN results. PET-guided targeted BM biopsy may reduce these FN findings.

SSG09-05 Radiomic Features of Glucose Metabolism Enable Prediction of Outcome in Mantle Cell Lymphoma

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S504CD

Participants
Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Presenter*) Speaker, Siemens AG; Research support, Siemens AG
Christopher C. Riedl, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anita Kumar, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Peter Gibbs, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Juliana B. Schilsky, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Heiko Schoder, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mayerhom@mskcc.org

PURPOSE

To determine whether, in mantle cell lymphoma (MCL), [18F]FDG-PET/CT-derived radiomic features are predictive of 2-year progression-free survival (PFS), alone or in combination with clinical, laboratory and biologic data, and whether they enable outcome prognostication.

METHOD AND MATERIALS

107 treatment-naïve MCL patients scheduled to receive CD20-antibody-based immuno(chemo)therapy were retrospectively included. Standardized uptake values (SUV), total lesion glycolysis, and 16 co-occurrence matrix radiomic texture features were extracted from metabolic tumor volumes on pre-therapeutic [18F]FDG-PET/CT. A multi-layer perceptron neural network in combination with logistic regression analyses for feature selection was used for 2-year PFS prediction. Outcome prediction was first performed for radiomic features alone, and then and in combination with ECOG, WBC, LDH, and Ki67 index. International prognostic indices (MIPI and MIPI-b) were calculated, and combined with radiomic data (MIPI-m, MIPI-bm). Kaplan-Meier estimates with log-rank tests were used for PFS prognostication.

RESULTS

SUVmean (odds ratio OR, 1.272; P=0.013) and Entropy (heterogeneity of glucose metabolism; OR, 1.131; P=0.027) were significantly predictive of 2-year PFS: median areas-under-the-curve were 0.72 based on the two radiomic features alone, and 0.82 with addition of ECOG, WBC, LDH, and Ki67. Higher SUVmean in combination with higher Entropy, reflecting high 'metabolic risk', was associated with a poorer prognosis (median PFS, 20.3 vs. 39.4 months; hazard ratio HR, 2.285; P=0.005). Best PFS prognostication was achieved with the MIPI-bm (i.e., combination of MIPI-b and metabolic risk): median PFS was 43.2 months in the low risk group; 38.2 months in the intermediate risk group; and 20.3 months in the high risk group (P=0.005).

CONCLUSION

In MCL, [18F]FDG-PET/CT-derived radiomic features SUVmean and Entropy may improve 2-year PFS prediction and PFS prognostication. Best results may be achieved by a combination of metabolic, clinical, laboratory and biologic data.

CLINICAL RELEVANCE/APPLICATION

Radiomic features extracted from pre-therapeutic [18F]FDG-PET/CT may improve outcome prognistication in mantle cell lymphoma patients, and may therefore be useful for risk stratification and treatment decisions. Radiomic features could be easily integrated into an artificial intelligence-based outcome prediction model together with clinical, laboratory and biological data.

SSG09-06 The Potential Value and Pitfalls of Radiomics for Clinical Positron Emission Tomography (PET) in DLBCL: Results from the Phase 3 GOYA Study

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S504CD

Participants
Stephane Chauvie, PhD, Turin, Italy (*Abstract Co-Author*) Stockholder, Dixit srl
Federico Dalmasso, Cuneo, Italy (*Abstract Co-Author*) Nothing to Disclose
Larry A. Pierce II, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Tina Nielsen, Basel, Switzerland (*Abstract Co-Author*) Employee, F. Hoffmann-La Roche Ltd
Deniz Sahin, Basel, Switzerland (*Abstract Co-Author*) Employee, F. Hoffmann-La Roche Ltd
Lale Kostakoglu, MD, MPH, New York, NY (*Abstract Co-Author*) Research Consultant, F. Hoffmann-La Roche Ltd
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company Co-founder, PET/X LLC

PURPOSE

We are using the large multi-center (207 sites) phase 3 GOYA study to investigate using quantitative image texture features (ITFs, i.e. 'radiomics') to improve the prognostic value of the FDG-PET baseline exams in patients with previously untreated diffuse large

B-cell lymphoma (DLBCL). Here we evaluate the robustness of ITFs in clinical practice.

METHOD AND MATERIALS

Images with regions of interest (ROIs) defined by qualified physicians were transferred to the imaging core laboratory. Analysis was performed on the original images and after interpolation to common voxel sizes of 2, 4, 5, 10mm. ITFs were computed using the open-source 'PET oncology radiomics test suite (PORTS). The stability of standard metrics (SUV-mean, SUV-max, MTV, TLG), SUV histogram metrics (variance, skewness and kurtosis), and ITFs were analyzed as a function of image voxel size. Supervised machine learning models (SVM, LDA, KNN, GBRM, RF) were applied to a training set (80% of patients) to differentiate the lesion from an ROI in liver. Diagnostic accuracy was calculated on the test set (20% of patients).

RESULTS

FDG-PET images came from a variety of PET/CT scanners; thus, a unified image reconstruction protocol was not possible. Using a threshold of > 5ml, a total of 1085 radiomics-evaluable patients with 9307 lesions were analyzed. Standard SUV and histogram metrics were stable w.r.t. to image voxel size. There was a substantial variation in the distribution of many of the ITFs w.r.t. to image voxel size. Eight of the ITFs were stable w.r.t. to image voxel size, in particular GTSDM Autocorrelation, and GLZSM High Gray-Level Zone Emphasis. While the rest of the ITFs were not stable, several were stable except for the 2 or 10 mm voxels (e.g. GTSDM Sum Entropy). The stable metrics were able to differentiate liver from lesions with a diagnostic accuracy for all ML models ranging from 0.995 to 0.999.

CONCLUSION

While radiomics signatures can potentially increase the prognostic value of risk prediction of DLBCL patients at baseline, the impact of variable voxel size inherent to clinical imaging, and the distributed nature DLBCL disease visualized by PET, imply caution in interpretation by image texture analysis.

CLINICAL RELEVANCE/APPLICATION

The impact of variable voxel size inherent due to variations inherent in clinical imaging, and the distributed nature DLBCL disease visualized by PET, imply caution in interpretation by image texture analysis.

SSG09-07 Is Inappropriate Imaging Really the Culprit? An Analysis and Comparison of Published PET/CT Guidelines

Tuesday, Dec. 3 11:30AM - 11:40AM Room: S504CD

Participants
Andreea Badea, BSC, Saskatoon, SK (*Presenter*) Nothing to Disclose
Sonia Vanderby, Saskatoon, SK (*Abstract Co-Author*) Nothing to Disclose
Paul S. Babyn, MD, Saskatoon, SK (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

andreea.badea@usask.ca

PURPOSE

Inappropriate imaging strains patients and the health system. Several Positron Emission Tomography/Computed Tomography (PET/CT) imaging guidelines have been proposed with varying formats. Our purpose was to examine the current rates of inappropriate imaging and guideline coverage using several national guidelines to evaluate PET/CT imaging in Canada.

METHOD AND MATERIALS

Academic PET/CT centers across Canada were surveyed and asked to provide exam requests from a consecutive 7-day period. Four sets of guidelines were used to analyze the appropriateness of the exam requisitions by the author and verified by a senior radiologist: the Canadian Association of Radiologists (CAR) Referral Guidelines, the American College of Radiologists (ACR) Appropriateness Criteria, the National Cancer Care Network (NCCN) Practice Guidelines and the Institut National d'Excellence en Santé et Services Sociaux (INESSS) Interactive Tool.

RESULTS

In total, 521 exam requisitions were received from 8 PET/CT centers across Canada with most (435, representing 83%) submitted for oncological investigations, 36 (7%) for neurological conditions, 26 (5%) to investigate infectious/inflammatory processes, and the remaining 24 (5%) for various reasons. The guidelines indicated that 14-31 (3-7%) of the oncological cases were inappropriate, 123-301 (29-69%) were appropriate, and the remaining 118-299 (27-69%) were indeterminate. Among neurological exams, 0-1 (0-3%) were inappropriate, 0-29 (0-81%) were appropriate and 0-36 (0-100%) were deemed indeterminate. Of the infection/Inflammation requests, 0-1 (0-4%) were inappropriate, 0-14 (0-56%) were appropriate, and 11-25 (44-100%) were indeterminate.

CONCLUSION

While the rate of inappropriateness was similar across guidelines, the proportions deemed appropriate and indeterminate varied substantially. These results demonstrate that in addition to the existence of guidelines, further education for referring physicians, as well as development of consensus, integrated guideline assistance and override justification could prove useful.

CLINICAL RELEVANCE/APPLICATION

Insufficient information on requests and lack of guidelines are much more prevalent than inappropriate imaging, further review of PET/CT guideline utility is required.

SSG09-08 Is it Time to Reduce FDG PET Dose to 5 mCi? Findings from an NCI Quick Trial NCT03519659

Tuesday, Dec. 3 11:40AM - 11:50AM Room: S504CD

Participants
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chadwick L. Wright, MD,PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Eric D. Miller, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Meng X. Welliver, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Amir Mortazavi, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Peter Kneuertz, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Maryam Lustberg, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Clark, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Taylor Porter, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Yu-lung Hsieh, PhD, Columbus , OH (*Abstract Co-Author*) Nothing to Disclose
Lai Wei, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

knopp16@osu.edu

PURPOSE

FDG PET imaging dosing in the US is based on two recommendations, the NCI workshop guidance (10 to 20 mCi FDG (Shankar et al.)) and the FDA packaging label for the production of FDG which allows dosing above 5 mCi. These recommendations have remained unchanged in spite of major PET technology developments. We performed a prospective clinical quick trial aimed to validate equivalency of 5 mCi, low dose FDG PET/CT compared to current standard of care (SOC) FDG PET/CT based on both true low dose and simulated low dose imaging.

METHOD AND MATERIALS

Low dose PET/CT imaging was assessed in 228 whole body PET studies exams, 50% true 5 mCi dosing, 50% simulated by reduced frame time of the SOC. As intraindividual comparison with two dose and scan sessions was not feasible, a matched pair distribution in BMI, gender, and age was accomplished within the desired time frame. All PET acquisitions were performed using time of flight 75 minutes post-injection using 90 seconds per bed position. A subpopulation of 97 patients were imaged on two TOF PET systems in direct succession. The low dose group had a dose of 4.9 mCi +/- 0.4, the matched SOC group 13.0 mCi +/- 0.8. Target lesion SUVmax and visual image quality evaluation were the primary assessment points. Secondary assessments include qualitative and quantitative image quality, uptake in other tissues, diagnostic confidence, and presence/visibility of artifacts. As established in prior studies, optimized image reconstruction was BMI adapted for the low dose data sets.

RESULTS

Assessment of image quality, diagnostic confidence, and image artifacts demonstrates equivalency ($p<.01$) for the dose reduced 5 mCi FDG for whole-body oncologic PET imaging. There was no loss of diagnostic capabilities, even when maintaining an acquisition time consistent with standard of care examinations. We have found that the key is the re-optimization of TOF reconstruction parameters to account for the reduced relative count density.

CONCLUSION

This trial demonstrates the ability to perform oncologic whole-body imaging at the low dose of 5 mCi with high quality and quantitatively equivalent by using TOF optimized, BMI adapted reconstruction at the lower count density without any negative diagnostic impact.

CLINICAL RELEVANCE/APPLICATION

We demonstrate that FDG dose reduction to 5 mCi is feasible in oncologic whole body TOF PET provided that an optimized, BMI adapted reconstruction approach is implemented.

SSG09-09 Accelerating Whole-Body PET Acquisitions Using Deep Learning: External Validation on Foreign Country Data

Tuesday, Dec. 3 11:50AM - 12:00PM Room: S504CD

Participants
Jose Leite, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose
Gustavo Tukamoto, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Akshay Chaudhari, PhD, Menlo Park, CA (*Abstract Co-Author*) Research Consultant and Stockholder, Subtle Medical; Research Consultant, Skope MR; Scientific Advisory Board and Stockholder, Brain Key; Scientific Advisory Board, Chondrometrics GmbH; Stockholder, LVIS Corporation; ;
Enhao Gong, PhD, Menlo Park, CA (*Abstract Co-Author*) Stockholder, Subtle Medical
Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical
Igor R. Dos Santos, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Kitamura, MD, MSC, Sao Paulo, Brazil (*Abstract Co-Author*) Consultant, MD.ai, Inc

For information about this presentation, contact:

enhao@subtlemedical.com

PURPOSE

The goal of this study was to evaluate the use of deep learning to enhance the image quality of 2-fold, 3-fold, and 4-fold accelerated whole-body PET acquisitions.

METHOD AND MATERIALS

Seven subjects (5 males, age: 57±14 years, weight: 81±10Kgs) referred for a whole-body FDG-18 PET/CT scan on a GE Discovery 710 scanner (GE Healthcare, Waukesha, WI) were recruited for this study following IRB approval and informed consent. The standard of care was a 2 min/bed PET acquisition acquired in list-mode. 2-fold, 3-fold, and 4-fold accelerated acquisitions were

synthesized using the first 30s, 40s, and 60s list-mode PET counts of the original 2min acquisition. All accelerated PET acquisitions were enhanced using a FDA-cleared commercially available deep learning software: SubtlePET (Subtle Medical, Menlo Park, CA). Quantitative image quality metrics such as normalized root-mean-squared-error (NRMSE), peak signal to noise ratio (PSNR), and structural similarity (SSIM) were calculated for all enhanced and non-enhanced accelerated PET scans, with the standard 2min acquisition as the ground-truth. Image slices in regions of elevated PET uptake (bladder and brain) were excluded from the analysis. Paired 2-tailed t-tests were computed to evaluate whether the quantitative metrics were superior for the deep-learning enhanced accelerated acquisitions compared to the non-enhanced acquisitions.

RESULTS

NRMSE, PSNR, and SSIM were significantly better ($p<0.001$) for all deep learning enhanced PET scans for all acceleration factors compared to the non-enhanced images (except 2-fold accelerated SSIM, $p<0.05$). All the deep learning enhanced images (2 to 4-fold) demonstrated similar perceptual image quality and lesion conspicuity when compared to standard of care scans. Representative PET images and quantitative metrics are seen in Figure 1.

CONCLUSION

Up to 4-fold faster PET scans can be enhanced using deep learning while maintaining similar image quality and diagnostic accuracy as the standard of care acquisition.

CLINICAL RELEVANCE/APPLICATION

Deep learning can enhance the speed of PET acquisitions for enhancing patient comfort and increasing efficiency and throughput of PET imaging, especially in resource constrained countries.

Printed on: 10/29/20

VSIO31

Interventional Oncology Series: From Bench to Bedside

Tuesday, Dec. 3 1:00PM - 3:00PM Room: S405AB

BQ IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Muneeb Ahmed, MD, Boston, MA (*Moderator*) Research Grant, General Electric Company Stockholder, Agile Devices, Inc Scientific Advisory Board, Agile Devices, Inc

LEARNING OBJECTIVES

1) Appreciate the mechanistic basis for improving interventional oncologic procedures based upon a better understanding of molecular interactions. 2) Understand how molecular knowledge can be used to better image patients and predict outcomes. 3) Gain awareness of the extent of potentially beneficial and harmful systemic effects of "focal" interventional oncologic therapy. 4) Learn how immuno-oncologic techniques can be combined with both percutaneous and transcatheter interventional oncologic therapies to potentially achieve better clinical outcomes.

ABSTRACT

This session has been organized into a thematic unit thatwill provide a series of six lectures by leaders in the field each dedicated to discussing basic science advances that currently impact upon or are likely to impact upon interventional oncologic practice in the near future. This will include lectures providing the scientific rationale behind combination approaches between interventional oncologic platforms and other conventional and immuno-oncologic therapies. Moreover, two lectures will highlight the latest advances in our understanding and potentiating of systemic effects of interventional oncologic procedures - including both potentially positive abscopal, immunogenic effects and less desired pro-tumorigenic phenomena. Finally, the session will conclude with two lectures addressing the ever expanding role of molecular imaging and biomarkers for stratification and prognosis and the potential roles that IO may serve in the future oncologic platforms. The session will further include selected complementary abstract presentations that highlight innovative research in these thematic areas.

Sub-Events

VSIO31-01 Combination Therapies

Tuesday, Dec. 3 1:00PM - 1:15PM Room: S405AB

Participants
S. Nahum Goldberg, MD, Efrat, Israel (*Presenter*) Consultant, AngioDynamics, Inc; Consultant, Cosman Medical, Inc; Consultant, XACT Robotics;

VSIO31-02 Immuno-oncology: Basic Principles

Tuesday, Dec. 3 1:15PM - 1:30PM Room: S405AB

Participants
Rony Avritscher, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rony.avritscher@mdanderson.org

VSIO31-03 Irreversible Electroporation Combined with Poly-ICLC Immunogenic Adjuvant Improves Tumoral Response in Preclinical Animal Models of Hepatocellular Carcinoma

Tuesday, Dec. 3 1:30PM - 1:40PM Room: S405AB

Participants
David Cano, MD, Pamplona, Spain (*Presenter*) Nothing to Disclose
Ana Ezponda, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Calvo-Imirizaldu, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Ignacio Gonzalez Crespo, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Juan J. Lasarte, PhD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose
Isabel Vivas Perez, MD, Pamplona, Spain (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dcanor@unav.es

PURPOSE

Irreversible electroporation (IRE) is an ablation technique that induces non-immunogenic tumor cell death. Indeed, IRE doesn´t promote inflammation that might help to activate antitumor immunity and get better long-term control of tumor growth. The

purpose was to evaluate the therapeutic efficacy of IRE combined with an immunogenic adjuvant Poly-ICLC (dsRNA analog mimicking viral RNA) to induce an antitumor immune response after death of the electroporated cells.

METHOD AND MATERIALS

Antitumor efficacy of IRE+Poly-ICLC was evaluated in models of hepatocarcinoma. Mice and rabbits bearing hepatocellular carcinoma tumors (Hepa.129 and VX2 tumor models, respectively) were treated with IRE (2 pulses of 2500V), with poly-ICLC, or with the combination IRE+poly-ICLC. Tumor growth in mice was monitored using a digital caliper and by computed tomography in rabbits. Histologic studies and statistical analysis (parametric (Student´s t test and one-way ANOVA) and non-parametric (Mann-Whitney U and Kruskal-Wallis) were carried on.

RESULTS

Intratumoral administration of poly-ICLC immediately before IRE elicited shrinkage of Hepat.129 cell-derived tumors in 70% of mice compared to 30% and 26% by poly-ICLC or IRE alone, respectively (p=.0004). This combined therapy induced the shrinkage of VX-2-based hepatocellular tumors in 40% of rabbits, whereas no response was achieved by either individual treatment (p=.045). The combined therapy activated a systemic antitumor response able to inhibit the growth of other untreated tumors (abscopal effect). In two rabbits a complete radiological response was achieved.

CONCLUSION

IRE treatment, immediately preceded by the intratumoral administration of an immunogenic adjuvant such as poly-ICLC, might enhance the antitumor effect of the IRE procedure. This combination might facilitate the induction of a long-term systemic response to prevent tumor relapses and the appearance of metastases.

CLINICAL RELEVANCE/APPLICATION

Intratumoral administration of poly-ICLC before IRE increases the antitumor efficacy of IRE, favoring the activation of a systemic immunity and enabling therapeutic control of untreated tumor. In clinical setting it has been described that patients with big tumors treated with IRE exhibited a considerably shorter lifespan probably because of the growth of non-ablated cells. The potential synergistic effect of PolyICLC+IRE might provide a therapeutic option for patients whose tumor >3 cm.

VSIO31-04 Immuno-oncology: Clinical Studies

Tuesday, Dec. 3 1:40PM - 1:55PM Room: S405AB

Participants
Bradford J. Wood, MD, Bethesda, MD (*Presenter*) Researcher, Koninklijke Philips NV; Researcher, Celsion Corporation; Researcher, BTG International Ltd; Researcher, Siemens AG; Researcher, XAct Robotics; Researcher, NVIDIA Corporation; Intellectual property, Koninklijke Philips NV; Intellectual property, BTG International Ltd; Royalties, Invivo Corporation; Royalties, Koninklijke Philips NV; Equipment support, AngioDynamics, Inc; Researcher, Profound Medical Inc; Researcher, Canon Medical Systems Corporation; Researcher, AstraZeneca PLC; Researcher, Exact Imaging Inc

For information about this presentation, contact:

bwood@nih.gov

LEARNING OBJECTIVES

1) Review clinical trial rationale and general concepts and research avenues for immuno-oncologic techniques in interventional oncology & interventional radiology. 2) Analyze clinical examples in HCC of percutaneous ablative and transcatheter embolization interventional oncologic therapies combined with checkpoint inhibitor drugs with molecular immune correlates. 3) Apply iRECIST and review pseudo-progression. 4) Ask relevant unanswered research questions within the space of immuno-oncology and image guided minimally invasive IR oncology therapies.

VSIO31-05 Post-ablation Tumorigenesis

Tuesday, Dec. 3 1:55PM - 2:10PM Room: S405AB

Participants
Muneeb Ahmed, MD, Boston, MA (*Presenter*) Research Grant, General Electric Company Stockholder, Agile Devices, Inc Scientific Advisory Board, Agile Devices, Inc

VSIO31-06 Novel MR-Based Molecular Imaging Biomarkers to Monitor Local Anti-Tumoral Immune Cell Response in an Animal Model of Liver Cancer

Tuesday, Dec. 3 2:10PM - 2:20PM Room: S405AB

Awards
Trainee Research Prize - Resident

Participants
Lynn J. Savic, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Isabel T. Schobert, BS, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Luzie A. Doemel, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ruth R. Montgomery, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Nikhil Joshi, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
James S. Duncan, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Lin Leng, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Richard J. Bucala, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Daniel Coman, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Fahmeed Hyder, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Julius Chapiro, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Guerbet SA; Consultant, Guerbet SA; Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Research Grant, Boston Scientific Corporation;

For information about this presentation, contact:

julius.chapiro@yale.edu

PURPOSE

To establish molecular imaging probes for the non-invasive MR-based monitoring of local immune cell activity within the tumor microenvironment (TME) in a translational animal model for liver cancer.

METHOD AND MATERIALS

VX2 liver tumor-bearing New Zealand White rabbits were assigned to undergo a) systemic intravenous infusion of rhodamine-conjugated small iron oxide nanoparticles (SPION) (n=3) or b) locoregional intraarterial infusion of gadolinium-labeled anti-HLA-DR antibodies (n=3) to allow for in vivo immune cell labeling. Twenty-four hours after contrast administration, animals were subjected to imaging using a human-size 3T MRI scanner, which included T1- and T2-weighted sequences and biosensor imaging of redundant deviation in shifts for extracellular pH (pHe) mapping. Radiological-pathological correlation comprised immunohistochemistry (IHC), Prussian blue staining of iron and fluorescence microscopy. Additionally, spatial distribution of gadolinium-conjugated antibodies was validated ex vivo using imaging mass cytometry (IMC) on paraffin-embedded tissue.

RESULTS

pHe mapping and IHC of VX2 liver tumors revealed relative tumor acidosis (pHe=6.79±0.09) compared to liver parenchyma (7.18±0.02, $p<0.001$) and immune cell infiltration into the peritumoral stroma. T2-weighted MRI with SPION showed curvilinear signal hypointensity surrounding the tumor, indicating selective SPION deposition in the peritumoral rim. Prussian blue staining and rhodamine fluorescence ex vivo confirmed the presence of SPION deposited in macrophages. T1-weighted MRI after administration of gadolinium-labeled anti-HLA-DR antibodies revealed localized ring enhancement in the peritumoral rim. IMC on tissue harvested from the same rabbits confirmed gadolinium-labeling of macrophages in the peritumoral rim corresponding with the signal distribution pattern on MRI.

CONCLUSION

The peritumoral MR signal from both SPION and gadolinium-tagged anti-HLA-DR antibodies correlated well with histopathological immune cell accumulation in an acidic TME. This translational study establishes MR-based molecular imaging instruments that allow for in vivo monitoring of specific immune cell populations with high three-dimensional spatial resolution.

CLINICAL RELEVANCE/APPLICATION

The results provide proof of concept for non-invasive immunophenotyping, which may serve as a monitoring tool for individual susceptibility and response to immuno-oncological and locoregional therapies.

VSIO31-07 Molecular Imaging for IO

Tuesday, Dec. 3 2:20PM - 2:35PM Room: S405AB

Participants
Terrance Gade, Philadelphia, PA (*Presenter*) Consultant, Trisalus Life Sciences

VSIO31-08 Predictive Biomarkers

Tuesday, Dec. 3 2:35PM - 2:50PM Room: S405AB

Participants
Etay Ziv, MD,PhD, New York, NY (*Presenter*) Research Grant, Johnson & Johnson;

VSIO31-09 Panel Discussion

Tuesday, Dec. 3 2:50PM - 3:00PM Room: S405AB

MSRO34

BOOST: Genitourinary-Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Dec. 3 3:00PM - 4:15PM Room: S103AB

GU OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Nicole Curci, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Arvin K. George, MD, Ann Arbor , MI (*Presenter*) Research Consultant, TROD Medical
Stanley L. Liauw, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

arvigeor@med.umich.edu

LEARNING OBJECTIVES

1) Understand the utility of Prostate MRI in clinical decision-making in the following areas: A) Primary diagnosis, B) Active Surveillance for Prostate Cancer, C) Surgical Planning, D) Treatment Failure, E) Selection for focal therapy candidacy.

MSRO38

BOOST: Lung, Mediastinum, Pleura-Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Dec. 3 3:00PM - 4:15PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Simon S. Lo, MD, Seattle, WA (*Presenter*) Editor, Springer Nature; Member, ICON plc; Member, Elekta AB;
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Clinical Bay; Researcher, Zai Lab
David W. Johnstone, Milwaukee, WI (*Presenter*) Nothing to Disclose
Jyoti D. Patel, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Feng-Ming Kong, MD,PhD, Cleveland, OH (*Presenter*) Speakers Bureau, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Describe the multidisciplinary management of lung cancer. 2) Describe the multidisciplinary management of mesothelioma. 3) Describe the multidisciplinary management of thymic tumors.

ABSTRACT

In this modern era, treatment outcomes of lung cancer, mesothelioma, and thymic tumors can be improved by using a multidisciplinary approach. This session will cover the multidisciplinary management of thoracic malignancies in a case-base format.

Printed on: 10/29/20

SSJ05

Chest (Artificial Intelligence/Machine Learning - Lung Malignancy)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S102CD

AI CH OI

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

FDA Discussions may include off-label uses.

Participants
Carol C. Wu, MD, Houston, TX (*Moderator*) Author, Reed Elsevier
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Research Grant, INFINITT Healthcare Co, Ltd; Research Grant, DONGKOOK Pharmaceutical Co, Ltd;

Sub-Events

SSJ05-01 Incidence Lung Cancer after a Negative CT Screening in National Lung Screening Trial: Deep Learning for Detection of Missed Lung Cancers

Tuesday, Dec. 3 3:00PM - 3:10PM Room: S102CD

Participants
Jungheum Cho, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jihang Kim, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Monitor Corporation; Research Grant, Seoul National University Bundabg Hospital
Kyong Joon Lee, Gyeonggi-do, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Monitor Corporation
Junghoon Kim, Seongnam-si , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyunghee Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Ministry of Trade, Industry, and Energy; Research Grant, SNUBH Research Fund
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

radio622@gmail.com

PURPOSE

To retrospectively analyze the screening CT examinations of the National Lung Screening Trial (NLST) participants with incidence lung cancer after a negative screening round and evaluate the value of deep learning-based computer-aided detection (CAD) system in the detection of missed lung cancers.

METHOD AND MATERIALS

The images of NLST participants diagnosed with incidence lung cancer after verifiable negative CT screen were retrospectively analyzed (n = 122). Two experienced radiologists classified each of the previous-round CT screens as positive or negative and determined if missed lung cancer was present according to the NLST criteria and Lung-RADS classification in a consensus manner. A CAD system based on DenseNet 3D convolutional neural networks, trained with LIDC-IDRI dataset, was then introduced. Patient-wise and lesion-wise sensitivities along with the patient-wise false-positive rates of the CAD system were analyzed according to the NLST criteria and Lung-RADS classification separately.

RESULTS

According to the NLST criteria, 84% (103 of 122) of the previous-round CT screens were determined as positive and 60% (73 of 122) had missed lung cancers. The CAD system found 95% (98 of 103) of the CT screens as positive with 16% (3 of 19) of false-positive rate, and successfully detected 74% (54 of 73) of the missed lung cancers. Following the Lung-RADS classification, 79% (96 of 122) CT screens were determined as positive and 54% (66 of 122) had missed lung cancers. The CAD system found 89% (85 of 96) as positive with 19% (5 of 26) of false-positive rate, and detected 74% (49 of 66) of the missed lung cancers.

CONCLUSION

In this retrospective study of incidence lung cancers, the majority of the previous-round CT screens met the criteria for a positive screen and had missed lung cancers. The sensitivity of deep learning-based CAD system was 89-95% for positive screens and 74% for missed lung cancer detection, while the false-positive rate was limited.

CLINICAL RELEVANCE/APPLICATION

Lung cancers are frequently missed in low-dose CT screening and a deep learning-based CAD system has the potential to improve early diagnosis.

SSJ05-02 How Many Malignancies Present at Baseline That Get Diagnosed in the Next Screening Round? Could Their Workup Be Accelerated?

Tuesday, Dec. 3 3:10PM - 3:20PM Room: S102CD

Participants

Nicholas Dowson, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd Co-founder, Optellum Ltd
Carlos Arteta, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd
Petr Novotny, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd
Jerome M. Declerck, PhD, Oxford, United Kingdom (*Presenter*) Employee, Optellum Ltd; Co-founder, Optellum Ltd
Reginald F. Munden, MD, DMD, Winston-Salem, NC (*Abstract Co-Author*) Stock options, Optellum Ltd Advisory Board, Optellum Ltd
Timor Kadir, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd

PURPOSE

In the context of screening, a high proportion of diagnosed cancers have been reported to be higher than Stage I in both the NELSON (33%) and NLST (46%) trials, even after baseline scanning in NLST (34%). We hypothesise that many cancers may be visible in the baseline low-dose CT (LDCT) despite only being diagnosed from the LDCT obtained one year later. We further hypothesise that an AI-based lung cancer prediction (LCP) score would help identify some of these missed cancers on the earlier CT.

