

Effects of Torture on the Brain's Neurophysiology and the Pain System, as well as the Efficiency of Using a Biopsychosocial Approach in Treatment

(A Narrative Review of the Literature on the Effects of Torture on the Brain and Pain System, As Well as the Impact of Biopsychosocial Intervention)

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Abstract

Torture aims to destroy its victim through the strategic and intentional use of pain to damage the physical, social, and psychological integrity of the individual. A core issue is the resulting multifaceted presentation of somatic, psychological and social problems in the same individual, leading to severe functional limitations and participation restrictions. Chronic pain considers one from the highest symptoms for torture survivors. This literature review of 25 studies will focus on the neurophysiology, and sensitivity of the nervous system after experiencing torture, the changes that happened at the brain level, and the pain system from a neuroscience point of view, and then the study will highlight the evidence-based practice for biopsychosocial intervention for torture survivors in treating chronic pain. The study findings and conclusion show that torture causes noticeable alterations to the brain and nervous system that manifest in the survivors as high PTSD symptoms, chronic pain, feelings of disempowerment, lack of control, personal boundaries being destroyed, or stress, with intermittent or continuous physiological hyperarousal. The classic fight-or-flight response to a perceived threat is a reflexive nervous phenomenon that has obvious survival advantages in evolutionary terms. When a person experiences severe circumstances like torture, which is often accompanied by intense fear, horror, and helplessness, the systems that organize the constellation of reflexive survival behaviors become dysregulated and hypersensitive like critical anatomical and neurophysiological alteration and chronic changes in the pain system, so, it's mandatory for the rehabilitation team to understand these changes and create a setting that takes into consideration these experiences. Research on chronic pain aims to understand the various risks and protective influences of biological, psychological, and environmental factors that are known to contribute to chronic pain disorders after torture.

Introduction

Torture aims to destroy the integrity of a person and eviscerate their sense of self. Torture seeks to "break" its victim through the intentional use of intolerable pain to destroy and/or damage the physical and psychological integrity of the individual. By the UNCAT's (1984) definition, torture is "any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him or a third person information or a confession, punishing him for an act he or a third person has committed, or is suspected of having committed; intimidating or coercing him or a third person; or for any reason based on discrimination of any type, when such pain or suffering is inflicted by, or at the instigation of, or with the consent or acquiescence of a public official. Studies show that at least 30 % of refugees have experienced torture or organized violence, and that refugees are rarely asked or assessed about experiencing violence. It is very unlikely that a refugee who has not been subjected to violence would be offended by being asked, while for the refugee who has experienced violence, the question indicates that the clinician

is aware and able to listen should he or she wish to disclose at a subsequent encounter (de C Williams & Baird, 2016). Torture not only causes extreme emotions such as guilt, fear, and shame, but the insidious intent behind torture also targets the entire person, affecting their self-concept, social relationships, and moral frameworks. Not surprisingly, torture exposure is the strongest predictor of posttraumatic stress disorder (PTSD) in refugees and conflict-affected people globally (Steel et al., 2009) and the physical torture is in most cases directed towards the body and musculoskeletal system, but the prevalence of post-traumatic stress symptoms, continued stress, anxiety, depression and other psychological disorders have been more thoroughly investigated than chronic pain, which is often dismissed as a non-specific aspect of a psychological disorder by mental health services (Amris et al., 2019). It is aimed at producing damage in the soft tissue and pain and usually leaving no visible evidence after the acute stage. Methods of torture that aim to cause severe and long-term psychological distress may less obviously elicit pain but achieve the

perpetrator's outcomes through extreme bodily stress. Some torture strategies that aim for exhaustion include prevent food and water, exposure to extreme cold and heat temperatures, sleep deprivation, social isolation, and confinement in small spaces which is come under positional torture. Other method is monopolization of perception, an example of that involves controlling the environment, so that the person receives only sensory information dictated by her/his captor, e.g., high-pitched sound, bright light. This may take the form of death threats or mock executions, or survivors may have witnessed, or been forced to participate in the torture on other victims, murder, or rape of other prisoners or family members (Amris et al., 2019).

