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ORIGINAL ARTICLE

Mild traumatic brain injury (mTBI) among UK military personnel whilst deployed in Afghanistan in 2011

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Abstract

Introduction: mTBI has been termed the 'signature injury' of recent conflicts in Afghanistan and Iraq. Most mTBI research uses retrospective accounts of exposure and point of injury symptoms; mTBI is reportedly less common among UK than US Forces.
Methods: This study examined the rate of mTBI exposure and symptoms in 1363 UK military personnel deployed in Afghanistan in 2011 using a self-report questionnaire. Data were collected in the operational location during the 5th month of a 6-month deployment. Personnel reported injuries and symptoms related to six events including fragmentation, blast, bullet, fall, motor vehicle accident and 'other' exposure.
Results: Eighty (5.9%) reported at least one potential mTBI exposure during the current deployment and 1.6% ($n = 22$) reported injury and one or more mTBI symptoms (1 year incidence rate = 3.2%). Higher PTSD symptom scores were significantly associated with reporting potential mTBI ($p \leq 0.001$) and mTBI with symptoms ($p \leq 0.001$).
Conclusion: This study used contemporaneous data gathered in the deployed location which are subject to less memory distortion than studies using post-deployment recall. The incidence of mTBI was substantially lower than those reported in both US and UK post-deployment studies which is consistent with inflated reporting of symptoms when measured post-deployment.

Keywords

Concussion, cultural, evaluation, head injury, mild brain injury, neuropsychiatric

History

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Introduction

Mild traumatic brain injury (mTBI) is a term used to describe symptoms that may occur following head trauma resulting from direct impact or from being in close proximity to a blast. mTBI can be considered when one or more of the following conditions are reported following head injury: confusion or disorientation, amnesia around the time of the injury, loss of consciousness for up to 30 minutes and neurological or neuropsychological impairment [1]. mTBI is a substantial concern for US Armed Forces and has been frequently designated the 'signature injury' of the recent Afghanistan and Iraq conflicts by US media and researchers [2]. Overall, the reported rate of sustaining mTBI is ~23% in US soldiers who deployed to Iraq and/or Afghanistan [3]; with the highest rates of clinician confirmed injury found amongst US combat personnel (22.8%) [4] and substantially higher rates in those sustaining combat injury (~59%) [5]. Rona et al. [6] evaluated mTBI in UK personnel who were asked about their previous deployment. The prevalence of symptomatic mTBI was lower than that reported in US military studies (4.4%, 9.5% in combat personnel); furthermore, symptoms of current post-traumatic stress disorder (PTSD) and alcohol misuse were both associated with mTBI. Post-concussion symptoms (PCS) were not associated with reported potential mTBI injury and symptoms of mental disorder often pre-dated mTBI.

The widely voiced claim that mTBI is the 'signature injury' of the Iraq and Afghanistan conflicts draws parallels with the controversy over shell shock, which might be designated the 'signature injury' of World War I. The conceptualization of mTBI as 'a signature injury' has been challenged by international researchers and re-appraised, particularly in the UK, in much the same way as the evolution of the debate about and re-conceptualization of shell shock. Physicians initially felt that shell shock was the product of head injury or toxic exposure; as the war continued, both psychological and social factors were increasingly implicated in the aetiology and outcome of shellshock [7]; ultimately, characteristic diagnostic criteria and aetiology were not identified or confirmed. There are striking parallels between the history of shell shock and the current debate regarding mTBI [8–11]. The costly post-World War I experience of the UK armed forces, in war pension claims and expensive

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initiatives designed to treat chronic cases of shell shock, highlights the unintended consequences of designating an injury as 'signature' when the aetiology and characteristics are subject to debate.

Research looking at this topic has consistently related mTBI symptoms to events that happened during the most recent deployment. Most UK and US epidemiological mTBI research relies on self-attribution of a link between retrospective accounts of head trauma, peri-traumatic psychological effects and current symptomatology. To lessen the possible influence of memory distortion, this study estimates the rate of reporting of potential mTBI and mTBI with symptoms amongst a cross-section of deployed United Kingdom Armed Forces (UK AF) personnel in Afghanistan using contemporaneous data.

Methods

The mTBI questions formed a sub-section of an operational survey which was powered on the 12 item General Health Questionnaire to detect a common mental disorder prevalence of between 18–22% with a confidence level of 95% amongst 10 000 personnel deployed in Afghanistan, giving a target sample size of 1332.

