



Defense Health Agency

Defense and Veterans Brain Injury Center

“Clinical Updates in Brain Injury Science Today [CUBIST]” Podcast

“Self-Reported Concussion Symptomology during Deployment: Differences as a Function of Injury Mechanism and Low-Level Blast Exposure”

Total Run Time: 10:48

Host: Ms. Amanda Gano

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Gano: The views, opinions, and findings contained in this podcast are those of the host and subject matter experts. They should not be construed as official Department of Defense positions, policies, or decisions unless designated by other official documentation.

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Gano: Hi. Welcome to Clinical Updates in Brain Injury Science Today, or “CUBIST,” a podcast for health care providers about current research on traumatic brain injury, also known as TBI. This program is produced by the Defense and Veterans Brain Injury Center, otherwise known as DVBIC. I'm your host today, Amanda Gano.

In this episode of CUBIST, I'll be talking with Dr. Donald Marion. Dr. Marion is a neurosurgeon and senior TBI consultant at DVBIC. Don and I will discuss a study entitled “Self-Reported Concussion Symptomology during Deployment: Differences as a Function of Injury Mechanism and Low-Level Blast Exposure” by Jennifer Belding and colleagues, and published in the Journal of *Neurotrauma* in May 2020.

Gano: Hi Don, thanks for bringing this article to our attention. What were the goals of the study?

Marion: Hi Amanda. So this study was designed to address two research questions. First, are blast-induced mild traumatic brain injuries (mTBI) associated with significantly more symptoms than impact-induced mild traumatic brain injuries? And the second question was, are mild traumatic brain injuries associated with increased symptom reporting among service members in occupations that involve low level blast exposure?

Gano: Interesting. So, what did they find?

Marion: So, Marines who screened positive on the Post-Deployment Health Assessment, or PDHA, for having had a mild traumatic brain injury while deployed reported more musculoskeletal, immunologic, and neurologic symptoms with the strongest increases in neurologic symptom reporting. Furthermore, symptom reporting was significantly higher when the mechanism was blast as opposed to impact, particularly for neurological symptoms. So, in short, blasts caused a lot more neurological symptoms than one would have expected.

In addition, Marines who screened positive for mild traumatic brain injury and were working in high-risk occupations reported significantly more neurological and musculoskeletal symptoms, but fewer immunological symptoms, than those working in low-risk occupations. And by low-risk and high-risk, I'm referring to low and high of low-level blast exposure. And I'll talk more about that. Interestingly, the increases in neurological symptoms for which Marines sought care during deployment occurred in both the presence and absence of a probable mild traumatic brain injury

based on their responses on the PDHA, which suggests that low-level blast is independently associated with neurological injury. And that's with-or-without a mild traumatic brain injury. While the effects of low-level blast are expected to be small and subclinical in nature, it is important to note that even relatively small effects can be practically significant for warfighter health and readiness, especially in critical situations in battle and thus warrant attention.

Gano: Wow Don, that's really interesting. I know that low-level blast exposure is something that is of major interest to our clinical community and our service members. So how exactly was this study done?

Marion: So, as I said, the Post-Deployment Health Assessment, or PDHA, data was obtained from 12,013 active-duty enlisted U.S. Marines deployed between 2003 and 2012. So this was a significant number of Marines that they were looking at, Amanda. All had completed an mTBI screen and could be classified as at high-or-low risk for low level blast exposure based on their military occupational specialty, or MOS. The PDHA is a carefully designed health assessment questionnaire that all service members are required to complete within 30 days of return from deployment. It includes several questions about demographic characteristics and deployment exposures, such as blast or motor vehicle crash, as well as an mTBI screen. The PDHA also assesses whether Marines sought care for various symptoms experienced during deployment, specifically whether they were seen in sick call, they were placed on quarters or given light duty, and whether they were still bothered by symptoms. For purposes of this study, these symptoms were grouped into three categories: neurological, musculoskeletal, and immunological.

