Journal Roundup: Recent Developments in Tumor Ablation

June 08, 2005 | Tumor Ablation [1]
Journal articles published since the beginning of this year look at new treatment modalities, provide more evidence of ablation’s efficacy, and identify potential complications. Imaging technologies and combination therapies are also covered.

The State of RFA

Concepts, considerations, and concerns on the cutting edge of radiofrequency ablation


Daniel B. Brown of the Mallinckrodt Institute of Radiology reviews the status of RFA outside the liver and lung, compares outcomes with current clinical standards, and examines how differences in local tissue environments affect clinical success in kidney studies.

Electrodes and multiple electrode systems for radiofrequency ablation: a proposal for updated terminology

*European Radiology* 2005;15:789-808

A Belgian group proposes and describes a standardized terminology for the different types of RFA electrodes.

Image-guided tumor ablation: standardization of terminology and reporting criteria

*Radiology* 2005;235:728-739

A special report from Beth Israel Deaconess Medical Center supports the need to standardize terminology and reporting criteria to help foster appropriate comparisons between treatments that use different technologies. The report provides a framework for proposed terminology and reporting criteria, as well as methods for standardizing reporting.

Large-volume radiofrequency ablation of ex vivo bovine liver with multiple cooled cluster electrodes

*Radiology* 2005;234:563-568

A University of Wisconsin study compared three methods of creating large thermal lesions with cool-tip cluster electrodes: sequential ablation, simultaneous activation of electrodes, and rapid switching of power between electrodes. The study found that electrical interference between electrodes in the simultaneous method led to little heating at the center between the electrodes and
created small discontinuous lesions. Rapid switching between electrodes created large round lesions, substantially reduced treatment time, and resulted in more effective heating between the electrodes.

Liver Treatment

Early-stage hepatocellular carcinoma in patients with cirrhosis: long-term results of percutaneous image-guided radiofrequency ablation

*Radiology* 2005;234:961-967

An Italian study examined the efficacy of RFA as a first-line treatment for patients with hepatic cirrhosis and early-stage hepatocellular carcinoma. It followed for seven years 206 patients who were excluded from surgery. RFA was performed in 187 patients. In the intention-to-treat analysis, the study found one-, three-, and five-year survival rates of 97%, 71%, and 48%. The researchers concluded that RFA is an effective first-line treatment for cirrhotic patients with early-stage HCC.

Radiofrequency ablation of hepatocellular carcinoma: treatment success as defined by histologic examination of the explanted liver

*Radiology* 2005;234:954-960

The UCLA study retrospectively evaluated the effectiveness of RFA in treating HCC, using histologic examination of the explanted liver. It found that 35 of 47 ablated tumors, including 29 of 25 tumors less than 3 cm in size, were successfully treated. The histological evidence was found to validate RFA as an effective treatment of HCC that were less than 3 cm in size.

Radiofrequency thermal ablation of liver tumors

*European Radiology* 2005;15:884-894

The joint Italian-German study examined the success rates for treatment of liver tumors with RFA since 1990. It identifies RFA as a curative/effective treatment for HCC and recommends that it replace percutaneous ethanol injection as a therapy. The study reports a low complication rate from the procedure and identifies key elements in a strategy to minimize complication.

Kidney Treatment

Percutaneous radiofrequency ablation of renal tumors: technique, complications and outcomes


The clinical study from MD Anderson Cancer Center evaluates the safety, success rates, and effectiveness of percutaneous RFA for renal tumors. The investigators followed 88 overlapping ablations in 29 patients over three years and found that technical success was achieved in all cases: The primary tumor was completely ablated in 23 of the 24 patients in whom eradication was the goal. There were four major complications and two minor complications.

Radiofrequency ablation for tumor-related massive hematuria

This joint report from the National Institutes of Health and the Aultman Health Foundation/NEOUCOM determined that RFA targeting of the tumor-collecting system interface may be an effective treatment option for patients with transfusion-dependent kidney tumor-related hematuria. The study involved four patients; the gross hematuria resolved in all four within 24 to 48 hours of treatment.

MR imaging follow-up after percutaneous radiofrequency ablation of renal cell carcinoma: findings in 8 patients during the first 6 months

Radiology 2005;235:1065-1071

The study, tracking 18 patients six months after RFA treatment of renal cell carcinoma, found that although renal RFA zones increased in size within the first two weeks, they shrank during the remainder of the follow-up period.

New Uses and Methods for RFA

Advanced hepatocellular carcinoma: treatment with high-intensity focused ultrasound ablation combined with transcatheter arterial embolization

Radiology 2005;235:659-667

A Chinese study evaluated the efficacy of ultrasound-guided high-intensity focused ultrasound ablation combined with transcatheter arterial chemoembolization (TACE) in 50 patients. The researchers treated liver tumors 4 to 14 cm in diameter. They found reduced or eliminated blood flow to the tumors after the combination therapy, compared with TACE alone, and concluded that the treatment is promising but needs additional follow-up data.