Torture survivors are vulnerable to ongoing social, mental, and health threats even after escape from their mother country or rescue. Away from the immediate threat of further torture, the psychological and physical impacts of torture continue, along with new burdens associated with internal or external displacement, through "temporary" encampment, often for many years, to resettlement into hostile host communities. Many torture survivors may have no access to healthcare institutions; even if they have, they may not be recognized when they are present, and the care available often falls short of their needs, or they may not be able to recognize the special consequences of their situation. There is a tendency in state and non-governmental organizations' services to focus on mental health and counseling, with poor understanding of physical aspects (Baird et al., 2017). If we want to talk about trauma in relation to torture, then trauma is described as "a shock to your system," either physically or emotionally. Once you've been through trauma, you understand that it may occur again. Your body and brain can then start working in "survival mode" as a result. This interferes with normal maintaining homeostasis and the connection between both the brain and body. Trauma essentially causes the autonomic nervous system to be dysregulated. The results of this are that multiple body systems are affected. Torture survivors struggle to manage both the chronic pain sustained as a result of the physical assaults and the disturbing biopsychosocial symptoms of trauma exposure, and struggle to cope with activities of daily living as a result of dysregulation in the nervous system. Aside from the psychological ramifications. The way your body perceives and manages pain can alter over time as a result of trauma. From that perspective, this study will highlight the neurophysiological effects of torture on the brain and pain system and how using biopsychosocial intervention during the healing journey will help in improving chronic musculoskeletal chronic pain.

Hypothesis for this Study

This study hypothesizes that chronic pain that appears after torture as a result of changes in brain connectivity and changes in the pain system as result of the effects of trauma or physical assaults will leave survivors with biopsychosocial symptoms that will require biopsychosocial intervention to improve symptoms and well-being.

Method

Multiple databases were used in identifying sources for this literature review. Initially, Google Scholar and PubMed and Dignity online library, were utilized to take an initial sample of what types of articles were available. The PubMed database was useful in locating full-text articles from well-known research journals and publications. A literature search was conducted using the search terms "chronic pain", "torture", "interdisciplinary rehabilitation", "biopsychosocial changes", "PTSD", "Neuroplasticity", "brain connectivity" and "biopsychosocial approach". After database searching, records identified studies after database searching are 300 studies; studies excluded based on title, or abstract review, 210 studies; excluded studies after recording screened 185; the authors selected 25 articles and chapters to include and review. The author evaluated the resources with the following criteria

- articles published in online peer-reviewed journals in English, published dissertations, and book chapters,
- focused on articles that discussed chronic pain with survivors of torture and severe violence; biopsychosocial interventions compared to any alternative intervention or no intervention; and pain outcome; and the study also focuses on approaches currently used in the Modern School of Pain, such as the trauma-informed model and the ICF model. Studies needed to have at least 10 participants in each arm for inclusion
- articles that measured both constructs across adult age groups, older than 18 years old, were included.
- how current are the resources: the majority of references were from the last 7 years, but a few studies from previous decades were included to establish foundation concepts that continue to this day.
- articles that focus on primary quantitative studies, including randomized and non-randomized controlled trials systematic review meta-analysis, narrative review and exclude quantitative studies that do not measure a change in health outcomes.

Literature Review of Torture and its Effect on Brain, and Pain System

Torture

Torture is defined in different ways, but the most widely used definition is Article 1 of the 1984 United Nations Convention Against Torture: any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him or a third person, information or a confession, punishing him for an act he or a third person has committed or is suspected of having committed; intimidating or coercing him or a third person, or for any reason based on discrimination of any kind, when such pain or suffering is inflicted by or at the instigation of or with the consent or acquiescence of a public official or other person acting in an official capacity. It does not include pain or suffering arising only from, inherent in, or incidental to lawful sanctions. The United Nations Convention Against Torture, Article 1.1. Torture is the deliberate infliction of severe pain or suffering on a person for reasons such as punishment, extracting a confession, interrogation for information, or intimidating third parties (UNCAT, 1984).

Structure and Function Changes in the Brain

As this study focuses on pain, the intensity of many profoundly cruel and destructive torture practices, and the distress at the time of infliction, it is not surprising that chronic pain is very common in survivors. Psychological effects can also develop and appear later, and we would not endorse the common practice of distinguishing between physical and psychological torture methods and torture effects, since the effects of any torture are holistic on a person, and assuming specific effects in biopsychosocial domains is inconsistent with the evidence. The context of torture, for both pain and psychological difficulties, is very important and the meanings, memories, and effects of this experience are different among torture survivors, from feelings of defeat and despair to pride in survival and resilience (de C Williams & Baird, 2016).

Torture as a Traumatic Event

Torture and other traumatic experiences put people at high risk for a variety of mental health and physical problems. Physical torture has been shown to be a robust predictor of mental distress in prisoners of war and other conflict-affected or displaced populations for years, and even a long period, after torture has occurred. Trauma results from an event, a series of events, or extraordinary circumstances. Trauma is an emotional or physical response to one or more physically harmful or life-threatening events or circumstances with lasting adverse effects on your mental and physical well-being, according to the Substance Abuse and Mental Health Services Administration (SAMHSA, 2014). Trauma is experienced by an individual as physically or emotionally harmful or life-threatening and that has lasting effects on all aspects of an individual, like functioning and mental, physical, social, emotional, or spiritual well-being.

