Editorial Commentary

Newly Reported Hypertension After Military Combat Deployment
Research Implications From a Biopsychosocial Perspective

Randall S. Jorgensen

Military service personnel have been reported to experience increased mental and physical problems after combat deployment. Likewise, attrition from military service and increased use of mental health services have been observed. Recent large prospective epidemiological studies have shown a covariation of combat exposure with self-reported posttraumatic stress disorder and depressive symptoms, both of which appear most pronounced for Reserve/National Guard personnel. The study by Milliken et al. showed increased concerns about alcohol consumption and interpersonal conflict when an initial survey was compared with a follow-up survey some 3 to 6 months later. Being the first large prospective-based study of reported hypertension, the study by Granado et al. with a follow-up of ~3 years, makes a significant contribution to the study of the sequelae of combat experience. In this commentary, strengths and limitations of the study by Granado et al. are first discussed, highlighting implications for the design of future longitudinal work. Because alcohol consumption, stress reactivity, and interpersonal conflict have been implicated in the development of stress-related hypertension, the results of the Granado et al. and the Milliken et al. studies are combined with other empirical work to suggest potential links among stress reactivity, alcohol consumption as a stress-dampening mechanism, and stress-related hypertension development. Finally, this literature is used to suggest additional avenues of work.

As with the other 2 studies cited earlier, Granado et al. duly note that reliance on self-report data is a limitation. The report of hypertension showed modest concordance with the International Classification of Diseases, Ninth Revision, Clinical Modification code for hypertension ($\kappa$<0.50 but >0.45). Until medically diagnosed hypertension is the basis of classification, it is difficult to know the degree to which the strength of the obtained association is underestimated because of classifying persons with hypertension as nonhypertensive (eg, people unaware of their hypertensive status) or is overestimated because persons with higher levels of mental distress (eg, the chronic experience of combat-related post-traumatic stress disorder or symptoms of depression) may also be likely to report somatic problems like hypertension without an actual diagnosis. In addition, the collection of blood pressure (BP) and pulse rate could have provided information on whether the combat and hypertension association is linked with systolic BP, diastolic BP, a wide pulse pressure (correlate of vascular stiffness), high pulse rate, or a pattern of these resting measures of cardiovascular activity. Such data could provide a glimpse into potential cardiovascular factors underlying this association.

Like the other 2 prospective studies presented, the analyses of the Granado et al. study relies on 2 assessment points. This design allows only for the testing of linear changes. Three or more assessment periods are desirable for the testing of nonlinear trends (eg, a curvilinear relationship where the association of combat with hypertension is found at the middle point of 3 assessments). Such information could provide clinicians with information on whether combat-related hypertension is likely to be manifested earlier or later after returning home or whether the association dissipates over time. Along similar lines, it is noteworthy that reports of mental health problems may not be manifested until several months after returning home. The Granado et al. study’s prospective linkage of multiple combat exposures to subsequent report of hypertension supports the use of more elaborate longitudinal studies involving multiple follow-up clinic visits for hypertension diagnosis, documentation of the basis of the diagnosis (elevated systolic BP, diastolic BP, or both), and other important measures (eg, markers of insulin resistance, lipid panels, and diagnostic interviews for psychosocial functioning) for a more in-depth examination of the association of combat with hypertension.

As noted earlier, Milliken et al. report an increase in concerns about alcohol consumption, interpersonal conflict, and psychological distress in the second screening 3 to 6 months after the initial screening. Because Granado et al. only did a baseline assessment of moderate versus heavy drinking (in terms of standard drinks, >1 drink per day for women and 2 for men), we are unable to assess whether postdeployment increases in alcohol consumption covary with reported hypertension occurrence; also, without actual BP values, we cannot study the links among combat stress, heavy drinking, and the important hypertension risk of prehypertension (systolic BP: 120 but ≤139 mm Hg and/or diastolic BP: 80 but ≤89). Although moderate drinking confers a decreased risk for cardiovascular disease, the risk for hypertension rises with ≥3 drinks per day. We showed recently that college students with prehypertensive BP levels...
were \( \approx 4 \) times more likely to consume alcohol levels associated with increased risk for hypertension. Likewise, heavier drinking has been correlated with markers of arterial stiffness.\(^7\) Research also exists showing alcohol to dampen stress reactivity,\(^8\) and it has been suggested that increased alcohol consumption may be a means of reducing the stress (eg, interpersonal conflict, anger, and symptoms of posttraumatic stress disorder) emanating from combat experience.\(^9\)

The figure highlights some possible factors contributing to the findings reported by Granado et al.\(^3\) Briefly, alcohol consumption may be used to dampen stress reactivity; however, increased drinking could also maintain or increase psychosocial stress\(^9\) (eg, marital conflict and difficulties at work). Both heavy alcohol consumption and stressor-induced (including intrusive ruminations) cardiac and vascular reactivity\(^10\) could contribute to preclinical manifestations of hypertension (prehypertension and increased vascular stiffness). If additional research supports these linkages, then timely medical (pharmacological and risk-factor modification) and psychosocial interventions (stress management or, in some cases, family therapy) could reduce the likelihood of hypertension development.

In closing, the article by Granado et al.\(^3\) is the first study to show a prospective association of multiple combat exposures with the reported occurrence of hypertension, thereby paving the way for research designed, ultimately, to enhance the cardiovascular health of our men and women in military service. In an effort to elucidate the synergies among biological, psychological, and social variables linking combat exposure with hypertension and cardiovascular disease in general, future cross-sectional and longitudinal research can deploy the following: (1) repeated clinic visits designed to assess physical and psychosocial well being; (2) central (eg, eye-blink startle)\(^6\) and peripheral (eg, behaviorally induced cardiovascular reactivity\(^10\)) markers of stress reactivity; (3) markers of vascular stiffness (eg, pulse transit time); and (4) field studies (in vivo assessment of affective and social states in tandem with ambulatory BP monitoring), with the aim of providing clinicians with information to optimize the treatment of our women and men in military service.

**Disclosures**

None.

**References**

Newly Reported Hypertension After Military Combat Deployment. Research Implications From a Biopsychosocial Perspective
Randall S. Jorgensen

Hypertension. published online September 14, 2009;
Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2009 American Heart Association, Inc. All rights reserved.
Print ISSN: 0194-911X. Online ISSN: 1524-4563

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://hyper.ahajournals.org/content/early/2009/09/14/HYPERTENSIONAHA.109.134478.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Hypertension can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Hypertension is online at:
http://hyper.ahajournals.org//subscriptions/