



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Neurocognitive and Psychological Health Outcomes Symptom Trajectories after Military Blast Exposure and the Influence of Mild Traumatic Brain Injury

The link between post-concussive syndrome (PCS) symptoms and blast-related mild traumatic brain injury (mTBI) is unclear, and longitudinal symptom data are sparse. The objective of this work, conducted by researchers at Virginia Commonwealth University School of Medicine (Richmond, Virginia) and the Hunter Holmes McGuire Veterans Affairs Medical Center (Richmond, Virginia), was to characterize post-deployment symptom levels and trajectories and to determine their relationship to blast-related mTBI.

A total of 216 participants within two years of a combat-related blast exposure underwent structured interviews or algorithmic questionnaires related to blast-related mTBI. Detailed symptom inventories for PCS, pain, posttraumatic stress disorder (PTSD), and depression were taken serially at enrollment, six months, and 12 months later. Repeated-measure analysis of variance models were built.

Up to 50 percent of participants had at least one high-grade blast mTBI with posttraumatic amnesia (PTA), 31 percent had low-grade only, and 19 percent had neither. Blast traumatic brain injury (TBI) grades are defined as follows: mTBI with PTA, mTBI without PTA, no mTBI; mTBI with PTA being the highest grade and no TBI being the lowest grade. Within the entire cohort, all four composite symptom scores started high and stayed unchanged. Among blast mTBI groups, symptom scores differed at every time point with some evidence of convergence over time. The PCS groups, different by definition to start, diverged further over time with those initially more symptomatic becoming relatively more so (Tables 1 and 2).

The history of blast-related mTBI accompanied by PTA is associated with greater nonspecific symptoms after deployment, and prognosis for improvement when symptoms are prominent is poor. This study provided preliminary evidence for significant post-deployment health distress after blast exposure that appears resistant to time and has a link with blast mTBI, especially when accompanied by posttraumatic amnesia.

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Previously published data from mandatory military post-deployment health assessments (and reassessments) have shown stable or worsening symptom course over the first few months after returning from Operation Enduring Freedom, Operation Iraqi Freedom, or Operation New Dawn (*Macera et al. 2012*). Adding those findings to these results from the ensuing 12 to 18 months suggests poor natural resolution of the broad range of negative health symptoms after combat deployment. Prognosis for symptomatic improvement seems especially poor among blast-exposed individuals who had high symptom distress early on.





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TABLE 1: Mean subscale score differences on the BC-PSI by blast exposure group. Effect sizes (partial eta squared) for the factors are .43, .09, .19, and .19, respectively, and .37 for total score. By convention, partial eta squared effect sizes are interpreted as: .01~ small, .06 ~ medium, and .14 ~ large (Murphy and Myers 2004). Total scores are based on the first 13 items only and are reported for comparison with past studies. a Significantly different mean score when compared to blast, no mTBI group at the $p < .05$ level. b Significantly different mean score when compared to blast, with mTBI group at the $p < .05$ level. c Significantly different mean score when compared to no blast, no mTBI control group at the $p < .05$ level. (Table used with permission from the authors)

