narcolepsy is difficult without careful symptom tracking over time and a comprehensive assessment of biological (e.g. hypocretin) and self-reported (e.g. sleepiness) symptoms.

Narcolepsy can also cause a number of psychiatric comorbidities, including ADHD, anxiety, and even eating disorders. Individuals with narcolepsy often experience sleepiness due to their disrupted sleep cycles, which can cause difficulty with attention, something attributed to ADHD. This sleepiness can also limit physical activity, which can lead to obesity [5] or various eating disorders, such as anorexia or bulimia nervosa. Additionally, the loss of control during a cataplectic event or frequent hallucinations for a person with narcolepsy can cause anxiety [4].

The main disease associated with narcolepsy, however, is depression. According to a study done in Taiwan about the comorbidity between narcolepsy and depression, patients with narcolepsy had a significantly greater risk of developing depression, including dysthymic disorder and major depressive disorder [6]. The results of this study were consequential, but not surprising. The daytime sleepiness and hallucinations can make it difficult to focus in school and work, therefore causing difficulty in daily life. Depression can be caused by the difficulty dealing with and managing a chronic disease, which explains the 57% comorbidity rate between depression and narcolepsy [4].

The symptoms of narcolepsy causing these various disorders can severely affect the life of someone with the disease. In addition to the treatment of narcolepsy, they must treat their other comorbidities with more medication and more therapies, which can be detrimental to one's mental and physical health, as well as expensive.

TREATMENT

Treatment for narcolepsy can help control its damaging effects. The first and most common method is pharmacological treatment. Although there are no medications that treat or cure narcolepsy directly, there are those that can manage some of its symptoms. There are four categories of medications that help control specific narcolepsy symptoms: stimulants and wakefulness-promoting agents control excessive daytime sleepiness and sleep attacks, while sodium oxybate and antidepressants control almost all narcolepsy symptoms, including cataplexy, sleep paralysis, and hallucinations [1, 7]. As managing symptoms is one of the most difficult parts of narcolepsy, many find these medications to be helpful in curbing symptoms that are harmful to daily functioning.

The other treatment of narcolepsy involves education and lifestyle adaptations. People with narcolepsy must be knowledgeable in their disease and educate those around them in order to understand it better and know what they can and cannot do. Understanding one's limitations, such as when to operate a car or not, is important for their safety as well as the safety of those around them. Lifestyle adaptations include practicing good sleep habits, such as establishing a nighttime routine and getting enough hours of sleep every night, both of which can help manage the REM cycle disturbance caused by narcolepsy. Strategic napping, which includes a few 15-minute naps a day in order to curb excessive daytime sleepiness and improve alertness, is a popular practice of those with narcolepsy as well [7]. The last treatment can involve cognitive behavioral therapy (CBT), which can help someone with narcolepsy get accustomed to how the disease will affect their life and relationships. CBT can also potentially help with the comorbidities that someone with narcolepsy might have.

CONCLUSION

Narcolepsy is an inherently underdiagnosed and rare disease. This rarity causes more difficulty to those who have it as education, diagnosis, and treatment can all be overlooked for other, more prevalent diseases. Studying the causes of narcolepsy and how they affect the brain is important, however, the psychosocial aspects of narcolepsy can be just as impactful on one's daily life and should be treated with equal importance. Educating the population on the hidden battles of narcolepsy not only can raise awareness but allows us to understand the impact of it and support all of those who struggle with it.

TRAUMA AND PTSD: UNDERSTANDING THE BRAIN IN THE MIDST OF RECOVERY

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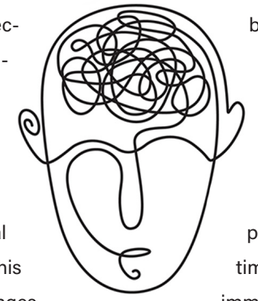
Post-traumatic stress disorder (PTSD) should be considered in anyone exposed to a traumatic event [1]. Approximately 60% of men and 50% of women will experience trauma at some point in their life. Nonetheless, trauma exposure does not guarantee the onset of PTSD symptoms; typically, only 4% of men and 10% of women end up developing PTSD after experiencing trauma [2]. The psychological mechanisms in which PTSD is prevented within an individual is not well understood. Thus, recognition of the onset of symptoms and comprehension of the neurobiology of this disorder are critical for diagnosis, treatment and recovery [1].



