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Reduction in the Efficacy of Irreversible Electroporation for the Ablation of Colorectal Liver Metastases in the Presence of Metallic Objects Can Be Modeled with Computer Simulations

Thursday, Nov. 29 12:15PM - 12:45PM Room: VI Community, Learning Center Station #7

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CONCLUSION

Presence of metallic objects within 1 cm of the ablation zone increases risk of treatment failure following IRE of CRLM. Numerical simulations can be used to predict regions of treatment failure.

Background

Irreversible electroporation (IRE) is used for the focal ablation of colorectal liver metastases (CRLM). Metallic objects such as surgical staples or clips are often present in the vicinity of the tumor, affecting locoregional electrical conductivity. The aim of this study was to evaluate the effect of peri-tumoral metallic objects on the safety and efficacy of percutaneous IRE of CRLM.

Evaluation

Twenty five patients (12 women, 13 men) underwent IRE for the treatment of 29 CRLM (median diameter: 18 mm ± 13, range: 3-66 mm). Gender, tumor location, size, number of ablation probes, probe spacing, treatment voltage, pulse length, number of pulses and the presence of metallic objects within 1 cm of ablation zone were evaluated as determinants of local tumor progression (LTP) with the competing risks model (uni- and multivariate analyses). A subset of 9 tumors in 7 patients was evaluated using patient specific computer simulations to determine local electric field distribution and probability of cell death around the metallic object.

Discussion

Patients had a median follow-up of 25 months (range: 1-54 months), during which no IRE related complications were reported. Univariate analysis showed that tumor diameter >2 cm (p=0.003), probe spacing >20 mm (p=0.018) and presence of metallic implants (p=0.001) were significant predictors of time to LTP, but only the latter was found to be an independent predictor on multivariate analysis (sub Hazard Ratio=6.5, [95% CI: 1.99, 21.4], P=0.002). Absence of metallic implants from the ablation zone was associated with higher 12 month progression free survival 92.3% [56.6, 98.9] vs. 12.5% [2.1, 32.8]). Simulations indicated reduction of electric field strength and the probability of cell death in the vicinity of metallic implants. Distortions in electric field distribution were especially evident in the ablation margin, having good concordance with local recurrence on imaging.