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Identifying technologies for rehabilitation of military traumatic brain injury [Abstracts]

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Identifying Technologies to assist Rehabilitation of Military Traumatic Brain Injury

Samantha L Wilson, Massimiliano Zecca, Matthew J Craner, Timothy J Hodgetts, David J Williams

Abstract—Traumatic brain injuries are heterogeneous in terms of their mechanisms, pathology, severity & treatment, with widely varying outcomes. Explosive blast injuries are the leading cause of TBI amongst deployed military personnel, with over sixty percent of blast injuries resulting in a TBI. TBI symptoms are broad-spectrum with long-term physical, cognitive, behavioural & emotional consequences. Military injuries result in unique & clinically challenging pathologies which complicate patient diagnosis, classification, treatment & rehabilitation. Improved interventions & use of novel technologies & multidisciplinary teams have the potential to address the concerns regarding the rehabilitation of TBI military veterans for previously un-survivable conditions.

I. INTRODUCTION

A Traumatic brain injury (TBI) is “an alteration in brain function or other evidence of brain pathology, caused by an external force” [1]; often referred to as the “signature wound” or of modern warfare [2]. Approximately 330,000 military personnel sustained combat-related TBI in the Iraq & Afghanistan conflicts [3], primarily due to increased frequencies of explosive blast attacks. Improvements to personal protective equipment [2]; tourniquet use [4]; better resuscitative techniques [5] & pre-hospital care [6]; coupled with highly efficient evacuation procedures have increased patient survivability of previously fatal wounds, in particular with regards to blast injuries. This has led to a new population of survivors with complex injuries including co-morbidities &/or polytrauma.

II. OBJECTIVE

To formulate a technology strategy for improved rehabilitation of both motor and cognitive impairments of military TBIs by determining key science & technology challenges & opportunities.

III. RESULTS

Eight overlapping & interrelated areas/needs for further research were identified (Figure 1).

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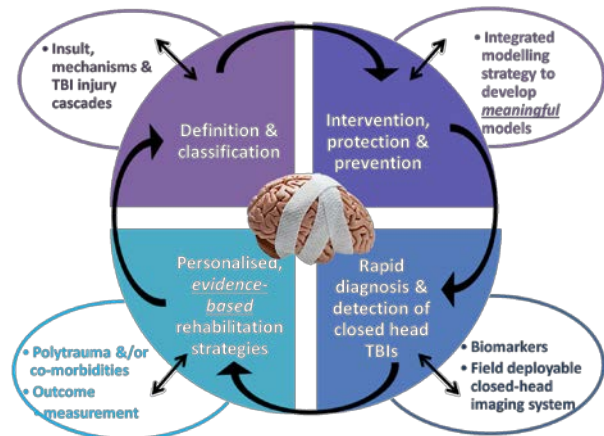


Figure 1. Key science & technology challenges related to military TBI

IV DISCUSSION & CONCLUSION

Overlapping symptoms & delayed clinical manifestations confuse precise epidemiological description of TBI, delivery of appropriate clinical management, & development of rational research strategies [1]; highlighting the need for objective diagnostic tools, able to classify TBI by incorporating pathological, clinical & mechanistic factors, whilst providing insight into TBI phenotype. Multi-disciplinary teams guided by clinicians from multiple specialisms, need to be assembled, to design, develop & establish useful & human-relevant blast models. Repair interventions including regenerative medicine, neuronal & bionic devices must be accounted for in rehabilitation strategies & *vice versa*. Personalized therapeutic intervention which utilizes bio-robotics & neuroprostheses as biomarkers of TBI have potential for the improved assessment & diagnosis of TBI; whilst assisting rehabilitation strategies by providing accurate monitoring & quantification of neural gain & improved outcomes.

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