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QUEnch assiSTed (QUEST) MRI Used as a Novel Approach to Identify Reactive Oxygen Species as a Result of Experimental TBI

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Intro:

Traumatic brain injury (TBI) generates reactive oxygen species (ROS), promoting inflammatory processes and impeding TBI recovery. Within the VA population, over 70% of military personnel that sustain a TBI receive opioid-based pain relief, however, opiates may actually exacerbate post-TBI complications through its documented recruitment of oxidative and inflammatory systems. Thus, we hypothesize that TBI and opioid treatment act synergistically to worsen post-TBI oxidative stress.

Methods:

Mice were exposed to either TBI or sham injury and administered morphine or saline in the acute post-injury period. Afterwards, neuroimaging was conducted using a novel technique, QUEnch assiSTed (QUEST) MRI, which compares standard MRI signals across mice that acutely receive an antioxidant "quench" therapy and those receiving saline as control. Therefore, differential MRI signals between these groups are an index of ROS generation. Changes in hippocampus and cortex signals were measured, as these structures are most commonly affected by TBI. Methylene blue and α-lipoic acid were used as antioxidants in the quenching step as they halt mitochondrial ROS production and scavenge excess ROS, respectively.

Results:

No significant changes in ROS levels were detected as a result of TBI, opioid exposure or their combination using QUEST MRI in either the cortex or hippocampus.

Conclusions and Future Directions:

While QUEST imaging did not yield significant changes between experimental groups, future work will include *ex-vivo* biochemical ROS analyses from harvested tissues, which will provide higher resolution quantification of oxidative processes than that of QUEST MRI.