METHOD AND MATERIALS

The data consisted of 3914 subjects from the NLST with at least one solid or semi-solid nodule with a long-axis diameter >=6mm in the baseline LDCT. Subjects either only had benign findings or were diagnosed with cancer at baseline or one year later. A manual evaluation was performed of malignancies diagnosed at time-point 1, to check if a nodule >=6mm in size was visible at baseline. Thresholds to rule-in malignancies using the LCP score and the Brock model were selected by matching the specificity to that (87.2%) reported for baseline LDCTs in a retrospective evaluation of LungRADS (Pinsky et al., 2015) with a reported sensitivity of 84.9%.

RESULTS

98 of the 147 cancers diagnosed at timepoint 1 were visible at baseline. Seven of the "non-visible" cancers presented with sizes between 3 and <6mm and were not considered further. The LCP score ruled-in 68 (16 Stage II+) of these 98 visible cancers while Brock ruled-in 38 (9 Stage II+) cancers. The sensitivity and 95% confidence interval (CI) of the LCP risk score of patients diagnosed at baseline was 94.6% (90.9, 97.1). The sensitivity when including cancers diagnosed at time-point 1 was 86.9% (82.1, 92.0). For Brock, that sensitivity was 65.1% (59.2, 71.3).

CONCLUSION

Cancers only diagnosed at time-point 1 have a less malignant appearance at baseline, but in many cases accelerated workup is possible with either method if an operating point is chosen appropriately (e.g. to match the specificity of LungRADS). Despite the introduction of cancers only diagnosed at the next screening round, the LCP score achieves a sensitivity at least as good as LungRADS when applied to baseline-diagnosed cancers alone.

CLINICAL RELEVANCE/APPLICATION

AI-based lung cancer prediction could accelerate the diagnostic work-up of cancers visible in baseline screening low dose CTs. This may lead to some cancers being diagnosed at an earlier stage.

SSJ05-03 Lung Malignancy Overlooked at Chest Radiography: Performance of a Deep Learning-Based Automatic Detection Algorithm

Tuesday, Dec. 3 3:20PM - 3:30PM Room: S102CD

Participants
Sowon Jang, Seongnam-si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyunghee Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Ministry of Trade, Industry, and Energy; Research Grant, SNUBH Research Fund
Yoon Joo Shin, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Junghoon Kim, Seongnam-si , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jihang Kim, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Monitor Corporation; Research Grant, Seoul National University Bundabg Hospital
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the performance of a recently developed deep learning-based automatic detection algorithm (DLAD) to detect lung malignancy overlooked at initial interpretation of chest radiograph by radiologists.

METHOD AND MATERIALS

Among the 5439 lung malignancies pathologically confirmed between April 2003 and May 2018 in a tertiary hospital, we identified patients who had overlooked lung malignancies on chest radiographs for this diagnostic cohort study. A total of 155 patients (mean patient age was 67 years [range, 29-90; 87 male patients {mean age, 67 years; range, 34-90} and 68 female patients {mean age, 64 years; range, 29-85}]) with overlooked malignant pulmonary lesions on chest radiographs were included in this study. Two radiologists independently determined whether the overlooked lesions were actionable or not. Discordant classifications were arbitrated by a third adjudicator radiologist. DLAD performance was measured in terms of sensitivities for the detection of overlooked lung malignancy and number of false-positive marks per radiograph.

RESULTS

Among 155 patients with overlooked malignancies, 127 patients were judged to have actionable lesions. When the threshold of activation value was set as 0.3, the sensitivity of DLAD for actionable lung malignancies (54% [68 of 127]) were higher than that for non-actionable lung malignancies (14% [4 of 28]). The number of false-positive marks per patient was 0.24 (31 of 127). When the threshold of activation value was set as 0.15, the sensitivity of DLAD for actionable lung malignancies increased to 60% (76 of 127), and the number of false-positive marks per patient was 0.35 (44 of 127).

CONCLUSION

The current DLAD algorithm can detect slightly more than half of the lung malignancy overlooked by radiologists at chest

radiography, with only a small number of false-positive marks.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the potential of a DLAD algorithm to reduce the number of lung malignancies that may be overlooked by radiologists.

SSJ05-04 The Utility of a Convolutional Neural Network (CNN) Model Score for Cancer Risk in Indeterminate Small Pulmonary Nodules Compared to Clinical Practice According to British Thoracic Society Guidelines

Tuesday, Dec. 3 3:30PM - 3:40PM Room: S102CD

Participants
Maria Tsakok, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Meghavi Mashar, MBBCh, London, United Kingdom (*Presenter*) Nothing to Disclose
Lyndsey C. Pickup, MEng, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd Co-founder, Optellum Ltd
Timor Kadir, Oxford, United Kingdom (*Abstract Co-Author*) Employee, Optellum Ltd
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Abstract Co-Author*) Consultant, Alliance Medical Limited Consultant, Blue Earth Diagnostics Ltd Consultant, Polarean, Inc

PURPOSE

To assess the potential utility of a convolutional neural network (CNN) model score for cancer risk compared to clinical practice performed following the British Thoracic Society (BTS) guidelines (2015), to improve care in patients with incidentally detected indeterminate small, < 15mm, pulmonary nodules at a UK tertiary referral centre.

METHOD AND MATERIALS

Following the implementation of BTS guidelines in 2015, 148 consecutive patients with 162 benign nodules and 10 malignant nodules were included in the analysis. It was necessary to boost the number of independent cancer nodule scores in order to power calculations based on the score distribution, so the population was enriched with 23 additional incidentally detected cancers detected over a wider time period. A review of the imaging and intervention recommendations and time intervals to establish the diagnosis, according to histology or 2-year follow-up, was conducted, blinded to the CNN model score. A CNN model, which had been trained on a manually-curated US National Lung Screening Trial (NLST) dataset was used to generate a score, which was applied to both cohorts. 6 nodules (1 cancer) were unable to be scored by the CNN and were excluded from analysis. In each case, the highest-scoring nodule in a patient was used as the index nodule.

RESULTS

Use of a threshold CNN score of 5.0 would have prevented 38 CT and 3 PET-CT scans in patients with benign nodules without missing any cancers, accounting for 41.3% of the total number of CT and 37.5% of the total PET-CT of follow-ups on these patients. 15 benign nodules would not have required any follow-up whatsoever, preventing 23 CTs, using a threshold of 0.56. In 11 patients (35.5%) with cancer, their investigation and intervention would have been expedited by 3.4 months using a CNN threshold score of 80.

CONCLUSION

A CNN generated model score applied to incidentally detected indeterminate small pulmonary nodules reduces the need for follow-up imaging in benign cases, whilst expediting imaging and intervention in cancer cases compared to actual practice.

CLINICAL RELEVANCE/APPLICATION

Our work shows the potential of CNNs in reducing the need for follow-up scans and intervention in low-scoring benign nodules, whilst potentially accelerating the investigation and treatment of high-scoring cancer nodules.

SSJ05-05 A Deep Learning-Based CAD that Can Reduce False Negative Reports: A Preliminary Study in Health Screening Center

Tuesday, Dec. 3 3:40PM - 3:50PM Room: S102CD

Participants
Hyunho Park, Seoul, Korea, Republic Of (*Presenter*) Employee, VUNO Inc
Soo-Youn Ham, MD,PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hwa-Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyon Joo Kwag, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seungho Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Gwangbeen Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Sangkeun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Minsuk Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Jin-Kyeong Sung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Kyu-Hwan Jung, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc

For information about this presentation, contact:

hyunho.park@vuno.co

PURPOSE

To evaluate the clinical value of a deep learning-based computer-aided detection (DLCAD) model that can reduce false negative reports on screening chest CTs that were considered normal.

METHOD AND MATERIALS

A DLCAD consisting of a 2.5D CNN for candidate detection and a 3D CNN for false positive reduction was trained with a public LIDC-IDRI dataset. Preliminary validation performance for the same dataset was 90.7% sensitivity under one false-positive per scan

threshold. Ten thousand low dose chest CT cases that were reported normal were collected from a single-center screening cohort from the year 2011 to 2015. 'Normal' was defined as containing no malignant or benign lesions. The deep learning-based CAD analyzed these cases reported as normal and detected nodule candidates. Four radiologists reviewed the results of CAD independently. When the candidate nodule was accepted, the type (solid, part-solid and ground-glass nodule [GGN]) and size of nodules were annotated.

RESULTS

DLCAD analyzed 9952 cases (48 cases with inappropriate parameters, scan range or field of view were excluded) and detected 471 nodule candidates. Among them, 283 nodules from 269 patients were reported to be the true nodules by more than three radiologists. Excluding 67 nodules (with insufficient consensus), 216 nodules were categorized to be the same diameter range and nodule type by more than three radiologists. Among 216 nodules, 151 (69.9%) nodules were solid, three (1.4%) were part-solid, and 62 (28.7%) were GGN. Among 151 solid nodules, 10 (6.6%) nodules were larger than or equal to 6mm (eight [5.3%] 6 to 8mm, two [1.3%] 8 to 15mm) and 141 (93.4%) were smaller than 6mm. All three part-solid nodules were smaller than 6mm. All 62 GGN were smaller than 20mm. According to the Lung-RADS, two solid nodules were category 4A, eight solid nodules were category 3, and the remaining 206 nodules were category 2.

CONCLUSION

The deep learning-based CAD has detected 2.7% (269/9952) false negative cases with neglected nodules. 4.6% (10/216) nodules were higher than Lung-RADS category 3, which require follow up scans.

CLINICAL RELEVANCE/APPLICATION

The deep learning-based CAD will perform an ancillary role as a safeguard and a competent second reader by reducing false negative rates.

SSJ05-06 Added Value of Machine Learning in Follow-Up Lung Cancer Screening

Tuesday, Dec. 3 3:50PM - 4:00PM Room: S102CD

Participants
Peng Huang, Baltimore , MD (*Presenter*) Nothing to Disclose
Cheng Ting Lin, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Yuliang Li, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Malcolm Brock, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Garner, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
David Ettinger, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Martin C. Tammemagi, St. Catharines, ON (*Abstract Co-Author*) Nothing to Disclose
Sukhinder Atkar-Khattra, BSC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Stephen Lam, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

phuang12@jhmi.edu

PURPOSE

Current challenge in lung cancer screening is the high false positive rate and overdiagnosis of indolent cancers. We examined if a machine learning predictor (ML) developed from combined longitudinal CT image features, patient demographics and clinical history could improve screening positive predictive value (PPV) and identify aggressive cancers.

METHOD AND MATERIALS

In a double-blinded study, we developed a ML predictor from 25,097 National Lung Screening Trial (NLST) individuals, and blindly validated it in 2,294 Pan-Canadian Early Detection of Lung Cancer Study (PanCan). All individuals who had received 2 or more CT screenings from both studies were included. We compared area under the time-dependent ROC curve (AUC) and PPV between ML and LungRADS, and examined the added value of ML to LungRADS in identifying aggressive cancers.

RESULTS

In PanCan validation sample, ML has higher 3-year time-dependent AUC(=0.899) as compared to LungRADS (AUC=0.858), p=0.028. When fixing the same sensitivity in the range of 80% - 90% for both ML and LungRADS, the ML has 28%-65% higher PPV than the LungRADS throughout all fixed sensitivity levels. Although ML high-risk group included only 9.6% of the total sample, it included 94.4% and 84.7% of all lung cancers diagnosed within 1 and 2 years. In the NLST, within LungRADS 4B individual, ML high-risk subgroup had higher lung cancer mortality (HR=31.8, P<0.001). In contrast, within ML high-risk subgroup, LungRADS 4B individuals had lower but non-significant lung cancer mortality (HR=0.93, p=0.59). Among N=404 NLST screening detected stage I&II lung cancers who received surgery, ML high-risk patients had higher lung cancer mortality (HR=44.3, p<0.001).

CONCLUSION

The ML predictor has higher sensitivity and PPV than LungRADS in lung cancer screening. It has added value in identifying more aggressive lung cancers among screening detected stage I&II cancers who received surgery.

CLINICAL RELEVANCE/APPLICATION

The ML predictor has potential added value to LungRADS in identifying aggressive lung cancers. It could help clinicians to determine the optimal nodule follow-up strategy and treatment of screen detected lung cancer.

VSIO32

Interventional Oncology Series: Colorectal Liver Metastases

Tuesday, Dec. 3 3:15PM - 5:15PM Room: S405AB

GI IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Constantinos T. Sofocleous, MD, PhD, New York, NY (*Moderator*) Consultant, General Electric Company; Consultant, Johnson & Johnson; Consultant, Terumo Corporation; Research support, BTG International Ltd; Research support, Johnson & Johnson; ; ; Sarah B. White, MD, Milwaukee, WI (*Moderator*) Research support, Guerbet SA; Research support, Siemens AG; Research support, Instylla; Research support, InSightec Ltd; Consultant, Guerbet SA; Consultant, BTG International Ltd; Consultant, Cook Group Incorporated; Consultant, Strategies MD

Sub-Events

VSIO32-01 Immunotherapy in the Treatment of CRC: Synergy with Interventional Oncology

Tuesday, Dec. 3 3:15PM - 3:30PM Room: S405AB

Participants
Ursina Teitelbaum, Philadelphia, PA (*Presenter*) Nothing to Disclose

VSIO32-02 Is a Cure Possible in Patients Undergoing Liver Resection with mCRC?

Tuesday, Dec. 3 3:30PM - 3:45PM Room: S405AB

Participants
Michael D'Angelica, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to define the rate of cure after complete resection of cure after resection of colorectal liver metastases. 2) Be able to discuss the factors associated with differences in rate of cure. 3) Be able to discuss the role of surgery in the treatment of colorectal liver metastases.

VSIO32-03 Rad Onc: Is XRT a Good Alternative to Ablation? Any Data Specifically for CLM?

Tuesday, Dec. 3 3:45PM - 4:00PM Room: S405AB

Participants
Karyn A. Goodman, MD, Aurora, CO (*Presenter*) Scientific Advisory Board, RenovoRx

For information about this presentation, contact:

karynaalamigoodman@gmail.com

LEARNING OBJECTIVES

1) Appreciate the clinical outcomes of SBRT for metastatic liver disease, in particular colorectal liver metastases. 2) Understand the selection criteria for SBRT for liver metastases 3) Compare the appropriateness and outcomes of SBRT versus ablation for liver metastases in various treatment scenarios. 4) Assess the potential for combining SBRT with other liver-directed therapies.

VSIO32-04 Increases in Cell Proliferation and Angiogenesis Markers in Untreated Tumors Following Radiofrequency Ablation of Liver Tumors

Tuesday, Dec. 3 4:00PM - 4:10PM Room: S405AB

Participants
Matthias M. Stechele, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Jens Ricke, MD,PhD, Berlin, Germany (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd Research Grant, Bayer AG
Haixing Liao, PhD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
MacIej Powerski, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Aurelia Markezana, MSc, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Nahum Goldberg, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

matthias.stechele@med.uni-muenchen.de

PURPOSE

To elucidate potential systemic off-target effects of radiofrequency ablation (RFA) in distant non-treated hepatocellular carcinoma

(HCC) and liver metastases of colorectal cancer.

METHOD AND MATERIALS

A prospective, national multicenter single-arm trial (THIAMAT) was performed on 9 patients undergoing 2 treatment sessions scheduled 2 weeks apart to treat multiple histologically confirmed HCC (n=3) or oligometastatic colorectal cancer (n=6) with RFA. In each session, core biopsy of a target tumor was obtained using coaxial technique prior to the RFA. This enabled comparison of the potential effects of the first treatment upon remote, non-ablated tumors. Samples were stained with immunohistochemistry of Ki-67 and CD34 to measure proliferation index and microvascular density, respectively. At least 5 high power fields for each patient and each staining were obtained and evaluated for positive stained cells by 3 blinded experienced readers. Pre- and post-treatment data were compared with 2-tailed Student t test.

RESULTS

Of 7 patients with diagnostic quality material on both biopsies, 4 (57.1%) demonstrated a statistically significant increase in one or both markers. CD34 was increased in 3 of 7 patients (42.8 %), (2x, 2x and 3x fold increases, all $p<0.01$). Ki-67 was statistically significant increased in 2 patients (5.1±3.0 to 18.6±12.9 and 2.6±1.3 to 15.4±3.6; $p<0.01$, both comparisons), with 1 patient having significant increases in both markers. An additional patient had several clusters of increased Ki-67 positive staining compared to baseline, which did not reach significance using parametric statistical testing ($p=0.15$).

CONCLUSION

RFA of liver tumors can induce increased proliferation and promote angiogenesis in distant non-treated tumors. These preliminary data provide further evidence of potentially systemic off-target effects put into motion by interventional oncologic treatment in the clinical setting. Further ongoing data collection may provide better understanding of underlying mechanisms and thus offer valuable insights into potential options for new diagnostic and therapeutic approaches to improve patient care by mitigating this unwanted phenomenon.

CLINICAL RELEVANCE/APPLICATION

Insights on mechanisms of potential off-target effects of minimally invase treatment may lead to development of combination therapies that can potentiate the effect of these procedures and thus provide better patient care.

VSIO32-05 IR: Role of Ablation in the Treatment of mCRC-Could It Ever Replace Resection?

Tuesday, Dec. 3 4:10PM - 4:25PM Room: S405AB

Participants
Constantinos T. Sofocleous, MD, PhD, New York, NY (*Presenter*) Consultant, General Electric Company; Consultant, Johnson & Johnson; Consultant, Terumo Corporation; Research support, BTG International Ltd; Research support, Johnson & Johnson; ; ;

VSIO32-06 IR: Role for IAT in mCRC-What is the Evidence for Abscopal Effects?

Tuesday, Dec. 3 4:25PM - 4:40PM Room: S405AB

Participants
Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd Consultant, Eisai Co, Ltd Consultant, Exelixis, Inc Consultant, Bristol-Myers Squibb Company Consultant, Dove

LEARNING OBJECTIVES

1) Learn about intra arterial therapies. 2) Discuss long-term outcomes and compare to surgical treatments.

ABSTRACT

VSIO32-07 Radioembolization-Induced Chronic Hepatotoxicity: A Multi-Center Study

Tuesday, Dec. 3 4:40PM - 4:50PM Room: S405AB

Participants
Brian M. Currie, MD , Philadelphia, PA (*Presenter*) Nothing to Disclose
Daniel B. Brown, MD, Nashville, TN (*Abstract Co-Author*) Research Support, Sirtex Medical Ltd Consultant, C. R. Bard, Inc Consultant, BTG International Ltd
Nicholas Fidelman, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, BTG International Ltd
Steven C. Rose, MD, San Diego, CA (*Abstract Co-Author*) Stockholder, Sirtex Medical Ltd Proctor, Sirtex Medical Ltd Scientific Advisory Board, Surefire Medical, Inc Consultant, Surefire Medical, Inc Stockholder, Surefire Medical, Inc Consultant, Embolx, Inc Consultant, Guerbet SA Consultant, XLSciTech, Inc
Sarah B. White, MD, Milwaukee, WI (*Abstract Co-Author*) Research support, Guerbet SA; Research support, Siemens AG; Research support, Instylla; Research support, InSightec Ltd; Consultant, Guerbet SA; Consultant, BTG International Ltd; Consultant, Cook Group Incorporated; Consultant, Strategies MD
Ghassan El-Haddad, MD, Tampa, FL (*Abstract Co-Author*) Advisory Board, Actinium Pharmaceuticals, Inc; Advisory Board, Oncoinvent, AS; Research Consultant, Canon Medical Systems Corporation; Speaker, Novartis AG;
Sharon W. Kwan, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Etay Ziv, MD,PhD, New York, NY (*Abstract Co-Author*) Research Grant, Johnson & Johnson;
Nahyun Jo, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rony Avritscher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Johnson, MD, Indianapolis, IN (*Abstract Co-Author*) Research Consultant, Bayer AG Research Consultant, Bristol-Myers Squibb Company Research Consultant, Boston Scientific Corporation Research Consultant, Cook Group Incorporated Research Consultant, BTG International Ltd Research support, BTG International Ltd Research Consultant, Surefire Medical, Inc Research support, Surefire Medical, Inc Research Consultant, Johnson & Johnson Research Consultant, Avantec
Michael C. Soulen, MD, Lafayette Hill, PA (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Guerbet SA; Research support, Guerbet SA; Research support, BTG International Ltd; Proctor, Sirtex Medical Ltd;

For information about this presentation, contact:

brian.currie@pennmedicine.upenn.edu

PURPOSE

The acute and subacute hepatic sequelae of trans-arterial radioembolization (TARE) are relatively well-characterized, but there is a paucity of literature evaluating delayed hepatotoxicity. Previous single-institution studies have been limited by the use of qualitative criteria for liver dysfunction and lack of rigorous attribution of toxicities. The objective of this multicenter study was to identify and describe TARE-related chronic hepatoxicity using standardized quantifiable metrics and multidisciplinary adjudication.

METHOD AND MATERIALS

IRB-approved multi-center retrospective analysis of all neuroendocrine tumor patients from 10 institutions receiving TARE from 2005-2018 and surviving at least one year from the initial TARE (n=166). Patients were evaluated for the presence or absence of Grade 3 or above hepatic toxicities occurring at least 6 months after TARE. The mean age of patients was 56 with a slight male predominance at 52%. Adjudication of hepatic decompensation was performed by a multidisciplinary panel from each institution comprised among hepatology, radiation oncology, medical oncology, and interventional oncology.

RESULTS

There were 57 patients (34%) who developed chronic Grade 3 and above hepatic toxicities with a total of 68 Grade 3 and 26 Grade 4 events, with ascites being the most common. There are least five deaths attributed to hepatic decompensation (3%), without evidence of underlying disease progression or another more plausible precipitant. Patients developing toxicities were more frequently treated with prior locoregional therapy 32% vs. 21% ($p = 0.18$) but received less cumulative activity, 67 vs. 78 mCi ($p = 0.18$). There was no difference in the number or treatments received (1.7 vs. 1.9) or the number of patients with intrahepatic tumor volume greater than 50% (29% vs. 28%).

CONCLUSION

Delayed hepatic toxicity occurred in 34% of patients following radioembolization with five fatalities adjudicated to be a result of the treatment. Patients treated with prior locoregional therapies may be predisposed to developing chronic toxicity.

CLINICAL RELEVANCE/APPLICATION

Chronic liver injury stemming from radioembolization remains an incompletely characterized phenomenon that leads to substantial morbidity and mortality. Fully elucidating this process would significantly impact patient care.

VSIO32-08 **Tumor Board**

Tuesday, Dec. 3 4:50PM - 5:15PM Room: S405AB

MSRO39

BOOST: Gastrointestinal- Anorectal Cancer eContouring

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S104B

GI OI RO

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

Participants
Edward Y. Kim, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Spencer C. Behr, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Consultant, Navidea Biopharmaceuticals, Inc; Grant, Navidea Biopharmaceuticals, Inc
Ryan O'Malley, MD, Seattle, WA (*Presenter*) Research Grant, General Electric Company

For information about this presentation, contact:

spencer.behr@ucsf.edu

edykim@uw.edu

Special Information

The e-contouring sessions may be used by participating radiation oncologists to fulfill a PQI (practice quality improvement) requirement for ABR (American Board of Radiology) MOC (Maintenance of Certification). Interested radiation oncologist can download a e-contouring PQI template here: https://academy.astro.org/content/econtouring-pqi-template and handouts directing users to the same website will be available at the actual session.

LEARNING OBJECTIVES

1) Develop familiarity with anatomic considerations relevant to radiotherapy planning for rectal cancer. 2) Apply information from diagnostic imaging studies to radiotherapy planning for rectal cancers.

ABSTRACT

Participants in this session will gain familiarity with anatomic considerations relevant to target contour definition for radiation treatment planning for rectal cancer. Expertise will be provided by diagnostic imaging and radiation oncology presenters.

RC418

Challenges and Opportunities for Cancer Screening

Tuesday, Dec. 3 4:30PM - 6:00PM Room: S401CD

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Ramona Woitek, MD, Vienna, Austria (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine the principles for assessing the evidence of benefit for cancer screening. 2) Assess the current advances in cancer prevention, early detection and genetic evaluation. 3) Describe how more sophisticated risk stratification could lead to tailored screening approaches. 4) Appraise the unintended consequences of screening and the need for new approaches to minimise harm. 5) Appreciate the various ways risk for developing breast cancer can be assessed. 6) Understand the contribution mammographic breast density to risk of developing breast cancer. 7) Recognise the problem of masking caused by breast density. 8) Appreciate the various supplemental imaging methods that can be offered to women with dense breasts. 9) Gain knowledge about the evidence supporting HCC surveillance. 10) Understand the modalities of HCC surveillance. 11) Be aware of main limitations and controversies. 12) Understand and compare the surveillance policies in different countries. 13) Describe the best use of Whole Body MRI for cancer screening. 14) Apply the most appropriate protocol when using Whole Body MRI for cancer screening. 15) Classify the findings detected on a Whole Body MRI for cancer screening.

Sub-Events

RC418A Cancer Screening Advantages and Pitfalls

Participants
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Presenter*) Editor, Journal of the American College of Radiology; Support, Harvey L. Neiman Health Policy Institute; In-kind support, Reed Elsevier;

RC418B Breast Cancer Risk Adaptive Screening

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Presenter*) Research Grant, Hologic, Inc; Research Grant, General Electric Company ; Research Consultant, Alphabet Inc; Research support, Bayer AG; Research collaboration, Volpara Health Technologies Limited

For information about this presentation, contact:

fjg28@cam.ac.uk

LEARNING OBJECTIVES

1) Appreciate the various ways risk for developing breast cancer can be assessed. 2) Understand the contribution mammographic breast density to risk of developing breast cancer. 3) Recognise the problem of masking caused by breast density. 4) Appreciate the various supplemental imaging methods that can be offered to women with dense breasts.

ABSTRACT

There are a number of factors that contribute to the risk of developing breast cancer. In those individuals with a genetic predisposition the lifetime risk can be up to 80%. For those without a genetic predisposition age is still the greatest risk but family history can play a big role as well as breast density. Single nucleotide polymorphisms have a very small risk but can give an additive effect. Together this information can be ised to create a risk profile For those women in the higher categories a more targetted imaging strategy can be used. This is being explored in the WISDOM and MyPEBS trials where frequency of mammography is being varied according to risk. Breast density can mask breast cancers and lead to detection at a later stage or interval cancers. Both have a much prognosis. Supplemental imaging is being advocated to to detect cancers at an earlier stage. However it is important to evaluate the variaous techniquessuch as abbreviated MRI, Contrast enhanced mammography and breast ultrasound. The size, type and grade of additional cancers that are found as well as interval cancer rates are important to estimate the benefits of making such changes to a screening programme.

RC418C Lung Cancer Screening

Participants
Claudia I. Henschke, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose

RC418D Liver Screening for HCC

Participants
Maxime Ronot, MD, Clichy, France (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

maxime.ronot@aphp.fr

LEARNING OBJECTIVES

1) Gain knowledge about the evidence supporting HCC surveillance. 2) Understand the modalities of HCC surveillance. 3) Be aware of main limitations and controversies. 4) Understand and compare the surveillance policies in different countries.

RC418E Whole Body MRI for Cancer Screening

Participants
Giuseppe Petralia, MD, Milano, Italy (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

giuseppe.petralia@ieo.it

LEARNING OBJECTIVES

1) Describe the best use of Whole Body MRI for cancer screening. 2) Apply the most appropriate protocol when using Whole Body MRI for cancer screening. 3) Classify the findings detected on a Whole Body MRI for cancer screening.

Printed on: 10/29/20

RC450

US for Thyroid Cancer: Diagnosis, Surveillance, and Treatment

Tuesday, Dec. 3 4:30PM - 6:00PM Room: S403A

NR US HN OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jill E. Langer, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Kathryn A. Robinson, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Sheila Sheth, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy. 2) Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. 3) Describe the indications for new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. 4) Review how to pall ACR TI-RADS. 5) Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer. 6) Discuss the rationale and method of performance of US-guided ethanol ablation of malignant cervical adenopathy in post thyroidectomy 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 based on ACR TI-RADS guidelines will be discussed. The second presentation will review the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. Additionally this presentation describes the indications for 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.

MSRO41

BOOST: Pediatric-Case-based Multidisciplinary Review (Interactive Session)

Wednesday, Dec. 4 8:30AM - 10:00AM Room: S103CD

OI PD RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Michael S. Gee, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Shannon A. MacDonald, MD, Boston, MA (*Presenter*) Nothing to Disclose
Camilo Jaimes Cobos, MD, Boston, MA (*Presenter*) Nothing to Disclose
Dave Ebb, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain imaging anatomy relevant to pediatric cancer staging and treatment. 2) Develop a search pattern for relevant oncologic anatomy on CT and MRI for pediatric patients with cancer.

ABSTRACT

None.

RC511

Update on Radionuclide Therapies

Wednesday, Dec. 4 8:30AM - 10:00AM Room: S504CD

IR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC511A New Guidelines for I-131 Therapy of Thyroid Cancer

Participants
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC

For information about this presentation, contact:

donyoo@brown.edu

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.

RC511B Lu177-DOTATATE Therapy for Neuroendocrine Tumors

Participants
Erik S. Mittra, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and role of Peptide Receptor Radionuclide Therapy (PRRT) for neuroendocrine tumors (NETs). 2) Review the latest publications on the subject. 3) Understand how to perform this therapy and future directions.

RC511C Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants
Charles Y. Kim, MD, Raleigh, NC (*Presenter*) Consultant, Medtronic plc; Consultant, Humacyte; Consultant, Galvani

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.

RC518

Metabolic Tumor Imaging: Current and Beyond

Wednesday, Dec. 4 8:30AM - 10:00AM Room: S501ABC

MR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Moderator*) Speaker, Siemens AG; Research support, Siemens AG

For information about this presentation, contact:

marius.mayerhoefer@meduniwien.ac.at

LEARNING OBJECTIVES

1) Learn about he new PET tracers and they new potential clinical applications. 2) Review the added value of PET/MRI in oncology. 3) Learn about the current and future applications of hyperpolarised MRI.

Sub-Events

RC518A PET Tracers: Which Ones Will Be Next to Make it to Clinical Practice?

Participants
Jan Grimm, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To have an appreciation for some of the latest PET tracers in clinical research in oncology. 2) Understand the PET and radiotherapy agents currently FDA approved and those undergoing the approval process. 3) Understand the next generation of PET tracers and molecular imaging agents that could be the next standard-of-care imaging probes.

RC518B PET/MRI: The Added Value in Oncology

Participants
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of value in imaging and how it relates to PET/MR technology. 2) To discuss the need for research specifically geared toward assessing the value of PET/MRI in oncology.

