2541. LITT Biopsy Artifact: Technical Considerations and Solutions

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Introduction

• The safety and effectiveness of laser interstitial thermal therapy (LITT) relies critically on the ability to continuously monitor ablation based on accurate, real-time temperature mapping of the region of interest.

• Currently, achieved by measuring phase change using a magnetic resonance imaging technique called MR Thermometry (MRT) which uses a gradient recalled echo (GRE) sequence to leverage six temperature-sensitive MR parameters (deSenneville 2007; Patel, 2016).

• GRE sequences are especially sensitive to susceptibility effects from air, blood, or other sources.

• During the process of biopsy blood and air causes a signal dropout effect during the ablation process.

• This artifactual phenomenon appears as greyed voxels where MRT is not acquiring thermal reads and involves the entire area of interest.
Case Report

- We present a case of a right-handed male in his 30s with a 3-year history of recurrent right frontal Glioblastoma Multiforme status post-chemotherapy and radiotherapy, who underwent a total of 6 core biopsies with standard aspiration technique for restaging, followed by LITT.

- During ablation, there was significant artifact that extended beyond the borders of the tumor making it difficult to assess the temperature within the tumor and at the borders during ablation.

- After the ablation, T1W and T2W MRI scans demonstrated blood and air within the ablated tumor.
Muner et al. suggested that when MRT signal artifact occurs, there is greater variation between intraoperative thermal damage estimate (TDE) and the ablated area seen on post-operative MRI (Munier, 2019).

We postulate that this minor artifact is due to presence of a small amount of air and blood introduced during biopsy or catheter exchange.

Similar to iron within heme molecules, the oxygen content of air is paramagnetic and can cause dephasing in T2* sensitive MR sequences, resulting in magnitude loss, phase shifts as well as geometric distortion during MR thermometry (Czervionke, 1988).

Discussion
Discussion

Recommendations:

• Considering the clinical need for a biopsy given the potential for artifact
• Ensure the speed of catheter exchange is slow which should prevent the risk of a significant air leak.
• Add a few mL of saline to tamponade and restore the local architecture.
• Find another sequence or scanning technique that would limit the artifact from blood and air such as spectroscopic imaging and water-fat proton chemical shift that do not depend on relative phase shifts may be less likely affected by the effect of susceptibility (Zhu, 2017).
Summary Points

• We present a case of a recurrent GBM that underwent biopsy and a signal dropout effect on MRT during ablation making it difficult to ascertain the extent of ablation.

• Potential solutions include introducing a small amount of saline to reconstitute the intra-tumoral environment, assessing the clinical need for biopsy, and additional computational techniques.
References