Data were collected using a self-report questionnaire from personnel in their operational location during the 5th month of a 6-month deployment to Afghanistan in 2011. The survey completion was supervised by a member of the survey team and was conducted at a large number of frontline locations including patrol bases and checkpoints. To assess potential mTBI, the survey utilized questions modified from the Brief Traumatic Brain Injury Screen previously used to assess mTBI in a UK AF sample [6]. The question stem was: 'during this deployment, have you received any injuries as a consequence of the following: fragmentation, round (bullet), fall, blast, direct head injury and motor vehicle accident (MVA)?'. In addition, the survey contained a freetext option where personnel could record any injuries arising from other sources. These were subsequently classified by the survey team as injury occurring proximal to the head and neck or a direct blow to the head vs all other injuries. One hundred and thirty-six personnel reported an injury under the 'other injury' freetext option; however, 129 injuries were excluded as they were deemed to have no risk of head trauma and included symptoms experienced as a result of heat and dehydration, sports injuries not involving the head and so forth. A second mTBI question enquired about symptoms related to any of the reported injuries including: being dazed, confused or seeing stars; not remembering the injury; loss of consciousness and headache and/or dizziness. Personnel were also asked to state the duration of any loss of consciousness. The survey included the Post Traumatic Stress Disorder Checklist Civilian Version (PCL-C) [12, 13]. The cut-off score for probable caseness on this measure was $\geq$50.

Reporting one or more mTBI symptoms (concussion, amnesia, loss of consciousness and headache/dizziness) indicated the presence of probable mTBI symptoms and this was treated as a binary categorical variable indicating symptoms present vs no symptoms for the purpose of analysis. As the number of PTSD cases (personnel reporting PCL-C cut off scores $\geq$50) in this study was small, the PCL was analysed as a continuous measure. As PCL data were not normally distributed, the differences in median PCL-C scores between those reporting probable mTBI exposure, mTBI symptoms and those who reported neither were assessed with the Mann-Whitney U-test with an estimation of effect size. Categorical data were analysed using Pearson's chi square test. Frequencies and percentages are presented.

Ethical approval for this study was granted by the Ministry of Defence's Research Ethics Committee.

Results

The final sample size was 1363 UK military personnel (response rate = 95.6%), representing ~17% of the deployed force and marginally greater than the projected sample size. Eighty (5.9%) of the surveyed personnel reported at least one potential mTBI exposure; overall, a total of 95 such injuries were reported, with some personnel reporting more than one injury. Twenty-two personnel reported at least one mTBI symptom associated with the potential mTBI exposure (27.5% of personnel exposed to a potential mTBI event; 1.6% of all personnel surveyed). The rate of mTBI symptoms in front line combat personnel ($n = 706$) was 2.1% ($n = 15$) and 1.0% ($n = 7$) in all other personnel ($n = 657$); the difference in the rate between the two groups was non-significant ($\chi^2 = 2.40$, df = 1, $p = 0.12$). The most frequently reported symptom was being dazed, confused or seeing stars; there were no reports of amnesia. All personnel who lost consciousness ($n = 6$) did so for less than 5 minutes. The detailed symptoms, symptom counts and probable mTBI exposures are detailed in Table I.

Twenty-four (1.8%) personnel in this study reported symptoms of probable PTSD. PCL-C scores were significantly higher amongst those who reported mTBI symptoms (Mdn = 27.5) than amongst those who did not (Mdn = 25.0)

Table I. Possible mTBI exposure, symptoms and symptom counts.

	n (%)*
Potential mTBI exposure ($n = 1363$)	
Sustained a physical injury as a consequence of:	
Fall	31 (2.3)
Blast	15 (1.1)
Motor Vehicle Accident	14 (1.0)
Fragmentation	14 (1.0)
Direct Head Injury	12 (0.9)
Other Injury with Possible Head Trauma	7 (0.5)
Small Arms Round (Bullet)	2 (0.2)
Total	95 (7.0)**
mTBI symptoms ($n = 80$)	
Following the injury experienced:	
Dazed, Confused or Seeing Stars	17 (21.3)
Loss of Consciousness (Knocked out)	6 (7.5)
Headache or Dizziness	10 (12.5)
Amnesia (Regarding the injury)	0 (0.0)
Number of symptoms in personnel reporting a probable mTBI injury ($n = 80$)	
No Symptoms	58 (72.5)
One Symptom	10 (12.5)
Two Symptoms	10 (12.5)
Three Symptoms	2 (2.5)

*Column totals may not sum to sample totals due to missing data.
**Some personnel reported more than one exposure, 80 (5.9%) of the deployed force reported exposure to at least one potential mTBI event.

($U = 7210.0$, $z = -4.18$, $p \leq 0.001$, with a small effect size $r = 0.11$). PCL-C scores were also significantly higher amongst those who reported probable mTBI exposure (Mdn = 25.5) than amongst those who did not (Mdn = 20.0) ($U = 31531.0$, $z = -5.85$, $p \leq 0.001$ with a small effect size $r = 0.16$). There were no significant differences in PCL-C scores between those reporting mTBI symptoms and exposure (Mdn = 27.5) and those reporting mTBI exposure alone (Mdn = 25.0) ($U = 512.5$, $z = -1.56$, $p = 0.18$).

Discussion

This study reports the results of an evaluation of UK AF personnel surveyed in their deployment location in Afghanistan. The main finding was that the reported rate of potential mTBI exposure with symptoms was 1.6% and the difference in the rates between combat and all other personnel was not statistically significant. Given that the data was collected at the end of a 6-month deployment and none of the participants had deployed in the 6-months prior to the current deployment, this gives a 1 year incidence of 3.2%.