RC518C Hyperpolarized MRI: Current and Future Applications

Participants
Ferdia A. Gallagher, PhD, FRCR, Cambridge, United Kingdom (*Presenter*) Research support, General Electric Company; Research support, GlaxoSmithKline plc

For information about this presentation, contact:

fag1000@cam.ac.uk

LEARNING OBJECTIVES

1) To explore the role of metabolism in cancer development. 2) To understand how these changes in metabolism can be exploited using hyperpolarized 13C-pyruvate. 3) To review the current evidence for hyperpolarized carbon-13 imaging in oncology. 4) To understand potential clinical applications for hyperpolarized carbon-13 imaging. 5) To consider the role of new hyperpolarized molecules in oncology.

ABSTRACT

There is increasing evidence to support a role for metabolism in tumor development; for example, deregulation of cellular energetics is now considered to be one of the key hallmarks of cancer. Changes in tumor metabolism over time are now known to be early biomarkers of successful response to chemotherapy and radiotherapy. There are a number of imaging methods that have been used to probe cancer metabolism: the most widely available is 18F-fluorodeoxyglucose (FDG), an analogue of glucose, used in PET. Hyperpolarized carbon-13 MRI (13C-MRI) is an emerging molecular imaging technique for studying cellular metabolism, particularly in the field of oncology. This method allows non-invasive measurements of tissue metabolism in real-time. To date, the most promising probe used in conjunction with hyperpolarized MRI has been 13C-labelled pyruvate: pyruvate is metabolized into lactate in normal tissue in the absence of oxygen, but in tumors this occurs very rapidly even in the presence of oxygen. Results from many animal models have shown that there is a reduction in the metabolism of pyruvate following successful treatment with chemotherapy. Tumor lactate labelling has also been shown to correlate with the grade of some tumor types. There are now a small number of sites performing human hyperpolarized carbon-13 MRI imaging. This talk will discuss the progress that has been made in this field within the area of oncology and potential clinical applications.

MSRO42

BOOST: Lymphoma-Case-based Multidisciplinary Review (Interactive Session)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: S103CD

CT MR NM OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Chelsea C. Pinnix, MD,PhD, Houston, TX (*Moderator*) Research Grant, Merck & Co, Inc; Consultant, Global One Inc; Speaker, International Journal of Radiation Oncology, Biology & Physics
Jurgen Rademaker, MD, New York, NY (*Presenter*) Nothing to Disclose
Yolanda D. Tseng, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Case-based review of staging and treatment response in lymphoma. 2) Discuss imaging findings in lymphoma and their clinical significance (PET, CT, MRI). 3) Describe the management of patients with lymphoma, including the role of imaging and radiation treatment options.

ABSTRACT

Management of lymphoma continues to evolve in the setting of improved imaging, pathologic understanding of this heterogeneous disease, systemic therapy, and radiotherapy techniques. This interactive, multi-disciplinary session is geared to general radiologists and radiation oncologists with the goal to provide clinically relevant, up-to-date knowledge and skills in evaluating and treating these patients. Through cases, we will review common manifestations of Hodgkin and non-Hodgkin lymphoma and imaging features of these lymphomas that are important for workup, staging, and assessment of treatment response. Cases will be used to walk participants through the management of common lymphomas with a focus on the role of radiotherapy.

SSK05

Chest (Lung Cancer Screening)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: N229

CH CT OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Jane P. Ko, MD, New York, NY (*Moderator*) Research collaboration, Siemens AG
Jo-Anne O. Shepard, MD, Boston, MA (*Moderator*) Editor with royalties, Reed Elsevier

Sub-Events

SSK05-01 Cancer Risk in Subsolid Nodules in the National Lung Screening Trial

Wednesday, Dec. 4 10:30AM - 10:40AM Room: N229

Participants
Mark M. Hammer, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Lauren Palazzo, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Chung Yin Kong, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andetta R. Hunsaker, MD, Sudbury, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mmhammer@bwh.harvard.edu

PURPOSE

Subsolid nodules, comprising pure ground glass (GGN) and part-solid (PSN) nodules, have a high risk of indolent malignancy. Lung-RADS management guidelines are based on expert opinion and lack independent validation. The purpose of this study is to evaluate Lung-RADS for its ability to estimate the malignancy rates of subsolid nodules, using nodules from the National Lung Screening Trial (NLST). Lung-RADS was also compared to the NELSON trial volumetric classification.

METHOD AND MATERIALS

Two hundred nodules from each of the following categories were selected from the NLST: GGN < 10 mm, GGN <= 10 mm, and PSN > 6 mm. A thoracic radiologist reviewed the baseline and follow-up CT images and measured the nodules. The primary outcome for each nodule was the development of a cancer in the same lobe. Analyses were weighted by the higher prevalence of the GGN < 10 mm category. Nodules were classified by either the Lung-RADS or NELSON trial systems.

RESULTS

A total of 434 nodules were true subsolid nodules. At baseline, Lung-RADS 2 comprised 282 (73%) of nodules, with a malignancy rate of 3%, greater than the reported 1% in the Lung-RADS document (p=0.0081). The malignancy rate for GGN < 10 mm (1.5%) was significantly smaller than that for GGN measuring 10 - 19 mm (7%), p=0.02. Lung-RADS 3 comprised 89 nodules (17%), with a malignancy rate of 13%, greater than the reported 2% in the Lung-RADS document (p<0.001). The area under the receiver operating characteristic curve for Lung-RADS at baseline was 0.715, compared to 0.668 for NELSON.

CONCLUSION

Subsolid nodules in Lung-RADS categories 2 and 3 have a higher risk of malignancy than reported, and GGN 10 - 19 mm have a risk that is closer to Lung-RADS 3 than Lung-RADS 2. There does not appear to be an advantage to using volumetric (NELSON) compared to linear measurement (Lung-RADS) classification schemes.

CLINICAL RELEVANCE/APPLICATION

The malignancy risk of subsolid Lung-RADS 2 and 3 nodules in lung cancer screening is higher than expected, which may require revision of management guidelines.

SSK05-02 Are We on the Same (Web) Page for Lung Cancer Screening? A Comprehensive Content Analysis of United States Lung Cancer Screening Program Websites

Wednesday, Dec. 4 10:40AM - 10:50AM Room: N229

Participants
Staci Gagne, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Melissa C. Price, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Milena Petranovic, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Florian J. Fintelmann, MD, Boston, MA (*Abstract Co-Author*) Consultant, Jounce Therapeutics, Inc; Research support, BTG International Ltd

Justin Stowell, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dexter Mendoza, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brent P. Little, MD, Boston, MA (*Presenter*) Author, Reed Elsevier; Editor, Reed Elsevier; Royalties, Reed Elsevier

For information about this presentation, contact:

blittle@partners.org

PURPOSE

To assess the scope and quality of patient educational content of United States Lung Cancer Screening (LCS) program websites.

METHOD AND MATERIALS

A Google searches for "lung cancer screening", "low dose CT screening", and "lung screening" performed September 15, 2018 yielded 269 LCS program websites. 258 unique websites were equally divided and randomly assigned to 9 Thoracic Radiologists for analysis. Each radiologist reviewed text, images, videos, and PDF attachments for a random subset of sites using a standardized checklist. All main landing pages for LCS sites, along with linked pages from the institution directly dealing with LCS were included in the analysis. Information on links external to the LCS institution were not included in the content analysis. Content areas for which websites were analyzed included (1) LCS eligibility criteria, (2) monetary costs and insurance coverage, (3) benefits and (4) risks of lung cancer screening.

RESULTS

While most sites mentioned eligibility for screening (98%), 13% reported ages 55-74, 42% ages 55-77, 17% ages 55-80, and 19% gave multiple ranges. A quarter of websites did not address monetary costs of screening; out-of-pocket costs as a result of screening were rarely mentioned. Many (93%) mentioned the possibility of early detection of lung cancer and the use of low-dose CT, but 39% of sites did not mention the magnitude of the benefit, and 47% made no mention of the U.S. National Lung Cancer Screening Trial. More than half of the websites (53%) did not address any risks related to screening. Categories of risks discussed included radiation (38%), false positives (37%), and further tests (40%). Fewer sites included false negatives (20%), overdiagnosis (12%), procedural complications (10%), and anxiety/worry (20%).

CONCLUSION

There is inconsistency in the information provided to patients about lung cancer screening. Stated ages for eligibility, while commonly reported, vary widely. Health care costs are a large concern for many and yet a quarter of webpages do not address cost. In addition, the majority of LCS sites fail to address the risks of screening.

CLINICAL RELEVANCE/APPLICATION

Radiology practices should increase efforts to offer updated, standardized LCS information on websites to improve public knowledge of this imaging-based cancer screening tool and help alleviate some patient concerns.

SSK05-03 Lung Cancer Screening in NLST Eligibles: Tailoring Annual Low-Dose Computed Tomography by Post-Test Risk Stratification

Wednesday, Dec. 4 10:50AM - 11:00AM Room: N229

Participants
Mario Silva, MD, Parma, Italy (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Speakers Bureau, F. Hoffmann-La Roche Ltd; Speakers Bureau, Boerhinger Ingelheim GmbH
Gianluca Milanese, MD, Parma, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Sabia, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Colin Jacobs, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, MeVis Medical Solutions AG; Royalties, MeVis Medical Solutions AG; Research Grant, Thirona
Bram van Ginneken, PhD, Nijmegen , Netherlands (*Abstract Co-Author*) Stockholder, Thirona ; Co-founder, Thirona ; Royalties, Thirona; Research Grant, Varian Medical Systems, Inc; Royalties, Varian Medical Systems, Inc; Research Grant, Canon Medical Systems Corporation; Royalties, Canon Medical Systems Corporation; Research Grant, Siemens AG;
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG Research Grant, Canon Medical Systems Corporation Speakers Bureau, Canon Medical Systems Corporation Research Grant, Siemens AG Speakers Bureau, Siemens AG Departmental spinoff, Thirona Departmental licence agreement, Varian Medical Systems, Inc
Cornelia M. Schaefer-Prokop, MD, Amersfoort, Netherlands (*Abstract Co-Author*) Researcher, Thirona; Researcher, Varian Medical Systems, Inc; Spouse, Speaker, Bracco Group; Spouse, Speaker, Bayer AG; Spouse, Speaker, Canon Medical Systems Corporation; Spouse, Speaker, Siemens AG; Spouse, Research support, Siemens AG; Spouse, Research support, Canon Medical Systems Corporation; Spouse, Researcher, Thirona; Spouse, Researcher, Varian Medical Systems, Inc
Stefano Sestini, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alfonso V. Marchiano, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Nicola Sverzellati, MD, Parma, Italy (*Abstract Co-Author*) Consultant, PAREXEL International Corporation; Consultant, Biomedic System; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Boehringer Ingelheim GmbH; Consultant, Galapagos; Advisory Board, F. Hoffmann-La Roche Ltd; Advisory Board, Boehringer Ingelheim GmbH; Speaker, F. Hoffmann-La Roche Ltd; Speaker, Boehringer Ingelheim GmbH;
Ugo Pastorino, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mariosilvamed@gmail.com

PURPOSE

To calculate the risk of lung cancer (LC) in 1 and 3 years after baseline low-dose computed tomography (LDCT), in screenees selected by National Lung Screening Trial (NLST) criteria

METHOD AND MATERIALS

For the aim of this post-hoc analysis, screenees from a prospective lung cancer screening (LCS) trial were retrospectively selected: age>=55years, pack-years>=30.Pre-test metrics: baseline demographics, medical interview, and pulmonary function test.Post-test

metrics: retrospective LDCT reading by FDA-approved workstation for LCS, featuring computer aided diagnosis (CAD) and advanced semi-automatic algorithm for volumetric segmentation of nodule. Solid nodules were classified into 3 categories: 1)no nodule or nodule 1-112mm^3; 2)nodule 113-260mm^3; 3)nodule>260mm^3. Subsolid nodules were assigned either category 2(non-solid or part-solid nodules with solid component>5mm) or category 3(solid component>=5mm).The highest category was used for screenee-wise risk assessment.The primary outcome was LC diagnosis at 1 year or 3 years; the secondary outcome was the stage of LC. The Chi squared test was used to test the association between metrics and the primary outcome at 1 or 3 years.The risk of LC in 1 or 3 years was calculated by univariate and multivariate models

RESULTS

In 1,248 NLST-eligible screenees, LC frequency was 1.2% at 1 year and 2.3% at 3 years. At 1 year, category 3 was the only predictor of LC risk in multivariate model (odds ratio 79.84 p<0.001), confirming that early follow up by LDCT (e.g.3months) is needed for characterisation of such nodules. At 3 years, LC risk was predicted by category 2 (OR5.99 p=0.009) and 3 (OR26.55 p<001), Tiffeneau<70% (OR 2.75 p=0.024). LCS simulation with triennial screening rounds for category 1 and selective annual round for category 2 and 3 (29% in our population) showed 35% reduction of LDCT through 3 years

CONCLUSION

Annual LCS could be selectively offered to 30% of NLST eligible screenees, while longer interval might be safe in those with category 1. Validation of volumetric thresholds is granted through multiple software vendors

CLINICAL RELEVANCE/APPLICATION

LCS strategy can be optimised by tailoring annual LDCT to a minority of subjects at high risk, while longer screening intervals could be a safe strategy for low risk subjects yielding substantial reduction of LDCT burden (radiation and cost).This model is being prospectively tested in a LCS trial with LDCT every 3 years

SSK05-04 Impact of Significant Coronary Artery Calcification Reported on Lung Cancer Screening Low Dose CT

Wednesday, Dec. 4 11:00AM - 11:10AM Room: N229

Participants
Dexter Mendoza, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bashar Kako, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (*Abstract Co-Author*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Clinical Bay; Researcher, Zai Lab
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Editor with royalties, Reed Elsevier
Brent P. Little, MD, Boston, MA (*Presenter*) Author, Reed Elsevier; Editor, Reed Elsevier; Royalties, Reed Elsevier

For information about this presentation, contact:

dpmendoza@partners.org

PURPOSE

Coronary artery calcification (CAC) is a common and important incidental finding in low dose CT lung cancer screening (LD-LCS). Our objective were to determine the incidence of significant coronary artery calcification (CAC) reported on LD-LCS and to determine the impact of its reporting on subsequent diagnostic and therapeutic interventions.

METHOD AND MATERIALS

In this IRB approved retrospective study, we queried our lung cancer screening database for reports of LD-LCS performed between January 2016 and September 2018. All reports with significant findings designated with the "S" modifier for any LungRADS category were reviewed, and those with the "S" modifier pertaining to significant CAC were selected. The grading of CAC was extracted from the reports and compiled into four groups: moderate, severe, other non-standard descriptors (e.g. extensive, dense, etc.), or unspecified. From the electronic medical record, we reviewed and recorded baseline clinical characteristics of included patients and subsequent changes in management that resulted from the report of significant CAC. Paired Student's t-test and Fisher's exact test were used to compare subsets of patients.

RESULTS

Out of the 3110 patients who underwent LD-LCS, 756 (24.3%) patients (mean age: 67 +/-6.4 year; M=466, 61.6%: F=290, 38.4%) were reported to have significant CAC. Of these, 236 patients (31.2%) had established, documented coronary artery disease at baseline. A change in management was noted in 155 patients (20.5%). The most common changes in management were medication regimen change (n=114/155, 73.5%), stress testing (n=65/155, 41.9%), and cardiology specialist referral (36/155, 23.2%). Percutaneous (3/155, 1.9%) and surgical (3/155, 1.9%) coronary interventions were infrequent. In those without known CAD, those whose CAC were semi-quantified as moderate, severe, or other nonstandard modifier were more likely to have a change in management compared to those whose CAC were unspecified (35% vs. 25%, p=0.02).

CONCLUSION

Coronary artery calcification is a common significant finding in LD-LCS. The reporting and semi-quantitative assessment of CAC in patients without established coronary artery disease resulted in change in management.

CLINICAL RELEVANCE/APPLICATION

Routine and standardized reporting of significant CAC found on LD-LCS has the potential to change patient management and may contribute to improved cardiovascular outcomes in this high-risk population.

SSK05-05 Interobserver Agreement for Lung-RADS Categorization in Subsolid Nodule-Enriched Lung Cancer Screening CT's

Wednesday, Dec. 4 11:10AM - 11:20AM Room: N229

Participants
Yongju Kim, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jihang Kim, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Monitor Corporation; Research Grant, Seoul National University Bundabg Hospital
Jungheum Cho, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kibbeum Doh, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Junghoon Kim, Seongnam-si , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyunghee Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Ministry of Trade, Industry, and Energy; Research Grant, SNUBH Research Fund
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the interobserver agreement for Lung-RADS categorization in subsolid nodule-enriched low-dose screening CTs.

METHOD AND MATERIALS

A retrospective review of the low-dose screening CT reports from 2013 to 2017 using keyword search for subsolid nodules found 54 baseline CTs. A total of 162 CTs, including 108 negative screening CTs as controls, were classified into Lung-RADS categories by two fellowship-trained thoracic radiologists in a consensus manner. We randomly selected 60 scans (20 in Category 1/2 and 3, 10 in Category 4A and 4B) to ensure a balanced representation of all lung-RADS categories. Five radiologists reviewed the 60 CT scans and classified each CT scans into Lung-RADS categories. Rates of concordance, minor and major discordance were calculated, with the major discordance defined as at least six months of management discrepancy. We analyzed the agreement of five observers using Cohen's kappa statistics.

RESULTS

Averaged correct categorization was achieved by five radiologists for 60.3% (181 of 300) in all cases and 45.0% (90 of 200) in positive screens. Minor and major discordance rate was 29.7% and 10.0% in all cases and 41.5% and 13.5% in positive screens, respectively. Pairwise interobserver agreement (weighted k) was 0.535 (range, 0.353-0.686; 95% confidence interval, 0.406, 0.664).

CONCLUSION

The accuracy of radiologists in the categorization of screening CTs with subsolid nodules varied and the interobserver agreement was only moderate in the retrospective study. This inconsistency may affect management recommendations in lung cancer screening.

CLINICAL RELEVANCE/APPLICATION

Lung-RADS categorization of low-dose screening CTs with subsolid nodules varies among radiologists and the inconsistency may affect management recommendations.

SSK05-06 Update on Lung Cancer Screening Utilization: Results from the 2017 Behavioral Risk Factor Surveillance System Cross-Sectional Survey

Wednesday, Dec. 4 11:20AM - 11:30AM Room: N229

Participants
Anand K. Narayan, MD,PhD, Boston, MA (*Presenter*) Nothing to Disclose
Gary X. Wang, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Diego Lopez, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Brent P. Little, MD, Boston, MA (*Abstract Co-Author*) Author, Reed Elsevier; Editor, Reed Elsevier; Royalties, Reed Elsevier
Florian J. Fintelmann, MD, Boston, MA (*Abstract Co-Author*) Consultant, Jounce Therapeutics, Inc; Research support, BTG International Ltd
Jo-Anne O. Shepard, MD, Boston, MA (*Abstract Co-Author*) Editor with royalties, Reed Elsevier
Justin Stowell, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

aknarayan@mgh.harvard.edu

PURPOSE

Lung cancer screening with low dose chest CT (LCS) reduces lung cancer mortality. Despite favorable recommendations from the USPSTF for LCS in 2013 and coverage by public and private payors since 2015, initial studies reported that only <5% of eligible patients are being screened. Despite increasing insurance coverage, public awareness, and availability of LCS nationwide, few studies have evaluated recent LCS utilization. Our purpose was to estimate LCS utilization using nationally representative cross-sectional survey data from the most recent Behavioral Risk Factor Surveillance System Survey (BFRSS) survey.

METHOD AND MATERIALS

BRFSS is a nationally representative, cross-sectional phone survey of adults in the United States. The 2017 survey included questions about LCS eligibility and utilization in 11 states (Florida, Georgia, Kentucky, Maryland, Missouri, Nevada, Oklahoma, Vermont, Wyoming, Kansas, Maine). Primary outcome was the proportion of patients ages 55-79 with at least a 30 pack year smoking history who reported undergoing LCS. Multivariable logistic regression models were used to evaluate the association between self-reported LCS usage and sociodemographic characteristics, adjusted for potential confounders and accounting for complex survey design elements.

RESULTS

30,362 participants were included of whom 27.8% reported at least 30 pack year smoking history. Among participants with at least a 30 pack year smoking history between the ages of 55-79, 12.2% (95% CI 10.7, 13.7) reported obtaining a chest CT scan specifically to evaluate for lung cancer. In our multiple variable analyses, age, education category, income category, health insurance status, race, marital status, and employment status were not associated with statistically significant differences in self-reported receipt of LCS ($p > 0.05$).

CONCLUSION

Overall, utilization of LCS remains low (12%) among eligible participants, however comparison with previously published studies suggests improvements in LCS utilization.

CLINICAL RELEVANCE/APPLICATION

LCS uptake among eligible patients is low. Provider education, public awareness campaigns, and continued improvements in health insurance coverage are required to save more lives with LDCT.

SSK05-07 Impact of Multidisciplinary Review of Lung Cancer Screening CT on LungRADS Score and Follow-Up Recommendations

Wednesday, Dec. 4 11:30AM - 11:40AM Room: N229

Participants
Michael F. Morris, MD, Scottsdale, AZ (*Presenter*) Speakers Bureau, Medtronic plc
Gordon Haugland, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Raul Galvez-Trevino, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Susan Passalaqua, MD, Gilbert, AZ (*Abstract Co-Author*) Nothing to Disclose
Archan Shah, Gilbert , AZ (*Abstract Co-Author*) Nothing to Disclose
Raed Alalawi, Phoenix , AZ (*Abstract Co-Author*) Nothing to Disclose
Jennifer Wrzesinske, Gilbert , AZ (*Abstract Co-Author*) Nothing to Disclose
Stacey Rodgers, Gilbert, AZ (*Abstract Co-Author*) Nothing to Disclose
Brett Broussard, Gilbert , AZ (*Abstract Co-Author*) Nothing to Disclose
Ryan Macke, Gilbert , AZ (*Abstract Co-Author*) Nothing to Disclose
John Breard, Gilbert, AZ (*Abstract Co-Author*) Nothing to Disclose
Elbert Kuo, MD,MPH, Phoenix, AZ (*Abstract Co-Author*) Speaker, Johnson & Johnson

PURPOSE

There is evolving consensus that positive lung cancer screening CT scans should be reviewed by a multidisciplinary panel. We assessed the impact of multidisciplinary review of lung cancer screening CTs initially coded as LungRADS (LR)-3, LR-4a, or LR-4b.

METHOD AND MATERIALS

From 1/2017-12/2018, 872 patients underwent lung cancer screening CT at 4 sites within an integrated health care system. A designated radiologist at each site interpreted CTs according to LR criteria. CT scans coded as LR-3 (n=71, 8.1%), LR-4a (n=33, 3.8%), or LR-4b (n=32, 3.7%) were reviewed by a multidisciplinary team of radiologists, interventional pulmonologists, and thoracic surgeons. Following multidisciplinary review, CTs were given a final LR score and follow-up recommendations were provided.

RESULTS

136 patients were coded as LR-3, LR-4a, or LR-4b by the site radiologist. After multidisciplinary review, 23 (16.9%) patients had the LR score changed. Baseline characteristic were similar between patients with a change in LR score compared to those with no change in LR score. 12 CTs (52%) had the LR score upcoded and 11 CTs (48%) were downcoded. Reasons for change in LR coding are described in Figure 1. CT scans not following LR assessment categories were more likely to be upcoded (p=0.03), whereas findings considered to be infectious/inflammatory/scarring were more likely to be downcoded (p=0.04). After LR upcoding, follow-up recommendations were changed to biopsy (n=4), PET/CT (n=4), or 3-month follow-up CT (n=4). LR downcoding resulted in follow-up recommendations being changed to 6 month follow-up CT (n=6), 12 month low dose CT (n=4), and PET/CT (n=1). LR upcoding facilitated early detection of lung cancer in one patient (4.3%), whereas downcoding resulted in a potential delay in cancer diagnosis in one patient (4.3%).

CONCLUSION

Multidisciplinary review of LR-3, LR-4a, and LR-4b CTs results in LR reclassification in 16.9% of patients within an integrated health care system. Lung nodules not coded according to LR assessment categories, or CT findings ascribed to infection/inflammation/scarring, were significantly more likely to have the LR score changed. Further studies should examine the impact of multidisciplinary review on CT screening outcomes.

CLINICAL RELEVANCE/APPLICATION

Multidisciplinary review of LR-3, LR-4a, and LR-4b cases results in LR reclassification and changes to follow-up recommendations in a significant minority of cases.

SSK05-08 Variability among Expert Readers in Low-Dose CT Lung Cancer Screening: Comparison of Readings between Individual Institution and Central Review in a Nationwide Lung Cancer Screening Project

Wednesday, Dec. 4 11:40AM - 11:50AM Room: N229

Participants
Eui Jin Hwang, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Mo Goo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, INFINITT Healthcare Co, Ltd; Research Grant, DONGKOOK Pharmaceutical Co, Ltd;
Soon Ho Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyae Young Kim, MD, PhD, Goyang-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jaeyoun Yi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeol Kim I, Goyang-si , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ken921004@hotmail.com

PURPOSE

Computer-aided detection and volumetry is known to reduce interobserver variability but its potential in a real world setting has rarely been reported. This study aimed to evaluate the variability among experts in a nationwide lung cancer screening project.

METHOD AND MATERIALS

We evaluated 1647 consecutive baseline screening CT scans obtained during one month period of December 2017 from a nationwide lung cancer screening project (K-LUCAS) in which 14 institutions participated. Chest radiologists of each institution assessed CT scans using a thin-client system equipped with semi-automated nodule segmentation and computer-aided detection software based on Lung-RADS (institutional reading). One chest radiologist retrospectively reviewed all these CT scans while minimizing modification of segmentation results and minimizing rejecting tiny nodules (central review). Reading results between institutional reading and central review were compared. Positive rates of central review using Lung-RADS and NELSON criteria were also compared.

RESULTS

The average per-case positive rate was significantly higher in central review (24.9% [410/1647; 11.1-32.7% across institutions] vs. 19.3% [319/1647; 5.6-30.0% across institutions]; P<.001). The number of detected nodules was significantly larger in central review (3.04 vs. 1.17 nodule/case; P<.001), while variability in positive rates among institutions were significantly lower in central review (coefficient of variability, 21.9% vs. 40.2%; P=.044). Manual measurements while rejecting segmentation results occurred in 1.6% (80/5008) of nodules at central review and in 17.8% (342/1920) nodules at institutional reading. Positive rate with Lung-RADS is higher (24.9%) compared with that of NELSON criteria (3.9%) but lower than indeterminate scan rate defined by NELSON criteria (33.4%) which requires additional scanning.

CONCLUSION

There is considerable variability among expert readers in reading of lung cancer screening CT mainly by discarding tiny nodules and modifying or rejecting segmentations results. NELSON criteria do not reduce the number of additional scanning in nodule management compared with Lung-RADS.

CLINICAL RELEVANCE/APPLICATION

Even in a situation where computerized tools are adopted, there is considerable variability among readers. The value of reducing variability by applying stricter rules should be further investigated.

SSK05-09 An Observer Study Comparing Radiologists with the Prize-Winning Lung Cancer Detection Algorithms from the 2017 Kaggle Data Science Bowl

Wednesday, Dec. 4 11:50AM - 12:00PM Room: N229

Participants
Colin Jacobs, PhD, Nijmegen, Netherlands (*Presenter*) Research Grant, MeVis Medical Solutions AG; Royalties, MeVis Medical Solutions AG; Research Grant, Thirona
Ernst T. Scholten, MD,PhD, Haarlemmerliede, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Anton Schreuder, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG Research Grant, Canon Medical Systems Corporation Speakers Bureau, Canon Medical Systems Corporation Research Grant, Siemens AG Speakers Bureau, Siemens AG Departmental spinoff, Thirona Departmental licence agreement, Varian Medical Systems, Inc
Bram van Ginneken, PhD, Nijmegen , Netherlands (*Abstract Co-Author*) Stockholder, Thirona ; Co-founder, Thirona ; Royalties, Thirona; Research Grant, Varian Medical Systems, Inc; Royalties, Varian Medical Systems, Inc; Research Grant, Canon Medical Systems Corporation; Royalties, Canon Medical Systems Corporation; Research Grant, Siemens AG;

For information about this presentation, contact:

colin.jacobs@radboudumc.nl

PURPOSE

The 2017 Kaggle Data Science Bowl challenge awarded 1 million dollars in prize money to develop computer algorithms for predicting, on the basis of a single low-dose screening CT scan, which individuals will be diagnosed with lung cancer within one year of the scan. Participating teams received a training set of around 1500 low-dose CT scans to develop and train their algorithms and final performance was measured on a test set of 500 scans, containing 151 lung cancer cases. Over 2000 teams submitted results. The best 10 algorithms all used deep learning and are freely available as open source code. To gain insight into how the performance of these algorithms compares to radiologists, we conducted an observer study including 11 readers who read 150 cases from the test set.

METHOD AND MATERIALS

We randomly extracted 100 benign cases and 50 lung cancer cases from the test set of the challenge. Each algorithm scored each test case with a score between 0 (low) and 1 (high) for harboring a malignancy. We developed a web-accessible workstation in which human experts could review chest CT scans. The web workstation included the common tools found in a professional medical viewing workstation. We invited 11 readers, a mix of radiologists and radiology residents, to read these 150 CT cases and assign a score between 0 (low) and 100 (high) whether the patient will develop a lung cancer within one year of the presented scan. ROC analysis was used to compare the performance of the human readers with the algorithms. The primary outcome was area under the ROC curve. 95% confidence intervals were computed by 1000 bootstrap iterations and are reported between brackets.

RESULTS

The mean area under the ROC curve for the human readers was 0.90 [0.85-0.94]. The mean area under the ROC curve for the algorithms was 0.86 [0.81-0.91]. The mean human reading time per case varied between 96 and 275 seconds.

CONCLUSION

The top 10 algorithms from the Kaggle Data Science Bowl 2017 showed promising performance, but were still inferior to human readers. Future analysis will focus on understanding the strengths and weaknesses of the computer algorithms and the human readers and how these can be optimally combined.

CLINICAL RELEVANCE/APPLICATION

Fully automatic algorithms using deep learning developed in a large-scale challenge show promising performance for lung cancer detection in chest CT, but performed inferior to radiologists in this subset of the test set.

VSIO41

Interventional Oncology Series: Renal Ablation/Embolization

Wednesday, Dec. 4 1:00PM - 3:00PM Room: S405AB

GU IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Stephen J. Hunt, MD,PhD, Philadelphia, PA (*Moderator*) Consultant, Amgen Inc; Research Consultant, BTG International Ltd; Speakers Bureau, Galil Medical Ltd; Research Grant, BTG International Ltd; Research Grant, Geurbet SA
Debra A. Gervais, MD, Boston, MA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

stephen.hunt@uphs.upenn.edu

LEARNING OBJECTIVES

1) Provide an overview of the current interventional oncology therapies utilized in the management of primary and metastic renal malignancies, their mechanisms of action, their indications for use, their published outcomes, and their modality specific complications. 2) Be able to provide examples of future interventional oncology therapies for renal malignancy currently in development.