Reactions to a traumatic event are different from one person to another. They could be temporary with immediate psychological and/or physical effects for some people. For others, trauma can have lasting effects on a person's life, functionality, and well-being. This reaction can become chronic or persistent with more severe, prolonged, or enduring mental health consequences. It can alter individual biology, neurology, and behavior over the life course, which can impact both interpersonal and intergenerational relationships (SAMHSA, 2014). The classic fight-or-flight response to a perceived threat is a reflexive nervous technique that has obvious survival advantages in evolutionary terms. However, the systems that organize the constellation of reflexive survival behaviors following exposure to a perceived threat can, under some circumstances, become dysregulated in the process. Chronic dysregulation of these systems can lead to chronic changes, and functional impairment and lead that person to become "psychologically traumatized" and suffer from post-traumatic stress disorder (PTSD). A body of data accumulated over several decades has demonstrated neurobiological and neurochemical abnormalities in PTSD patients. The signs and symptoms of PTSD, therefore, appear to reflect a persistent, abnormal adaptation of neurobiological systems to the stress of witnessed trauma.

Certain hormone and neurotransmitter pathways, as well as a network of brain regions known to control fear behavior at both the conscious and unconscious levels, are among the neurobiological systems that control stress reactions. A study was done by (Shahin et al., 2016) to investigate the brain changes in torture survivors by PET and MRI. In the study they found that the mean left hippocampal volume for the torture survivors who have PTSD symptoms was significantly lower than in the healthy volunteer group, and there was a significant difference between the gray matter volume of the patients with torture survivors who have PTSD symptoms and the healthy volunteer group. The torture survivors group showed significantly lower the expansion of the ventricles, in contrast to the healthy group. Diffusion-weighted imaging revealed significant differences in the right frontal lobe and the left occipital lobe between torture survivors who have PTSD symptoms and healthy volunteers' groups. For more details about these changes, we want to highlight the main neurochemical and neuroanatomical changes after trauma exposure.

The hypothalamic-pituitary-adrenal axis

The hypothalamic-pituitary-adrenal (HPA)/corticotropin-releasing factor (CRF)/axis system is crucial to the stress response. A negative feedback effect on the axis at the level of the pituitary, as well as central brain sites like the hypothalamus and hippocampus, is caused by the release of CRF from the hypothalamus, which stimulates the release of adrenocorticotropic hormone (ACTH) from the pituitary. This in turn causes the release of glucocorticoids from the adrenal (Bremner, 2006). PTSD's core endocrine features include abnormalities in thyroid hormone and cortisol regulation. In short, the HPA axis is made up of endocrine hypothalamic components, including the anterior pituitary, as well as an effector organ, the adrenal glands. Upon exposure to stress, neurons in the hypothalamic paraventricular nucleus (PVN) secrete corticotropin-releasing hormone (CRH) from nerve terminals in the median eminence into the hypothalamo-hypophyseal portal circulation, which stimulates the production and release of adrenocorticotropic (ACTH) from the anterior pituitary. ACTH in turn stimulates the release of glucocorticoids from the adrenal cortex. Sustained and continued glucocorticoid exposure has adverse effects on hippocampal neurons, including reduction in dendritic branching, loss of dendritic spines, and impairment of neurogenesis (Vermetten & Bremner, 2002).

One of the main neurochemical features of PTSD includes abnormal regulation of catecholamine and serotonin, which are found in brain circuits that regulate and integrate stress and fear responses.

The Catecholamines

Dopamine (DA), norepinephrine (NE) are among the monoaminergic neurotransmitters known as catecholamines (Highland et al., 2015). To mediate adaptive reactions to acute stressors, the sympathetic nervous system induces the release of the catecholamines epinephrine, norepinephrine,

