

Abstract No. 504**Ex vivo evaluation of the effect of multiple electrode radiofrequency needle tip convergence on size of ablation zone**

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Purpose: Radiofrequency ablation (RFA) is an established therapy for treatment of malignancy in several organs, including the liver. One commonly used system, the Cool-tip Cluster Electrode, uses three parallel needles fixed in a triangular geometry. However, upon insertion, the final geometry of the needle tips can vary. In the case of converging needles, ablation volumes have been anecdotally observed to be smaller than expected. The study objective is to determine whether needle tip convergence significantly affects ablation zone in a bovine liver model.

Materials: Cool-tip Cluster Electrodes were used to perform RFA in an ex vivo bovine liver using a 3D-printed guide to produce: no, partial or full convergence of the electrode needle tips. Ablation time was 12 minutes. Cone beam computed tomography scans were obtained to verify needle positions. Time to first roll off and period between roll-offs was recorded. Gross pathology was performed to estimate ablation zone volumes.

Results: Preliminary results from the initial pilot experiment found partial needle tip convergence decreased ablation zone volume by 6.13 cm³ (40.3%), time to first roll-off by 5.16 minutes (36.1%), and average time between roll-offs by 16 seconds (25.5%) compared to no convergence. Full convergence resulted in ablation zone volume decrease by 10.3 cm³ (67.7%), time to first roll-off decreased by 5.45 minutes (39.5%), and the average time between roll-offs decreased by 13 seconds (31.4%) compared to no convergence.

Conclusions: Preliminary results suggest significant decrease in ablation volume and faster roll-off as the electrode tips increasingly converge. Further experiments are planned to test the study hypothesis with statistical significance. If confirmed, these results suggest confirmation of needle tip geometry prior to ablation should be performed clinically in order to ensure adequate ablation volumes when using Cool-tip Cluster electrodes.

Distance Between Electrodes (mm)	Diameter of Ablation Zone (cm)	Ablation Volume (cm ³)	Time to First Roll-Off (min)	Average Time Between Roll-Offs (sec)
4	4.4	15.21	8.53	51
3	3.4	9.08	3.37	38
0	2.5	4.91	3.08	35

Abstract No. 505**Image-guided radiofrequency ablation of benign thyroid nodules: a literature review**

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Purpose: The purpose of the study is to evaluate the efficacy, safety and utility of radiofrequency ablation (RFA) in the treatment of benign thyroid nodules (TNs).

Materials: Four health databases were screened using a search strategy including MeSH terms from 2000-2018: PUBMED, EMBASE, WEB OF SCIENCE, and COCHRANE. Reference lists were manually reviewed. Studies identified were screened in duplicate in three stages: title review, abstract review and full-text review to determine eligibility.

Results: In 28 studies including 2639 patients, the ability of RFA treatment to reduce the volume of benign TNs ranged from 49.7% after 6 months to 93.5% after 48 months. Initial nodule volume was not predictive of RFA efficacy as it did not appear to correlate with volume reduction, while lower percent of solidarity in nodules was. With regards to number of RFA treatment sessions, RFA energy delivered per nodule volume, and training of RFA operators, there were many differences in the studies with no consensus or significant superiority being demonstrated. Regrowth of incompletely treated TNs poses a disadvantage to RFA treatment, occurring in up to 5.6% of some studies. There were no reports of life-threatening events; however, minor side effects of pain and a sensation of heat as well as infrequent complications of voice change, hematoma, vomiting, and skin burns did occur. This is in contrast to surgery, the traditional treatment of RFA, which has significantly more complications.

Conclusions: RFA is an efficacious treatment of TNs with study results showing tremendous promise. Although some of the literature suggests treating smaller and cystic TNs with short and powerful sessions of RFA for greater efficacy, the effect of these factors still remains controversial. Further studies, with longer follow-up periods, are needed to continue elucidating the efficacy, safety, and techniques of RFA as well as the characteristics of TNs which would respond best to treatment. RFA might not necessarily replace surgery as of yet, although it would be a promising candidate. Instead, it can be an effective complementary or alternative treatment in TN management.

Abstract No. 506**Image-guided radiofrequency hyperthermia-enhanced direct chemotherapy of hepatic tumors: the underlying biomolecular mechanisms**

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Purpose: To evaluate the treatment effects of combined therapy using Doxorubicin and radiofrequency hyperthermia and expound the mechanism of local Chemotherapy under the heat-stress condition in vitro and in a rabbit VX2 liver tumor model

Materials: Institutional Animal Care and Use Committee approved all studies. In vitro experiments VX2 cell lines cultured and were randomly assigned to four treatment groups, namely. Group A, phosphate-buffered saline ($n = 6$); group B, 5 μ M Doxorubicin alone; group C, 42°C culture for 20 min ($n = 6$); and group D, 5 μ M doxorubicin plus under 42°C culture for 20 min ($n = 6$). The viability and doxorubicin uptake of VX2 tumor cells line were assayed by flow cytometer and fluorescence microscopy at 24h after different treatment. Western blot was used to evaluate the