ABSTRACT

This course provides an overview of interventional oncology techniques for the management of primary and metastatic renal malignancies. Treatment modalities that will be discussed include radiofrequency ablation, microwave ablation, cryoablation, embolization, and combined modalities. After participating in this course, participants will be able to provide an overview of the current interventional oncology therapies utilized in the management of primary and metastic renal malignancies, their mechanisms of action, their indications for use, their published outcomes, and their modality specific complications. Participants will also be able to provide examples of furture interventional oncology therapies for renal malignancy currently in development.

Sub-Events

VSIO41-01 Historical Overview of Renal Ablation

Wednesday, Dec. 4 1:00PM - 1:15PM Room: S405AB

Participants
Susan Shamimi-Noori, MD, Philadelphia, PA (*Presenter*) Consultant, Sirtex Medical Ltd; Consultant, Boston Scientific Corporation

For information about this presentation, contact:

susan.shamimi-noori@pennmedicine.upenn.edu

LEARNING OBJECTIVES

1) To understand how ablation technology has evolved, particularly in relation to treatment of renal lesions.

VSIO41-02 RF Ablation of Renal Masses

Wednesday, Dec. 4 1:15PM - 1:30PM Room: S405AB

Participants
Stephen J. Hunt, MD,PhD, Philadelphia, PA (*Presenter*) Consultant, Amgen Inc; Research Consultant, BTG International Ltd; Speakers Bureau, Galil Medical Ltd; Research Grant, BTG International Ltd; Research Grant, Geurbet SA

LEARNING OBJECTIVES

1) To understand the basic mechanism of radiofrequency ablation. 2) To identify the advantages and disadvantages of RF ablation in the kidney compared with other modalities. 3) To know when to use RF for treatment of RCC and how to perform the procedure safely.

VSIO41-03 MWA of Renal Masses

Wednesday, Dec. 4 1:30PM - 1:45PM Room: S405AB

Participants
John J. Schmitz, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to articulate the basic principles behind microwave ablation. 2) Be able to identify strengths and potential shortcomings of microwave ablation in the kidney. 3) Understand how microwave ablation of renal masses fits into the larger picture of treatment

options available.

VSIO41-04 Safety and Oncologic Efficacy of Cryoablation in Small Renal Masses (SRMs) Using an Innovative Liquid Nitrogen-Based Device

Wednesday, Dec. 4 1:45PM - 1:55PM Room: S405AB

Participants
Tamar Gaspar, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Ilya Volovik, MD, Haifa, Israel (*Presenter*) Nothing to Disclose
Simona Croitoru, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Karina Dorfman, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Yair Halpern, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Sagi Shprits, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Ofir Avitan, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Zaher Bahouth, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose
Robert Sachner, MD, Haifa, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We assessed safety, efficacy, and oncologic outcomes of the new innovative Liquid Nitrogen device in patients with early-stage (T1a) SRMs.

METHOD AND MATERIALS

74 patients (mean age: 69y; 68% males) with 78 lesions (mean: 2.35 cm) smaller than 4 cm, were included; Mean R.E.N.A.L score was 6.53; 16% were endophytic. Percutaneous cryoablation using ProSense™ (10G/13G; IceCure Medical Ltd, Caesarea, Israel) was performed in all patients under CT guidance with sedation/light general anesthesia. It's extremely low temperatures (-1960C) produces larger lethal zone per needle. All procedures were done in two cycles of freezing with intervening passive thaw. Patients underwent imaging and clinical surveillance every 3 months during first year and annually thereafter. Oncologic success was indicated by a reduction in lesion size and lack of enhancement on follow-up CT or MRI. Safety was determined by monitoring Creatinine (Cr) and Hemoglobin (Hb) levels.

RESULTS

Ablation was oncologically successful in all 78 lesions. Average freezing cycles was 22 minutes. Average procedure time was 50.5 min. 45 lesions were followed in 42 patients for more than 12 months (mean: 18.2 m). 3 treatment failures occurred (6.6%): of them, one is a candidate for repeat procedure. One serious event was noted; a late-onset ipsilateral hydronephrosis in a patient treated for a complex medial lower pole lesion (1.2%). Mean Cr and Hb levels remained unchanged in all patients.

CONCLUSION

Cryoablation of SRMs with an innovative Liquid Nitrogen cryogenic device is feasible and safe procedure, with similar oncologic results as nephron spearing surgery and with low rate of serious adverse events.

CLINICAL RELEVANCE/APPLICATION

Cryoablation of SRMs with a new Nitrogen cryogenic device is feasible and safe procedure with low rate of serious adverse events.

VSIO41-05 Cryoablation of Renal Masses

Wednesday, Dec. 4 1:55PM - 2:10PM Room: S405AB

Participants
Andrew J. Gunn, MD, Vestavia Hills, AL (*Presenter*) Consultant, BTG International Ltd; Speakers Bureau, BTG International Ltd; Research support, Penumbra Inc

LEARNING OBJECTIVES

1) Explain the technology underlying cryoablation. 2) List the advantages of cryoablation for renal masses. 3) List the disadvantages of cryoablation for renal masses. 4) Develop a safe approach in using cryoablation for renal masses.

VSIO41-06 Outcomes for Ablation versus Resection of Small Renal Masses

Wednesday, Dec. 4 2:10PM - 2:25PM Room: S405AB

Participants
Nima Kokabi, MD, Atlanta, GA (*Presenter*) Research support, Sirtex Medical Ltd

LEARNING OBJECTIVES

1. Learn the most up-to-date guidelines regarding managment of small renal masses. 2. Learn the contemporary evidence regarding oncologic outcome of treating small renal masses with thermal ablation. 3. Learn the contemporary evidence regarding oncologic outcome of treating small renal masses with partial nephrectomy.

VSIO41-07 Is There a Role for Combination Arterial Embolotherapy and Ablation for Renal Tumors?

Wednesday, Dec. 4 2:25PM - 2:40PM Room: S405AB

Participants
David C. Madoff, MD, New York, NY (*Presenter*) Advisory Board, RenovoRx Consultant, General Electric Company Consultant, Terumo Corporation Consultant, Argon Medical Devices, Inc Consultant, Abbott Laboratories Consultant, Embolx, Inc

VSIO41-08 Treatment Approach for Renal Cell Carcinoma Metastases

Wednesday, Dec. 4 2:40PM - 2:55PM Room: S405AB

Participants
Matthew R. Callstrom, MD,PhD, Rochester, MN (*Presenter*) Research Grant, EDDA Technology, Inc Research Grant, Galil Medical Ltd Consultant, Medtronic plc Consultant, Endocare, Inc Consultant, Johnson & Johnson Consultant, Thermedical, Inc

For information about this presentation, contact:

callstrom.matthew@mayo.edu

LEARNING OBJECTIVES

1) Description of the clinical situations for patients with metastatic renal cell carcinoma that are appropriate for consideration of interventional oncology intervention. 2) Understand how interventional oncology has a role in the treatment of patients with metastatic renal cell carcinoma.

VSIO41-09 Panel Discussion

Wednesday, Dec. 4 2:55PM - 3:00PM Room: S405AB

MSRO44

BOOST: Advanced Techniques in Image-guided Therapy (Interactive Session)

Wednesday, Dec. 4 3:00PM - 4:15PM Room: S103CD

CT MR NM OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Florence K. Keane, MD, Boston, MA (*Presenter*) Advisory Board, AstraZeneca PLC
Susanna I. Lee, MD,PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv; Royalties, Springer Nature
Homer A. Macapinlac, MD, Houston , TX (*Presenter*) Nothing to Disclose
Peter Balter, PhD, Houston, TX (*Presenter*) Research Grant, Varian Medical Systems, Inc; Research Grant, RaySearch Laboratories AB

For information about this presentation, contact:

slee0@mgh.harvard.edu

LEARNING OBJECTIVES

1) Explain and apply modern CT, MR, and PET technologies for treatment planning of solid malignancies in the chest, abdomen and pelvis. 2) Explain and apply the modern techniques in radiotherapy safely and effectively in the chest, abdomen and pelvis.

ABSTRACT

The last decade has seen emergence of important advances in locoregional cancer therapy. Use of functional imaging and advanced radiotherapy often integrated with targeted chemotherapy have improved patient outcomes. This course will present the underlying principles in diffusion MRI, novel MR contrast agents, ultrasound contrast agents and dual energy CT. PET tracers to be discussed are F-18 FDG, widely used for most solid tumors, C-11 choline/F-18 Fluciclovine for prostate cancer and Ga-68-DOTATATE for neuroendocrine tumors. Advances in PET detector instrumentation will be presented. Advanced radiotherapy techniques such as Image Guided Radiotherapy (IGRT), Intensity Modulated Radiation Therapy (IMRT), and Stereotactic Body Radiation Therapy (SBRT) using image guidance with X-ray, CT, MRI and PET will be described.

Printed on: 10/29/20

SSM05

Chest (Dual-energy CT - Malignancy)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N226

CH CT OI

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

FDA Discussions may include off-label uses.

Participants
Patricia J. Mergo, MD, Jacksonville, FL (*Moderator*) Nothing to Disclose
Jeffrey B. Alpert, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSM05-01 Improved Differentiation between Primary Lung Cancer and Pulmonary Metastases by Combining Dual-Energy CT Derived Iodine Concentration and Conventional CT Attenuation

Wednesday, Dec. 4 3:00PM - 3:10PM Room: N226

Participants
Dominik A. Deniffel, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Yucheng Zhang, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Andreas Sauter, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander A. Fingerle, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniela Pfeiffer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ddeniffel@lunenfeld.ca

PURPOSE

To assess the clinical utility of dual-energy CT (DECT) derived iodine concentration (IC) in addition to conventional CT attenuation (HU) for the discrimination between primary lung cancer and pulmonary metastases from different primary malignancies.

METHOD AND MATERIALS

In this retrospective research ethics board approved study, we analyzed contrast-enhanced DECT scans in 79 patients with primary lung cancer (adenocarcinoma, n=45; squamous cell carcinoma (SCC), n=16; small-cell lung cancer (SCLC), n=18) and 89 patients with pulmonary metastases from primary breast (invasive-ductal adenocarcinoma, n=17), colorectal (adenocarcinoma, n=27), head and neck (squamous cell carcinoma, n=17), kidney (RCC) (clear-cell renal cell carcinoma, n=10) and pancreato-biliary (PBC) (adenocarcinoma, n=18) malignancies. Quantitative IC and conventional HU values were extracted and normalized to the thoracic aorta. Differences between groups were assessed by Kruskal-Wallis test with Dunn's post-hoc correction. Multivariate logistic regression was used to generate a diagnostic model. Diagnostic accuracy was evaluated by the area under receiver operator characteristic (ROC) curve (AUC).

RESULTS

Significant differences in conventional HU values ($p<0.001$) were found only between SCLC and metastases from RCC, with median HU [IQR] values of 57 [18] and 100 [35], respectively. Significant differences in IC ($p<0.05$) were noted for SCC (1.3 [0.71] mg/ml) and SCLC (1.2 [0.68] mg/ml) versus pulmonary metastases from RCC (2.8 [1.7] mg/ml) and PBC (2.1 [1.2] mg/ml). In multivariate analysis, both IC (odds ratio 0.16, $p<0.0001$) and HU (odds ratio 1.06, $p<0.0001$) were independent diagnostic features for the discrimination of primary lung cancer from pulmonary metastases. The corresponding multivariate model (AUC=0.73) significantly outperformed both single parameters in diagnostic accuracy (IC: AUC=0.57, $p<0.01$; HU: AUC=0.55, $p<0.001$), achieving a sensitivity and specificity (at maximum Youden index) of 65.82% and 76.40%, respectively.

CONCLUSION

A combined diagnostic model incorporating both DECT derived IC, and conventional CT attenuation values significantly improves the differentiation between primary lung cancer and pulmonary metastases.

CLINICAL RELEVANCE/APPLICATION

A combination of dual-energy CT derived iodine concentration, and conventional CT attenuation provides improved discrimination between primary lung cancer and pulmonary metastases.

SSM05-02 Improving Diagnostic Accuracy for Pulmonary Nodules with the Combination of Morphological Characteristics and Spectral CT-Specific Multi-Parameters

Wednesday, Dec. 4 3:10PM - 3:20PM Room: N226

Participants
Zhanli Ren, Xianyang, China (*Presenter*) Nothing to Disclose

He Taiping, MMed, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yong Yu, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Nan Yu, MD, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company
Yun Shen, PhD, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Researcher, General Electric Company
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Lei Yuxin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Zhang Yanzi, Xianyang City , China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

395654582@qq.com

PURPOSE

To demonstrate the value of improving pulmonary nodules (PN) diagnostic accuracy by combining the morphological characteristics and spectral CT-specific parameters.

METHOD AND MATERIALS

173 patients with pulmonary nodules (61 benign pulmonary nodules (BPN) and 112 malignant pulmonary nodules (MPN)) underwent dual-phase contrast-enhanced spectral CT. Monochromatic and material decomposition images were reconstructed. The morphological characteristics of PN were observed on 70keV images, including location, size, bronchial truncation, density, shape, lobulation, spiculation, spinous sign, vessel convergence sign, boundary, cavity, necrosis, lymph node, pleural invasion, pleural effusion, enhanced pattern and vascular invasion. The CT values from 40keV to 140keV, Effective-Z, blood concentration (BC), iodine concentration (IC), water concentration (WC) of PN and the aorta at the same level were measured to calculate the slope of spectral HU curve (λ), normalized blood concentration (NBC), normalized iodine concentration (NIC) and normalized water concentration (NWC). The receiver operating characteristic (ROC) curve was drawn to evaluate the diagnostic performance of differentiating BPN from MPN.

RESULTS

The two patient groups were similar demographically (P>0.05). The incidence of bronchial truncation, irregular shape, lobulation, pleural effusion and vascular invasion in MPN was significantly higher than those in BPN (P<0.05). The CT values from 40keV to 90keV, λ40keV-90keV, λ100keV-140keV, λ40keV-140keV, BC, IC, NBC, NIC, Effective-Z values of BPN were significantly higher than those of MPN (P<0.05), while both lesions had similar CT values from 100keV to 140 keV, and WC and NWC values (P>0.05). The diagnostic accuracy in differentiating BPN and MPN (AUC 0.891) with combined morphological characteristics and spectral CT-specific parameters was significantly higher than that of only using morphological characteristics (AUC 0.726) or spectral multi-parameters (AUC 0.843).

CONCLUSION

Morphological characteristics with combination of spectral CT multi-parameters spectral CT can help to improve the diagnostic accuracy in differentiating pulmonary nodules.

CLINICAL RELEVANCE/APPLICATION

The morphological characteristics with combination of multi-parameters based on spectral CT can improve the diagnostic accuracy of pulmonary nodules.

SSM05-03 Comparison in Pulmonary Small Vessel Area and Association with Pulmonary Emphysema between Lower and Standard Energy Data Acquisition: Quantitative Assessment with Dual-Energy Computed Tomography

Wednesday, Dec. 4 3:20PM - 3:30PM Room: N226

Participants
Yukihiro Ichikawa, RT, Osaka,Osaka , Japan (*Presenter*) Nothing to Disclose
Yukihiro Nagatani, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Hirose, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenji Furuichi, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kie Shindo, MD, Osaka,Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Akikatsu Sakumoto, RT, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinsuke Tsubouchi, RT, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hao Zhong, Suita,Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

muff.fuzz.ukulele.guide2@gmail.com

PURPOSE

To investigate the merit of lower energy data acquisition on computed tomography(CT) for the quantification of pulmonary smaller vessels and emphysema

METHOD AND MATERIALS

The institutional review board approved this study and consents from patients were waived because of retrospective study design. A hundred and fifty patients underwent chest CT by using fast kVp switching dual-energy scanner (80/140 kVp) with scan parameters to secure target standard deviation(SD) 11 (Revolution GSI, General Electric Medical Systems, Milwaukee, WI, USA). Scan data were converted to virtual monochromatic images (VMI) at 3 tube voltages; 40, 55 and 70 KeV. Low attenuation area < -950 HU (% LAA-950) was quantified with dedicated software as emphysema extent. By using a free software Image J, percentage

of cross-sectional area of pulmonary vessels < 5 mm2 to total lung field (%CSA<5) was calculated as pulmonary small vessel area at predefined 3 trans-axial levels; aortic arch, bronchial bifurcation and right pulmonary veins orifice, and SD in CT density in 10 mm-quadrangular region of interest inside descending aorta was measured as objective image noise (OIN) at the bronchial bifurcation level. %LAA-950 and %CSA<5 in total and each of the 3 levels were compared among the 3 tube voltages by using Friedman and Wilcoxon signed rank test. Spearman's rank correlation analyses were performed to assess the associations of the %LAA-950 and %CSA< 5, and analyses of covariance were performed to assess the similarity of slope of regression lines among the 3 tube voltages.

RESULTS

%CSA<5 on VMI at 40 KeV in total as well as the 3 levels was the largest (1.96±0.32), followed by that at 55 (1.34±0.30) and 70 KeV (0.85±0.27). %LAA-950 on VMI at 40 KeV was also the largest (14.6±8.9 %), followed by that at 55 (5.9±7.6 %) and 70 KeV (2.8±6.6 %). Negative correlation was found between %CSA<5 and %LAA-950 all in the 3 tube voltages (r = -0.529, p <0.001 at 40 KeV). Slope of regression line at 40 KeV was similar to that at 55 KeV irrespective of OIN increase.

CONCLUSION

Data acquisition at 40 KeV can be useful for quantification of pulmonary smaller vessels closely-associated with emphysema on CT.

CLINICAL RELEVANCE/APPLICATION

Data acquisition at 40KeV may be potential to play an important role for early detection of peripheral vessel impairment leading to pulmonary hypertension in combination with iterative reconstruction.

SSM05-04 Can Dual-Energy Derived Perfusion Parameters Provide Information on Tumor Hypoxia? Preliminary Experience in 49 Operable Non-Small Cell Lung Carcinomas

Wednesday, Dec. 4 3:30PM - 3:40PM Room: N226

Participants
Julie Dewaguet, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Marie-Christine Copin, MD, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Alain Duhamel, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Thomas G. Flohr, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Jacques Remy, MD, Mouvaux, France (*Abstract Co-Author*) Research Consultant, Siemens AG
Martine J. Remy-Jardin, MD, PhD, Lille, France (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

For information about this presentation, contact:

martine.remy@chru-lille.fr

PURPOSE

To investigate potential relationships between DECT perfusion characteristics and prognostic histopathologic features.

METHOD AND MATERIALS

A two-phase DECT scanning protocol was obtained in the presurgical evaluation of 49 tumors (squamous cell carcinomas: n=12; adenocarcinomas: n=37), including (a) an early phase over the entire thorax (i.e., intravascular phase of tumoral perfusion); (b) completed by a delayed acquisition over the tumor, 50 s later (i.e., interstitial phase of tumoral perfusion). The first-pass and delayed iodine concentration (IC; mg/mL) and the arterial enhancement fraction (AEF=first pass IC/delayed IC x 100) were calculated over the entire tumor and within the most peripheral 2-mm thick tumor layer, automatically segmented. The expression of the membranous carbonic anhydrase IX (mCAIX), an immunohistochemical marker of hypoxia, was assessed in tumor specimens.

RESULTS

33 tumors were mCAIX positive (Group 1) and 16 mCAIX negative (Group 2), the former showing a statistically significantly larger volume (p=0.04). At the level of the whole tumor, the delayed IC was significantly higher than that at first pass (median: 1.53 vs 1.4; p=0.04), suggestive of extravascular leakage within the interstitial space; there was no difference in DECT perfusion parameters between the two groups. Compared to Group 2, the outer layer of Group 1 tumors had significantly higher median values of IC (0.53 vs 0.21; p=0.02) and AEF (102.6 vs 65.6; p=0.02) with a trend toward higher delayed IC (0.48 vs 0.39; p=0.34). The distribution of neovessel profile was significantly different between Groups 1 & 2 with a greater proportion of functional neovessels in Group 1.

CONCLUSION

DECT can provide insight into perfusion characteristics at the level of the tumoral invasion front.

CLINICAL RELEVANCE/APPLICATION

Hypoxia-induced neovascularization may contribute to tumor progression and metastasis. DECT can provide information on perfusion characteristics at the level of the tumoral invasion front.

SSM05-05 The Predictive Value of Energy Spectrum CT Parameters for Ki67 Expression of Lung Cancer

Wednesday, Dec. 4 3:40PM - 3:50PM Room: N226

Participants
Pei P. Dou, Xuzhou , China (*Presenter*) Nothing to Disclose
Zhongxiao Liu, Xuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yankai Meng, Beijing , China (*Abstract Co-Author*) Nothing to Disclose
Yingying Cui, Xuzhou , China (*Abstract Co-Author*) Nothing to Disclose
Guangjun Cheng, Xuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hongmei Zhang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kai Xu, MD, PhD, Xuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chun-Wu Zhou, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

1062920760@qq.com

PURPOSE

To investigate the predictive value of energy spectrum CT parameters for lung cancer Ki67 expression.

METHOD AND MATERIALS

Between December 2018 and February 2019, 27 primary lung cancer patients confirmed by pathological examination enrolled this prospective cohort study. All patients underwent energy spectrum CT (ESCT) scan . ESCT parameters were derived from dual-energy virtual imaging in Siemens postprocessed workstation by a radiologist (M.Y.K.). All enrollment patients clinicopathological data derived from electronic record system. SPSS 19.0 were used for statistical analysis.Quantitive and qualitative data used X2, t and Rank test respectively.ROC curves were used for analysis predicting performance of the Ki67 expression. P<0.05 was considered statistically significant.

RESULTS

Tumor was larger in Ki67 high expression group than low group (P=0.046). The other demographic and clinicopathological characteristics of all enrollment patients showed no significant difference (Table 2). Venous phase iodine value (IV), iodine ratio (IR) and the slope of the 40-80 keV energy spectrum curve (SP) improved than arterial phase IV, IR and SP, respectively (Fig. 1). The arterial phase IV, IR, SP and venous phase IV are no significant difference in low and high Ki67 expression group (P value ranged from 0.105 to 0.182) (Table 3). There are significantly different in two groups for venous phase IR and SP (0.249±0.083, 0.360±0.162, P=0.033 in IR and 1.744±0.607, 2.562±1.236, P=0.037 in SP, respectively) (Table 3, Fig. 2). Venous phase IR ROC analysis showed boderline P value (P=0.056) with AUC, sensitivity (SE), specificity (SP) and cutoff value were 0.717, 92.86, 61.54 and <=0.347 respectively. The AUC, SE, SP and cutoff value were 0.698, 92.86, 53.85 and <=2.407 respectively (Table 4, Fig. 6).

CONCLUSION

Venous phase IR and SP based on single energy spectrum curve and iodine image may effectively stratify primary lung cancer Ki67 expression into low and high group. The efficacy of other energy spectrum parameters need further investigation.

CLINICAL RELEVANCE/APPLICATION

The baseline energy spectrum CT parameters may non-invasion predict Ki67 expression. And the results may use for stratification lung cancer patients and individulization treatment in some extent.

SSM05-06 The Application of Spectral CT Multi-Parameter in Differentiating Pathological Types of Lung Cancer

Wednesday, Dec. 4 3:50PM - 4:00PM Room: N226

Participants
Zhanli Ren, Xianyang, China (*Presenter*) Nothing to Disclose
He Taiping, MMed, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yong Yu, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Nan Yu, MD, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company Researcher, General Electric Company
Jianying Li, Beijing, China (*Abstract Co-Author*) Employee, General Electric Company
Yongjun Jia, MMed, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Sijin Dong, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the application of spectral CT multi-parameter in differentiating pathological types of lung cancer.

METHOD AND MATERIALS

57 patients with lung cancer who underwent spectral CT imaging were collected,of which there were 24 cases with adenocarcinoma,18 cases with squamous cell carcinoma and 15 cases with small cell lung cancer.The dual-phase (aortic phase and pulmonary venous phase) enhanced scanning was used for all patients.The CT values of 40kev-90kev,iodine concentration(IC),water concentration(WC),effective-Z and the iodine concentration and water concentration of aorta at the same level were measured in the arterial phase,and the normalized iodine concentration(NIC) and the normalized water concentration(NWC) and the spectral curve slope were calculated.One-way ANOVA was used to compare the parameters.

RESULTS

The CT values of 40kev-60kev,iodine concentration,normalized iodine concentration,effective-Z and the spectral curve slope showed significant difference among three kinds of lung cancer(P<0.001).The CT values of 40kev-60kev,iodine concentration,normalized iodine concentration,effective-Z and the spectral curve slope in adenocarcinoma and squamous cell carcinoma were significantly different from small cell lung cancer(P<0.001).The CT values of 40kev-60kev,iodine concentration,normalized iodine concentration,effective-Z and the spectral curve slope in adenocarcinoma were higher than those in squamous cell carcinoma(P<0.001).

CONCLUSION

Spectral CT multi-parameter can be used to identify different pathological types of lung cancer,of which the iodine concentration,normalized iodine concentration,effective-Z,CT values of 40kev-60kev and spectral curve slope played a role in differential diagnosis.

CLINICAL RELEVANCE/APPLICATION

Spectral CT imaging can provide multi-parameter identification basis for the pathological types of lung cancer,which was helpful to determine the reasonable treatment plan and improve the prognosis.

SSM16

Molecular Imaging (Oncology)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S505AB

MI OI

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

FDA Discussions may include off-label uses.

Participants
Pedram Heidari, MD, Charlestown, MA (*Moderator*) Nothing to Disclose
Benjamin Larimer, PhD, Charlestown, MA (*Moderator*) Co-founder, Cytosite Biopharma Inc; Consultant, Cytosite Biopharma Inc; Stockholder, Cytosite Biopharma Inc

Sub-Events

SSM16-01 **Prospective Evaluation of the First Integrated PET/Dual-Energy CT System in Patients with Lung Cancer**

Wednesday, Dec. 4 3:00PM - 3:10PM Room: S505AB

Awards
Trainee Research Prize - Resident

Participants
Simon S. Martin, MD, Charleston, SC (*Presenter*) Institutional Research support, Siemens AG
Marly van Assen, MSc, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Philip Burchett, MSc, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
James G. Ravenel, MD, Charleston, SC (*Abstract Co-Author*) Consultant, ImBio, LLC
Leonie Gordon, MBChB, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, Atlanta , GA (*Abstract Co-Author*) Research Grant, Siemens AG
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Research Grant and Travel Support, Siemens AG Research Consultant, Elucid Bioimaging
Thomas J. Vogl, MD, PhD, Frankfurt , Germany (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Bayer AG; Research Grant, Bracco Group; Research Grant, Siemens AG; Research Grant, Heartflow, Inc; Research support, Bayer AG; Consultant, Elucid BioImaging Inc; Research Grant, Guerbet SA; Consultant, HeartFlow, Inc; Consultant, Bayer AG; Consultant, Siemens AG; ; ;

For information about this presentation, contact:

carlo.dececco@emory.edu

PURPOSE

The aim of this study was to prospectively evaluate the first integrated positron emission tomography (PET)/ dual-energy computed tomography (DECT) system in patients with small-cell lung cancer (SCLC) or non-small-cell lung cancer (NSCLC).

METHOD AND MATERIALS

In this single-center HIPAA compliant prospective trial, we included 25 patients (age range, 41-84 years; median age, 62 years) with NSCLC (n=21) or SCLC (n=4) who were referred for a PET/CT study between May 2017 and June 2018. All patients received contrast-enhanced imaging on a clinical PET/DECT system 70 min after the administration of 5MBq/kg of 18F-fluorodeoxyglucose (18F-FDG). Data analysis included PET-based standard uptake values (SUVmax) and DECT-based iodine densities of tumor masses and lymph nodes. Results between the different parameters were compared using Pearson correlation analysis and receiver operating characteristics (ROC) analysis.

RESULTS

SUVmax and iodine density parameters were measured in 33 malignant lung masses (15.0 and 2.3 mg/mL, respectively) and 56 enlarged mediastinal or hilar lymph nodes (8.4 and 2.2 mg/mL, respectively). A moderate correlation was found for SUVmax and iodine density values in tumor masses (r=0.53). SUVmax and iodine density values of lymph node metastases showed a weak correlation (r=0.36). Additionally, iodine quantification analysis provided no added value for the differentiation of malignant from benign lymph nodes with an area under the curve (AUC) of 0.52 using PET-based SUVmax analysis as the reference standard.

CONCLUSION

The integration of PET/DECT information in lung cancer staging can provide additional insights in the assessment of primary lung cancer and on the correlation between tumor vascularization and metabolic activity, offering an alternative for tumor characterization improvements. However, the weak correlation between SUVmax and iodine density in malignant lymph nodes suggest that iodine density alone has a limited value for lymph node characterization.

CLINICAL RELEVANCE/APPLICATION

This is the first clinical study on an integrated PET/DECT which provides additional insights in the assessment of lung cancer, offering an alternative for tumor characterization improvements.

SSM16-02 Deep Learning for Prostate Cancer Lymph Node Staging: Balance and Location Matter

Wednesday, Dec. 4 3:10PM - 3:20PM Room: S505AB

Participants
Alexander Hartenstein, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Falk Lubbe, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Canon Medical Systems 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
Marcus R. Makowski, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Penzkofer, MD, Berlin, Germany (*Presenter*) Researcher, AGO; Researcher, Aprea AB; Researcher, Astellas Group; Researcher, AstraZeneca PLC; Researcher, Celgene Corporation ; Researcher, Genmab A/S; Researcher, Incyte Coporation; Researcher, Lion Biotechnologies, Inc; Researcher, Takeda Pharmaceutical Company Limited; Researcher, Morphotec Inc; Researcher, Merck & Co, Inc; Researcher, Tesaro Inc; Researcher, F. Hoffmann-La Roche Ltd;

For information about this presentation, contact:

tobias.penzkofer@charite.de

PURPOSE

To evaluate if PSMA-PET lymph node status can be predicted using deep convolutional networks (CNN) from CT imaging alone and assess the influence of class balancing and anatomical context on classification results compared to radiologists' performance.