THE BRAIN DURING TRAUMA

Traumatic events cause the brain to enter a survival mechanism called the fight-or-flight response. This response triggers a variety of physiological changes which are mediated through activation of both the parasympathetic, which is responsible for calming the body down in response to stress, and sympathetic nervous system, which is responsible for preparing the body for stress [3]. Such changes include increased heart rate, increased cardiac output and temporary inhibition of digestive functions. These modifications prime the body to efficiently fight or flee from danger.

Everyday, subconsciously, the eyes and ears send what you see and hear to the amygdala, which acts as the emotion processing region of the brain. The amygdala must rapidly decide if the information received must trigger the fight-or-flight response. If the response is activated, the amygdala will signal the hypothalamus, the hormone-producing region of the brain, which quickly enacts a survival mechanism in response to the sensed danger. A brain focused on survival is not able to weigh every decision as thoroughly as it normally does; it's goal is simply to assure survival [4].

The freeze response is another example of a trauma response that is less commonly known. Commonly referred to as tonic immobility (a temporary state of movement inhibition), freeze responses are believed to be an innate biological response to extreme stress. It is a desire to flee when acute fear and physical limitations make fleeing impossible. Physical limitations are prevalent in abuse and violent trauma cases due to the strained power dynamic between a perpetrator and victim. During violence or abuse, victims can remain immobile despite wanting abuse to end—this is the freeze response. Such a response occurs when winning a fight or fleeing successfully is unlikely [5].

THE BRAIN AFTER TRAUMA

Post-traumatic stress disorder (PTSD) is characterized by the persistence of one or more of the following symptoms: reliving the event, avoiding situations similar to the events, undergoing negative changes in beliefs, having difficulty trusting friends or family, or experiencing constant hyperarousal or overactivity, for more than one month after traumatic onset [2]. Widespread symptoms are believed to be linked to extensive alterations within the brain in response to trauma. PTSD affects brain regions that control fear and emotion-processing. One of the brain regions affected by PTSD is the amygdala, which

recognizes trauma and becomes hypersensitive to emotional triggers that are not trauma-related. The mechanism that allows the amygdala to process fear and emotions operates via neuronal signaling by chemicals called neurotransmitters. Overexposure to glutamate, an excitatory neurotransmitter that promotes electrical signaling, causes neurons in the prefrontal cortex to lose function and structural integrity [6]. Given that the prefrontal cortex is integral in regulating emotional feedback from the amygdala, these functional and structural changes are damaging. Furthermore, due to the decreased function of the prefrontal cortex and the increased sensitivity of the amygdala in PTSD victims, the brain has a lower threshold for activation which leads to overstimulation [7].

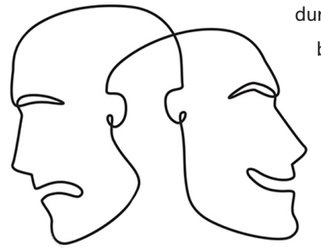
The hypothalamus, which initiates the survival mechanism during extreme stress, remains chronically overactive in PTSD patients. In a healthy stress response, a signaling cascade—a series of chemical reactions in response to a stimulus— triggers the release of a stress hormone called cortisol. An increase in cortical levels communicates to the hypothalamus that the body is aware and prepared for the danger detected by the amygdala. In a brain with PTSD, there is an error in the cascade, preventing the release of cortisol, so the hypothalamus is not notified that the body is aware of the danger and remains active to try to inform the brain of detected stressors. This communication issue within the body causes the hypothalamus to exhibit amplified responses to stressors. For example, someone with PTSD could encounter a mild daily stressor, like traffic, but because of the continued activity of the hypothalamus, the body prepares for a stressor of similar magnitude to the one that initially caused PTSD [6]. In conclusion, hypothalamic overactivation, hypersensitivity in the amygdala, and decreased activity in the prefrontal cortex are all major causes of PTSD symptoms.

To understand how PTSD works, it is important to examine its pathology, specifically the neural pathways and brain regions affected. A study titled, Intrusive Memories of Distressing Information: An fMRI study was conducted by Battaglini and her team. The study aimed to identify the brain regions activated when faced with visual trauma. Participants were exposed to visuals of mutilated bodies or neutral objects simulating trauma, and their brain activity was measured using functional magnetic resonance imaging (fMRI). The fMRI measures brain activity as indicated by changes in regional blood flow. Their findings suggest that verbal and visual processing, measured by activation of emotional processing regions, during trauma makes an individual more likely to experience intrusive thoughts, commonly referred to flashbacks [8].