Mean subscale score differences on the BC-PSI by blast exposure group.			
Group	M	SD	N
<i>Cognitive subscale</i>			
No blast controls	0.79 ^{a,b}	0.76	23
Blast, no mTBI	1.88 ^{b,c}	1.16	20
Blast, with mTBI	2.72 ^{a,c}	0.93	47
Total	2.04	1.24	90
<i>Vestibular subscale</i>			
No blast controls	0.26 ^b	0.60	23
Blast, no mTBI	0.53	0.89	20
Blast, with mTBI	0.93 ^c	1.07	47
Total	0.67	0.97	90
<i>Affective subscale</i>			
No blast controls	0.65 ^b	1.15	23
Blast, no mTBI	1.50	1.49	20
Blast, with mTBI	2.09 ^c	1.16	47
Total	1.59	1.37	90
<i>Anger subscale</i>			
No blast controls	0.48 ^{a,b}	0.86	23
Blast, no mTBI	1.60 ^c	1.43	20
Blast, with mTBI	2.27 ^c	1.33	47
Total	1.66	1.45	90
<i>Somatic subscale</i>			
No blast controls	1.21 ^b	1.03	23
Blast, no mTBI	1.80	1.20	20
Blast, with mTBI	2.45 ^c	1.06	47
Total	1.99	1.20	90
<i>Average total score (Items 1–13)</i>			
No blast controls	0.72 ^{a,b}	0.74	23
Blast, no mTBI	1.54 ^{a,c}	0.86	20
Blast, with mTBI	2.17 ^{b,c}	0.80	47
Total	1.67	1.00	90
<i>Total score (13-item total score)</i>			
No blast controls	9.35 ^{a,b}	9.63	23
Blast, no mTBI	20.05 ^{a,c}	11.19	20
Blast, with mTBI	28.27 ^{b,c}	10.36	47
Total	21.68	12.95	90

Note. mTBI = mild traumatic brain injury; BC-PSI = British Columbia Postconcussion Symptom Inventory. Effect sizes (partial eta squared) for the factors are .43, .09, .19, .27, and .19, respectively, and .37 for total score. By convention, partial eta squared effect sizes are interpreted as: .01 ~ small, .06 ~ medium, and .14 ~ large (Murphy & Myers, 2004). Total scores are based on the first 13 items only and are reported for comparison with past studies.

^aSignificantly different mean score when compared to blast, no mTBI group at the $p < .05$ level. ^bSignificantly different mean score when compared to blast, with mTBI group at the $p < .05$ level. ^cSignificantly different mean score when compared to no blast, no mTBI control group at the $p < .05$ level.

TABLE 2: Mean subscale score differences on the BC-PSI for Veterans with and without PTSD. Table legend: Note: Effect sizes (partial eta squared) for the factors are .23, .02, .02, .07, and .02, respectively, and .17 for total score. By convention, partial eta squared effect sizes are interpreted as: .01 ~ small, .06 ~ medium, and .14 ~ large (Murphy and Myers 2004). a Significantly different mean score for PTSD versus no PTSD groups. (Table used with permission from the authors)

Mean subscale score differences on the BC-PSI for veterans with and without PTSD.			
Group	M	SD	N
<i>Cognitive subscale^a</i>			
PTSD	2.89	0.93	37
No PTSD	1.46	1.06	53
<i>Vestibular subscale</i>			
PTSD	1.09	1.00	37
No PTSD	0.37	0.83	53
<i>Affective subscale</i>			
PTSD	2.07	1.24	37
No PTSD	1.25	1.36	53
<i>Anger subscale^a</i>			
PTSD	2.47	1.24	37
No PTSD	1.09	1.31	53
<i>Somatic subscale^a</i>			
PTSD	2.65	0.91	37
No PTSD	1.52	1.16	53
<i>Average total score (Items 1–13)^a</i>			
PTSD	2.39	0.69	37
No PTSD	1.24	0.90	53
<i>Total score (13-item total score)</i>			
PTSD	30.32 ^a	8.77	37
No PTSD	15.49 ^a	11.92	53

Note. BC-PSI = British Columbia Postconcussion Symptom Inventory; PTSD = posttraumatic stress disorder. Effect sizes (partial eta squared) for the factors are .23, .02, .02, .07, and .02, respectively, and .17 for total score. By convention, partial eta squared effect sizes are interpreted as: .01 ~ small, .06 ~ medium, and .14 ~ large (Murphy & Myers, 2004).

^aSignificantly different mean scores for PTSD versus no PTSD groups.

REFERENCES:

Macera, C. A., Aralis, H. J., Macgregor, A. J., Rauh, M. J., and Galarneau, M. R. 2012. "Postdeployment Symptom Changes and Traumatic Brain Injury and/or Posttraumatic Stress Disorder in Men." *J Rehabil Res Dev* 49 (8):1197-208.