METHOD AND MATERIALS

549 patients, who had received 68Ga-PSMA PET/CT examination, were included. 2616 lymph nodes (LN) were segmented on CT, the corresponding status was determined from PSMA-PET/CT. Two training datasets were used: The first set ('naively balanced', NB) was created by balancing the infiltration status alone. The second set ('location balanced', LB), was created by additionally balancing within each anatomical region. 130 nodes were set aside for independent testing, leaving 732 (NB) and 548 nodes (LB) after balancing. Three CNNs were created, the first two trained with contrast-enhanced CT images and segmentations of either NB or LB test sets respectively, while the third received masked CT images of the NB set (xMask). All networks were analysed for their test set performance (vs. two radiologists) and heatmap patterns.

RESULTS

The NB trained CNN performed best, with an AUC of 0.955 (95% CI 0.923-0.987). The LB and xMask trained CNN performed comparably well, with AUCs of 0.858 (LB, 95% CI 0.793-0.922) and 0.863 (xMask, 95% CI 0.804 - 0.923). The radiologists achieved an average AUC, sensitivity, specificity and accuracy of 0.81, 65%, 96% and 81% respectively. Analyzing the heatmaps, activation patterns suggest, that CNNs learn features within the lymph nodes but also, and more troublingly, outside of the lymph nodes, which correlate to the infiltration status. It is critical to note that our best performing model appears to rely on features outside of the lymph node in question, such as the skin/air border often found in the inguinal region, which are rarely infiltrated.

CONCLUSION

Deep Learning systems are prone to learning unknown bias present in data, and efforts should be made to prove that classification systems perform as intended. Nevertheless, our results show that CNNs are capable of determining the 68Ga-PSMA PET/CT infiltration status from PCa on contrast-enhanced CT scans alone.

CLINICAL RELEVANCE/APPLICATION

Careful training of CNNs to predict the PSMA/PET lymph node status from CT alone could add value to non-PET staging examinations.

SSM16-03 18F-FMISO PET May Be Applicable in The Evaluation of Colorectal Cancer Liver Metastasis

Wednesday, Dec. 4 3:20PM - 3:30PM Room: S505AB

Participants
Huijie Jiang, PhD, MS, Harbin, China (*Abstract Co-Author*) Nothing to Disclose
Mingyu Zhang, PhD, harbin, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jhjemail@163.com

PURPOSE

Positron emission tomography (PET) imaging is a non-invasive functional imaging method used to reflect tumor spatial information, and to provide biological characteristics of tumor progression. The aim of this study was to focus on the application of 18F-fluoromisonidazole(FMISO) PET quantitative parameter of maximum standardized uptake value (SUVmax) ratio to detect the liver metastatic potential of human colorectal cancer in mice.

METHOD AND MATERIALS

Wound healing assays were performed to examine the ability of cell migration in vitro. 18F-FMISO uptake in CRC cell lines was measured by cellular uptake assay. 18F-FMISO-based micro-positron emission tomography imaging of colorectal liver metastasis and tumor-bearing mice was performed and quantified by tumor-to-liver SUVmax ratio. The correlation between the 18F-FMISO SUVmax ratio, liver metastases number, hypoxia-induced HIF-1a and serum starvation-induced GLUT-1 was evaluated using Pearson correlation analysis.

RESULTS

Compared with HT29 and HCT116, LoVo-CLM mice had significantly higher liver metastases ratio and shorter median survival time. LoVo cells exhibited stronger migration capacity and higher radiotracer uptake compared with HT29 and HCT116 in in vitro. Moreover, 18F-FMISO SUVmax ratio was significantly higher in both LoVo-CLM model and LoVo-bearing tumor model compared to models established using HT29 and HCT116. In addition, a linear regression analysis revealed a significant correlation between 18F-FMISO SUVmax ratio of CLM-mice and number of liver metastases larger than 0.5cm, as well as between 18F-FMISO SUVmax ratio and HIF-1a or GLUT-1 expression in tumor-bearing tissues.

CONCLUSION

18F-FMISO parameter of SUVmax ratio may provide useful tumor biological information in mice with CRC liver metastasis, thus allowing for better prediction of CRC liver metastasis and yielding useful radioactive markers for predicting liver metastasis potential in CRC.

CLINICAL RELEVANCE/APPLICATION

Better prediction of CRC liver metastasis and yielding useful radioactive markers for predicting liver metastasis potential in CRC.

SSM16-04 Comparison of 18F-DCFPyL-PSMA PET/CT and PET/MR for Detection of Prostate Cancer Biochemical Recurrence: Additive Value of PyL PET with Pelvic MRI for Salvage Radiation Therapy Planning

Wednesday, Dec. 4 3:30PM - 3:40PM Room: S505AB

Participants
Edward M. Lawrence, MD, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Minnie Kieler, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Shane A. Wells, MD, Madison, WI (*Abstract Co-Author*) Consultant, Johnson & Johnson
Greg Cooley, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, Advanced Accelerator Applications SA;

For information about this presentation, contact:

scho@uwhealth.org

PURPOSE

To evaluate prostate specific membrane antigen (PSMA)-based 18F-DCFPyL(PyL) PET in prostate cancer (PC) biochemical recurrence (BCR) and benefit for salvage radiation therapy (RT) planning.

METHOD AND MATERIALS

Patients with PC history, prior prostatectomy, and planned RT for BCR were prospectively recruited. Three PyL PET studies were done - whole body PET/CT (wbPET/CT) on a Discovery 710, [pelvic PET/MR (pPET/MR) with multiparameteric pelvic MR (mpMRI), and whole body PET/MR (wbPET/MR) on a Discovery 710 and Signa scanner [GE, Waukesha, WI] respectively. Patients then underwent salvage RT. Two readers independently used two proposed PSMA PET evaluation methods (PSMA-RADS v1, PROMISE) for PET evaluation followed by third reader adjudication. Separately, the mpMRI was evaluated for local or pelvic lymph node (LN) recurrence and proposed post-PET treatment was compared to a standard plan using clinical risk and mpMRI. PET positive sites were evaluated in relation to the actual radiation field.

RESULTS

12 patients (mean age, 61.8 yrs; median pre-RT PSA, 0.92 ng/mL) had 29 PET sites of suspected recurrence. Eight of 12 patients (66%) had a positive PyL PET with suspected disease confined to the pelvis (n=5) or with distant disease (n=3). Positive sites had consensus PSMA-RADS scores of 5 (n=15), 4 (n=1), and 3 (n=12) as well as PROMISE miPSMA expression scores of 3 (n=5), 2 (n=12), and 1 (n=10). Median maximum standardized uptake value (SUVmax) was 9.5, 6.3, and 5.4 for reader 1 and 9.5, 5.9, and 6.1 for reader 2 on pPET/MR, wbPET/MR, and wbPET/CT respectively. pPET/MR detected all PET positive sites within the pelvis. Compared to PyL PET, mpMRI detected 2/4 sites of suspected local recurrences and 1/16 PET positive LNs. Five of 12 patients would have had a proposed treatment plan change based on PyL PET. One RADS-5 LN and 5 equivocal targets (LN, n=2; rib lesion, n=3) were outside the actual radiation field. Additionally, two RADS-5 LNs were at the edge of the field and would have resulted in extended coverage.

CONCLUSION

PSMA-based PyL PET detected suspicious sites in 66% of BCR patients with highest median SUVmax on pPET/MR. PyL PET results would have theoretically changed management in 42% (n=5) patients.

CLINICAL RELEVANCE/APPLICATION

PyL PET was positive in two-thirds of BCR after prostatectomy. PyL PET improves detection of suspected sites of PC recurrence and could impact patient management and RT treatment field planning.

SSM16-05 Real-Time 3D Thermography in a Liver Tumor Ablation Model Using Magnetic Particle Imaging

Wednesday, Dec. 4 3:40PM - 3:50PM Room: S505AB

Participants
Johannes M. Salamon, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Caroline Jung, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Knopp, DIPLENG, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

j.salamon@uke.de

PURPOSE

Evaluation of the feasibility of visualizing the temperature course during a thermal ablation in an in vitro liver tumor phantom using MPI and different iron oxide tracers.

METHOD AND MATERIALS

In vitro liver tissue phantoms with different iron oxide tracers (L93, Bayer-Schering; LS008, Load Spin Labs; MM4, TOPASS GmbH, concentrations of 0.1-0.5 mg/ml) were generated in Eppendorf-Tubes using a 1:1 volume mixture of protein and water (Chicken White Protein, Sigma Aldrich). The phantoms were heated by means of an inserted copper wire (1 mm diameter) and MPI-induced eddy currents. The resulting signal changes of the phantom were simultaneously imaged by MPI. As an in vitro liver tumor ablation model, tracer-free protein (pseudotumor) was embedded in protein (pseudo-liver tissue) mixed with L93 (CFe = 0.356 mg/ml). The pseudotumors were heated by means of an inserted copper wire with simultaneous detection of the MPI signal of the surrounding pseudo-liver tissue. All experiments were carried out on a commercial MPI system (Philips/Bruker) using a FoV of 37.3 x 37.3 x 18.6 mm3 and a frame rate of 46 frames/s.

RESULTS

Corresponding to the heating, MPI signal increase could be detected in all tracers. L93 showed the highest temperature changes/sensitivity. In the liver tumor ablation model, the ablation of the pseudo-liver tissue was visualized in 3D in real time by MPI signal changes.

CONCLUSION

MPI is suitable for visualizing temperature distribution and changes in a liver tumor ablation model. The sensitivity depends decisively on the used tracer. A temperature monitoring of healthy tissue for optimized MPI-guided tumor ablation in real time and 3D is feasible.

CLINICAL RELEVANCE/APPLICATION

Real time temperature measurement using MPI in the course of an ablation procedure might emerge as a powerful tool for exact monitoring of ablation success.

SSM16-06 Study of Hypoxia in Pancreatic Cancer Patients Using Dynamic [18F]-FAZA PET

Wednesday, Dec. 4 3:50PM - 4:00PM Room: S505AB

Participants
Fiona Li, BS, London, ON (*Abstract Co-Author*) Nothing to Disclose
Edward Taylor, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Ivan Yeung, PHD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
David A. Jaffray, PhD, Toronto, ON (*Abstract Co-Author*) Research Grant, Koninklijke Philips Electronics NV Research Grant, Elekta AB Research Grant, Raysearch Laboratories AB Research Grant, IMRIS Inc Research Grant, Varian Medical Systems, Inc Research Grant, Modus Medical Devices Inc Royalties, Raysearch Laboratories AB Royalties, Modus Medical Devices Inc Royalties, Elekta AB Royalties, IMRIS Inc
David W. Hedley, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Ting-Yim Lee, MSc, PhD, London, ON (*Presenter*) License agreement, General Electric Company; License agreement, Neusoft Digital Medical Systems Co, Ltd

For information about this presentation, contact:

fli222@uwo.ca

PURPOSE

To estimate kinetic parameters of [18F]-FAZA in highly hypoxic pancreatic cancer and determine the sensitivity of these parameters in distinguishing normal tissue from hypoxic cancer.

METHOD AND MATERIALS

Twenty patients with pancreatic ductal adenocarcinoma underwent 55 min of dynamic [18F]-FAZA scan. The tissue time activity curve (TAC) was analysed using graphical methods - Patlak and Logan plot to determine the reversibility of binding and using standard two tissue compartment model (S2TCM) as well as our bespoke kinetic model, the flow modified two tissue compartment model (F2TCM) to estimate the kinetic parameters. F2TCM models mean transit time through blood vessels, which could significantly affect parameter estimations. Multivariate logistic regression was used to find the optimal parameter set for distinguishing normal tissue from hypoxia tumor.

RESULTS

Graphical analysis showed that the tracer was reversibly bound and distribution volume (DV) determined by S2TCM and F2TCM was correlated to that of Logan plot. F2TCM fitted TACs better than S2TCM according to the Akaike Information Criteria. Logistic regression determined that DV and dissociation rate constant (k4) classified normal tissue from hypoxic tumor with sensitivity, specificity and negative predictive value (NPV) of 57%, 95% and 92% respectively while it is lower - 43%, 79 % and 67% for Logan's DV.

CONCLUSION

Contrary to the accepted notion that [18F]-FAZA is irreversibly bound, both graphical and kinetic analysis showed that the binding is reversible. The proposed mechanism for the reversibility is that the reduced metabolite, amino-FAZA, is conjugated to glutathione (amino-FAZA-GS) which is usually trapped in cells due to its hydrophilicity, however, in the presence of elevated multidrug resistance protein (MRP-1) in pancreatic tumor, amino-FAZA-GS can be 'pumped' out of the cells leading to radioactivity washout or reversible binding. Besides distinguishing normal pancreatic tissue from hypoxic tumor, kinetic modeling allows evaluation of k4 which can be associated with MRP-1 activity, while the binding rate constant (k3) can be associated with nitroreductase and glutathione activity.

CLINICAL RELEVANCE/APPLICATION

Non-invasive monitoring of MRP-1 activity and hence drug resistance for hypoxic tumor with [18F]-FAZA could lead to personalization of cancer treatment.

Printed on: 10/29/20

VSIO42

Interventional Oncology Series: Clinical Trials in Interventional Oncology

Wednesday, Dec. 4 3:15PM - 5:15PM Room: S405AB

IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

Participants
Riad Salem, MD, MBA, Chicago, IL (*Moderator*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd Consultant, Eisai Co, Ltd Consultant, Exelixis, Inc Consultant, Bristol-Myers Squibb Company Consultant, Dove

LEARNING OBJECTIVES

1) Learn about clinical trial design. 2) Discuss strengths and weaknesses of IO therapies.

Sub-Events

VSIO42-01 Educating the Next Generation of Interventional Oncology Doctors and Researchers

Wednesday, Dec. 4 3:15PM - 3:35PM Room: S405AB

Participants
Michael C. Soulen, MD, Lafayette Hill, PA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Guerbet SA; Research support, Guerbet SA; Research support, BTG International Ltd; Proctor, Sirtex Medical Ltd;

For information about this presentation, contact:

Michael.soulen@uphs.upenn.edu

LEARNING OBJECTIVES

1) Identify the gaps in necessary knowledge of oncology present in existing radiology training schemes and opportunities to close these gaps. 2) Identify the expected standards for clinical research in oncology and what interventional oncologists need to do to meet them. 3) Outline unique challenges in clinical trial design in IO and strategies to overcome them.

VSIO42-02 Liver Transplantation after Y90 Radioembolization of Hepatocellular Carcinoma Patients Presenting Beyond Milan Criteria

Wednesday, Dec. 4 3:35PM - 3:45PM Room: S405AB

Participants
Ahmed Gabr, MD, MBBCh, Chicago, IL (*Presenter*) Nothing to Disclose
Ahsun Riaz, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Samdeep Mouli, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Rehan Ali, MBBS, Staten Island, NY (*Abstract Co-Author*) Nothing to Disclose
Ronald A. Mora, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kush R. Desai, MD, Chicago, IL (*Abstract Co-Author*) Speakers Bureau, Cook Group Incorporated; Consultant, Cook Group Incorporated; Consultant, Koninklijke Philips NV; Consultant, The Spectranetics Corporation; Consultant, AngioDynamics, Inc; Consultant, Boston Scientific Corporation; Consultant, W. L. Gore & Associates, Inc
Kent T. Sato, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Bartley Thornburg, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Riad Salem, MD, MBA, Chicago, IL (*Abstract Co-Author*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd Consultant, Eisai Co, Ltd Consultant, Exelixis, Inc Consultant, Bristol-Myers Squibb Company Consultant, Dove
Robert J. Lewandowski, MD, Chicago, IL (*Abstract Co-Author*) Consultant, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Advisory Board, ABK Biomedical Inc; Advisory Board, Accurate Medical; Consultant, C. R. Bard, Inc;

For information about this presentation, contact:

ahmed.gabr@northwestern.edu

PURPOSE

To report outcomes of radioembolization (TARE) of hepatocellular carcinoma (HCC) patients successfully downstaged to liver transplantation (LT) despite presenting with tumor stage beyond Milan Transplant Criteria.

METHOD AND MATERIALS

With IRB approval, we conducted a retrospective chart review (2005-2018) for HCC patients who presented with tumors beyond Milan criteria and were successfully downstaged to LT with TARE. Baseline (pre-TARE) and imaging immediately prior to LT were assessed to confirm and compare UNOS tumor stage. All explants underwent histopathologic assessment to evaluate degree of tumor necrosis and presence of vascular invasion (PVT). Overall survival (OS) and recurrence free survival (RFS) rates were estimated using Kaplan-Meier method.

RESULTS

38 (30 males; mean age 60 years) patients underwent LT after TARE as a downstaging therapy. Prior to TARE, 22 (58%) patients had T3 tumors, 12 (32%) had T4a tumors and 4 (10%) had T4b tumors with PVT. Patients were listed for LT after achieving good response to TARE at a median of 3.8 (CI: 2-6) months. 29 (76%) patients received cadaveric organs while 9 (24%) received living donor organs. At time of LT, 18 (47%) were downstaged to T2 (14 from T3, 2 from T4a, 2 from T4b). 20 (53%) patients did not achieve downstaging by size, but they achieved necrosis (mRECIST) response allowing LT. 16 (42%) displayed complete tumor necrosis at explant, 15 (39%) and 7 (18%) had extensive (>50%) and partial (<50%) necrosis, respectively. Median OS of entire cohort was 12.5 (CI: 4.6-12.5) years from LT. There was no difference in OS between patients who were downstaged by size to T2 vs patients who were >T2 at LT (p = 0.8). Median RFS was 6.5 (3.1-12.5) years, not significantly different for T2 vs >T2 tumors at LT.

CONCLUSION

TARE is effective in downstaging HCC patients beyond Milan Criteria, facilitating long-term survival outcomes following LT in these patients. This is evident not only in patients with T3 tumors but also for those with T4a and T4b disease. The results are consistent for both those downstaged based on size and necrosis criteria.

CLINICAL RELEVANCE/APPLICATION

Outcomes of Liver transplantation of HCC patients beyond Milan Criteria are satisfactory provided that they underwent downstaging treatment with Y90 radioembolization which can be achieved by inducing mRECIST response and tumor necrosis.

VSIO42-03 Statistics in Image-guided Therapy: The Basics

Wednesday, Dec. 4 3:45PM - 4:05PM Room: S405AB

Participants
Jeffrey D. Blume, Nashville, TN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

j.blume@vanderbilt.edu

LEARNING OBJECTIVES

1) To explain the role of p-values and their proper usage. 2) To understand why confidence intervals are essential for proper interpretation of results. 3) To introduce modern assessment tools, such as second-generation p-values and false discovery rates.

ABSTRACT

In March of 2016, the American Statistical Association (ASA) released a statement on statistical significance and p-values. The statement detailed a vision for a reduced role of p-values in science, with greater emphasis on estimation, confidence intervals, and alternative assessments that account for clinical significance. In this talk, I will review the origins of p-value based inference and discuss the main thrust of the ASA's statement. I will also introduce more modern tools (second-generation p-values, false discovery rates, interval estimation) that provide a more nuanced statistical assessment, which is often more appropriate for science.

VSIO42-04 Imaging Following Locoregional Therapies: Challenges

Wednesday, Dec. 4 4:05PM - 4:25PM Room: S405AB

Participants
Mishal Mendiratta-Lala, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mmendira@med.umich.edu

LEARNING OBJECTIVES

1) Become familiar with the various types of locoregional therapy, using hepatocellular carcinoma as a prototype. 2) Evaluate imaging post-locoregional therapy to assess treatment response. 3) Identify imaging challenges when assessing tumor response after various forms of locoregional therapy. 4) Become familiar with existing tumor response criteria, such as mRECIST, EASL and LIRADS while also understanding pitfalls in treatment response assessment based on the type of locoregional treatment.

VSIO42-05 The Use of Augmented Reality Guidance and Navigation for Percutaneous Ablation of Liver Tumors

Wednesday, Dec. 4 4:25PM - 4:35PM Room: S405AB

Participants
Charles Martin III, MD, Pepper Pike, OH (*Presenter*) Scientific Advisory Board, Boston Scientific Corporation Scientific Advisory Board, BTG International Ltd Consultant, Terumo Corporation
Jeffrey H. Yanof, PhD, Solon, OH (*Abstract Co-Author*) Patent pending, Co-inventor on System and Method for Holographic Image-guided Non-vascular Percutaneous Procedures, MediView XR Licensee
Sara Al-Nimer, MENG, Cleveland, OH (*Abstract Co-Author*) Patent pending, System & Method for Holographic Image-Guided Non-vascular Percutaneous Procedures, MediView XR Licensee; Inventor, System & Method for Holographic Image-Guided Non-vascular Percutaneous Procedures, MediView XR Licensee
Crew J. Weunski, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Karl West, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Aydan Hanlon, BS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Gaurav Gadodia, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

martinc7@ccf.org

PURPOSE

To describe our use of true 3D holographic guidance for PTA (3D HPA) in our first five first-in-human clinical evaluations, leading to increased ablation accuracy and usability of this technilogy.

METHOD AND MATERIALS

3D Holograms of the ablation probe and the liver and its target tumors, based on fused CT and real-time ultrasound images, are created using Unity software and then superimposed directly onto the operative site for more accurate probe placement relative to the preoperative plan. More accurate delivery of heat to target tumors with less to adjacent healthy tissue will yield fewer post-procedure complications and is key for treating tumors (<3 cm diameter) and complex anatomy. The resulting accuracy and usability provided by real-time, fused holographic visualization is of growing significance, as the use of PTA is increasing.

RESULTS

We demonstrate in our first five cases that that this novel technique can be used to accurately target liver tumors and effectively ablate the lesions of concern in the liver.

CONCLUSION

New augmented reality (AR) headsets such as HoloLens have potential to benefit percutaneous intervention by overcoming limitations of 2D monitors presently used in standard-of-care image-guidance. Through these first five procedures our plan is to demonstrate the benefits of the unique platform relative to the use of 2D-monitors alone including improved tumor targeting (3), lower x-ray radiation dose (4), decreased procedure time (2), and improved overall outcomes for tumor ablation and a broad range of minimally invasive applications.

CLINICAL RELEVANCE/APPLICATION

This technique improves the safety and effectiveness of tumor ablation, and possibly other percutaneous procedures, by enhancing spatial and depth perception in comparison with 2D displays.

VSIO42-06 Pivotal Trials in HCC: Contemporary Update

Wednesday, Dec. 4 4:35PM - 4:55PM Room: S405AB

Participants
Aparna Kalyan, MD, Chicago, IL (*Presenter*) Advisory Board, Eisai Co, Ltd; Advisory Board, Bristol-Myers Squibb Company; Advisory Board, Exelis; Advisory Board, Ipsen SA; Advisory Board, BTG International Ltd; Research funded, Bristol-Myers Squibb Company

VSIO42-07 Patient-reported Outcomes in Interventional Oncology

Wednesday, Dec. 4 4:55PM - 5:15PM Room: S405AB

Participants
Sharon W. Kwan, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define what constitutes patient reported outcomes. 2) Describe the main types of patient reported outcome instruments. 3) Understand why patient reported outcomes are important in interventional oncology.

MSRO49

BOOST: Lung Stereotactic Body Radiotherapy (SBRT)-eContouring

Wednesday, Dec. 4 4:30PM - 5:30PM Room: S103CD

CH OI RO

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

Participants

Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Speaker, Siemens AG; Research Grant, Lunit Inc; Researcher, Merck & Co, Inc; Researcher, Pfizer Inc; Researcher, Bristol-Myers Squibb Company; Researcher, Novartis AG; Researcher, F. Hoffmann-La Roche Ltd; Researcher, Polaris Pharmaceuticals, Inc; Researcher, Cascadia Healthcare, LLC; Researcher, AbbVie Inc; Researcher, Gradalis, Inc; Researcher, Clinical Bay; Researcher, Zai Lab
Stephen Chun, MD, Houston, TX (*Presenter*) Nothing to Disclose
Florence K. Keane, MD, Boston, MA (*Presenter*) Advisory Board, AstraZeneca PLC

Special Information

The e-contouring sessions may be used by participating radiation oncologists to fulfill a PQI (practice quality improvement) requirement for ABR (American Board of Radiology) MOC (Maintenance of Certification). Interested radiation oncologist can download a e-contouring PQI template here: https://academy.astro.org/content/econtouring-pqi-template and handouts directing users to the same website will be available at the actual session.

LEARNING OBJECTIVES

1) Understand strategies to optimize tumor target delineation and motion management. 2) Differentiate between gross tumor and atelectasis. 3) Identify and contour cardiac/great vessel anatomy on CT-imaging. 4) Identify brachial plexus on CT-imaging. 5) Define the central airways and the central 'no fly zone'. 6) Learn appropriate normal tissue constraints for SBRT.

ABSTRACT

Stereotactic body radiation therapy (SBRT) has is a non-invasive therapeutic option that can deliver ablative radiation doses to both primary thoracic malignancies and lung metastases. The effectiveness and toxicity profile of SBRT is highly dependent upon accurately targeting the tumor as well as precise delineation of non-target organs at risk. With highly conformal SBRT plans, accurate tumor targeting is important to prevent marginal failure and also to minimize radiation delivered to normal tissues. As ablative doses pose substantial risk of injury, it is critical to accurately identify normal tissue structures such as the brachial plexus, central airways, heart, and great vessels to prevent catastrophic injury. This session will focus on strategies for tumor targeting through diagnostic evaluations, optimizing motion management and reconciling tumor anatomy in 4 dimensions. The session will also review the anatomy of critical thoracic anatomic structures at risk for injury with SBRT with appropriate radiation dose constraints. Information from the session is expected to facilitate safe treatment of thoracic malignancies with SBRT in light of potentially increasing indications such as oligometastases.

RC618

Tumor Imaging Metrics: Is it Time to Invest in a Service?

Thursday, Dec. 5 8:30AM - 10:00AM Room: S404AB

BQ OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

Sub-Events

RC618A Current Response Assessment Tools in Clinical Trials

Participants
Les R. Folio, MPH,DO, Bethesda, MD (*Presenter*) Institutional research agreement, Carestream Health, Inc

For information about this presentation, contact:

Les.Folio@nih.gov

LEARNING OBJECTIVES

1) Comprehend objective tumor assessment criteria, such as RECIST 1.1, in a variety of clinical trials. 2) Exploit existing and evolving PACS along with other available image processing tools to improve tumor assessment consistency and workflow efficiency. 3) Optimize radiology report value with more consistent tumor quantification.

ABSTRACT

Cancer patients enrolled in clinical trials require objective imaging criteria (e.g. RECIST 1.1) rarely included (in the US) in routine radiologists' clinical reports. With oncologists' need for consistent target lesion selection and measurements many cancer centers have tumor assessment core labs consisting of various radiology personnel dedicated to image processing for consistent tumor measurements, organ/lesion segmentation for volumetric quantification, display (3D) and/or density/texture analysis. There are a variety of approaches and challenges to successfully support oncologists' needs for consistent quantification. This presentation addresses the balance between measurements made in PACS that are included in radiology reports and those that are used in objective tumor assessments by core labs supporting oncologists. By comprehending the tumor assessment requirements and process, radiology reports can be more valuable to oncologists when target lesion selection and measurements are concordant with oncologists' records used to assess therapeutic response. Consistent application of existing and evolving tools, such as line, two-diameter and volumetric segmentations, can improve report value and radiology services to include tumor imaging core labs. Understanding tumor assessment terminology (e.g. response categories, such as 'Stable Disease' or 'Partial Response') can also enhance report value while minimizing the need to addend reports. A familiar example involves using words in the impression such as 'disease progression' or 'stable disease' where radiologists are usually not aware of pertinent information. For example, may not know the previously established target lesions, the criteria used, baseline date or nadir. Without this information, progressive or stable disease often cannot be concluded. Between radiologists and oncologists, communication beyond the standard radiology report can further improve with use of PACS tools such as key images and bookmark tables to label target lesions while also establishing a workflow with more consistent and concordant measurements. Improved efficiency can result from minimizing duplication in disparate systems where data does not automatically transfer (e.g. from PACS to RIS to EMR to cancer database).

RC618B Developing Robust Imaging Biomarkers for Use in Drug Development

Participants
Nina Tunariu, MD, Sutton, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To be able to understand and differentiate different types of imaging biomarkers. 2) Achieve an understanding of the use and value of imaging-based biomarkers in the various phases of clinical drug development. 3) Have a better understanding of the barriers and opportunities for using robust quantitative imaging biomarkers in oncological drug development.

RC618C Should Every Radiology Department Invest in a Quantitative Imaging Lab?

Participants
Gordon J. Harris, PhD, Boston, MA (*Presenter*) Medical Advisory Board, Fovia, Inc; Member, IQ Medical Imaging LLC; Member, Novometrics, LLC; ;

For information about this presentation, contact:

gjharris@partners.org

LEARNING OBJECTIVES

1) Assess the pros and cons of establishing a Quantitative Imaging Lab for clinical trials image assessments. 2) Explain to Radiology Department leadership the benefits of establishing a Quantitative Imaging Lab. 3) Specify the requirements and evaluate options for implementing a Quantitative Imaging Lab.

ABSTRACT

Managing oncology clinical trials imaging assessment requests can be very difficult for radiologists, especially with the increasing complexity of protocols and modifications to tumor response criteria. There may be hundreds of active clinical trials enrolling patients at cancer centers, each with specific protocol modifications among dozens of assessment criteria. Challenges for radiologists include maintaining protocol compliance so that each patient is assessed with the correct specific criteria and keeping up with the requirements for rapid turnaround times prior to patient office visits. Furthermore, all trial data must be assessed accurately and be available for data locks, monitoring visits, and audits to avoid protocol violations. These challenges can be addressed through a Quantitative Imaging Lab that provides quality reviews, assessment criteria training, and consistent tumor metrics data. This presentation will discuss our 15 years of experience in developing such a service, the Tumor Imaging Metrics Core (TIMC) as a shared resource of the Dana-Farber/Harvard Cancer Center (DF/HCC), as well as our informatics and image assessment platform that we developed to manage this complex workflow, Precision Imaging Metrics. The TIMC uses this web-based platform to manage over 1,000 active clinical trials and performs over 15,000 time point image assessments per year, with turnaround available in as little as one hour after scanning is completed, and the majority of assessments completed on the day of the scan. In addition, eight NCI-designated Cancer Centers around the US have implemented the Precision Imaging Metrics platform developed by TIMC at DF/HCC to manage their clinical trials image assessments. In this presentation, we will discuss the pros and cons for a radiology department to implement a Quantitative Imaging Lab for managing clinical trials image assessments.

