Project Title: Temporary Progression of Closed Globe Injury from Blast Exposure
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Background: Most eye injuries resulting from combat are the consequence of blast and blast fragmentation. Open globe injuries are typically easy to identify and immediately treated, but closed globe injury may not be immediately recognizable and can develop into visual dysfunction months or even years after the blast exposure. The progression of eye injury and vision degradation following blast exposure has not been well characterized, and it is unknown if there are early indicators that signify an increased risk for developing ocular/visual disorders.

Objectives: 1) Identify the probability of visual system injury from blast exposure that is not immediately identifiable using standard methods of care, and determine the time delay to presentation and diagnosis. 2) Characterize the progression of visual system injury from blast exposure. 3) Correlate changes in progression of visual system injury with blast severity. 4) Identify early markers for the development of visual dysfunction from blast exposure.

Hypothesis: Visual system injury from blast exposure may not be immediately identifiable and exhibits a temporal response that worsens with time. Also, early identifiers for visual system injury can assist in the diagnosis and detection of blast related eye injury.

Specific Aims: 1) Investigate the progression of visual system injury in service members exposed to a blast retrospectively through chart review, as well as prospectively; 2) investigate the progression of visual system injury following blast exposure in an animal model and identify early indicators of visual dysfunction; and 3) identify changes in vitreous protein expression that correlate with visual system injury.

Study Design: Dr. Coats proposes to investigate the ocular changes associated with blast and blunt injury to the eye through a retrospective chart review of military personnel who have experienced eye damage, to help create a prospective study of new patients with ocular injury who will be well characterized in terms of structural and functional aspects of vision. In parallel, the PI will use a blast injury model with rats that will be characterized in a similar functional and structural manner as military personnel, to determine the temporal course of events of blunt ocular trauma and to identify biomarkers of vision loss. Lastly, the PI will attempt to discover molecular biomarkers using cytokine array studies of the vitreous from eyes affected by blast injury.

Relevance: In the most recent war, 13% of service members in Operations Iraqi and Enduring Freedom have suffered ocular injuries. Using this present day percentage of injury and incorporating historical rates of inflation for medical care, the current estimate for short and long term care vision care for our soldiers will be 37 billion dollars. However, this estimate likely does not account for the number of service members that may have closed globe injury and are unaware of any visual difficulties. Developing screening parameters based on traumatic brain injury may not be sufficient to identify ocular trauma from a blast. Understanding the progression of eye injury from blast exposure and determining early indicators of visual degradation will be critical to the development of additional screening parameters for visual system injury. Furthermore, earlier diagnosis of injury will enhance the opportunity for treatments for mitigating the development of visual dysfunction. This will keep soldiers on active duty longer, decrease long term costs of vision care, and will overall improve the quality of life of our military personnel.