

Physician verified blast exposure is associated with small airway dysfunction in Iraq and Afghanistan Veterans

Sean Hu, Drew A. Helmer, Andrew Berman, Anays Sotolongo, Nisha Jani, Jacquelyn Klein-Adams, Ryan Butzko, Ronaldo Ortiz-Pachecho, Venkatasivasaisjith Sajja, Michael J. Falvo

Rationale: Self-reported blast exposure during military deployment to Iraq and Afghanistan is associated with symptoms of dyspnea and exercise intolerance among participants in a national registry. The purpose of our study was to evaluate the association between physician verified blast exposure and lung function assessed via pulmonary function testing (PFT) and forced oscillation technique (FOT).

Methods: We performed a retrospective chart review in 204 Iraq and Afghanistan veterans referred for dyspnea evaluation. Electronic medical records were reviewed by a physician using a standardized chart extraction tool to determine the presence and severity of blast exposure, with severity defined by traumatic brain injury associated with blast. We examined the association of select PFT (TLC, FRC, and RV/TLC) and FOT variables (R4-R20, AX, and Fres) with blast, adjusted for smoking history, BMI and cumulative deployment length. Blast (none, single or multiple exposure) was used to evaluate the presence of a dose-response relationship.

Results: Median age was 40 years (IQR: 32, 47) and time since deployment was 7.8 (5.1, 10.0) years. Blast was indeterminate in 10.8% (n = 22), not present in 55.9% (n = 114), single exposure in 19.6% (n = 40), or multiple exposure in 13.7% (n = 28). Complete PFT and FOT data were available in 96.1% (n = 196) and 44.6% (n = 91), respectively. We observed no association between blast and PFT variables. In comparison to no blast, multiple exposures were associated with greater AX ($\beta = 205.2$; 95% CI: 42.3, 368.1; $p = 0.01$) and Fres ($\beta = 33.9$; 95% CI: 7.3, 60.6; $p = 0.01$), but not for R4-R20 ($\beta = 11.0$; 95% CI: -0.5, 22.5; $p = 0.06$). No associations were observed when comparing single exposure to none. In comparison to a single exposure, multiple blast exposure was associated with greater AX ($\beta = 194.5$; 95% CI: 14.2, 374.7; $p = 0.04$), but not for Fres ($\beta = 25.1$; 95% CI: -4.4, 54.6; $p = 0.10$) nor R4-R20 ($\beta = 10.0$; 95% CI: -2.7, 22.7; $p = 0.12$).

Conclusions: In our models adjusted for smoking history, BMI and cumulative deployment length, multiple blast exposures were associated with greater small airway dysfunction as defined by FOT. Our findings suggest that blast exposure of sufficient intensity may have a profound effect on the small airways that may not be readily apparent on PFT. Future work is necessary to confirm these findings and understand the mechanism of injury.