Printed on: 10/29/20

SSQ06

Gastrointestinal (Oncology)

Thursday, Dec. 5 10:30AM - 12:00PM Room: S103AB

GI OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Andrew D. Smith, MD, PhD, Birmingham, AL (*Moderator*) CEO, AI Metrics LLC ; Owner, AI Metrics LLC ; CEO, Radiostics LLC; Owner, Radiostics LLC; CEO, Liver Nodularity LLC ; Owner, Liver Nodularity LLC ; Research Grant, General Electric Company; Speaker, Canon Medical Systems Corporation; Speaker, AlgoMedica, Inc
Carolyn L. Wang, MD, Seattle, WA (*Moderator*) Research Grant, General Electric Company
Erik K. Paulson, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSQ06-01 CT Resectability According to NCCN Criteria After Neoadjuvant FOLFIRINOX Chemotherapy for Borderline and Unresectable Pancreatic Ductal Adenocarcinoma

Thursday, Dec. 5 10:30AM - 10:40AM Room: S103AB

Participants
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Keon Jang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jihun Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hee Son, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Hee 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
Hyoung Jung Kim, MD, 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 assess CT resectability according to NCCN criteria and associated CT findings for predicting R0 resection after neoadjuvant FOLFIRINOX chemotherapy in patients with pancreatic ductal adenocarcinoma (PDAC)

METHOD AND MATERIALS

Among 204 consecutive patients with PDAC who underwent neoadjuvant FOLFIRINOX therapy from 2013 to 2017, eligible patients fulfilled the following criteria were identified: 1) patients underwent both pre- and post-chemotherapy multiphase CT, 2) available pathologic result of resection margin, and 3) borderline or unresectable PDAC assessed on pre-chemotherapy CT according to NCCN criteria. We finally analyzed 64 patients (36 men; mean age, 58.8 years). For CT resectability after chemotherapy, two abdominal radiologists independently evaluated following CT findings: a) contact angle of artery or vein, b) involved depth of artery or vein, 3) degree of perivascular tumor enhancement of artery or vein in portal venous phase, and 4) tumor size and enhancement. Change in CT resectability before and after therapy was classified as regression, stable or progression. Inter-reader agreement was evaluated using intraclass correlation coefficient (ICC). Uni- and multi-variate logistic analyses were used to identify R0 resection-associated CT findings.

RESULTS

ICC for CT findings ranged from 0.64 to 0.94. R0 resection was achieved in 67% (6/9), 72% (23/32) and 68% (15/22) patients with resectable, borderline and unresectable PDAC, respectively. Sensitivity and specificity of CT resectability (resectable & borderline vs. unresectable) for R0 resection were 66% and 37%, respectively. R0 resection was made in 58% (11/19), 74% (24/31) and 69% (9/13) patients with regression, stable and progression, respectively. Sensitivity and specificity of change in CT resectability (regression & stable vs. progression) for R0 resection were 80% and 21%, respectively. On univariate analysis, low perivascular tumor enhancement of artery or vein was significant. Low perivascular enhancement of vein (<=42.5 HU; odds ratio, 6.50; P<.02) was independently associated with R0 resection on multivariate analysis.

CONCLUSION

CT resectability according to NCCN criteria after neoadjuvant chemotherapy was sensitive but not specific for assessing R0 resection. The degree of perivascular tumor enhancement may have added values to predict R0 resection.

CLINICAL RELEVANCE/APPLICATION

Efficacy of CT resectability after neoadjuvant FOLFIRINOX chemotherapy

SSQ06-02 MDCT-Based Radiomic Signature as A Predictor of Disease-Free Survival: Bringing Promotion to Preoperative Clinical Model of Gastric Cancer

Thursday, Dec. 5 10:40AM - 10:50AM Room: S103AB

Participants
Siwen Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Caizhen Feng, MBChB, Beijing, China (*Presenter*) Nothing to Disclose
Di Dong, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Haidong Xiang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxuan Jia, MA, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yingjiang Ye, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Nan Hong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Tian, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fengcaizhen2016@163.com

PURPOSE

To establish a contrast-enhanced multiple-row detector computed tomography (MDCT)-based radiomic signature for disease-free survival (DFS) prediction in gastric cancer and validate its incremental value to the preoperative clinical risk model.

METHOD AND MATERIALS

A total of 249 gastric cancer patients in this retrospective study were randomly divided into a training cohort (n=166) and a validation cohort (n=83) at a ratio of 2:1. Two-dimensional radiomic feature extraction was conducted based on tumor volumes of interest from portal venous phase MDCT images. The least absolute shrinkage and selection operator penalized Cox proportional hazards regression was used to select radiomic features and establish a radiomic signature. A radiomic nomogram in combination with the radiomic signature and significant clinical factors was developed by multivariate Cox regression. Model 1 (radiomic signature), model 2 (clinical model), and model 3 (radiomic nomogram) were evaluated in terms of discrimination, calibration, and clinical usefulness.

RESULTS

A four-feature radiomic signature showed good stratification ability in gastric cancer patients with high-risk and low-risk of DFS in both cohorts (training cohort: hazard ratio [HR] = 2.718, $P < 0.001$; validation cohort: HR = 1.825, $P < 0.05$). Univariate radiomic feature indicated good predictive performance with Harrell's concordance indices (shape feature, 0.664; first-order feature, 0.625; two texture features, 0.543 and 0.487). The radiomic nomogram (model 3) combining the radiomic signature and two significant clinical factors (AFP and EMVI defined on MDCT) demonstrated the best performance over model 1 and model 2 with a concordance index of 0.721 (95% confidence interval [CI], 0.648-0.793) as well as good fitness by calibration curves and great clinical usefulness by decision curves.

CONCLUSION

MDCT-based radiomic signature was established and validated as a preoperative predictor of DFS in gastric cancer patients, offering assistance to prognostic prediction and treatment decisions.

CLINICAL RELEVANCE/APPLICATION

For individualized treatment decision, prognosis of gastric cancer can be analyzed by radiomic approach based on high-throughput mining of quantitative image features from preoperative medical imaging.

SSQ06-03 Development of Prognostic Prediction Model of TACE for Hepatocellular Carcinoma Based on Radiomics Analysis of Preoperative DCE-MRI

Thursday, Dec. 5 10:50AM - 11:00AM Room: S103AB

Participants
Jianfei Tu, MD, Lishui, China (*Presenter*) Nothing to Disclose
Wei Weng, Lishui, China (*Abstract Co-Author*) Nothing to Disclose
Jingjing Song Jr, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Fazong Wu, Lishui, China (*Abstract Co-Author*) Nothing to Disclose
Xulu Wu, Lishui, China (*Abstract Co-Author*) Nothing to Disclose
Qiaoyou Weng, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhao, Lishui, China (*Abstract Co-Author*) Nothing to Disclose
Minjiang Chen, Lishui, China (*Abstract Co-Author*) Nothing to Disclose
Jiansong Ji, MD, Lishui , China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tjf562878@gmail.com

PURPOSE

Transcatheter arterial chemoembolization (TACE) is the first-line treatment for hepatocellular carcinoma (HCC), but its efficacy often has individualized differences. The purpose of this study was to develop a precise prognostic model for TACE treatment of hepatocellular carcinoma based on dynamic contrast;enhanced magnetic resonance imaging (DCE-MRI).

METHOD AND MATERIALS

Retrospective collection of 107 pathologically confirmed liver cancer patients who underwent TACE in our hospital from January 2013 to June 2018 in present study. All patients underwent DCE-MRI before treatment and followed up for 3 months after TACE, who were further divided into effective group (n=70) and ineffective group (n=37) according to the reaction of the tumor based on

mRECIST criteria. The enrolled patients in the above two groups were randomly divided into a training set (n=74) and a validation set (n=33). Analysis Kit software was used to delineate the volume of interest (VOI) of lesions based on the contrast-enhanced T1-weighted images and extract a total of 396 quantitative texture parameters, which were further dimension reduction by Kruskal-Wallis (K- W) one-way ANOVA test, univariate logistic regression and LASSO algorithm, and selected the most useful features. The selected imaging features were then combined into a Rad score, which was further assessed by ROC curve analysis in the training and validation sets.

RESULTS

Six radiomic feature were finally selected to form the Rad score. The AUC for differentiating between effective group and ineffective group in the training set was 0.868 (95% CI: 0.802, 0.901), and the sensitivity and specificity were 73.5% and 88.2%, respectively. In the validation group, the AUC was 0.853 (95% CI: 0.782, 0.891), and the sensitivity and specificity were 81% and 82.6%, respectively.

CONCLUSION

A reliable TACE prognostic prediction model was developed based on the radiomics analysis of contrast-enhanced T1-weighted images, which is of great value for prognosis management of HCC patients undergoing TACE.

CLINICAL RELEVANCE/APPLICATION

A good and stable TACE short-term prognostic prediction model was constructed by using DCE-MRI based texture analysis, which is of great value for the management of HCC patients undergoing TACE.

SSQ06-04 Prognostic Value of Extracellular Volume Fraction Determined by Equilibrium Contrast-Enhanced CT in Patients with Pancreatic Adenocarcinoma Who are Scheduled for Chemoradiotherapy

Thursday, Dec. 5 11:00AM - 11:10AM Room: S103AB

Participants
Yutaka Toyomasu, MD, Tsu, Japan (*Presenter*) Nothing to Disclose
Yasutaka Ichikawa, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Motonori Nagata, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoko Kawamura, Mie, Japan (*Abstract Co-Author*) Nothing to Disclose
Akinori Takada, MD, Koriyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoki Nagasawa, RT, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kakuya Kitagawa, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihito Nomoto, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Research Grant, EIZAI; Research Grant, DAIICHI SANKYO Group; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Research Grant, Nihon Medi-Physics Co, Ltd;

PURPOSE

Several recent studies indicated that extracellular volume fraction (ECV) of the malignant tumors may be useful in evaluating tumor aggressiveness and response to therapy. The purpose of this study was to determine the prognostic value of ECV quantified by equilibrium contrast-enhanced CT obtained prior to chemoradiotherapy (CRT) in patients with pancreatic adenocarcinoma.

METHOD AND MATERIALS

Thirty-five patients with histologically-proven pancreatic adenocarcinoma who had no distant metastasis and underwent dynamic CT before treatment were retrospectively studied. Absolute enhancement in Hounsfield unit was determined for the tumor (Etumor) and aorta (Eblood) by placing regions-of-interest on pre-contrast and equilibrium-phase CT images. The tumor ECV was calculated as the following equation: ECV(%) = Etumor x (100 - hematocrit(%)) / Eblood. Univariate and multivariate analyses were performed to evaluate the value of the tumor ECV as well as age, sex, primary tumor site, tumor diameter, surgical indication, and CA19-9 for the prediction of progression-free survival (PFS) and overall survival (OS).

RESULTS

The median and interquartile range of ECV in pancreatic adenocarcinoma was 35.8% and 25.0 - 43.6% in all patients. During the median observation period of 23 months, 29 (83%) of 35 patients experienced disease recurrence (n=25) or death (n=19). Kaplan-Meier curves for PFS and OS according to the ECV are shown in Figure 1. In univariate analysis, the tumor ECV of > median (35.8%) was significantly associated with better prognosis for both PFS (p=0.017) and OS (p=0.003). Multivariate analysis revealed that tumor ECV was an independent prognostic factor for PFS (Hazard ratio [95% CI], 0.383 [0.165-0.889]; p=0.025) and OS (Hazard ratio [95% CI], 0.213 [0.069-0.660]; p=0.003).

CONCLUSION

Higher tumor ECV determined by pre-contrast and equilibrium-phase CT prior to CRT is significantly associated with better outcome in patients with pancreatic adenocarcinoma. The tumor ECV can be quantified by routine dynamic CT and has excellent prognostic value in patients with pancreatic adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

Tumor ECV quantified by equilibrium contrast-enhanced CT is a novel imaging biomarker that permits prediction of the prognosis in patients who are scheduled for CRT.

SSQ06-05 Baseline Clinical and Imaging Predictors of Treatment Response and Overall Survival of Patients with Metastatic Melanoma Undergoing Immunotherapy

Thursday, Dec. 5 11:10AM - 11:20AM Room: S103AB

Participants
Ahmed Othman, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Amadeus Schraag, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Saif Afat, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Thomas Eigentler, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernhard Klumpp, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ahmed.e.othman@googlemail.com

PURPOSE

We aimed to identify predictive clinical and CT imaging biomarkers and assess their predictive capacity regarding overall survival (OS) and treatment response in patients with metastatic melanoma undergoing immunotherapy.

METHOD AND MATERIALS

The local institutional ethics committee approved this retrospective study and waived informed patient consent. 103 patients with immunotherapy for metastatic melanoma were randomly divided into training (n= 69) or validation cohort (n=34). Baseline tumor markers (LDH, S100B), baseline CT imaging biomarkers (tumor burden, Choi density) and CT texture parameters (Entropy, Kurtosis, Skewness, uniformity, MPP, UPP) of the largest target lesion were extracted. To identify treatment response predictors, binary logistic regression analysis was performed in the training cohort and tested in the validation cohort. For OS, Cox regression and Kaplan Maier analyses were performed in the training cohort. Bivariate and multivariate models were established. Goodness of fit was assessed with Harrell's C-index. Potential predictors were tested in the validation cohort also using Cox-regression and Kaplan-Meier analyses.

RESULTS

Baseline S100B (Hazard ratio(HR)= 2.543, p0.018), tumor burden (HR=1.657, p=0.002) and Kurtosis (HR=2.484, p<0.001) were independent predictors of OS and were confirmed in the validation cohort (p<0.048). Tumor burden and Kurtosis showed incremental predictive capacity allowing a good predictive model when combined with baseline S100B levels (C-index=0.720). Only S100B was predictive of treatment response (OR<=0.630, p<=0.022). Imaging biomarkers didn't predict treatment response.

CONCLUSION

We identified easily obtainable baseline clinical (S100B) and CT predictors (tumor burden and Kurtosis) of OS in patients with metastatic melanoma undergoing immunotherapy. However, imaging predictors didn't predict treatment response.

CLINICAL RELEVANCE/APPLICATION

Baseline S100B levels, baseline tumor burden and Kurtosis of the largest target lesions are independent survival predictors in patients with metastatic melanoma undergoing immunotherapy. Baseline S100B level are also predictive of response to immunotherapy.

SSQ06-06 Evaluating for Primary Malignancy in Patients with Solitary and Multiple Brain Lesions: the Diagnostic Value of CT Chest, Abdomen, and Pelvis

Thursday, Dec. 5 11:20AM - 11:30AM Room: S103AB

Participants
Richard K. Rothman, MD, West Haven, CT (*Presenter*) Nothing to Disclose
Jeffrey C. Weinreb, MD, New Haven, CT (*Abstract Co-Author*) Consultant, Bayer AG
William B. Zucconi, DO, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, Stamford, CT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

richard.rothman@yale.edu

PURPOSE

Patients with newly discovered brain lesions on CT or MRI often undergo CT of the chest, abdomen, and pelvis in an effort to identify a primary cancer that may have metastasized to the brain. The aim of this study was to determine the frequency of finding a primary cancer on CT of the chest, abdomen, and/or pelvis in these patients.

METHOD AND MATERIALS

We evaluated how often a primary malignancy was diagnosed in the chest versus abdomen and pelvis portions of CT scans in patients with newly identified brain lesions. Multiple brain lesion characteristics were recorded, such as size, the presence of enhancement and hemorrhage as well as whether lesions were single or multiple.

RESULTS

Out of 287 consecutive cases over five years, the final diagnoses were 136 primary brain malignancies (47%), 91 metastatic malignancies (32%), and 60 benign entities (21%). Of the 91 metastatic malignancies, 68 were of lung primary (75%). Chest CT identified a primary malignancy in 65 of 287 total cases (23%), 62 of which were lung cancers. The abdomen and pelvis portion of the CT scans identified a primary malignancy in only 3 cases (1%). In 26 cases, where the brain lesion(s) did not enhance, only 1 was a metastasis.

CONCLUSION

In patients with newly discovered brain lesions on imaging, CT of the chest to identify a primary lung cancer is warranted in patients with enhancing brain lesions. Without signs/symptoms of abdominopelvic malignancy, CT of the abdomen/pelvis will rarely reveal a primary cancer that metastasized to the brain.

CLINICAL RELEVANCE/APPLICATION

Utilizing CTC in place of CTCAP would reduce healthcare costs and patient radiation dose in patients with new brain lesions found on imaging and without sign/symptoms of an abdominopelvic malignancy.

SSQ06-07 Prediction of Outcome in Anal Squamous Cell Carcinoma Using Radiomic Feature Analysis of Pre-

Treatment FDG PET-CT

Thursday, Dec. 5 11:30AM - 11:40AM Room: S103AB

Participants
Peter Brown, MBChB, BSc, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Russell Frood, MBBCh, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Jim Zhong, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Stuart Currie, FRCR,MD, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alexandra Gilbert, MBBS, MRCP, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ane L. Appelt, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
David Sebag-Montefiore, MD, PhD, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew F. Scarsbrook, FRCR, York, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Incidence of anal squamous cell carcinoma (ASCC) is increasing, with curative chemoradiotherapy (CRT) as the primary treatment of non-metastatic disease. A significant proportion of patients have loco-regional treatment failure (LRF), but rarely distant relapse. Accurate prognostication of progression free survival (PFS) would help personalisation of CRT regimens. The study aim was to evaluate novel imaging pre-treatment features, to prognosticate for PFS in ASCC.

METHOD AND MATERIALS

Consecutive patients with ASCC treated with curative intent at a large tertiary referral centre who underwent pre-treatment FDG-PET/CT were included. Radiomic feature extraction was performed using LIFEx software on baseline FDG-PET/CT. Outcome data (PFS) was collated from electronic patient records. Elastic net regularisation and feature selection was used for logistic regression model generation on a randomly selected training cohort and applied to a validation cohort using TRIPOD guidelines. ROC-AUC analysis was used to compare radiomic feature model performance with a regression model combining standard prognostic factors (age, sex, tumour and nodal stage).

RESULTS

189 patients were included in the study, with 102/145 in the training cohort and 30/44 in the validation cohort. PFS and median follow-up were 70.3% / 35.1 months and 68.2% / 37.9 months, respectively. GLCM Entropy (a measure of randomness of distribution of co-occurring pixel grey-levels), NGLDM Busyness (a measure of spatial frequency of changes in intensity between nearby voxels of different grey-level), minimum CT value (lowest HU within the lesion) and SMTV (a standardized version of MTV) were selected for inclusion in the prognostic model. AUC for elastic net model prediction in the validation cohort was 0.738, the AUC for standard prognostic factors was 0.602.

CONCLUSION

Radiomic features extracted from pre-treatment FDG-PET/CT in patients with ASCC may provide better PFS prognosis than conventional staging parameters. With external validation this might be useful to help personalise CRT regimens in the future.

CLINICAL RELEVANCE/APPLICATION

Radiomic feature analysis with FDG-PET/CT can be used in anal squamous cell carcinoma to predict outcomes, which could potentially be used to help personalise future chemoradiotherapy regimens.

SSQ06-08 Radiomics Analysis of Advanced Gastric Cancer: A More Accurate Method for Real-Time Assessment of Treatment Response to Neoadjuvant Chemotherapy

Thursday, Dec. 5 11:40AM - 11:50AM Room: S103AB

Participants
Qinmei Xu, MS,PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Shangsheng Zhou, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Danyang Ren, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Xiuli Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Long Jiang Zhang, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Guang Ming Lu, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

xqm@smail.nju.edu.cn

PURPOSE

To develop a computed tomography (CT) based radiomics method for diagnosis of pathological downstaging after each cycle of neoadjuvant chemotherapy (NAC) in advanced gastric cancer (AGC), evaluate its performance and compare with the clinical conventional RECIST assessment at CT imaging.

METHOD AND MATERIALS

This retrospective study include 247 AGC patients who received 1-4 cycles of NAC and followed by surgery. Ninety-two of them (37.2%) achieved pathological downstaging. We extracted 1231 features from post-NAC portal venous-phase CT scans for each patient, then made up 28 cross-combination radiomic models with 7 feature selection methods and 4 classifiers within a nested cross-validation (CV) structure. The optimal model was selected. Its performance was assessed with respect to its discrimination and compared with that of RECIST at CT imaging in two external validation cohorts, which included patients who received 1-2 cycles and 3-4 cycles of NAC, respectively.

RESULTS

The optimal radiomics model consisting of the feature selection method of wilcoxon and classifier of linearSVC achieved a mean AUC of 0.919 (the highest among the 28 machine-learning models). It used 92 features, including wavelet-LHL_glszm_GrayLevelNonUniformity, wavelet-LLL_glrlm_RunLengthNonUniformity, and wavelet-LHL_firstorder_TotalEnergy, the

weight of which ranked in the top 3. This model had a good diagnostic ability in both two external validation cohorts (AUC 0.927±0.093; AUC 0.884±0.102, respectively), which outperformed the RECIST method (NRI 39.5%, p<0.05; NRI 35.4%, p<0.05, respectively).

CONCLUSION

Contrast-enhanced CT based radiomics has an excellent ability of preoperative diagnosis and early detection of pathological downstaging, more sensitive and accurate than routine method, which may have significant clinical implications on real-time assessment of downstaging for AGC patients who were experiencing NAC.

CLINICAL RELEVANCE/APPLICATION

The effective radiomics model combining 85 radiomic features might turn into a noninvasive and convenient potential imaging biomarker of chemotherapy response, providing more accurate and timely evaluation to optimize and individualize the treatment.

SSQ06-09 Agreement between Prospective Local Evaluation and Retrospective Central Evaluation of Metastatic Colorectal Cancer by RECIST

Thursday, Dec. 5 11:50AM - 12:00PM Room: S103AB

Participants
Tugce Agirlar Trabzonlu, MD, Chicago, IL (*Presenter*) Grant, Siemens AG
Roozbeh Houshyar, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Mohammad Helmy, MD, Anaheim, CA (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Cecil G. Wood III, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tugce.trabzonlu@northwestern.edu

PURPOSE

Response evaluation criteria in solid tumors (RECIST) measurements are commonly performed prospectively at the cancer centers in order to assess disease progression. However, data from clinical trial are also commonly assessed by a central review in retrospective fashion at the conclusion of trial. The purpose of our study was to assess concordance level between prospective and retrospective RECIST reporting performed by trained radiologists.

METHOD AND MATERIALS

The study was IRB approved. One hundred five CT studies in 39 patients with metastatic colorectal cancer were included. Radiologists reviewed all scans using RECIST guideline both prospectively and retrospectively. Prospective and retrospective studies were evaluated six weeks apart. The agreement in RECIST between prospective and retrospective assessment were evaluated.

RESULTS

In 34 of 39 (87.2%) patients and in 59 of 66 (89.4%) follow-up assessments, prospective and retrospective evaluation with different radiologists agreed on RECIST classification. In all patients with discordance, the radiologists selected at least 1 different target lesion in every patient. In patients with the same target lesion selected (n=7), prospective and retrospective RECIST agreement reached to 100%. When prospective and retrospective RECIST evaluation were performed by the same radiologist, agreement rate was slightly higher when compared to performance of two different radiologists (89.7% vs 87.2% of patients and 93.9% vs 89.4% of follow-up assessments (p>0.05). In the prospective and retrospective evaluation by the same radiologist, measurement variabilities resulted in RECIST discordance in 2 patients (5.1%).

CONCLUSION

If RECIST is strictly applied by blinded and trained radiologists, a strong agreement between prospective and retrospective evaluation can be observed. However, differences in target lesion selection and measurement variations may lead to differences in response assessment.

CLINICAL RELEVANCE/APPLICATION

If RECIST is strictly applied by blinded and trained radiologists, a strong agreement between prospective and retrospective evaluation can be observed. Therefore, prospective evaluation of response rate during the trial using RECIST may be a valid reflection of future evaluation by a central imaging core.

SSQ14

Nuclear Medicine (Breast/General Oncology Nuclear Medicine and PET)

Thursday, Dec. 5 10:30AM - 12:00PM Room: S402AB

BR MR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd

Sub-Events

SSQ14-01 Can We Replace Sentinel Lymph Node Resection in Breast Cancer Patients by Breast MRI, Axillary MRI, Axillary 18F-FDG PET/MRI or Axillary Sonography?

Thursday, Dec. 5 10:30AM - 10:40AM Room: S402AB

Participants
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils M. Bruckmann, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of Mamma-MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography in the detection of lymph node metastases in patients suffering from breast cancer.

METHOD AND MATERIALS

56 female patients with breast cancer (mean age 53.5±12.2 years) with newly diagnosed, histopathologically proven breast cancer were prospectively enrolled in this two-center trial. All patients underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI as well as axillary sonography. Sentinel lymph node biopsy (SLNB) and/or axillary lymph node dissection were performed in all patients and histopathology served as reference standard. Sensitivity, specificity, PPV, NPV and accuracy regarding axillary lymph node assessment were calculated for dedicated breast MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography.

RESULTS

According to the reference standard, lymph node metastases were present in 25 patients with a total of 78 metastases. On a patient based analysis, dedicated breast MRI identified 14/25 (56%), axillary MRI 15/25 (60%), axillary PET/MRI 19/25 (76%) and axillary sonography 18/25 (72%) of the patients with a positive nodal status. On a lesion-based analysis, sensitivity, specificity, PPV, NPV and accuracy were 54.5%, 88.9%, 88.9%, 54.5% and 67.6% for breast MRI; 55.1%, 90%, 89.3%, 53.2% and 57,5% for axillary MRI; 71.4%, 92.1%, 65.0%, 89.7% and 78.2% for axillary PET/MRI and 60.0%, 86.2%, 84.0%, 61.1% and 71.9% for axillary sonography.

CONCLUSION

18F-FDG PET/MRI and sonography serve equally acceptable diagnostic accuracy for nodal staging in breast cancer patients and are both superior to dedicated breast MRI or supine whole-body MRI. Although PET/MRI provides important information for staging workup breast cancer patients, neither PET/MRI nor axillary sonography do reliably differentiate N-positive from N-negative breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Sentinel lymph node biopsy cannot be replaced by imaging procedures alone and is still mandatory for staging breast cancer patients.

SSQ14-02 Simultaneous PET/MRI in the Early Prediction of Response to Neoadjuvant Chemotherapy in Patients with Locally-Advanced Breast Cancer

Thursday, Dec. 5 10:40AM - 10:50AM Room: S402AB

Participants
Valeria Romeo, Naples, Italy (*Presenter*) Nothing to Disclose
Carlo Cavaliere, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Basso, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Nunzia Garbino, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose

Mario Petretta, 80125, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuele Nicolai, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Imbriaco, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Salvatore, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

valeria.romeo@unina.it

PURPOSE

Aim of the study was to assess whether simultaneous PET/MRI could be helpful in the early prediction of the response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer (LABC).

METHOD AND MATERIALS

Between January 2017 and July 2018, 20 consecutive patients (mean age 45 yrs) with LABC who underwent anthracycline- and taxane-based neoadjuvant chemotherapy (NAC) followed by surgical resection were prospectively enrolled. Simultaneous breast PET/MRI examination was performed twice in each patient, one week before NAC and early after the second anthracycline cycle. PET/MRI images were analyzed to extract quantitative diffusion (ADCmin, ADCmean), perfusion (Ktrans, Kep, Ve, IAUC) and metabolic (SUV2d, SUV3d, MTV) parameters. The variation of each parameter (delta, D) after the second anthracycline cycle was then calculated. The normality of the data was tested using the Shapiro-Wilk test. Differences in terms of pre-treatment and D parameters between patients histologically classified as complete response (CR) and partial response (PR) were compared using of the nonparametric Mann-Whitney U test. Logistic regression analysis was performed to identify imaging parameters predictive of the response.

RESULTS

D-Size, D-Ktrans, Kep, D-Kep, MTV and D-MTV resulted significantly different ($p<0.03$) between patients who showed CR and PR. In detail, pre-treatment Kep and MTV were significantly lower in patients with CR while the variation of each parameter was significantly higher in patients with CR as compared to patients with PR. A cut-off value of 5.09 D-MTV perfectly predicted the response to treatment (Figure 1). MRI parameters significantly associated to the response to treatment were D-Ktrans ($p=0.05$), Kep (0.04), and D-Kep (0.05).

CONCLUSION

Simultaneous breast PET/MRI could be useful to early predict the response to NAC in patients with LABC. Our preliminary observations show that functional (i.e. perfusion and metabolic) rather than morphological parameters may identify patients who will respond completely, particularly using both pre-treatment and the variation of quantitative parameters early after the second cycle of NAC.

CLINICAL RELEVANCE/APPLICATION

Simultaneous breast PET/MRI may be useful for early identification of LABC patients who would benefit from continuing NAC or for whom surgical excision could be optionally considered.

SSQ14-03 Quantitative 18F-FDG Uptake of Invasive Breast Cancer Using Harmonized Prone PET/CT and Simultaneous Breast PET/MRI with 10 Minute PET Acquisition Time

Thursday, Dec. 5 10:50AM - 11:00AM Room: S402AB

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Presenter*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Manoj Kumar, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Leah Henze Bancroft, PhD, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company
Jacob Johnson, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company
Jillian A. Karow, MD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Kelley Salem, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Tyler Bradshaw, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Alan B. McMillan, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company

For information about this presentation, contact:

afowler@uwhealth.org

PURPOSE

To compare tumor 18F-FDG uptake measured with 10 min PET acquisition using breast PET/MRI harmonized with prone PET/CT in patients with newly diagnosed invasive breast cancer.

METHOD AND MATERIALS

This HIPAA-compliant, IRB-approved single-institution, prospective study was performed from 2016 to 2018. Patients with biopsy-proven invasive breast cancer undergoing preoperative breast MRI were included. Patients who were pregnant, lactating, had implants, or underwent neoadjuvant therapy were not eligible. Fasting subjects underwent PET/CT (Discovery 710) of the breasts 60 min after injection of 10 mCi 18F-FDG. Patients were scanned at one bed position for 10 min in the prone position using the breast MRI coil housing with metal components removed. A low dose CT scan was obtained for attenuation correction. Subjects then underwent simultaneous breast PET/MRI (Signa 3.0T PET/MR) using an 8-channel breast coil 85 min after 18F-FDG injection. Standard clinical breast MRI sequences and Dixon-based sequences for attenuation correction were obtained simultaneously with the PET acquisition for 30 min. PET reconstruction was harmonized between scanners based on phantom scans. For analysis, the first 10 min of PET/MRI acquisition was compared to PET/CT. Standardized uptake value (SUV) measurements were performed for the tumor and contralateral normal (nl) fibroglandular tissue. Bland-Altman analysis was performed to determine measurement bias and 95% limits of agreement.

