



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Neuroimaging Biomarker Studies

Early Magnetic Resonance Imaging Detection of Mild Traumatic Brain Injury

The Defense and Veterans Brain Injury Center (DVBIC) estimates that approximately 297,000 Service members have received a diagnosis of mild traumatic brain injury (mTBI) between 2000-2016 (*DVBIC 2016*). Most individuals with a mTBI fully recover, but for those who do not, life dramatically changes in that they have difficulty returning to normal daily activities and work. Currently, computed tomography (CT) scanning is the imaging method used to assess mTBI and to guide decision making about further treatment. However, its low incidence of findings in the mTBI population and lack of evidence for use in all mTBI patients calls for a better diagnostic that can be used within hours of injury and that is more sensitive to the various subtle changes in the brain following injury. That better diagnostic may be magnetic resonance imaging (MRI), an imaging method proposed to be sensitive to the changes that occur in a mTBI.

Researchers in the National Institutes of Health Stroke Diagnostics and Therapeutics Section at the Center for Neuroscience and Regenerative Medicine (Bethesda, Maryland) have conducted an exploratory study to determine whether MRI could be used to quickly (within 48 hours of injury) assess mTBI specific structural changes in an acute setting and to distinguish traumatic from non-traumatic brain pathologies. To address these questions, the study team compared patients with suspected mTBI to patients with suspected minor acute stroke who presented to the emergency department at Suburban Hospital (Bethesda, Maryland).

The study demonstrated the feasibility of using a short MRI protocol in an acute setting; images taken within 48 hours of injury from 12 of the 22 suspected mTBI participants showed abnormalities consistent with this type of injury and they were specific to the mTBI group (*Chiara Ricciardi et al. 2017*) (Figure 1). Interestingly, of the 19 suspected mTBI patients who presented with a negative CT scan, nine had findings on MRI consistent with traumatic injury. Specifically, they had linear hypointensities on T2 weighted images and enhancement meninges on post-contrast fluid-attenuated inversion recovery MRI. In addition, in the suspected mTBI group, the researchers observed enhancement of the meninges, which are a series of membranes covering the brain and spinal cord. The specificity of these findings to the mTBI group may point to their utility as imaging biomarkers of TBI pathology and contradicts the prevailing notion that mTBI cannot be detected on early neuroimaging.

Although the size of the study precludes generalizing, the results are strongly suggestive of the feasibility and utility of using MRI in the acute stage of mTBI.

In conclusion, this study demonstrates the ability of MRI to detect abnormalities consistent with trauma-induced acute injury to the brain in patients with suspected mTBI within 48 hours of injury enabling rapid diagnosis of mTBI in the warfighter.





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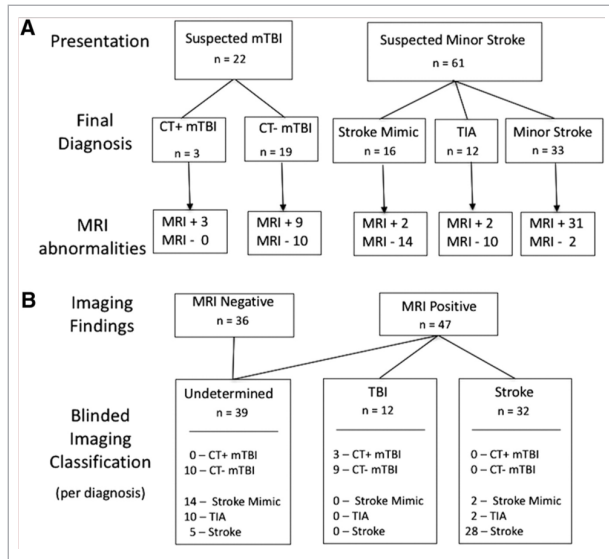


FIGURE 1: (A) Flow diagram of the enrolled patients, final clinical diagnosis, and number of patients with MRI abnormalities for each diagnosis. Of the 22 patients with suspected mTBI, three had complicated mTBI, showing evidence of brain injury on early CT scan. Sixty-one suspected minor stroke patients were included as a comparative non-trauma group. (B) MRI interpretation: of the 83 MRI examinations, 47 were read as positive. MRI abnormalities consistent with a diagnosis of trauma occurred in 12 in the group of suspected TBI patients and in 32 in the group of patients with suspected stroke-like symptoms. None of the suspected stroke patients were incorrectly classified as a TBI patient and none of the TBI patients were incorrectly classified as a stroke patient. Final diagnosis of ischemic stroke was confirmed in 28 of the 32 patients with positive MRI scans. (Figure from Chiara Ricciardi et al. (2017) used with permission from the authors)

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