and dopamine. Additionally, they are connected to the long-term memory of incidents that cause emotional responses like horror. They are recognized as being crucial in the control of the mechanisms underlying various PTSD symptoms (Pan et al., 2018). Increased urine excretion of DA and its metabolite has been seen in patients with PTSD after the lap test, which was used in various investigations (Vermetten & Bremner, 2002). Dopamine is involved in the regulation of fear-conditioning in a number of brain areas including the medial prefrontal cortex (mPFC), nucleus of amygdala (Eiden, 2013). Individuals who have gone through trauma generally have hyperresponsive dopaminergic systems, which has been correlated to PTSD symptoms like anxiety, nightmares, fearful flashbacks (Pan et al., 2018). NE, is one among the key players in the central and peripheral nerve systems in mediating autonomic stress responses. The majority of the central nervous system norepinephrine is transferred from locus coeruleus (LC) that project to various brain regions involved in the stress response, including the prefrontal cortex, amygdala, hippocampus, hypothalamus, periaqueductal grey, and thalamus. In the periphery, stress-induced sympathetic nervous system activation results in the release of NE and epinephrine from the adrenal medulla, increased release of NE from sympathetic nerve endings, and changes in blood flow to a variety of organs as needed for fight-or-flight response. A systematic review and meta-analysis study was done by (Pan et al., 2018) to assess whether concentrations of the catecholamines dopamine, norepinephrine, and epinephrine are associated with PTSD, and they found that PTSD patients had significantly higher norepinephrine levels than controls, which lead to sustained hyperactivity of the autonomic sympathetic branch of the autonomic nervous system, as evidenced by elevations in heart rate, sensory alert, muscle tension, skin conductance, and change body temperature (Vermetten & Bremner, 2002).

Serotonin

Serotonin (5HT) is a neurotransmitter synthesized from the amino acid tryptophan. Neurons containing 5HT come from the medial, and dorsal raphe nuclei in the brainstem and connect to multiple forebrain regions, including the amygdala, hippocampus, hypothalamus, and prefrontal cortex (Vermetten & Bremner, 2002). The serotonin system plays a critical role in behavioral and emotional regulation (Chaouloff et al., 1999). Sexual behavior, sleep, impulsivity, appetite, motor activity, analgesic, and neuroendocrine function are few of the activities and bodily functions that 5HT controls. Given its interconnectedness and extensive homeostatic function, it is not surprising that 5HT has been linked to the modulation of affective and stress responses, as well as PTSD symptoms following trauma. The effects of 5HT on affective and stress responses is different according to stressor intensity, brain area, and receptor type. It is believed that 5HT neurons of the dorsal raphe mediate anxiogenic effects via 5HT₂ receptors through projections to the amygdala and hippocampus. In contrast, 5HT neurons from the median raphe are thought to mediate anxiolytic effects, facilitate extinction and suppress encoding of learned associations via 5HT_{1A} receptors (Sherin & Nemeroff, 2011). Chronic exposure to stressors induces upregulation of 5HT₂

and downregulation of 5HT_{1A} receptors in animal models. A circuit of cortical and subcortical brain areas has been shown to govern stress-related behaviors that may be disrupted in people with PTSD, according to functional neuroimaging research. This circuit, which encompasses the striatum, amygdala, hippocampus, and anterior cingulate cortex (ACC), is heavily innervated by serotonin-containing neurons that emerge from raphe nuclei in the brainstem (Phillips et al., 2003). Evidence suggests that serotonergic pathways play an important role in this process. Maladaptive behavioral reactions to trauma exposure and clinical symptoms of PTSD are thought to result from neurochemical and neurophysiologic malfunction of this circuit (Murrugh et al., 2011). Indirect evidence suggests a role for 5HT in PTSD related behaviors including impulsivity, hostility, aggression, depression, and suicidality (Vermetten & Bremner, 2002).

The amygdala, hippocampus, and prefrontal cortex are three regions of the brain that are connected to the stress response. Traumatic stress may cause long-lasting alterations in these brain regions. In this section, there will be highlighted the main changes in these brain areas who are affected after trauma, and its comorbidity with chronic pain.

Cortex

The anterior cingulate cortex (ACC), subcallosal cortex, and medial frontal gyrus make the medial prefrontal cortex (mPFC). The medial PFC exerts inhibitory control over stress responses and emotional reactivity in part due to its circuit connections with the amygdala. It is a key area for top-down cognitive control of emotion-driven behavior. Through activating the inhibition of learned fear responses, it also mediates the extinction of conditioned fear. People who have experienced trauma and have PTSD symptoms had smaller frontal brain sizes overall, including smaller ACC volumes. According to some studies, changes in ACC volume are a biological indicator of how severe PTSD symptoms are caused by implanted traumatic memories. As a result, interactions in activation patterns between the amygdala and medial PFC have been documented in PTSD, however the direction of the association varies among investigations (Sherin & Nemeroff, 2011). The mPFC has a significant role in the processing of emotion and cognitive functions in chronic pain. We can say that chronic pain develops as a result of a persistent pain memory and the inability to remove that memory following an injury. A failure to remove subcortically motivated fear behaviors could come from abnormalities in mPFC function, which, given the crucial role it plays in the extinction of fear behaviors, would cause pain to progress to chronic pain. Patients with chronic pain have also been shown to have a decrease in mPFC volume (Yang & Chang, 2019).