RESULTS

23 women (mean 49.6 yrs; 33-70) with 24 biopsy-proven sites of invasive breast carcinoma participated. Mean lesion size was 3.8 cm (1.1-8.8 cm) on MRI. Mean±SEM for tumor SUVmax, tumor SUVmean, and nl breast SUVmean for PET/MRI vs PET/CT, respectively, were 8.6±1.3 vs 7.3±1.1, 4.9±0.76 vs 3.7±0.57, and 1.4±0.083 vs 1.3±0.090. Measurement bias for PET/MRI vs PET/CT was 15.6% [-15.1,46.2] for tumor SUVmax, 28.7% [-7.21,64.6] for tumor SUVmean, 3.74% [-29.3,36.7] for tumor SUVmax/nl breast SUVmean, and 17.1% [-18.2,52.5] for tumor SUVmean/nl breast SUVmean.

CONCLUSION

Quantitative assessment of 18F-FDG uptake of invasive breast cancer is feasible using simultaneous breast PET/MRI with acceptable agreement between PET/MRI and PET/CT.

CLINICAL RELEVANCE/APPLICATION

Establishing the agreement between PET/CT and simultaneous breast PET/MRI for tumor 18F-FDG uptake is important for potential clinical applications such as neoadjuvant therapy response assessment.

SSQ14-04 Comparison of Whole-Body 18F-FDG-PET/MRI and PET/CT in Terms of Lesion Detection in Asymptomatic Subjects: A Retrospective Study

Thursday, Dec. 5 11:00AM - 11:10AM Room: S402AB

Participants
Mingxiang Sun, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Mu Lin, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Liling Peng, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xin Gao, MD, Shanghai , China (*Presenter*) Nothing to Disclose
Holger Schmidt, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

To compare fluorine fluorodeoxyglucose (18F-FDG) combined positron emission tomography and magnetic resonance imaging (PET/MRI) with 18F-FDG combined positron emission tomography and computed tomography (PET/CT) in terms of organ-specific lesion detection in asymptomatic subjects for cancer screening.

METHOD AND MATERIALS

2794 individuals undergoing PET/MRI (Biograph mMR, Siemens Healthcare, Erlangen, Germany) and 4283 individuals undergoing PET/CT examinations (Biograph mCT, Siemens Healthcare, Knoxville, USA), from January 2016 to December 2017 in our center, were enrolled for this retrospective study. The local ethics committee approved this study. Written, informed consent was obtained from all subjects. Besides PET/MRI and PET/CT examinations, the screening methods included ultrasound, CT (for PET/MRI), MRI (for PET/CT) and tumor marker tests of CEA, CA19-9, PSA (for male) and CA125 (for female), dependent on the cancer type. Subjects who had no positive findings in the following 12 months were considered as 'cancer negative'.

RESULTS

In the 2794 subjects, PET/MRI detected 66 suspicious lesions, 54 of them were diagnosed as malignant tumors (true positive) and 12 of them were benign (false positive). 12 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/MRI screening were 1.93% (54/2794), 81.8% (54/66), 99.5% (2715/2728), 81.8% (54/66) and 99.5% (2715/2728) respectively. In the 4283 subjects, PET/CT detected 55 suspicious lesions and 48 of them were malignant tumors (true positive) and 7 of them were benign (false positive). 7 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/CT screening were 1.12% (48/4283), 87.3% (48/55), 99.8% (4228/4283), 87.3% (48/55) and 99.8% (4228/4283) respectively. The detailed distribution of cancer types is shown in Figure.

CONCLUSION

To our best knowledge, this is the first work to compare the diagnostic values of PET/MRI and PET/CT for cancer screening in asymptomatic subjects. Both methods can detect a wide variety of cancer at early stage.

CLINICAL RELEVANCE/APPLICATION

Compared to PET/CT, PET/MRI has a higher detection rate and a higher sensitivity in solid organs except lung. Considering also the reduced radiation dose, PET/MRI is recommended as part of a cancer screening program for asymptomatic subjects.

SSQ14-05 Whole-Body MRI and 18F-FDG PET/MRI for N and M Staging in Primary Breast Cancer: A Multicenter Trial

Thursday, Dec. 5 11:10AM - 11:20AM Room: S402AB

Participants
Nils M. Bruckmann, MD, Duesseldorf, Germany (*Presenter*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate and compare the diagnostic potential of whole-body MRI and 18F-FDG PET/MRI for N and M staging in newly diagnosed, histopathological proven breast cancer.

METHOD AND MATERIALS

A total of 77 patients with newly diagnosed, histopathological proven breast cancer were enrolled in this study prospectively. All patient underwent a whole-body 18F-FDG PET/MRI in supine position. The MRI protocol included a transverse T2-weighted, a T1-weighted and a DWI sequence of the whole body from head to the thigh. The N and M staging was assessed according to the eighth edition of the American Joint Committee on Cancer staging manual in MRI datasets alone and in 18F-FDG PET/MRI datasets, respectively. Histopathology or follow up examination as reference standard were available in all 77 patients for N and M staging. A McNemar chi2 test was performed to investigate whether differences in the evaluation of the correct N and M stage between 18F-FDG PET/MRI and MRI were statistically significant.

RESULTS

MRI and PET/MRI were concordant for N and M staging in 74 of 77 (96.1%) patients. Compared to the reference standard, PET/MRI as well as MRI determined a correct N and M stage in 57/77 (74%) of the patients, respectively. A positive nodal status was present in 33/77 patients (43%). PET/MRI determined the N stage correctly in 62 of 77 (80.5%) patients with a sensitivity of 78.8% and a specificity of 93.2%. MRI determined the N stage correctly in 61 of 77 (79%) with a sensitivity of 75.8% and a specificity of 93.2%. Distant metastases were present in 4/77 patients (5%). PET/MRI detected all of the histopathological proven metastases (100% identification), while one metastasis was missed in MRI (75% identification). Additionally, PET/MRI leads to false-positive findings in 6 patients (8%) and MRI in 5 patients (7%). No statistically significant differences between the modalities were seen.

CONCLUSION

18F-FDG PET/MRI was shown to be slightly superior to MRI in the N and M staging in primary breast cancer patients. However, both modalities bear the risk to overestimate the M-stage.

CLINICAL RELEVANCE/APPLICATION

A whole-body 18F-FDG PET/MRI and MRI are highly accurate for evaluating the M stage in breast cancer patients and therefore could be considered in combination with a dedicated breast 18F-FDG PET/MRI as staging method of choice at time of diagnosis.

SSQ14-06 Correlation of 18F-FDG PET/MRI Imaging Information with Relevant Immunohistochemical Markers in Breast Cancer Patients: Could PET/MRI Identify High-Risk Patients?

Thursday, Dec. 5 11:20AM - 11:30AM Room: S402AB

Participants
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils M. Bruckmann, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Yan Li, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To correlate prognostically relevant immunohistochemical parameters of breast cancer with simultaneously acquired standardized uptake values (SUV) and apparent diffusion coefficient (ADC) derived from hybrid PET/MRI.

METHOD AND MATERIALS

56 female patients with therapy naive, histologically proven breast cancer (mean age 54.1±12.0 years) underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI. As part of the diagnostic imaging protocol, diffusion-weighted imaging (DWI, b values: 0, 500, 1000 s/mm²) was performed simultaneously with PET acquisition. A region of interest (ROI) encompassing the entire primary tumor was drawn into each patient's breast and prone PET/MR images to determine the glucose metabolism represented by maximum and mean SUV and into ADC maps to assess tumor cellularity represented by mean and minimum ADC values. Histopathological tumor grading as well as additional prognostically relevant immunohistochemical markers, i.e. Ki-67, progesterone, estrogen receptor, and human epidermal growth factor receptor 2 (HER2/neu) were determined.

RESULTS

We found a significant inverse correlation between both SUV- and ADC-values derived from breast PET/MRI ($r=-0.49$ for SUVmean vs. ADCmean and $r=-0.43$ for SUVmax vs. ADCmin, both $p<0.001$). Tumor grading as well as Ki67 showed a significant positive correlation with SUVmean from both whole-body PET/MRI ($r=0.42$ and $r=0.37$, $p<0.001$) and breast PET/MRI ($r=0.37$ and $r=0.32$, $p<0.01$). For immunohistochemical markers, HER2/neu significantly correlates inverse with ADC-values from breast PET/MRI ($r=-0.35$, $p<0.01$). In addition, estrogen receptor expression showed significant inverse correlation with SUV-values from whole-body PET/MRI ($r=-0.47$, $p<0.001$) and breast PET/MRI ($r=-0.45$, $p<0.001$).

CONCLUSION

The present data show a correlation between increased glucose-metabolism, cellularity, degree of differentiation as well as Ki67 and HER2/neu expression of breast cancer primaries. 18F-FDG-PET and DWI from hybrid PET/MRI may offer complementary information for evaluation of breast cancer aggressiveness in initial staging and treatment response.

CLINICAL RELEVANCE/APPLICATION

Easily applicable information from PET/MRI leads to complementary knowledge in breast cancer staging workup. This could help to identify high-risk patients efficiently.

SSQ14-07 Impact of 18FDG PET/MRI on Therapeutic Management in Breast Cancer Patients - A Prospective Multicenter Comparison Trial to the Guideline Staging Algorithm

Thursday, Dec. 5 11:30AM - 11:40AM Room: S402AB

Participants
Julian Kirchner, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Julian.Kirchner@med.uni-duesseldorf.de

PURPOSE

To investigate whether the differences between the traditional staging imaging algorithm and 18F-FDG PET/MR lead to different therapeutic decisions in patients with breast carcinoma

METHOD AND MATERIALS

A total of 57 female patients with newly diagnosed breast cancer and elevated pre-test probability for distant metastases (initial tumor stage, immunohistochemical receptor expression) from two centers were prospectively included in this study. The traditional staging imaging algorithm was performed in clinical routine at the home institution of the patient. Additionally, each patient underwent a PET/MRI including dedicated diagnostic breast imaging and a whole-body MRI. Tumor stage was determined according to AJCC Staging Manual separately for both, 18F-FDG PET/MR and traditional staging algorithm. To determine the different treatment strategies each patient was discussed two times in separate DMT sessions. In one, the determination of the treatment strategy was based exclusively on the results of the traditional algorithm and in the other on the PET/MR. The primary endpoint was the incidence of differences between the therapy recommendations. The secondary endpoint was the comparison of diagnostic accuracy between the traditional staging algorithm and PET/MR for the TNM classification.

RESULTS

PET/MR and the traditional staging algorithm agreed on TNM-stages in 45 of 57 (78.9%) patients. All deviations between were due to a higher stage in PET/MR. Compared with the reference standard, PET/MR determined correct stage in 53/57 (93.0%) and the traditional staging algorithm in 43/57 (75.4%), respectively and resulting in a significant higher diagnostic accuracy in PET/MR. Different therapeutic decisions between PET/MR and the traditional staging algorithm occurred in 7/57 (12.3%) of the patients.

CONCLUSION

For breast cancer patients with elevated pre-test probability for distant metastases a change of the therapy regime occurs in 12.3% compared to the traditional staging algorithm when staged by 18F-FDG PET/MR. Furthermore the study revealed the diagnostic superiority for determining the exact TNM stage of 18F-FDG PET/MR over the traditional staging algorithm

CLINICAL RELEVANCE/APPLICATION

Current guidelines should consider systemic staging with 18F-FDG-PET/MRI in breast cancer patients with elevated pre-test probability for distant metastases at the time of initial diagnosis.

SSQ14-08 CT-Less Direct Correction of Attenuation and Scatter in Image Space Using Deep Learning for Total-Body PET: A Feasibility Study

Thursday, Dec. 5 11:40AM - 11:50AM Room: S402AB

Participants
Jaewon Yang, San Francisco, CA (*Presenter*) Nothing to Disclose
Dookun Park, PhD,DPhil, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Grant Gullberg, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Youngho Seo, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A total-body PET scanner like EXPLORER provides a substantial sensitivity gain of a factor of approximately 40 over current clinical PET scanners. The 40-fold increase in the effective sensitivity can reduce total radiation dose by 1/40th; however, the extra radiation dose of CT for PET attenuation and scatter correction (ASC) will mitigate the merit of the ultralow-dose PET. Therefore, we propose CT-less direct ASC without any intermediate step using deep learning (DL) potentially for total-body PET.

METHOD AND MATERIALS

In an IRB-approved study, we obtained images from 59 whole-body 18F-FDG PET/CT studies that were acquired from March 2016 through August 2017. A deep convolutional neural network (DCNN) was implemented with the 59 pairs of uncorrected PET (without ASC; PETUC) and corrected PET (with ASC; PETASC) as inputs to predict attenuation-scatter corrected PET (PETDCNN) directly from uncorrected PET (50/9 split for training and test data). Quality of the predicted images (PETDCNN) was evaluated using standardized uptake values (SUV) by the normalized root mean square error (NRMSE), peak signal to noise ratio (PSNR), and structural similarity index (SSIM). Statistical analyses were performed using joint and error histograms.

RESULTS

The overall performance of PETDCNN is quantitatively comparable to CT-based ASC (PETASC). Across the test set of 9 subjects, the NRMSE was 0.26 ± 0.05; the average PSNR was 14.75 ± 3.22; the average SSIM was 0.94 ± 0.03, demonstrating high image similarity between PETDCNN and reference PETASC. The joint histogram shows the voxel-wise similarity between PETDCNN and

reference PETASC with the slope of 1.05 and R2 of 0.90 which was consistent with the result of the error histogram where most of errors (~ 90%) stay within ±0.5 SUV differences.

CONCLUSION

We demonstrated the feasibility of CT-less direct ASC using deep learning potentially for total-body PET. The clinical translation of our approach will remove the need of CT scans for PET ASC, which results in significant reduction of radiation dose particularly for pediatric patients or treatment follow-ups.

CLINICAL RELEVANCE/APPLICATION

Our proposed DL method can remove the need of CT for PET ASC, which reduces the radiation dose from a whole-body CT scan, preserving the merit of ultra-low dose imaging in total-body PET.

SSQ14-09 Quantitative Standardized Uptake Value Evaluation of 4x Faster PET Scans Enhanced Using Deep Learning

Thursday, Dec. 5 11:50AM - 12:00PM Room: S402AB

Participants
Akshay Chaudhari, PhD, Menlo Park, CA (*Abstract Co-Author*) Research Consultant and Stockholder, Subtle Medical; Research Consultant, Skope MR; Scientific Advisory Board and Stockholder, Brain Key; Scientific Advisory Board, Chondrometrics GmbH; Stockholder, LVIS Corporation; ;
Praveen Gulaka, PhD, Menlo Park, CA (*Presenter*) Employee, Subtle Medical
Tao Zhang, Menlo Park, CA (*Abstract Co-Author*) Employee, Subtle Medical
Shyam Srinivas, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical
Enhao Gong, PhD, Menlo Park, CA (*Abstract Co-Author*) Stockholder, Subtle Medical

For information about this presentation, contact:

enhao@subtlemedical.com

PURPOSE

The goal of this study was to evaluate the accuracy of quantitative standardized uptake values (SUV) for noisy PET scans acquired 4x faster and subsequently enhanced using deep learning.

METHOD AND MATERIALS

15 subjects (7 male, 8 female; mean age: 67 years, range: 45;85 yrs, average BMI: 30, range: 19-48) referred for clinical whole-body PET/CT exams underwent two separate PET scans - one with the standard acquisition duration followed by one acquired 4 times faster, following IRB approval and informed consent. The 4x faster PET images were enhanced using a deep learning (DL) software (SubtlePET, Subtle Medical, Menlo Park, CA). One nuclear medicine physician reviewed the standard acquisition PET images, identified possible lesions and some normal regions, and drew regions of interest (ROIs) in OsiriX. The same lesions were reviewed on the DL-enhanced 4x faster scan images and the ROIs from the standard acquisition were propagated to the DL-enhanced 4x faster scan. Quantitative mean and maximum SUV values per ROI between the standard and DL-enhanced 4x faster acquisitions were visualized using Bland-Altman tests and compared using concordance correlation coefficients (CCC), linear regressions, and Mann-Whitney U-Tests.

RESULTS

A total of 63 ROIs were identified in the standard acquisition PET images. The Bland-Altman plot in Fig.1a-b (dotted line indicating mean, and dashed line indicating 95% limits of agreement) showed minimal differences between SUVs obtained from the two sets of scans, with almost all values contained within the 95% limits of agreement interval. CCC and linear Pearson coefficient values of 0.99 for both SUV-max and SUV-mean indicated very strong agreement between the SUV values from standard acquisition and DL-enhanced scan (Fig.1c-d, where the dotted line indicates the unity line). This was further indicated by the lack of statistical significance of p=0.68 for SUV-max and p=0.77 for SUV-mean values using the Mann-Whitney U-Test. Sample images can also be seen in Fig.1.

CONCLUSION

Deep learning can enhance 4x faster PET acquisitions without compromising quantitative SUV values compared a standard duration acquisition.

CLINICAL RELEVANCE/APPLICATION

Deep learning can enhance image quality of noisy 4x faster PET acquisitions thereby enabling higher comfort for patients, higher throughput of PET scans for hospitals, or reduced radiotracer dosages.

VSIO51

Interventional Oncology Series: Musculoskeletal Intervention

Thursday, Dec. 5 1:00PM - 3:00PM Room: S405AB

IR MK OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Steven Yevich, MD, MPH, Houston, TX (*Moderator*) Speakers Bureau, Endocare, Inc
Matthew R. Callstrom, MD,PhD, Rochester, MN (*Moderator*) Research Grant, EDDA Technology, Inc Research Grant, Galil Medical Ltd Consultant, Medtronic plc Consultant, Endocare, Inc Consultant, Johnson & Johnson Consultant, Thermedical, Inc

For information about this presentation, contact:

callstrom.matthew@mayo.edu

Sub-Events

VSIO51-01 Treatment of Non-malignant MSK Tumors

Thursday, Dec. 5 1:00PM - 1:10PM Room: S405AB

Participants
Steven Yevich, MD, MPH, Houston, TX (*Presenter*) Speakers Bureau, Endocare, Inc

VSIO51-02 Top 10 Lessons Learned in MSK Ablation and Embolization

Thursday, Dec. 5 1:10PM - 1:20PM Room: S405AB

Participants
Anil N. Kurup, MD, Rochester, MN (*Presenter*) Research Grant, Galil Medical Ltd; Research Grant, EDDA Technology, Inc; Royalties, Wolters Kluwer nv

For information about this presentation, contact:

kurup.anil@mayo.edu

LEARNING OBJECTIVES

1) To describe common complications that occur with MSK intervention. 2) To share tips and tricks to facilitate effective MSK interventions. 3) To highlight necessary pre-procedural patient preparation and post-procedural expectations.

VSIO51-03 Ablation in the Spine and Paraspinal Tissues

Thursday, Dec. 5 1:20PM - 1:30PM Room: S405AB

Participants
Jack W. Jennings, MD, Saint Louis, MO (*Presenter*) Speakers Bureau, Merit Medical Systems, Inc; Consultant, Merit Medical Systems, Inc; Consultant, Medtronic plc; Consultant, Galil Medical Ltd; Consultant, BTG International Ltd; Consultant, C. R. Bard, Inc

VSIO51-04 Spine SBRT: Local Control and Fracture Risks

Thursday, Dec. 5 1:30PM - 1:40PM Room: S405AB

Participants
Sean S. Park, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe spine SBRT: indications and patient selection, technique and delivery, and oncologic outcomes and toxicities.

VSIO51-05 Transarterial Embolization with Microsphere for Treatment-Refractory Malignant Bone and Soft-Tissue Tumors

Thursday, Dec. 5 1:40PM - 1:50PM Room: S405AB

Participants
Junichi Taniguchi, Nishinomiya, Japan (*Presenter*) Nothing to Disclose
Haruyuki Takaki, MD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Kunimoto, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Yokoyama, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Ogasawara, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose

Hiroshi Kodama, MD, Nishinomiya , Japan (*Abstract Co-Author*) Nothing to Disclose
Yasukazu Kako, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaoru Kobayashi, MD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Futani, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichiro Yamakado, MD, PhD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively evaluate the clinical utility of transarterial embolization using microsphere (MS) in patients with treatment-refractory malignant bone and soft tissue tumors.

METHOD AND MATERIALS

Between 2014 and 2018, 11 patients (7 female and 4 males) with a median age of 69 years (range, 49-89 years) underwent embolization using MS for the treatment of treatment-refractory malignant bone and soft tissue tumors. Tumors were located in the body trunk in 8 patients (73%) and in the limb in 3 patients (27%) with a median maximum tumor diameter of 9.2 cm (range, 2.1-24.6 cm). Seven patients (64%, 7/11) complained of pain caused by tumors before embolization. The response [complete remission (CR) + partial remission (PR)] and the disease control [CR + PR + stable disease (SD)] rates were evaluated by modified Response Evaluation Criteria in Solid Tumor (mRECIST) criteria, adverse events by Common Terminology Criteria for Adverse Events (CTCAE) version 5.0, and survival rate after embolization by Kaplan-Meyer method. Visual analog scale (VAS) scores were evaluated before and within 1 week after embolization.

RESULTS

The response rate was 36% [CR, 18% (2/11); PR, 18% (2/11)], and disease control rate 82% [SD, 45% (5/11)] at 1 month after embolization. Grade 3 skin ulcer developed in 2 patients (18%, 2/11), and paresthesia in a patient (9%, 1/11). The cumulative overall survival rates were 40% (95% confidence interval (CI), 6-74%) at 1 year and 20% (95% CI, 1-58%) at 3 years, and with a median survival time of 11 months. VAS scores decreased 2 or more in 5 patients (71%, 5/7).

CONCLUSION

This preliminary study demonstrated possibility that MS embolization may help to control treatment-refractory bone and soft tissue tumors and relieve pain caused by tumors.

CLINICAL RELEVANCE/APPLICATION

Transarterial embolization with microsphere for treatment-refractory malignant bone and soft tissue tumors can be effective for local tumor control and pain relief.

VSIO51-06 Vertebral Augmentation in Cancer Patients

Thursday, Dec. 5 1:50PM - 2:00PM Room: S405AB

Participants
Rahul A. Sheth, MD, Houston, TX (*Presenter*) Nothing to Disclose

VSIO51-07 Ablation-Osteoplasty-Reinforcement-Internal Fixation (AORIF) for Osteolytic Skeletal Metastases

Thursday, Dec. 5 2:00PM - 2:10PM Room: S405AB

Participants
Nariman Nezami, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Francis Y. Lee, MD,PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Igor Latich, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dr.nezami@gmail.com

PURPOSE

Open surgical repair is often not feasible or safe in patients with osseous metastatic disease, particularly in areas at risk for pathologic fracture adjacent to weight-bearing articular surfaces. However, percutaneous cementoplasty and internal fixation with screws have each shown to be effective independently. This study reports Ablation-Osteoplasty-Reinforcement-Internal Fixation (AORIF) technique and technical success for osteolytic skeletal metastases adjacent to weight-bearing articular surfaces.

METHOD AND MATERIALS

This is a retrospective analysis of 18 patients who underwent image guided percutaneous internal screw fixation, radiofrequency ablation, balloon osteoplasty, and cementoplasty in 16 sites of osseous metastasis. Post-procedural outcomes, improvement of pain and mobility were evaluated. All of the patients had advanced osseous metastatic disease with impending pathologic fractures and persistent pain refractory to radiotherapy or systemic treatment.

RESULTS

100% of the procedures were technically successful without post-procedural complications. All of the patients who received the modified technique were found to have improved pain and mobility after the procedure. Importantly, all patients, except for one, were treated on outpatient basis and none required conversion to open repair.

CONCLUSION

The AORIF is an effective strategy in improving pain and reducing the risk of pathologic fracture in patients with advanced osteolytic metastatic disease near articular surfaces. Concomitant RFA provides a degree of local tumor control and in conjunction with balloon osteoplasty creates increases the penetration of cement within the diseased bone.

CLINICAL RELEVANCE/APPLICATION

The AORIF is an effective strategy in improving pain and reducing the risk of pathologic fracture in patients with advanced

osteolytic metastatic disease near articular surfaces.

VSIO51-08 MSK Immuno-Oncology: Talk the Talk

Thursday, Dec. 5 2:10PM - 2:20PM Room: S405AB

Participants
Muneeb Ahmed, MD, Boston, MA (*Presenter*) Research Grant, General Electric Company Stockholder, Agile Devices, Inc Scientific Advisory Board, Agile Devices, Inc

VSIO51-09 Pediatric MSK Interventions

Thursday, Dec. 5 2:20PM - 2:30PM Room: S405AB

Participants
Allison S. Aguado, MD, Wilmington, DE (*Presenter*) Nothing to Disclose

VSIO51-10 Advanced Imaging Techniques for MSK IO

Thursday, Dec. 5 2:30PM - 2:40PM Room: S405AB

Participants
Julien Garnon, MD, Strasbourg, France (*Presenter*) Proctor, Galil Medical Ltd

LEARNING OBJECTIVES

1) To understand the role of multimodality image guidance for MSK procedures to see the clinical benefit of combined fluoroscopy and CT-scan for complex bone procedures. 2) To understand how ultrasound and MRI can improve the precision of soft tissue interventions.

VSIO51-11 Approach to Pelvic Fixation

Thursday, Dec. 5 2:40PM - 2:50PM Room: S405AB

Participants
Frederic Deschamps, Villejuif, France (*Presenter*) Research Consultant, Medtronics plc; Research Consultant, BTG International Ltd; Research Consultant, General Electric Company

VSIO51-12 Fixation Outside of the Pelvis

Thursday, Dec. 5 2:50PM - 3:00PM Room: S405AB

Participants
Sean M. Tutton, MD, Milwaukee, WI (*Presenter*) Consultant, BTG International Ltd; Consultant, Galil Medical Ltd; Consultant, Biocompatibles International plc; Consultant, IZI Medical; Consultant, Stryker Corporation; Researcher, Siemens AG; Consultant, Siemens AG;

For information about this presentation, contact:

stutton@mcw.edu

Printed on: 10/29/20

VSIO52

Interventional Oncology Series: International Interventional Oncology-South Korea Presents

Thursday, Dec. 5 3:15PM - 5:15PM Room: S405AB

IR OI RO

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Hyunchul Rhim, MD,PhD, Seoul, Korea, Republic Of (*Moderator*) Consultant, STARmed Co Ltd; Research Grant, Johnson & Johnson
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Moderator*) Grant, Bayer AG; Speaker, Bayer AG; Grant, Canon Medical Systems Corporation; Grant, Koninklijke Philips NV; Grant, General Electric Company; Grant, Guerbet SA; Speaker, Guerbet SA; Grant, Samsung Electronics Co, Ltd; Speaker, Samsung Electronics Co, Ltd; Grant, Bracco Group; Speaker, Siemens AG

Sub-Events

VSIO52-01 30 Years of Interventional Oncology in Korea

Thursday, Dec. 5 3:15PM - 3:30PM Room: S405AB

Participants
Hyunchul Rhim, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Consultant, STARmed Co Ltd; Research Grant, Johnson & Johnson

For information about this presentation, contact:

rhim.hc@gmail.com

LEARNING OBJECTIVES

1) To understand 30 years history of interventional oncology in Korea. 2) To understand the current status of interventional oncology in Korea.

VSIO52-02 Radiofrequency Ablation for HCC: Where Are We?

Thursday, Dec. 5 3:30PM - 3:45PM Room: S405AB

Participants
Min Woo Lee, Seoul, Korea, Republic Of (*Presenter*) Grant, STARmed Co Ltd; Consultant, STARmed Co Ltd

For information about this presentation, contact:

leeminwoo0@gmail.com

LEARNING OBJECTIVES

1) To know recent advances in local ablation therapy of hepatocellular carcinoma (HCC). 2) To understand the importance of tumor biology and tumor location for local ablation therapy of HCCs.

VSIO52-03 Manual Versus Automated Image Fusion of Real-time Ultrasonography and MRI/CT Images for Radiofrequency Ablation of Hepatic Malignancies: Results of a Randomized Prospective Clinical Trial (NCT********)

Thursday, Dec. 5 3:45PM - 3:55PM Room: S405AB

Participants
Moon Hyung Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Joon-Il Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Youngjun Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seo Yeon Youn, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soyoung Cho, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

dumkycji@gmail.com

PURPOSE

Automatic registration technique for imaging fusion of ultrasonography and MRI/CT can simplify the steps of imaging fusion. The purpose of this trial is to compare the technical and clinical outcomes of manual and automatic registration system for radiofrequency ablation (RFA) of hepatic malignancies.

METHOD AND MATERIALS

Inclusion criteria are 1) patients older than 40 years of age who are undergoing RFA for hepatocellular carcinoma (HCC) or colorectal cancer liver metastasis (CRLM), 2) a tumor <= 4 cm in longest diameter, number of tumors <= 3. 70 consecutive patients

(M:F=47:23, 67.1±10.9 years old) were prospectively enrolled and randomly assigned to manual or automatic registration group. Two operators performed RFA using one of two fusion techniques. Registration error, time required for image registration, number of point registrations were compared between manual and automatic registration groups. Clinical outcomes including technical success, technical effectiveness, local tumor progression (LTP)-free survival and disease-free survival (DFS) were also compared.

RESULTS

35 HCC patients were treated using the automatic registration, and 34 HCCs and 1 CRLM patient were treated using the manual registration. There was no significant difference in registration error, time required for the registration, and number of point registrations between both groups (5.7±4.3 mm, 147.8±78.2 sec and 3.26±1.20 for automatic registration, and 6.3±5.0 mm, 150.3±89.7 sec and 3.20±1.13 for manual registration, respectively). Both technical success and effectiveness rate were 97.1% for automatic registration and 100.0% for manual registration without any significant difference. LTP-free survival and DFS between both groups (14.2 months and 12.2 months, respectively, for automatic registration, and 15.6 months and 12.9 months, respectively, for manual registration) showed no significant difference during the mean follow-up period of 20.1 months.

CONCLUSION

The technical performance and clinical outcomes of the manual and automatic registration, including long-term follow-up, are comparable for RFA of hepatic malignancies.

CLINICAL RELEVANCE/APPLICATION

Considering its easy application and comparable technical and clinical outcomes, automatic imaging fusion technique can be helpful for physicians performs interventional procedures targeting hepatic lesions under US-guidance, especially for physicians with little experience.

VSIO52-04 Superselective Chemoembolization and Radioembolization: Is This Going Far Enough?

Thursday, Dec. 5 3:55PM - 4:10PM Room: S405AB

Participants
Hyo-Cheol Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Speaker, Guerbet SA; Speaker, BTG International Ltd

For information about this presentation, contact:

angiointervention@gmail.com

LEARNING OBJECTIVES

1) Define superselective and ultraselective catheterization. 2) List the benefit of superselective catheterization. 3) Describe the possible pre-shaping of microcatheter and micro-guide wire. 4) Explain the dosimetry in superselective radioembolization.

