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Mild Traumatic Brain Injury Implementing Data Mining Software

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Traumatic brain injury (TBI) is one of the most common injuries of combat in Iraq and Afghanistan. It is divided by severity into three injuries. (Fig. 1)

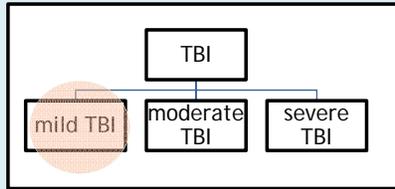


Figure 1. TBI divisions

- Exponential growth of military mild TBI (mTBI)
- Difficulties in mTBI detection
- Post-traumatic stress disorder (PTSD) and mTBI comorbidity

Research objectives

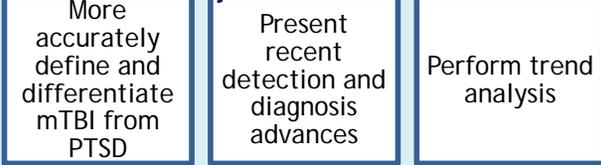


Figure 2. Research objectives

Methodology

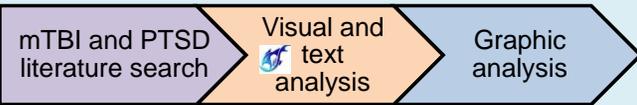


Figure 3. Three step methodology

Literature search

- mTBI in military
- detection methodologies
- mTBI with post-traumatic stress disorder

Visual and text analysis using Piranha

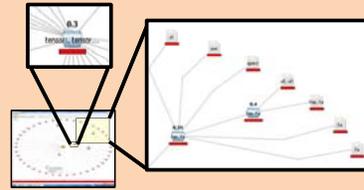


Figure 4. Piranha cluster showing diffusion tensor imaging (DTI) and fractional anisotropy (FA)

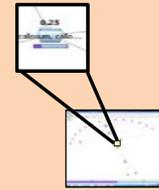


Figure 5. Piranha cluster showing corpus callosum (CC)

Trend analysis/graphics

- Genu (anterior CC) and splenium (posterior CC) injury (Fig. 6) - mild vs. moderate TBI (Fig. 7)
- FA change over time (Fig. 8)
- Mean diffusivity (MD) change over time

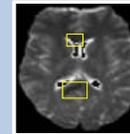


Figure 6: Genu and splenium mTBI Injury Rutgers et al. 2008

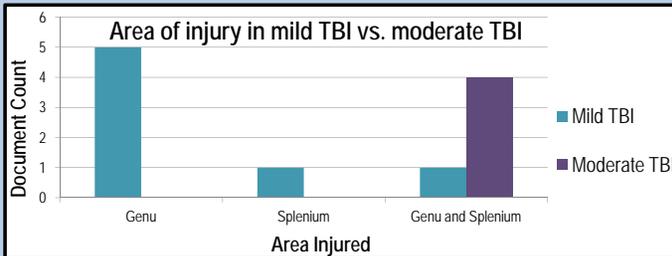


Figure 7. Chart of injury in corpus callosum for mild and moderate TBI (30 people average per study)

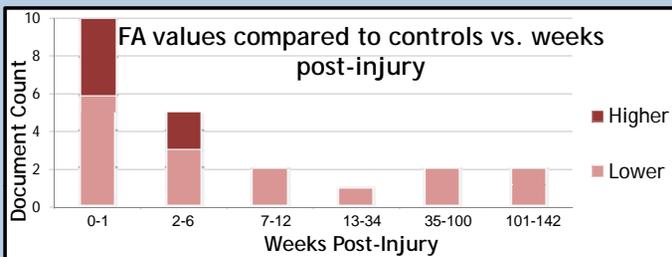


Figure 8. Graph showing counts of documents with FA values higher and lower than controls and weeks post-injury (22 people average per study)

Results

- DTI – detects DAI
- DAI - main TBI mechanism
- FA decreases over time – possible explanation = cytotoxic edema (Fig. 9)
- Injury location varies among mild and moderate TBI (genu/splenium of the CC)

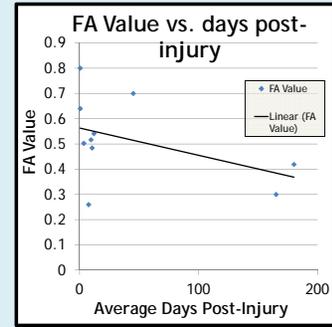


Figure 9. Graph of mTBI FA values over time, showing general negative correlation

Conclusions / Future research

	Higher than Control	Lower than Control	
FA	<ul style="list-style-type: none"> • Cytotoxic edema • Axonal swelling • Tract disruption • Myelin degeneration • Wallerian axon degeneration 	<ul style="list-style-type: none"> • Cytotoxic edema/axonal injury • Impaired axonal plasmatic transport 	<ul style="list-style-type: none"> • Potential mTBI indicators • Time frame of DTI metrics (Fig. 10) • Injury to only the genu of the CC • DAI may differentiate PTSD and mTBI
RD	<ul style="list-style-type: none"> • No myelin • Myelin degeneration 	<ul style="list-style-type: none"> • Myelin sheath water content • Decrease in extracellular water 	
AD		<ul style="list-style-type: none"> • Axonal damage 	

Figure 10. Chart of three DTI metrics and possible explanations for their changes

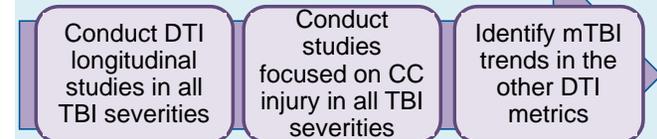


Figure 11. Future research

[DTI of White Matter]. Retrieved July 13, 2012 from <https://www.medical.siemens.com/webapp/wcs/stores/serve/PS/OctonProduct/DisplayView?catalogId=118&storeId=100010100788612724108495&storeId=118&productId=191673&productType=&storeId=10001>
[MRI of the Brain]. Retrieved July 13, 2012 from <http://www.medical.siemens.com/webapp/wcs/serve/PS/OctonProduct/DisplayView?catalogId=118&storeId=100010100788612724108495&storeId=118&productId=191673&productType=&storeId=10001>
Rutgers, D. R., F. Toussaint, J. Czeisler, P. Filard, P. Lajthai, & D. Ducreux. White matter abnormalities in mild traumatic brain injury: a diffusion tensor imaging study. *American Journal of Neurology* 29 (2008): 514-519.