Prolonged hypothalamic activity activates survival mechanisms after exposure to daily stressors. Survival mechanism activation induces a variety of symptoms including accelerated heart rate, rapid breathing, and anxious feelings [9]. Anxious feelings are associated with difficulty concentrating and sleeping, and can have negative effects on social relationships [10]. Sleep is vital for maintaining the overall health and wellbeing of the person, thus, poor quality of sleep can exacerbate PTSD symptoms [11]. Repeated and overstimulated physiological reactions can result in development of an anxiety disorder. Overactivation of the Hypothalamic Pituitary Adrenal (HPA) axis, a stress-regulating system, also potentiates major depression and schizophrenia [12]. Depression and depressive feelings can make it difficult to maintain close relationships, causing individuals suffering from PTSD to feel detached from friends and family [2]. PTSD has the ability to affect every aspect of one's life, from poor sleep quality, to attention deficits during the work or school day, or lack of stability in romantic and familial relationships [10]. PTSD causes the brain to constantly be in survival mode, experiencing amplified reactions to daily stressors.

THE BRAIN RECOVERING FROM TRAUMA

Understanding stress responses is crucial for the de-stigmatization of trauma. Because stress responses happen subconsciously, passive trauma responses do not imply willful participation in the traumatic event. In other words, passive trauma responses do not define a person [4].



PTSD is difficult to treat because of the broad effects it has within the brain and its ability to impact every aspect of daily life. Physicians typically prescribe and recommend a variety of different strategies on a case by case basis. It is important to note that while the trauma itself may never be entirely forgotten, a PTSD diagnosis is not life-long. With accurate and prompt care, PTSD symptoms can subside below the diagnosis threshold or subside entirely. Examining PTSD, Priebe and their team or researchers interviewed veterans diagnosed with war-related post-traumatic stress disorder, 10.7 years after trauma exposure, who never received PTSD treatment. 83.7% of those interviewed met qualifications for a PTSD diagnosis from the trauma they were exposed to nearly 11 years earlier. This indicates the importance of seeking appropriate treatment because of the high likelihood of continued prevalence of PTSD when left untreated [13].

Environmental triggers, like anniversaries of the trauma, can reactivate the freeze response, causing a dissociation from one's self and others. One strategy for abating the freeze response or immobility is shifting focus on the actions the body is currently performing, like breathing. One can begin by focusing on how the chest and shoulders raise with inhalation, and then by evaluating how other body regions feel, like how the feet feel against the ground and how the spine feels retaining the body's posture. Physical awareness of the body allows for small movements to be made which overtime terminates the freeze response.

Unfortunately, PTSD has broad impacts within the brain, so one prescription cannot restore all the adaptations of symptoms. A combination of pharmacological intervention, therapy styles, and coping techniques are essential to healing. Selective serotonin reuptake inhibitors (SSRI) and benzodiazepines, drugs designed to calm a person, inhibit the amygdala, thus decreasing arousal. The main concern with this method of recovery is that there is no learned coping skill, meaning decreased arousal only occurs with drug exposure [4].

Recurring flashbacks and memories of trauma activate innate survival mechanisms similar to initial arousal during the PTSD-inducing event(s). Cognitive-behavioral therapy (CBT) and eye movement desensitization and reprocessing (EMDR) aim to minimize associated arousal by re-linking memories with the past rather than the present, as normally seen with flashbacks. CBT can also assist in eliminating self-blame, which inhibits PTSD recovery [4,14]. Difficulty falling and staying asleep is typically associated with overarousal or persistent nightmares. Nightmares typically subside with CBT or EMDR because nightmares present similarly to flashbacks that take place while sleeping. Overarousal is largely caused by hypothalamic overactivation, hypersensitivity in the amygdala, and decreased activity in the prefrontal cortex. Symptoms of overarousal include difficulty sleeping, concentrating, and consistent anxiety. These symptoms can be treated with a combination of therapies, techniques, and prescription medications [15].

CONCLUSION

The ability to recover from PTSD is significantly greater in patients that receive proper medical care. Understanding the biologically innate response to trauma is critical to alleviate shame associated with the freeze response. A combination of pharmaceuticals, therapies, and coping techniques can prevent PTSD from becoming a lifelong diagnosis.

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