VSIO52-05 Combined Treatment of Chemotherapy (Gem/nPac) and Focused Ultrasound for Unresectable Pancreatic Cancer: Prospective Study for Safety and Initial Efficacy

Thursday, Dec. 5 4:10PM - 4:20PM Room: S405AB

Participants
Jae Young Lee, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Do-Youn O. Oh, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung-Hun O. Lee, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Hyub O. Lee, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo Yeon Kang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Keonho Son, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, Alpinion Medical Systems Co, Ltd
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

leejy4u@gmail.com

PURPOSE

To check safety of combined treatment of focused ultrasound (FUS) and anticancer drug (Gemcitabine+nab-Paclitaxel, Gem/nPac) for patients with unresectable pancreatic cancer and determine the optimal FUS intensity by comparing efficacy

METHOD AND MATERIALS

According to FUS intensity, low (1.5 kw/cm2), intermediate (1.5 kw/cm2) and high (2.5 kw/cm2) intensity treatment groups were predefined (duty cycle of 1%, exposure time of 3 seconds, PRF of 10). Beginning low intensity, at least three patients with unresectable pancreatic cancer were designed to be enrolled in each treatment group. If adverse device effect or dose-limiting toxicity (DLT) occurred during treatment, the number of enrolled patients increased up to 6 patients in each group. The combined treatment of FUS and Gem/nPac was repeated weekly for 2 months (total 6 times) per patient. The presence of adverse effect was monitored. Tumor size change and tumor response of pancreatic cancer at follow-up CT were evaluated. CA 19-9, Karnofsky performance status, pain scale and life quality (QLQ-C30 and QLQ-PAN26) were also evaluated.

RESULTS

Each 3 patients were enrolled in each intensity treatment group (total, 9 patients). Because no adverse effects or DLT occurred in any patients, increase in number of patient enrollment was not needed. Seven of nine patients were decreased in size on immediate follow-up CT. CA 19-9 decreased in all patients. Pain scale was not changed significantly. Intermediate intensity treatment group showed tumor size decrease in all patients, partial remission (n=2) or stable disease (n=1) in tumor response and complete cancer-pain relief in two patients.

CONCLUSION

The 1.5 kW/cm2 to 2.5kw/cm2 FUS intensity with very low duty cycle were safe in the combined treatment of FUS and Gem/nab. Intermediate intensity group showed the best results in tumor size change, tumor response and pain reduction.

CLINICAL RELEVANCE/APPLICATION

1. Drug enhancement by focused ultrasound is well-established fact in many preclinical studies. This study shows the potential that FUS treatment can be used to enhance the effect of anticancer drug in clinical practices.

VSIO52-06 Image-guided Ablation in Treating Recurrent Genitourinary Tumors Following Conventional Treatments

Thursday, Dec. 5 4:20PM - 4:35PM Room: S405AB

Participants
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

1436park@gmail.com

LEARNING OBJECTIVES

1) To know how to do patient selection or what to tell patients prior to thermal ablation. 2) To determine what type of thermal ablations is appropriate for patients with recurrent tumors. 3) To show treatment techniques leading to successful ablation. 4) To describe how to follow patients.

ABSTRACT

Image-guided ablation is usually performed as an alternative treatment in patients with early staged cancer. This treatment technique is known to be useful in treating patients with small hepatocellular carcinoma or renal cell carcinoma. However, it is not still widely used for those who have recurrent cancers occurring after conventional treatments such as surgery, radiation therapy, and chemotherapy are done. There are very few investigations for beginners who want to perform thermal ablation in patients with recurrent cancers. The purpose of my presentation is to know how to do patient selection or what to tell patients prior to ablation treatment, to determine what type of thermal ablations is appropriate for recurrent cancers, and to show ablation techniques leading to successful treatment.

VSIO52-07 Thyroid RFA: Complications and Solutions

Thursday, Dec. 5 4:35PM - 4:50PM Room: S405AB

Participants
Jung Hwan Baek, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Consultant, STARmed Company; Consultant, RF Medical Company

For information about this presentation, contact:

radbaek@naver.com

LEARNING OBJECTIVES

1) Understand the types and incidence of complications that can occur during thyroid RFA. 2) Understand the ultrasound features of critical structures around the thyroid tumors. 3) Understand the solutions to minimize complications during thyroid RFA.

ABSTRACT

Thyroid radiofrequency ablation (RFA) is effective treatment tool for benign and malignant thyroid tumors. Generally speaking, the incidence and severity of complications are lower than surgery. However, several types of serious complications have been reported. Therefore understanding of broad spectrum of complications and solutions enables the interventional radiologists to minimize complications during thyroid RFA. In this lecture, we will discuss possible complications of thyroid RFA, related anatomy of critical structures and commplication prevention methods.

VSIO52-08 Stent Development and Application in Interventional Oncology

Thursday, Dec. 5 4:50PM - 5:05PM Room: S405AB

Participants
Ji Hoon Shin, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jhshin@amc.seoul.kr

LEARNING OBJECTIVES

1) To understand indications and roles of various stents in the oncology field. 2) To understand limitations and complications of stents in the oncology field. 3) To know application plan of stent graft for bleeding complications in the oncology field.

VSIO52-09 Panel Discussion

Thursday, Dec. 5 5:05PM - 5:15PM Room: S405AB

RC707

Advances in Imaging of Small Incidental Renal Masses (Including Cancers): Implications for Management

Thursday, Dec. 5 4:30PM - 6:00PM Room: E353B

GU OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Nicole M. Hindman, MD, New York, NY (*Presenter*) Nothing to Disclose
Matthew S. Davenport, MD, Ann Arbor, MI (*Presenter*) Royalties, Wolters Kluwer nv
Nicola Schieda, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Stuart G. Silverman, MD, Brookline, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sgsilverman@partners.org

Nicole.Hindman@nyulangone.org

LEARNING OBJECTIVES

1) Recommend appropriate management for the incidental renal mass using the latest guidelines. 2) Generate a comprehensive evaluation of indeterminate renal masses using a novel structured report. 3) Predict malignant subtypes of renal cancers (and differentiate from benign masses) using new developments in CT and MRI. 4) Manage small renal masses, including select renal cancers, with active surveillance based on imaging and biopsy.

RC718

Interactive Game: Pearls and Tips in Oncologic Image Interpretation (Interactive Session)

Thursday, Dec. 5 4:30PM - 6:00PM Room: S404AB

OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Yuliya Lakhman, MD, New York, NY (*Moderator*) Nothing to Disclose

Special Information

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC718A Head and Neck

Participants
Birgit B. Ertl-Wagner, MD, Toronto, ON (*Presenter*) Spouse, Stockholder, Siemens AG; Author, Springer Nature;

For information about this presentation, contact:

BirgitBetina.Ertl-Wagner@sickkids.ca

LEARNING OBJECTIVES

1) Appreciate the importance of the location, imaging features and potential nodal involvement of head and neck tumors for diagnostic decision-making and prognostication. 2) Describe important imaging signs to differentiate tumors of the skull base differentiate common benign and malignant disorders of the head and neck based on their imaging presentation.

RC718B Chest

Participants
Katherine A. Kaproth-Joslin, MD, PhD, Rochester, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Katherine_kaproth-joslin@urmc.rochester.edu

LEARNING OBJECTIVES

1) To better understand what the ordering clinician is looking for on imaging, both pre and post treatment. 2) Review the latest version of lung cancer TNM staging. 3) Understand the pearls and pitfalls of oncologic imaging in the chest, including tricks to identify recurrent disease post treatment, unique properties of certain lung cancers, and mimics of disease progression.

RC718C Abdomen

Participants
Khaled M. Elsayes, MD, Pearland, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kmelsayes@mdanderson.org

LEARNING OBJECTIVES

1) Describe most commonly encountered imaging pitfalls, pseudolesions and misdiagnoses that can be encountered on imaging the liver. 2) Discuss relevant technical background. pathophysiology and hemodynamics of these pitfalls. 3) Correlate imaging features of these masses with clinical and pathologic findings. 4) Provide useful pearls and clues to reach a specific diagnosis.

ABSTRACT

There is a wide range of common pitfalls and pseudo-lesions encountered in liver imaging, which can lead to incorrect diagnoses mainly because many radiologists are not completely familiar with anatomical, morphological, physiological, hemodynamic and biological principles. This leads to common misinterpretations which would further results in wrong management with potentially negative outcome. In this exhibit, we will discuss the spectrum of these pathologies and provide clues to correct diagnoses

RC718D Female Pelvis

Participants
Helen C. Addley, MRCP, FRCR, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

helenclareaddley@hotmail.co.uk

LEARNING OBJECTIVES

1) Highlight common pearls and pitfalls in gynae-oncology imaging. 2) Review post-treatment appearances of the female pelvis. 3) Discuss the most frequent pitfalls in gynae-oncology image interpretation from tumor board of cancer center.

Printed on: 10/29/20

SST06

Nuclear Medicine (Thoracic Oncology Nuclear Medicine and PET)

Friday, Dec. 6 10:30AM - 12:00PM Room: E353B

CH NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SST06-01 TNM Sub-Stage Does Not Predict Survival in Surgical Patients with Both Clinical and Pathological Stage I Non-Small Cell Lung Cancer

Friday, Dec. 6 10:30AM - 10:40AM Room: E353B

Participants
Jingmian Zhang, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Bill C. Penney, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Daniel E. Appelbaum, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

PURPOSE

To determine if TNM sub-stage (IA1-IB) and PET tumor measurements are predictive of survival in surgical patients with both clinical and pathological stage I non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

This study reviewed surgical patients with clinical and pathological stage I NSCLC and a baseline FDG PET/CT between Feb 2004 and Dec 2014. The pathological staging was based on the prevailing staging system at the time of the surgery. The clinical stage (8th edition) was determined retrospectively by radiologists based on FDG PET/CT and contrast CT. The metabolic tumor volume (MTV), total lesion glycolysis (TLG), and SUVmax from PET/CT were measured. The primary endpoint was overall survival (OS). Kaplan-Meier and Cox survival analyses were performed.

RESULTS

172 surgical patients with pathological stage I also had clinical stage I (9 with IA1, 63 with IA2, 63 with IA3 and 37 with IB) (111 females and 61 males), with 44.8% who expired during follow-up, median OS was 69.1 months; and the 1-year, 2-year, and 5-year OS rates were 96.0%, 88.3% and 71.7 %, respectively. The median follow-up among survivors was 79.2 months. Univariate analysis showed that age [hazard ratio (HR) of age for every year= 1.04, p=0.001] and ECOG performance status (p=0.027) were associated with OS. Clinical TNM sub-stage (p=0.702), gender (p=0.405), smoking status (0.171), histology (p=0.111), ln(MTV) (p=0.120), ln(TLG) (p=0.147) and ln(SUVmax) (p=0.316) were not significantly associated with OS. The statistically significant association of age (HR= 1.04, p=0.002) and ECOG performance status (p=0.027) with OS persisted in multivariate Cox regression analyses after adjusting for clinical TNM sub-stage and ln(MTV). However, there was no significant association of clinical TNM sub-stage (p=0.451) and ln(MTV) (p=0.08) with OS. Kaplan-Meier survival analysis showed statistically significant association of MTV (>=3.5 ml vs <3.5ml, p=0.049), age (p=0.001) and ECOG performance status (p=0.02) with OS.

CONCLUSION

Clinical TNM sub-stage is not associated with OS in the surgical patients with both clinical and pathological stage I NSCLC. Age, MTV (>=3.5 ml vs <3.5ml) and ECOG performance status are significantly associated with OS in such patients.

CLINICAL RELEVANCE/APPLICATION

Patients with clinical stage 1 as determined with CT and PET, and pathologic stage 1 do well after surgery. Clinical TNM sub-stages add little prognostic information in this group.

SST06-02 Mediastinal Lymph Nodal Staging by 18 F FDG PET CT in Patients with Co-Existent Carcinoma Lung and Tuberculosis: A Tertiary Care Centre Experience

Friday, Dec. 6 10:40AM - 10:50AM Room: E353B

Participants
Ritu Verma, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ram K. E, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Amit Dhamija, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ankur Pruthi, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ethel S. Belho, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Dharmender Malik, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nikhil Seniaray, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Vanshika Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

Nitin Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Harsh Mahajan, MD,MBBS, New Delhi, India (*Presenter*) Director, Mahajan Imaging Pvt Ltd; Research collaboration, General Electric Company; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health
Vidur Mahajan, MBBS, New Delhi, India (*Abstract Co-Author*) Researcher, CARING; Associate Director, Mahajan Imaging; Research collaboration, General Electric Company ; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health; Research collaboration, Oxipit.ai; Research collaboration, Synapsica; Research collaboration, Quibim

For information about this presentation, contact:

drrituverma29@gmail.com

PURPOSE

The aim of this study is to evaluate the imaging characteristics of metastatic and benign (Tubercular) lymph nodes on 18 F FDG PET/CT, in patients with co-existent Carcinoma lung and Tuberculosis, and correlation with histopathological analysis.

METHOD AND MATERIALS

A retrospective analysis of 25 patients (19 males, 6 females; mean age 62.4+/- 10.08 years) with co-existent Carcinoma lung and Tuberculosis was done. All the subjects underwent F-18 FDG PET/CT scanning and subsequently the mediastinal lymph nodes were biopsied. SUV Max-Tumour, SUV Max-Lymph node and SUV Max-Ratio (SUV Max Lymph node / SUV Max Tumour) for each lymph node station on 18F-FDG PET/CT was determined and then each station was classified into one of the three groups based on SUV Max -Tumour (low, medium and high SUV Max -Tumour groups). Diagnostic performance was assessed based on receiver operating characteristic (ROC) curve analysis, and the optimal cut-off values that would best discriminate metastatic from benign lymph nodes were determined for each method.

RESULTS

A total of 115 lymph node stations with a mean of 4.6 lymph node station per patient and total of 540 lymph nodes with a mean of 21.6 lymph nodes per patient were resected and biopsied. 79 nodes were reported positive for metastasis and 27 nodes were reported as granulomatous. On pre-treatment 18F-FDG PET/CT scan, the mean SUV Max-Tumour of squamous cell carcinoma was significantly higher than that of adenocarcinoma (9.9±3.97 vs. 5.76±3.48, P<0.001). The mean SUVmax of malignant lymph nodes was significantly higher than that of tubercular lymph nodes (6.7±0.94 vs. 2.7± 0.84 P<0.001). The mean SUV Max -Ratio in patients with malignant lymph nodes was significantly higher than in those with tubercular lymph nodes (0.91±0.36 vs. 0.41±0.28, P<0.001).

CONCLUSION

The overall diagnostic accuracy of 18 F FDG PET CT in mediastinal lymph nodal staging in patients with co-existent Tuberculosis and Carcinoma lung carcinoma is 67.4 %, if SUV Max of 2.5 is taken as the cut off criteria, however if SUV Max-Ratio is taken into consideration, the overall diagnostic accuracy increases to 74.8%, thus helping in the accurate staging of patients

CLINICAL RELEVANCE/APPLICATION

Carcinoma lung with co-existing Tuberculosis results in false positive mediastinal lymph nodes and fallacies in pre-operative staging.

SST06-03 Improving Accuracy of FDG PET/CT to Diagnose Mediastinal Nodal Involvement in Non Small Cell Lung Cancer (NSCLC): Utility of Using various Predictive Models

Friday, Dec. 6 10:50AM - 11:00AM Room: E353B

Participants
Boon Mathew, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Nilendu C. Purandare, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Ameya D. Puranik, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Sneha A. Shah, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Archi Agrawal, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
C S Pramesh, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Venkatesh Rangarajan, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

drboonmathew@gmail.com

PURPOSE

Accurate nodal staging is crucial in deciding the therapy for NSCLC patients. PET using FDG as well as CECT scan have not been proven to be sufficiently accurate in predicting mediastinal nodal disease, particular in infection endemic regions of the world. The purpose of the study was to determine a predictive model that could improve the accuracy for identifying mediastinal (N2) nodal metastases based on both PET and CT findings seen on baseline FDG PET/CT.

METHOD AND MATERIALS

This retrospective study includes 339 patients with NSCLC who underwent FDG PET/CT within 6 weeks prior to surgery. PET parameters obtained were 1) number of visual PET positive N2 nodes (FDG uptake more than mediastinal blood pool), 2) maximum standardized uptake value (SUVmax) of nodes and 3) ratio of node to aorta (N/A) SUVmax. CT parameters obtained were 1) short axis diameter and 2) Hounsfield units (HU) of PET positive nodes. Cutoff value of N/A ratio and HU for predicting metastases were obtained from ROC curve analysis. PET and CT parameters were correlated with nodal histopathology alone and in combination to find out the sensitivity, specificity, PPV and NPV. 3 different predictive models (PM) were devised and the incremental improvement in accuracy was determined.

RESULTS

PET positive N2 nodes were seen in 139 patients. Pathologically proven N2 disease was seen in 54 patients. 285 patients were negative for N2 nodal metastases. Predictive model (PM1) based on visual PET positivity showed sensitivity, specificity, PPV, NPV and accuracy of 70.3, 64.6, 27.3, 92 and 65.5 respectively. Predictive model (PM2) which combined visual PET positivity and N/A ratio >= 2 showed sensitivity, specificity, PPV, NPV and accuracy of 57.4, 92.2, 55.4, 91.9 and 85.8 respectively. Predictive model

(PM3) which combined visual PET positivity, N/A ratio >= 2 and HU < 75 showed sensitivity, specificity, PPV, NPV and accuracy of 55.5, 96.5, 75, 92 and 90 respectively.

CONCLUSION

Predictive model (PM3) which combined visual PET positivity, N/A ratio >= 2 and HU < 75 showed much improved accuracy in the preoperative diagnosis of mediastinal nodal metastases.

CLINICAL RELEVANCE/APPLICATION

Predictive model combining PET and CT parameters can identify N2 nodal involvement with high accuracy than either alone. The specificity and NPV appears excellent. However the sensitivity and PPV is only modest, demanding invasive nodal sampling especially in infectious endemic areas

SST06-05 FDG-PET/MRI versus Whole-Body MRI versus FDG-PET/CT versus Conventional Radiological Examination: Diagnostic and Prediction Capabilities for Postoperative Recurrence in Non-Small Cell Lung Cancer Patients

Friday, Dec. 6 11:10AM - 11:20AM Room: E353B

Participants
Yoshiharu Ohno, MD,PhD, Toyoake, Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, DAIICHI SANKYO Group; ;
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Yuji Kishida, MD,PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation

For information about this presentation, contact:

yohno@fujita-hu.ac.jp

PURPOSE

To compare the utilities of diagnostis and prediction for postoperative recurrence among FDG-PET/MRI, whole-body MRI, FDG-PET/CT and conventional radiological method in non-small lung cancer (NSCLC) patients.

METHOD AND MATERIALS

484 consecutive postoperative NSCLC patients (289 men, 195 women; mean age 69 years) prospectively underwent whole-body MRI, integrated PET/CTs and conventional radiological method as well as follow-up and pathological examinations. Then, all patients were divided into recurrence (n=42) and non-recurrence (n=484) groups based on pathological and follow-up examination results. 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. Then, diagnostic accuracy of postoperative recurrence was statistically compared each other by using McNemar's test. Finally, multivariate analysis was performed to determine predictors for postoperative recurrence.

RESULTS

Area under the curves (Azs) of PET/MRI (Az=0.99) was significantly larger than that of MRI (Az=0.97, $p<0.05$), PET/CT (Az=0.97, $p<0.05$) and conventional radiological examination (Az=0.94, $p<0.05$). When applied feasible threshold values, accuracy of PET/MRI (97.7%) was significantly higher than that of others (MRI: 96.3%, p=0.004; PET/CT: 94.8%, p=0.0001; conventional radiological method: 90.0%, $p<0.0001$). Accuracy of MRI was also significantly higher than that of PET/CT (p=0.02) and conventional radiological method ($p<0.0001$). Moreover, accuracy of PET/CT was significantly higher than that of conventional radiological method ($p<0.0001$). As the results of multivariate analysis for prediction of postoperative recurrence, histological subtype (p=0.005), tumor marker ($p<0.0001$), PET/MRI result (p=0.001) and conventional radiological method result (p=0.002) were determined as significant predictors.

CONCLUSION

FDG-PET/MRI has better potential for diagnosis of postoperative recurrence than others and considered as one of the predictors in postoperative NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/MRI has better potential for diagnosis of postoperative recurrence than others and considered as one of the predictors in postoperative NSCLC patients.

SST06-06 Radiomics Features of Lung Adenocarcinoma Based on 18F-FDG PET/CT for Predicting the Mutation Status of EGFR and Its Correlation Analysis with Prognosis

Friday, Dec. 6 11:20AM - 11:30AM Room: E353B

Participants
Bin Yang, MD, Dali, China (*Presenter*) Nothing to Disclose
Guangming Lu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Qian Ge, Philomont, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yangbinapple@163.com

PURPOSE

To investigate whether the radiomics features of 18F-FDG PET-CT in lung adenocarcinoma combining with relevant clinical

characteristics can predict the EGFR mutation status, and to explore the association with the prognosis of patients with different mutation status.

METHOD AND MATERIALS

A total of 174 patients with lung adenocarcinoma who received PET/CT scan and EGFR gene test were retrospectively analyzed. 1672 Radiomics features were extracted from PET/CT images using a Radiomics prototype (Frontier, VB10, Siemens Healthineers). The clinical and pathological datas were retrospectively analyzed and a combination of radiomics signature with clinical factors model was constructed using the Randon Forest (RF) method to identify EGFR mutants from wild types. The mutant/wild model was trained on a set of 149 patients and validated on an independent test group (n=35) using the AUC. A subset of 99 patients with EGFR mutation were further analyzed. The second model was built with RF classifier to predict 19/21 mutation site. The performance of training group (n=79) and test group (n=20) were evaluated by AUC. And then, and the COX proportional hazard model of multivariate analysis was established.

RESULTS

56.9% (99/174) of patients showed EGFR mutation. EGFR mutation of exon 21wa the most common mutation type (57/99) . We identified a combined radiomics signature and clinical factor model to discrimated between EGFR mutant and wild type in the training group (AUC=0.77) and the validation group (AUC=0.71). (Figure1)The performance of the second model for the identification of 19/21 mutation site reached an AUC of 0.82 and 0.73 in the training group and validation group, respectively. (Figure2) The average survival time of the mutant and wild-type patients was 54.653 months (95% CI:44.940 - 64.366) and 35.993 months (95% CI: 29.377 -42.608)respectively; the median survival time was 46 months (95% CI: 39.216-52.784) and 28 months (95% CI : 18.842-37.158) respectively. (Table1,2)(Figure3)

CONCLUSION

Radiomics features based on the 18F-FDG PET/CT combining with clinical pathological data could have the potential to predict EGFR mutation type, moreover, associated with patients' prognosis, thus providing reference for individualized molecular targeted therapy.

CLINICAL RELEVANCE/APPLICATION

Radiomics features based on the 18F-FDG PET/CT could have the potential to predict EGFR mutation type.

SST06-07 18F-FDG PET-CT Can Predict the Major Pathologic Response to the Neo-Adjuvant PD-1 Blockade in Resectable Non-Small Cell Lung Cancer

Friday, Dec. 6 11:30AM - 11:40AM Room: E353B

Participants
Xiuli Tao, Beijing, China (*Presenter*) Nothing to Disclose
Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie He, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Shugeng Gao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ning Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhijie Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jianming Ying, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yun Ling, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei Tang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate if 18F-FDG PET-CT has the potential to predict the major pathologic response to the neoadjuvant PD-1 blockade in resectable NSCLC patients.

METHOD AND MATERIALS

From March 2018 to March 2019, 35 patients with resectable NSCLC (the largest diameter of the pulmonary mass was 2.0 cm or larger) who were eligible to the open-label, single-center, single-arm phase Ib clinical trial with PD-1 blockade (IBI308) as neoadjuvant therapy treatment were enrolled. All patients received two doses of intravenous PD-1 blockade (at a dose of 200mg) every 2 weeks. PET-CT scan was performed before neoadjuvant therapy (baseline) and 4 weeks after the first dose (before surgery). PET responses were classified using PET response criteria in solid tumors (PERCIST). Peak standardized uptake values normalized by lean body mass (SULpeak) were measured, and post-treatment percentage changes in SULpeak (ΔSULpeak%) were calculated. The above metabolic information on FDG-PET was correlated with the surgical pathology.

RESULTS

After 4 weeks of neoadjuvant PD-1 blockade treatment, all 35 patients were under surgery, and the major pathological response (MPR, defined as 10% or less residual viable tumor) occurred in 13 of 35 resected tumors (37%). 13 patients (37%) showed partial metabolic response (PMR), 21 (60%) had stable metabolic disease (SMD), and 1 (3%) had progressive metabolic disease (PMD). There was a significant correlation between the pathological response and the PET responses which were classified using PET response criteria in solid tumors (PERCIST). All (100%) the partial metabolic response (PMR, ΔSULpeak% < -30%) tumors showed the major pathological response (MPR, defined as 10% or less residual viable tumor). The patient who had progressive metabolic disease (PMD, ΔSULpeak% > 30%) was progressive confirmed by the biopsy of the pleural metastasis.

CONCLUSION

18F-FDG PET-CT can predict the major pathologic response to the neoadjuvant PD-1 blockade in resectable non-small cell lung cancer.

CLINICAL RELEVANCE/APPLICATION

Metabolic responses by 18F-FDG uptake which were classified using PET response criteria in solid tumors (PERCIST) are significant associated with therapeutic response at 4 weeks after PD-1 blockade treatment. Even if morphological changes on CT scans are investigated to evaluate the response to PD-1 blockade at an early phase, it is difficult to distinguish between responders and non-

responders. Thus, the uptake of 18F-FDG PET-CT appears to be a promising biomarker for sift patients who probably benefit form immunotherapy.

SST06-08 Relationship between the Expression of PD-L1 and F-FDG Uptake in Advanced Non-Small Cell Lung Cancer (NSCLC)

Friday, Dec. 6 11:40AM - 11:50AM Room: E353B

Participants
Wang Huoqiang, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Zhao Long, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

whq2216@sina.cn

PURPOSE

Programmed cell death-ligand 1 (PD-L1) have been identified as novel targets of immunotherapy of lung cancer. To our knowledge, all published studies of the relationship between the 18F-FDG uptake of lung cancer and PD-L1 expression were performed in patients undergoing surgical resection. However, majority of reports have demonstrated the superiority of PD-L1 inhibitors as a therapy for patients with advanced lung cancer. The purpose of this study is to investigate the predictive value of 18F-fluorodoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) in evaluating PD-L1 expression in advanced non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

From January 2017 to December 2018, advanced NSCLCs were retrospectively identified in 154 consecutive patients who underwent 18F-FDG PET/CT scan and PD-L1 expression test. The histopathological results were confirmed by aspirated or biopsied samples. The maximum standardized uptake value (SUVmax) of 18F-FDG uptake were calculated for the primary lesion. Associations between quantitative continuous variables and PD-L1 expression were investigated by using the Mann-Whitney U test. This study was approved by the institutional review board of our hospital.

RESULTS

PD-L1 expression were identified in 77 patients (50%). PD-L1 expression of NSCLC occurred more frequently in larger lesions ($p = 0.039$), higher SUVmax value ($p = 0.019$), KRAS mutation-positive ($p = 0.048$). PD-L1 expression of adenocarcinoma (ADC) occurred more frequently in larger lesions ($p = 0.022$), higher SUVmax value ($p = 0.043$). The receiver operating characteristic (ROC) curve yielded area under the curve (AUC) values of 0.596 (95%CI, 0.506-0.686, $p = 0.039$) and 0.633 (95%CI, 0.509-0.756, $p = 0.043$) for NSCLC and ADC, respectively.

CONCLUSION

We demonstrated that higher 18F-FDG uptake may be helpful in predicting PD-L1 expression of advanced NSCLC, especially advanced ADC.

CLINICAL RELEVANCE/APPLICATION

For the first time, we demonstrated that PD-L1 expression were more frequent in advanced NSCLC with higher 18F-FDG uptake.

SST06-09 The Role of 18F-FDG SPECT/CT in Predicting Expression of PD-1/PD-L1 in Surgically Resected Non-Small Cell Lung Cancer (NSCLC)

Friday, Dec. 6 11:50AM - 12:00PM Room: E353B

Participants
Wang Huoqiang, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Zhao Long, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

whq2216@sina.cn

PURPOSE

Although 18F-fluorodoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) has been widely used, there are still many hospitals performing 18F-FDG single photon emission computed tomography/computed tomography (18F-FDG SPECT/CT) scan. In previous studies, 18F-FDG SPECT/CT was a reliable tool in evaluation of malignant tumours, which were concordant with 18F-FDG PET/CT. At present, some studies have demonstrated a correlation between PD-1/PD-L1 expression and SUVmax in NSCLC, but the relationship between PD-1/PD-L1 expression and T/NT value are not clear. The purpose of this study is to investigate the value of 18F-FDG SPECT/CT predicting expression of PD-1/PD-L1 in NSCLC.

METHOD AND MATERIALS

From July 2014 to May 2016, NSCLCs were retrospectively identified in 229 consecutive patients who underwent 18F-FDG SPECT/CT scan and PD-1/PD-L1 expression test. The histopathological results were confirmed by resected samples. Tumor-to-normal tissue (T/NT) uptake ratios of 18F-FDG were calculated for the primary lesion.

RESULTS

PD-1 and PD-L1 expression were identified in 120 patients (52.4%) and 81 patients (35.4%), respectively. PD-L1 expression occurred more frequently in males ($p = 0.013$), larger lesions ($p < 0.001$), higher T/NT value ($p < 0.001$), T3/4 stage ($p = 0.002$), III stage ($p = 0.002$). In multivariate analysis, T/NT was significantly associated with PD-L1 expression. PD-1 expression occurred more frequently only in patients with higher T/NT value ($p = 0.028$). The receiver operating characteristic (ROC) curve yielded area under the curve (AUC) values of 0.685 (95%CI, 0.615-0.756, $p < 0.001$) and 0.568 (95%CI, 0.512-0.659, $p = 0.025$) for PD-L1 and PD-1 expression, respectively.

CONCLUSION

We demonstrated that T/NT value of FDG uptake may be helpful in predicting PD-1/PD-L1 expression, which is consistent with results of 18F-FDG PET/CT. In some countries, 18F-FDG SPECT/CT scan is covered by medical insurance, while 18F-FDG PET/CT is not, which enhances the clinical value of 18F-FDG SPECT/CT scan for cost reasons.

CLINICAL RELEVANCE/APPLICATION

For the first time, we demonstrated that PD-1/PD-L1 expression were more frequent in NSCLC with higher T/NT value.

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