Literature Review: Posttraumatic Stress Disorder as a Physical Injury

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Introduction

Posttraumatic stress disorder (PTSD) is induced by traumatic experiences, such as serious accidents or injuries, assault or abuse, combat experience, exposure to terrorism, or substantial emotional loss (O'Doherty et al., 2017; Kessler et al., 1995). Historically, PTSD was seen as a psychological disorder associated with military combat veterans and labeled accordingly as "shell shock" or "battle fatigue" (McFarlane, 2010; Friedman, 2016; Monson et al., 2009). However, in the last twenty years, researchers have increasingly demonstrated that PTSD can stem from non-combat experiences as well (Kubzansky et al., 2014; Friedman, 2016), and that, in addition to psychological effects, PTSD causes physical changes to the brain structure that have extensive impacts on overall health (Kubzansky et al., 2014; Bremner et al., 2003, Rosen & Fields, 1988). Reductions in the brain areas of PTSD victims, including the frontal lobe, gray matter, and hippocampus are associated with impairments in learning, concentration, memory, cardiovascular disease and cardiometabolic disease. (Bremner et al., 2003; O'Doherty et al., 2017). These notable reductions indicate that PTSD is a physical injury that can lead to whole-body consequences.

To reflect the developing research and increasingly nuanced understanding of PTSD, the American Psychiatric Association recently updated its criteria for PTSD diagnosis to the following eight categories: "direct or indirect exposure" to trauma, "intrusive recollections" through flashbacks or reminders, "avoidance" or denial, progressively worsening "negative thoughts," sustained symptoms, symptoms causing "functional impairment," symptoms independent from drugs or other illness, and "hyperarousal," which encompasses the irritable outburst frequently associated with PTSD (2013). At any given time, approximately 8% of

Americans are struggling with PTSD (PTSD United, 2013). This significant societal prevalence emphasizes the urgency to better understand how PTSD alters the brain and impacts overall livelihood.

Recent studies now have substantial data to prove that PTSD causes alterations in brain structure and function that lead to sustained negative health effects throughout the body. Understanding the neurobiology of PTSD may contribute to the future clinical application of potential treatments or therapies. Research in this field is ongoing, but not yet comprehensive, in terms of the direct relationship between affected brain regions and PTSD symptoms. This review consolidates current studies within the field to investigate the physical trauma of PTSD. Demonstrating the causal relationship between PTSD and physical trauma will contribute to changing public perception of PTSD as a valid, physical injury that is not limited to only psychological effects.

Analysis

Alterations in Brain Structure

Recent studies focusing on brain alterations indicate a trend towards increasing research establishing the connection between PTSD-induced physiological abnormalities and changes in brain structure. Current research substantiates early studies done on rhesus macaque models which indicated that prolonged exposure to environmental stress induced neurochemical changes and dysregulation in catecholamines, which led to heart disease and stress ulcers in primates (Rosen & Fields, 1988). These early studies indicated a need for documentation of brain alterations in human PTSD subjects; since then, research has established that physical changes in brain structure have a strong causal relationship to the characteristics defining PTSD

(McFarlane, 2010; Kubzansky, 2014; Kroes et al., 2011; O'Doherty et al., 2017). Continuing studies help develop a deeper understanding of the neurobiological foundations of PTSD, which can be used to establish relationships to the sustained consequences impacting the body.

PTSD induces diminished gray matter volumes, causing a decline in emotional processing and memory, which is seen through common PTSD symptoms such as hyperarousal and flashbacks. Through magnetic resonance imaging (MRI), PTSD subjects indicated gray matter atrophy in the limbic and cortical brain regions, including decreased gray matter volumes in the hippocampus and amygdala (O'Doherty et al., 2017). Gray matter is associated with "memory processes," "emotional self-awareness," and "perception" (Chalavi et al., 2015; Chen et al., 2006; Craig, 2009). As a result, decreased volumes in these parts of the brain affect memory and standard processing. Reduced gray matter volume in the inferior temporal gyrus has been linked to the frequent flashback memories of the traumatic event due to that region of brain's decreased ability to control memory retrieval (Kroes et al., 2011; Brewin et al., 2010). Studying the structural changes in the gray matter directly relates to the general understanding of PTSD symptoms.

Dysfunction in the hippocampal region, caused by a PTSD-induced decline in volume and activity, results in defects that match PTSD symptoms, such as emotional numbing and increased irritability. The hippocampus is a region closely associated with emotional processing, learning, and declarative memory (Sass et al., 1994; Lencz et al., 1992). As a result, measuring a decrease in hippocampal volume using MRI and a decline in hippocampal activity, recorded by positron emission tomography (PET), is indicative of cognitive decline (Bremner et al., 2003). In comparison to women who neither suffered from abuse nor had PTSD, women with PTSD indicated a 19% smaller hippocampal volume, and 16% smaller volume compared to women

who suffered from abuse, but did not develop PTSD (Bremner et al., 2003). The data from the observational group of women who experienced trauma, but did not develop PTSD, suggests that PTSD is its own unique disorder with significant consequences to mental health. Based on the results of these studies, continuing research on the neurobiology of PTSD will greatly contribute to the understanding of both physical and mental symptoms and their underlying causes, which could eventually lead to potential treatments.

