



Review article

Immobility reactions under threat: A contribution to human defensive cascade and PTSD



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ABSTRACT

Violence exacts a burden on public health. Gun violence is a major trigger for motor defensive reactions in humans and post-traumatic stress disorder (PTSD) is its main psychiatric sequela. However, studies of the human defensive cascade, especially the motor reactions, are at an early stage. This review focuses on studies that employ stabilometry, a methodology that assesses whole body motor reactions, to address defensive behaviors to violence-related threats. Special attention is given to three reactions: “attentive immobility”, “immobility under attack” and “tonic immobility”, with emphasis on the latter – a peritraumatic reaction which has been strongly associated with the severity of PTSD. These reactions are characterized by reduced body sway and bradycardia, except tonic immobility that presents robust tachycardia. The advances made by investigations into the immobility reactions of the human defensive cascade contribute to helping to bridge the gap between human and non-human species. Furthermore, progresses in basic research to objectively monitor motor defensive reactions under threat can help to develop a dimensional, trans-diagnostic approach to PTSD.

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1. Introduction

1.1. Violence

In 1996, the Forty-Ninth World Health Assembly declared violence a major and growing public health problem across the world (World Health Assembly, 1996). Six years later, the World Health Organization launched the first report on violence and health aimed at raising awareness about the problem of violence globally, its prevention and the role of public health in addressing its causes and consequences (Krug et al., 2002). In 2014, the World Health Organization, jointly with the United Nations Development Program and the United Nations Office on Drugs and Crime, published the Global Status Report on Violence Prevention (World Health Organization, 2014) which reviewed violence prevention efforts in countries, and called, among other strong recommendations, for the enhancement of services for the victims of violence.

Apart from being a cause of death, violence exacts an enormous burden on public health with extremely deleterious consequences, particularly from gun violence (Webster et al., 2016). The toll of gun violence is not just premature death but a series of serious snowball effects on education, health, family instability, incarceration, and social capital (Winker et al., 2016).

1.2. Post-traumatic stress disorder

Post-traumatic stress disorder (PTSD) is the main psychiatric sequela from exposure to traumatic events such as gun violence. Presently, the trigger of PTSD is considered to be exposure to actual or threatened death, serious injury or sexual violation. For the diagnosis of PTSD, in addition to the exposure to one or more of those potentially traumatic events, the DSM-5 requires that a given person presents, for at least one month, symptoms of intrusion, persistent avoidance of stimuli, negative alterations in cognitions and mood, and alterations in arousal and reactivity, all of them related to the traumatic event. Similarly to other DSM-5 diagnosis, symptoms must create distress and/or functional impairment (American Psychiatric Association, 2013).

However, since at its conception, PTSD diagnosis has been surrounded by controversy (Miller et al., 2014). This controversy has further increased with the revision of the PTSD criteria in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), which has expanded the construct to include additional symptom presentations (American Psychiatric Association, 2013). In DSM-IV (American Psychiatric Association, 1994) there were 17 PTSD symptoms, divided in three clusters: intrusive re-experiencing, avoidance/numbing, and hyperarousal. This allowed various combinations of required symptoms to meet the PTSD diagnosis, resulting in a total of 79,794 possible symptom presentations. DSM-5 increased the number of symptoms from 17 to 20, and the number of clusters from three to four with the addition of alterations in mood and cognition, raising the number of possible symptom presentations meeting the PTSD diagnosis from 79,794

to 636,120 (Galatzer-Levy and Bryant, 2013). As a consequence, the new PTSD definition is much more heterogeneous than before, and also more heterogeneous than the majority of the other DSM psychiatric disorder such as panic, social phobia, or major depression. In fact, PTSD research has been plagued by lack of replication, mixed findings, and poor specificity despite massive research funding and intensive investigative efforts. The main factor that may explain the disappointing lack of progress in this field is the heterogeneity derived from the different clinical manifestations of PTSD that may impede progress in the identification of the biological underpinnings of this disorder (Nemeroff et al., 2013).

1.3. The Research Domain Criteria

The heterogeneity found in PTSD diagnosis using DSM is an example of a research obstacle that has led the National Institutes of Mental Health (NIMH) to develop the Research Domain Criteria (RDoC) (www.nimh.nih.gov/research-priorities/rdoc/index.shtml), a research framework which adopts a trans-diagnostic approach (Cuthbert, 2014; Galatzer-Levy and Bryant, 2013; Insel et al., 2010). This change in focus by NIMH reflects the concern that research based on DSM diagnoses are limited due to their primary focus on reliability at the expense of validity – leading to scientifically inconsistent findings. The RDoC project considers it fundamental to capture the underlying mechanisms of dysfunction, opening new possibilities for treatments targeted to pathophysiological mechanisms. The RDoC project extends the categorical view of mental illness diagnosis, and suggests an dimensionality to mental disorders, as a spectrum that ranges from normal to abnormal. It also focuses on the underlying mechanisms (psychological, behavioral, physiological, the neural circuit framework, etc.) that cut across a wide array of psychiatry manifestations, operating outside the traditional diagnostic boundaries. Therefore, the RDoC takes a translational, dimensional approach to defining psychopathology, and aims to promote the development of an interdisciplinary science of psychopathology that consists of dimensional constructs integrating elements of psychology and biology (Kozak and Cuthbert, 2016). An objective of this approach is to develop, for research purposes, new ways of classifying mental disorders based on dimensions of observable behavior and neurobiological measures (NIMH, 2016).

In line with the RDoC initiative, we developed a research project associated with the outpatient clinic of the Federal University of Rio de Janeiro (Brazil) specializing in PTSD assessment and the treatment of victims of urban violence. The research team comprises a multi-disciplinary group of researchers from different fields including: basic neuroscience, psychophysiology, psychiatry, psychology and epidemiology. In the present mini-review, part of the results gathered by this network will be considered.

The RDoC project identified five research domains (negative valence, positive valence, cognitive, social processes, arousal and regulatory systems) within which the “negative valence systems” domain is the one more closely related to our research focus.

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