Study limitations

As with all self-report studies, this study was unable to confirm the reported exposures, nor could it confirm possible symptoms in the absence of a clinical examination. The data are cross-sectional and so there is limited ability to infer cause between any of the studied variables. Although the data were collected during deployment, which is considered a strength, we cannot rule out the effects of variable lengths of time between injury and data collection; however, this is more likely to be shorter than in other post-deployment mTBI studies and, therefore, less subject to memory distortion. Although this survey sample contained personnel who remained deployed following a physical injury, we were unable to survey those who had been evacuated for further medical treatment, amongst who the rate of mTBI with symptoms may have been higher.

The rate of probable mTBI exposure and symptoms found in this study was substantially lower than previous estimates of probable mTBI in UK AF personnel. Rona et al. [14] found that the reported rate of probable mTBI injury with symptoms related to the most recent 6-month deployment was 4.4% overall, whereas the prevalence in combat personnel was 9.5%. As combat exposure reportedly increases the risk of mTBI [15] and exposure to blast is an important precursor of mTBI [16], US Forces have invested in the early identification and treatment of mTBI in deployed personnel. They have established in-theatre services for those in close proximity to blast on multiple occasions in an attempt to screen for and mitigate the effects of potential mTBI [17]. UK medical command has taken pro-active steps to investigate psychological symptoms in those sustaining a serious head injury during deployment and offers a treatment service for those exhibiting persistent concussion symptoms through expert advice to treating physicians or residential medical rehabilitation depending on the severity and persistence of symptoms [18]. UK commanders have yet to adopt the same level of deployed clinical resources dedicated to detecting mTBI as their US counterparts.

Although gathered some years after [14] completed data capture, the data appear to be commensurate with the notion that the reporting of probable mTBI symptoms may be inflated when measured post-deployment compared to in-theatre data capture, an effect that has also been reported in US studies [19]; this may be related to memory distortion [20] or the influence of current mental health symptoms [21]. The frequency of PTSD symptoms amongst personnel participating in this study was also low at 1.8% compared to ~4% in the King's Centre for Military Health Research's cohort study of UK military personnel [22, 23]. It is suggested that those with more substantial injuries might be evacuated from theatre and would not, therefore, be represented in the deployment sample, whereas they could be enrolled in a post-deployment or cohort study; however, the overall numbers of seriously injured UK personnel evacuated from deployment is relatively low. Most published studies report an association between PTSD and mTBI [24] and whilst this study did not have sufficient PTSD cases to adequately assess such an association, significantly higher PTSD symptom scores were found amongst those reporting probable mTBI exposure with symptoms than amongst those not reporting them; PTSD symptom scores were also significantly higher amongst those reporting potential mTBI exposure than amongst those who did not. In those reporting probable mTBI symptoms related to potential mTBI exposure, the median PTSD scores were of a similar magnitude to those reporting potential mTBI exposures alone, suggesting that potential mTBI exposure alone may have a role to play in the development of PTSD symptoms and that there may be a substantial inter-play between potential mTBI exposure and PTSD; researchers evaluating mTBI in US veterans have noted that combat stress symptoms are often associated with mTBI symptoms [25]. This survey sample constituted ~17% of UK AF deployed in Afghanistan at the time of the survey and, although personnel reporting mTBI exposure and symptoms may represent a minority in the deployed force overall (potentially ~130 personnel), all of those surveyed were carrying out their operational tasks. This study is likely to be considerably less confounded by memory distortion than post-deployment studies as the data were gathered relatively close to the time of injury in the deployed location and towards the end of the 6-month combat deployment.

Conclusion

Both potential mTBI exposure and probable mTBI symptoms amongst UK service personnel serving in exposed locations in Afghanistan in 2011 were relatively uncommon and lower than levels found in a previous study of UK personnel carried out after deployment. Given the relatively small numbers of personnel identified, little evidence was found to suggest that a specific mTBI screening service is required in the deployment area. In keeping with other research outcomes, an association was found between PTSD and probable mTBI with symptoms and it is suggested that further research may be required to clarify the nature of this relationship. At present, the UK policy of focusing treatment on those with moderate or severe TBI and persistent post-concussion syndrome following head injury in combination with other rehabilitation strategies, rather than in-theatre intervention, is supported by the data. The data also suggest that caution is needed in screening for the presence of probable mTBI after deployment, as reporting of exposure and symptoms are likely to be substantially inflated.

Declaration of interest

N.G. and M.F. are full-time members of the UK Armed Forces. N.J. is a full-time reservist. N.G., M.F. and N.J. are currently seconded to King's College London. N.T.F., S.W. and M.J. are employed by King's College London which receives funding from the UK Ministry of Defence. S.W. is also an honorary civilian consultant advisor in psychiatry to the British Army and is a trustee of Combat Stress, a UK charity that provides service and support for veterans with mental health problems. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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