Hippocampus

The hippocampus is implicated in the control of stress responses, declarative memory, and contextual aspects of fear conditioning. The hippocampus is one of the most brain regions that have a neuroplasticity feature (Bremner, 2006). Long time or chronic exposure to stress lead to irreversible

damage in the hippocampus and affect its neurological feature like reduction in dendritic branching, loss of dendritic spines, and impairment of neurogenesis. In a study done by (Gurvits et al., 1996) when comparing combat veterans with PTSD and healthy controls, combat-related PTSD was associated with bilateral hippocampus volume reductions. Combat intensity and volume reduction were associated. Wechsler Memory Scale measurements of verbal declarative memory performance showed a correlation between smaller volume and deficits in the verbal declarative memory (Bremnar et al., 1995). Recent research also suggests that decreased hippocampal volumes might be a pre-existing vulnerability factor for developing PTSD. Hippocampal decrease in PTSD may reflect the cumulative toxic effects of constant exposure to increased glucocorticoid levels or increased glucocorticoid sensitivity (Sherin & Nemeroff, 2011). If we want to look at hippocampus changes after chronic pain experiences, the hippocampus's role in neurogenesis, which helps with learning and memory, may lead to the onset of chronic pain. Cognitive impairments and altered emotional states, such as protracted stress, sadness, and anxiety disorders, are frequently present in patients with chronic pain.

Changes in the hippocampus' structure and function, such as decreased hippocampal neurogenesis, are linked to chronic pain according to recent studies of the brain (Yang & Chang, 2019).

Amygdala

The amygdala is a limbic structure involved in emotional processing and is critical for the acquisition of fear responses. The amygdala, in particular, regulates the formation and expression of conditioned fear as well as the consolidation of emotional memory (Koenigs & Grafman, 2009). Studies have shown that trauma has an impact on the amygdala's volume. It is interesting to note that children and adults respond differently to traumatic stress on the amygdala volume. Traumatic stress in adults is linked to decreased amygdala volume, but childhood trauma is linked to increases in amygdala volume (Mehta et al., 2009). The functional role of the amygdala in mediating both stress responses and emotional learning implicate its role in the pathophysiology of PTSD. Functional imaging studies have revealed hyper-responsiveness in PTSD during the presentation of stressful scripts, cues, and/or trauma reminders.

The amygdala, particularly its central nucleus, has also emerged in the last 20 years as a significant component of the pain matrix, due to the fact that pain has a strong affective and emotional component. There are changes in the activation of the amygdala in chronic pain situations. There are studies suggesting that the amygdala has an important role in the emotional affective aspects of pain. Chronic and persistent pain changes the central nucleus of amygdala activity, which affects how one experiences pain and the emotional, affective, and motivational states that go along with it. These moods can alter how information is processed by the amygdala and how it affects pain in a reciprocal manner (Veinante et al., 2013).

Torture exposure was associated with distinct brain activity and connectivity patterns during threat and reward processing, dependent on trauma exposure and posttraumatic stress disorder symptom severity. Torture appears to affect emotional brain functioning, and findings have the potential to guide more targeted interventions for torture survivors. Torture survivors deactivated the ventral striatum during happy processing compared to non-torture survivor controls. The ventral striatum has a prominent role in reward processing. With strong connections with other emotion generators, this region is active during the anticipation and receipt of monetary and social rewards. And as a function of increased posttraumatic stress disorder, symptom severity lead to deactivate that part of the brain and lead to particularly avoidance symptoms.

Neuroscience of Pain and Pain for Torture Survivors

Pain

Torture experience exposes a person to excruciating pain. As a result, the person often develops a very stress memory about pain, and that leads him/her to avoid pain. Many torture survivors have a low pain threshold and their pain response will easily be provoked. That is why, during the first stage of rehabilitation, the therapist must care how to avoid painful treatments, especially in the parts that need physical intervention. Many patients have little understanding of the reasons for their pain. Pain will often provoke anxiety and high stress, as the survivor perceives the pain as a sign of injury or seriously ill. Therefore, it is crucial that the clinician has a thorough understanding of the nature of pain following traumatic experience and that they give the survivors with information on pain and pain processes throughout the early stages of rehabilitation. Pain is a normal human experience and the inability to experience pain provides a significant risk to survival for any human being (Mollica et al., 2009).