Amanda, I think that the neurological and musculoskeletal symptoms are fairly straight forward following trauma and are well known to the listener. The immunological symptoms included difficulty breathing, cough, runny nose, fever, weakness, red eyes, chest pain, and skin diseases or rashes. Marines were also grouped according to high vs. low risk of low-level blast exposure based on their MOS. Occupations considered high-risk included ammunition and explosive ordnance disposal, field artillery, and infantry. Occupations considered low-risk for low-level blast included aviation logistics, communications, and food service, among several others. In this cohort, 7,180 Marines had relative high-risk for low-level blast occupations, and 4,833 had relatively low-risk for low-level blast occupations.

The group was predominantly male, more than 95 percent, and were disproportionately in the E-3 or E-4 pay grades approximately 70 percent. Few Marines in the sample, that is only about six percent, had been hospitalized during deployment, suggesting that most did not sustain TBIs above mild in severity.

Gano: That's interesting, I do have a couple of questions Don. So, if I understand you correctly, all of the Marines included in this study had a history of deployment related mTBI, and those Marines who also served in occupations that were at high-risk for low-level blast exposure had worse outcomes than those who didn't following an mTBI. Am I correct?

Marion: Good question Amanda. Actually, that is not exactly true. Not all service members who complete the PDHA also complete the mTBI screen, which are questions 10a, 10b and 10c on the Department of Defense Form 2796. I suspect, Amanda, you filled out a similar form following your deployment. The sample of 12,013 Marines were selected because all had completed question number 10. What is a bit confusing from this paper is that some of the Marines screened negative, meaning that their responses to question a, b, and c suggest that they had not had an mTBI or mild traumatic brain injury. Unfortunately, I could not find what that number or percentage of the entire group was by reading through the paper. But getting back to your original question, the investigators did find that low-level blast exposure was associated with increased and prolonged neurologic symptoms in Marines who screened positive or negative for an mTBI.

Gano: I know that PTSD is associated with mTBI in the military. Is possible that posttraumatic stress may play a role in the development of the self-reported symptoms and potentially confound these results?

Marion: You know, I wondered that myself, Amanda. In order to address this concern though, they repeated their analyses while controlling for probable posttraumatic stress disorder, and all effects and their interpretation were consistent with those that they reported.

Gano: Oh, gotcha. So, what were the limitations of the study?

Marion: So there are several. First, although it is policy for Marines to complete the PDHA within 30 days of return from deployment, previous research has demonstrated that those who fail to complete it are at significantly higher risk for TBI, suggesting that the results reported here may underestimate the true prevalence and effects of mild traumatic brain injury among service members. Secondly, the mild traumatic brain injuries examined were identified by self-report rather than an official clinical diagnosis. A direct comparison of symptom reporting among service members with clinically diagnosed blast TBIs and impact TBIs, including that which can control for the mechanisms of blast injury that is primary versus secondary, to healthy controls is clearly warranted.

Gano: Gotcha. So, what were the key take-a-ways? What do you want providers to take away from the study?

Marion: Amanda, I found the most interesting findings were the apparent independent effects of the mechanism of injury, blast vs. Impact, as well as the daily exposure to low level blast, on the likelihood of prolonged neurologic symptoms after a concussion. And in the case of the occupations or MOSs that require frequent exposure to low level blast, the Marines were often symptomatic even without a history of mild traumatic brain injury. Clearly, the provider needs to consider the past exposure to low level blast when evaluating a service member who presents with deployment related headaches, dizziness, balance difficulties, or other neurologic symptoms that otherwise would have been related to a traumatic brain injury.

Gano: Yea, taking that history of blast exposure is really important. Thanks Don, that's really interesting. Unfortunately, that's all we have time for today.

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"CUBIST" is produced and edited by Vinnie White and was hosted today by me, Amanda Gano. It is a product of the Defense and Veterans Brain Injury Center, led by Division Chief Captain Scott Pyne, Medical Corps, United States Navy.

Thank you for listening to this episode. Next time, we will discuss TBI research getting attention in the mainstream press.

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