Physical Consequences of PTSD

Due to PTSD's alterations to the brain structure, the brain becomes hypersensitive, which is indicated by common symptoms, including recurring flashbacks and hyperarousal to associated stimuli. This constant and repeated activation of cortical activity results in "broader disruption of neurobiological systems," thus making the body more susceptible to health consequences (McFarlane, 2010, p.8). In fact, based on a longitudinal study, 78.8% of severely injured soldiers diagnosed with PTSD seven months after trauma did not show sufficient symptoms for diagnosis at the four-month mark (McFarlane, 2010; Grieger et al., 2006). This suggests that the onset of trauma initiates a progressive impact on the body. PTSD induced sensitivity to stressors contributes to hypertension, emphasizing the established association of PTSD and cardiovascular disease (McFarlane, 2010). This is alarming because it indicates that someone suffering from PTSD is caught in a cycle of additive stressors, with long-term consequences.

PTSD is a synergistic disorder and the body's increased susceptibility to stress and hypertension contributes to an increased likelihood for comorbid health consequences, such as obesity. PTSD has been established as a risk factor for cardiometabolic diseases (Kubzansky et al., 2009; McFarlane, 2010), and Kubzansky builds upon previous studies by establishing a

connection to increased BMI and obesity in women (2014). This longitudinal study was based on annual self-reported BMI data from nurses, who also indicated depression, if applicable, to control for possible external factors influencing or biasing the data (Kubzansky, 2014). The compiled results indicated a positive BMI trajectory in women with PTSD even after adjusting for depression, which is important for clinicians to be aware of, given that obesity is a prevalent public health issue especially in the United States. PTSD-induced obesity has a particularly greater effect on women, affecting reproductive health and outcomes, thus having inter-generational consequences, in addition to effects on aging and psychological distress (Kubzansky et al., 2014; Kulie et al., 2011; Ryan, 2007). The additive physical consequences of PTSD emphasize how the body becomes more susceptible to many comorbid illnesses that have long-term consequences.

These studies substantiate the physical trauma associated with PTSD and the sustained, progressive impacts of the injury. Current research corroborates the inverse relationship between PTSD and cardiometabolic health. Deeper understanding of the affected brain regions can help researchers and clinicians pinpoint symptoms and causes. Additionally, the accumulation of comorbidity presents an interesting feedback loop regarding the influence of self- and public perception on health.

The Effect of Social Stigma

PTSD creates a disconnect between the individual and society, which severely impacts recovery. As previously discussed, PTSD causes an increased sensitivity to the environment due to constant cortical activation. Charuvastra & Cloitre present a framework for how “both PTSD risk and recovery are highly dependent on social phenomena” (p.301) by arguing that positive social interactions provide a network of security and community which alleviates the emotional

detachment of PTSD (2008). Social support can help an individual with PTSD regulate emotions (Koenen et al., 2003), which can in turn help the individual control responses to hyperarousal. Moreover, potential effective treatment could be to target strengthening interpersonal relationships (Charuvastra & Cloitre, 2008). This suggests that further research into the neurobiology of PTSD may pinpoint how social bonds affect the body in such a significant way.

The emotional numbing associated with PTSD presents another victim-society barrier due to its link to a decline in brain reward circuits. When recorded through MRI and presented with a reward stimulus, PTSD subjects indicated diminished neural activity in the prefrontal cortex associated with positive reward feedback compared to non-PTSD subjects, which suggests that PTSD leads to disinterest and apathy (Charuvastra & Cloitre, 2008; Elman et al., 2005). This has a significant influence on recovery because people suffering from PTSD are less likely to seek out or accept support from others, since they perceive less of a benefit from external help (Norris & Kaniasty, 1996). As a result, negative perception and apathy, from both the individual with PTSD and society, have a significant influence on PTSD victims and their health.

This is a field that urgently needs more research because PTSD is a disorder that evolves and is influenced by the environment, so PTSD symptoms and effects vary even within the same individual, given different circumstances. Further research can help address the dynamic nature of PTSD and how it causes the brain to change over time. The strong correlation between the plasticity of mental health and societal perception supports the urgent need for PTSD to be seen as a valid health issue. Disinclination of PTSD sufferers to seek external help is likely reinforced by the negative stereotypes within society.

Discussion

Current research indicates that PTSD is a physical injury, despite the social stigma that it is purely psychological. Increased awareness of the physical trauma caused by PTSD may alleviate this widespread misconception and public apathy, particularly in cases where the PTSD stems from stigmatized trauma associated with shame, such as sexual abuse, as opposed to trauma associated with heroism, such as in emergency first responders (Charuvastra & Cloitre, 2008). The alterations in the brain lead to and contribute to holistic impacts on an individual's wellbeing, which highlights the need to understand the effects of PTSD. The studies on the physical changes in brain structure are relatively recent and conclude with a call for further research. Many investigations are focused on the increased risk of combat veterans due to their repeated exposure to trauma and higher scientific interest and funding (Kubzansky et al., 2014; Barber et al., 2011; Chwastiak et al., 2011 Chwastiak et al., 2010 Coughlin, 2011). Additional research on non-military related PTSD would contribute to the overall understanding of PTSD and how the two may compare in terms of how the brain structure is affected.

PTSD is a long-standing injury that increases in severity over time, underlying the urgency of further research. In addition, people with PTSD may experience symptoms differently over time (Hiskey, 2012). This variation emphasizes the need for a broader study of the disorder. Further research addressing the neurobiology of PTSD at multiple stages in life would greatly contribute to the comprehensiveness of the literature. Future research should continue to deepen understanding of the neurobiology of PTSD, eventually leading to effective treatments for the disorder based on what and how abnormalities alter brain function.

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