Acute Pain

Usually comes from tissue damage, termed nociceptive pain or pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors. That is, a signal is generated from abnormal peripheral tissues and send up by the dorsal horn pain transmission neurons to the regions of the brain that receive this input. While the term neuropathic pain is referring to pain caused by a lesion or disease of the somatosensory nervous system. This requires a demonstrable lesion (seen on imaging, neurophysiology tests, biopsy results, laboratory testing) or a disease (stroke, vasculitis, diabetes, shingles) that satisfies established diagnostic investigations. Many times, however, the nature, severity or intensity of the pain complaint cannot be explained by biochemical, or anatomical processes. In these cases, we may need to invoke the central amplification of pain (Hanne, 2014).

Acute Pain and Injuries for Torture Survivors

Most of the shared and published studies in medical literature on torture are retrospective studies on the aftermath of torture in living survivors. These studies are mainly conducted on refugees and asylum seekers. Very few studies have addressed

the medical aspects of torture in active field investigations, while torture is occurring, unless a forensic study on the people who did not survive, and their family had a chance to receive their corpse. Thus, virtually nothing significant has been published about torture as a clinicopathological entity.

Chronic Pain

It is usually defined as pain lasting more than 3 months and almost certainly has some, albeit variable, element of central sensitization. Chronic pain is a complex process of sensory and emotional experience that varies widely between people depending on the context of the life and understanding, and beliefs, and thoughts about the pain and the psychological state of the person during the injury time. Cognitive and emotional factors have a critically important influence on pain perception and these relationships lie in the connectivity of brain regions controlling pain perception, attention or expectation, and emotional states (brain is a moderator of pain according to a new school of pain). Imaging studies that conduct on people who experience chronic pain have confirmed that activity of afferent and descending pain pathways is altered by attentional state, negative emotions, mental status, or social situation, among many other factors unrelated to the pain stimulus itself or to injured tissue.

The physiology of central pain amplification at the level of the brain considers these important connections. There is now a high amount of studies that prove and demonstrate that patients with chronic pain have alterations in brain regions involved in cognitive and emotional modulation of pain. This complex interplay may explain why patients with long-term chronic pain develop anxiety, stress, change in behaviors, physical disability and depression, and in the opposite side why those with negative psychological states, and cognitive distortion are at higher risk for chronic pain and central amplification of pain (Crofford, 2015).

Pathophysiology of Post-Torture Pain

Pain for torture survivors can be complex with unfamiliar presentations and the pains hard to assign to specific injury or known reason, or disorders. For many survivors, pain and associated disability are overshadowed by psychological distress, often by high anxiety, or post-traumatic stress symptoms that can be frightening and lead to avoidance and isolation, specially that pain feeling work with survivors as a trigger that stimulate the memory of torture experience. Actually, torture is designed to inflict suffering without visual traces. Chronic pain is often unrelated to actual observable injury (Dibaj et al., 2020). Several studies, such as (Siqueland, 2017) proved that PTSD moderated the relationship between intentional trauma exposure and chronic pain. Specific torture methods may lead to specific pain sequels that then lead to specific problems. The clinical picture of pain in the clinic is one of regional or widespread pain. The most common pain is musculoskeletal pain, back pain, chest pain, stomach pain, joint pain including neck, and shoulder pain, headache and pelvic pain. Visceral symptoms (cardiovascular, respiratory, intestinal, changes in urinary, or sexual system) are also prevalent (Hanne, 2014).

However, the division of torture and pain into categories in this way may be considered primarily academic, and not very practical in the rehabilitation field, as most survivors are subjected to varying torture methods, within varying time frames, with different intensity, and frequency and, as we mentioned before, chronic pain is complex and multi-faceted.

Theory of Chronic Pain

Gate Control Theory

It explains the experience of pain (including psychological factors) on a physiological level. In the gate control theory, pain is divided into two components that are processed separately by the body. These are signals from the peripheral nervous system which is outside of the brain and spinal cord, and signals from the central nervous system, including the spinal cord and the brain. Nociceptive signals flow along the peripheral nerves to the spinal cord and proceed to the brain. In the spinal cord, there are “gates” (in the dorsal horn substantia gelatinosa) that can inhibit (close) or facilitate (open) nerve impulses going from the body to the brain. These “gates” are influenced by a number of factors, including the diameter of the active peripheral nerve converging in the dorsal horns, as well as “signals/information/instructions” descending from the brain. When the gates are more open, a person experiences more pain since the messages flow freely. When the gates close, the pain is decreased, or the feeling of pain is blocked. Of course, the theory is much more complicated than that, but this is a simple description of it. Some of the physiological assumptions of the gate control theory have been updated, but the conceptual model has remained an important piece of pain science.

