AbstractID: 13067 Title: Electrode Displacement Strain imaging for monitoring in-vivo Ablative therapies

Purpose: Percutaneous RF ablation is evolving into an accepted minimally-invasive treatment for hepatic tumors. Monitoring and delineating the treated region is essential for its success. Ultrasound elastography can become a convenient and cost-effective means to delineate thermal lesion boundaries. This study assesses electrode displacement based strain imaging for monitoring abdominal RF ablation procedures that are difficult to monitor with conventional elastography

Method and Materials: Thirteen RF ablated regions were created in-vivo in pig liver. Radiofrequency echo signal data for strain imaging were acquired using a Siemens Antares clinical scanner immediately following RF ablation procedures. Small displacements were applied to the unconstrained end of the ablation electrode in-vivo, resulting in localized tissue deformation. Strain images were then compared to gross-pathology images of the same lesion along the two-dimensional imaging plane. Gross-pathology images were obtained by fixing the excised thermal lesion and slicing though the lesion, utilizing marks on the liver surface denoting the imaging plane and visual inspection of the electrode track.

Results: Cross-sectional area measurements of the thermal lesion obtained from the strain images were derived using both manual and automated segmentation. Areas were compared with cross-sectional area measurements from gross pathology images. Area measurements from strain images were highly correlated to areas measured on gross-pathology, where the linear correlation coefficients were $R = 0.894$, $P < 0.001$ and $R = 0.828$, $P < 0.001$, for the manual and automated segmentation, respectively.

Conclusions: Electrode displacement based strain imaging provides high contrast between ablated and normal liver tissue, allowing for clear delineation of the thermal ablation zone. This complements clinical ultrasound imaging, the preferred modality for real-time guidance for the placement of the RF needle into the tumor, allowing multiple imaging tasks to be performed with a single ultrasound machine.

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