



MAGNETIC RESONANCE GUIDED FOCUSED ULTRASOUND TO OPEN THE BLOOD-SPINAL CORD BARRIER AND GLIAL SCAR

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Abstract: Few methods currently prove effective in repairing a spinal cord injury (SCI) due to the inability to deliver therapeutics past the blood spinal cord barrier (BSCB) and glial scar. MRI guided focused ultrasound (MRgFUS) has been proven to effectively open the blood brain barrier (BBB) for chemical delivery, but few studies have been conducted quantifying the effect of MRgFUS on the opening of the BSCB and the glial scar that forms after injury. We sought to quantify the opening of the BSCB and glial scar in a rat injury model. To quantify opening, we compared contrast uptake at the site of injury/sonication, to a site 2 cm below that did not receive treatment. We found a significant increase in contrast uptake at the site of injury, which suggests that MRgFUS can open the BSCB and glial scar. However, there was not a significant increase in contrast uptake in rats with no SCI. This is most likely a result of the bone of the lamina and spinous process altering the ultrasound during the procedure. Our findings indicate the potential to use MRgFUS to increase access to the SCI, which may increase the effectiveness of drug and gene therapies.

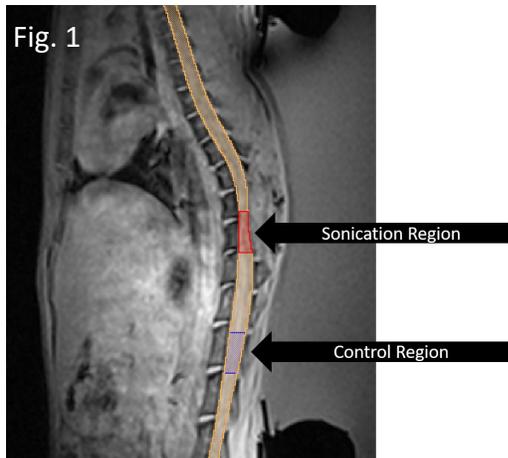


Fig. 1. MRI image of rat spinal cord overlaid with segmentation. The sonication and control regions are detailed by red and blue, respectively.

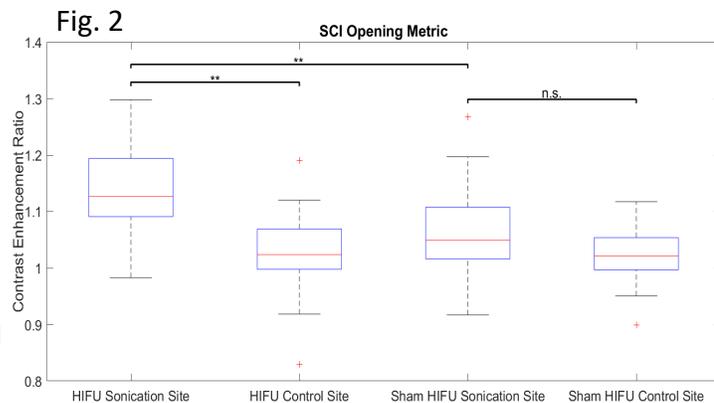


Fig. 2. Contrast enhancement of the spinal cord for rats with SCI for both the HIFU and sham HIFU procedures. The rats receiving HIFU experienced an increase in contrast enhancement by 14.13% at the site of sonication in comparison to just 2.59% at the control site. For the sham HIFU procedure, an average contrast enhancement of 5.04% and 2.31% was measured at the sonication and control site respectively. All t-tests were performed with a significance level of $\alpha = 0.01$.