Referring to the pain gate theory that we mention above, (Robert et al., 2021) suggests that the psychosocial component in the gate control theory contributes a great deal in treating patients with pain. Negative states of mind such as sadness, high stress, anxiety, depression, sleep problems, lack of movement and anger tend to amplify the intensity of the sensory input, while strategies focusing on healthy coping and stress control like exercising, deep talking, and breathing help to “close” the gate. So, promoting healthy coping strategies, and positive behaviors, proactive choices can be important factors in lessening the perception of pain, and close the gate.

The Neuromatrix Theory

This theory is a further development of the Gate Control Theory. In the neuromatrix theory, pain is seen as a multidimensional experience, it is like looking to a person from a holistic point of view. The pain experience is divided into three dimensions: one is the sensory-discriminative (somatosensory), which refers to the sensation of pain and includes its intensity, duration location, (e.g. deep, superficial, continued, intermittent, burning, dull, or sharp). Two is the affective-motivational (limbic), which encompasses the emotional component, and reactions to pain, for instance how much the pain bothers, triggers, and gets the patient afraid. The evaluative-cognitive (thalamocortical), which refers to how pain is perceived and interpreted, and that is mainly related to beliefs, thoughts, and attitude toward

pain, which may come from their cultural background and from previous pain experiences play a crucial part in this dimension, which can modify the two other dimensions. All three dimensions contribute equally to the experience of pain and also motivate actions to relieve pain.

For chronic pain, there are changes in synaptic functionality. Glutamate functions as one of the main excitatory neurotransmitters in the CNS and exists in synapses throughout the brain.

Furthermore, glutamate and its receptor subtypes, N-methyl-D-aspartic acid (NMDA) receptor and α -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor have been found to be involved in the occurrence and development of chronic pain and depression. In the spinal cord, both increased excitatory system activity and the accompanying reduced inhibitory system are known to contribute to central hyperalgesia and to ultimately lead to the progression of pathological pain (Sheng et al., 2017).

The conclusion is that there is not just one center of the brain which processes pain, but rather the pain experience/perception is a compilation of activities at multiple levels within the brain. Also, the more chronic the condition, the smaller the role of the somato/sensory, and the larger the roles of the limbic and thalamocortical centers. This is important knowledge to convey, and explain to the patients. One implication for treatment is to make use of positive thoughts or actions which can overshadow and therefore lessen the pain perception.

Pain Mechanisms after Torture

Sensitization can be both Central and Peripheral. Nociceptive mechanisms

If we want to have a closer look to pain that result from physical assault, and the mechanism that the body uses to alert a person, so the more likely the mechanisms that the body used are nociceptive mechanisms. Acute pain after torture may be related to the inflammation response, which sensitizes tissues and lowers the thresholds of mechanical nociceptors to increase noticing, and alerting person about that pain, and enhance healing process, with not miss the deformity caused by burning, abuses, swelling fracture or dislocation. In subsequent months and years, the contribution of nociceptors to pain may be decreased to the mechanics of an uncorrected deformity or less likely reinjury, and the central sensitization mechanism become more likely to control pain (Amris et al., 2019).

Central Sensitization

Increased responsiveness of nociceptive neurons in the central nervous system to their normal or sub threshold afferent input. Central sensitization is normally initiated only by nociceptor sensory inflow and is characterized by reductions in threshold and increases in the responsiveness of dorsal horn neurons, as well as by enlargement of their receptive fields.

There are some symptom constellations that are considered to

indicate pain due to central sensitization: increased intensity of spontaneous pain, without a corresponding worsening of the underlying (peripheral) pathology, increased pain following palpation, increased pain intensity following physical activity, or body part movement, increased pain during resting and due to different posture like sitting and standing, which makes the person change position constantly (Hanne, 2014).

Nociplastic mechanisms and altered central pain modulation

Factors that influence the central modulation of nociception are now termed “nociplastic”. The central (spinal and supraspinal) moderating and mediating factors are likely important in the pain experience of torture survivors. Torture survivor pain includes widespread, non-localized musculoskeletal pain and hypersensitivity in peripheral tissues with no apparent tissue injury or pathology. Headache is also common, as well as general body fatigue and sleep problems (this symptom appears primarily as a result of changes in central nervous system sensitivity caused by decreased central inhibition and/or central amplification).

Systematic studies addressing risk and protective factors associated with the development of persistent pain after torture are lacking. However, pain is inflicted in torture often under severe conditions with extreme stress that may have profound effects on neurophysiology and the processing of pain, according to previous pain theories that we described (Liu et al., 2019).