Porcine liver: morphologic characteristics and cell viability at experimental radiofrequency ablation with internally cooled electrodes

Radiology 2005;235:478-486

In a Hong Kong-based study of the morphologic characteristics and cell viability of RFA zones in pig livers, researchers used internally cooled electrodes to produce 120 ablated zones with single or clustered electrodes, then measured each ablated zone. They report that the distance of ablation beyond the tip of the electrode was constant with different conditions of ablation and that complete cellular destruction was achieved in the white zone of the ablated area.

Prognostic factors for survival in patients with hepatocellular carcinoma after percutaneous microwave ablation

Radiology 2005;235:299-307

This Chinese study looked at the long-term survival and prognostic factors in 288 patients with 477 liver lesions who had been treated with microwave ablation over an eight-year period. The one-, two-, three-, four-, and five-year survival rates among all 288 patients were 93%, 82%, 72%, 63%,...
and 51%, respectively. The study concluded that microwave ablation provides a high probability of long-term survival in patients with a single lesion of 4 cm or less and class A cirrhosis.

Bipolar radiofrequency ablation in ex vivo bovine liver with the open-perfused system versus the cooled-wet system


Korean researchers studied the efficacy of bipolar RFA with open-perfused and cooled-wet electrodes. The cooled-wet electrodes generated a more spherical ablation zone than open-perfused electrodes. In addition, bipolar RFA with cooled-wet electrodes exhibited approximately double the power output and induced a larger volume of tissue coagulation than open-perfused electrodes.

### Imaging Technologies

Navigation with electromagnetic tracking for interventional radiology procedures: a feasibility study


A laboratory investigation assessed the feasibility of using preprocedural imaging for device navigation with electromagnetic tracking in phantom and animal models. It concluded that previously acquired CT, MR, or PET data can be accurately co-displayed during procedures with reconstructed imaging, based on the position and orientation of devices.

VX2 carcinoma in rabbits after radiofrequency ablation: comparison of MR contrast agents for help in differentiating benign periablation enhancement from residual tumor

*Radiology* 2005;234:423-430

An experimental study in Korea compared the accuracy of blood pool agent SH L 643A with gadopentetate dimeglumine in follow-up imaging of ablated tumors and determined that SH L 643A provides more accurate follow-up imaging.

Can we differentiate residual untreated tumor from tissue responses to heat following thermal tumor ablation?

*Radiology* 2005;234:317-318

Dr. S. Nahum Goldberg of Beth Israel Deaconess Medical Center assessed strategies for differentiating benign residual tissue and viable tumors after RFA. He references the Korean study recommending blood pool agent SH L 643A for follow-up studies.

### Combination Therapies

Combination radiofrequency ablation with intratumoral liposomal doxorubicin: effect on drug accumulation and coagulation in multiple tissues and tumor types in animals

*Radiology* 2005;235:469-477
The experimental study considered whether RFA combined with IV liposomal doxorubicin leads to increased tissue coagulation and drug accumulation more effectively than either treatment alone. After performing animal studies, the investigators concluded that the combination therapy did increase the treatment effect and may be useful for treating large tumors and achieving an ablative margin within the untreated tissue surrounded RFA-treated tumors.

Reduced tumor growth with combined radiofrequency ablation and radiation therapy in a rat breast tumor model

*Radiology* 2005;235:81-88

An experimental animal study appraised the efficacy of combined RFA and external-beam radiation therapy compared with either method alone. It found that the combination therapy resulted in complete local control in 82% of tumors, compared with 9% in the tumors treated with RFA alone and none in the tumors treated with radiation therapy alone.

Delivery of systemic chemotherapeutic agent to tumors by using focused ultrasound: study in a murine model

*Radiology* 2005;234:431-437

The Stanford University experimental study found that pulsed high-intensity ultrasound in the delivery of systemic liposomal doxorubicin to tumors was an effective method of targeting systemic drug delivery to the tumor tissue.

**Possible Complications from RFA**

Needle tract seeding after radiofrequency ablation of hepatic tumors


The Toronto-based clinical study evaluated the incidence and risk factors of needle tract seeding after RFA of liver tumors. It tracked 200 patients who underwent 298 treatment sessions over the course of four years. Both primary and secondary tumors were treated, and the needle tract was not routinely coagulated or embolized. The group found that 4% of patients experienced needle tract seeding. Statistically significant risk factors included treatment of subcapsular lesions, multiple treatment sessions, and multiple electrode placement.

Radiofrequency ablation of needle tract seeding in hepatocellular carcinoma


This brief report from the Institut Gustave Roussy describes the treatment of a 20-mm needle tract seeding found 10 months after initial RFA treatment of a 55-mm subcapsular hepatocellular carcinoma. The seeding was treated with RFA, and no recurrence was found after a two-year follow-up.

Bronchobiliary fistula after radiofrequency thermal ablation of hepatic tumor
A report from Korea on an instance of bronchobiliary fistula encountered after RFA of a metastatic liver tumor, which the researchers assume developed from collateral damage to the adjacent diaphragm and lung base as well as biloma formation at the ablation zone. The fistula was persistent on a two-month follow-up image.

A tamponade leading to death after radiofrequency ablation of hepatocellular carcinoma

The French report details a case of hemorrhagic cardiac tamponade after RFA of HCC. It suggests that discussion of better treatment options for lesions adjacent to cardiac cavities is necessary.

Disclosures:

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