Pain Rehabilitation for Torture Survivors Pain Rehabilitation for Torture Survivors

Rehabilitation, as a form of reparation for the human rights violation of torture, is defined in the United Nations Convention against Torture’s General Comment number 3 on article 14 (‘General Comment’) as “the restoration of function or the acquisition of new skills required as a result of the changed circumstances of a victim arising from torture or ill-treatment” and as seeking “to enable the maximum possible self-sufficiency and function for the individual concerned, and may involve adjustments to the person’s physical and social environment. (Patel & Williams, 2022). In general, the ultimate outcome goal when providing rehabilitation for torture survivors who have chronic pain conditions is improving functional capacity, which correlates with stable psychological statuses, physical strength and mobility, together with an improved self-esteem (Robert et al., 2021).

Torture survivors are a complex target group with very diverse backgrounds. The nature of the torture, the duration, and the type of trauma have all had a psychological and physical impact on them, with symptoms such as PTSD, continuous stressors, fears, sleep problems, depression, and chronic pain being common. The focus of rehabilitation should be goal-oriented according to what the person needs, and it should be a cooperative process involving the person him/herself, family members, or care givers if needed, and professionals. The goal of this process is to improve this person’s quality of life by

ensuring that the person who has challenges with his physical, mental, and social functions can achieve independence and rediscover the meaning of his life. According to this, rehabilitation considers the person's situation as a whole and the decisions he or she must make by providing a strength-based approach. The processes should be coherent and knowledge-based (Jørgensen et al., 2010). According to what this study presents above about the relationship between chronic pain and torture, and its relationship with biopsychosocial changes and because chronic pain is associated with abnormal ways of perceiving and reacting to sensory information, the clinician is placed into a situation that requires a judgment about the veracity of patient reports, and consider the whole aspect of that person during rehabilitation, and not only focusing on the medical side. And this is not saying that rehabilitation would work differently in survivors of torture than in people who is not a survivor of torture, but that pain resulting from torture can be difficult to understand from one perspective in the light of current studies, and that survivors are, because of their massive experience, often hypersensitive to medical procedures required for diagnosis and treatment. The treatments available for chronic pain, particularly the use of opioid analgesics, are not effective and can be addictive, misused, abused, and diverted (Crofford, 2015), so we want to present the intervention for chronic pain from a biopsychosocial perspective. As a result, chronic pain after torture must be discussed on multiple levels and from various perspectives. Pain and the emotional distress associated with it are perceived differently in different cultures. They propose an eco-social framework that focuses on larger systems like attachment, security, identity, justice, and existential meaning. This viewpoint considers contextual factors and recognizes that pain perception and response are culturally based.

Trauma Informed Care

Trauma-Informed Care has become recognized as a valuable part of patient care in settings of torture survivors. Using this approach in clinical settings and intervention across disciplines can help to avoid re-traumatization and improve treatment outcomes for trauma survivors. The trauma-informed care model is a framework that acknowledges the impact of trauma, as well as ways to respond to trauma and provides survivors power by using a client-centered approach to rebuild their self-control and empowerment rather than conventional medicine approaches. This approach also provides patients with more opportunities to engage in services, and restore the power that they lost during the torture experience (SAMHSA, 2014).

Trauma-informed care is applicable to all rehabilitation practices and patients, not just torture survivors. Trauma-Informed Care adheres to five guiding principles that serve as a framework for how service providers and health-care systems can collaborate to reduce the risk of re-traumatization. The principles define a set of practices and procedures that can be interpreted and applied in different ways depending on the type of service setting (Harries, 2001).

The basic principles of trauma-informed care can be summarized as follows:

- **Safety:** health-care providers and survivors feel physically and psychologically safe; common areas are welcoming; and privacy is respected.
- **Trustworthiness and Transparency:** organizational operations and decisions are transparent and trust is built. And respectable and professional boundaries are maintained.
- **Collaboration:** this principle is about levelling power differentials between staff and client and client's family to ensure a collaborative approach to healing. And the individual is given a significant role in planning, and later evaluation of the service.
- **Empowerment:** this principle emphasizes the trauma-informed care's strengths-based approach. And it is to provide an atmosphere that allows individuals to feel validated.
- **Choices:** an individual has choice and control, and they provided a clear and appropriate message about their rights and responsibilities.

Biopsychosocial Approach

The biopsychosocial model was first introduced in medicine by Engel when he highlighted the fact that, as a medical illness became more chronic in nature, then psychosocial "layers" (e.g., distress, illness behavior, and the sick role) emerged to complicate assessment and treatment. (Robert et al., 2021). The aims of pain treatment should be to improve control of pain, build realistic understanding of problems and reduce unhelpful beliefs about pain, improve function by working towards short-and long-term goals in graded steps, increase participation in different life aspects, increase body awareness, and enhance self-regulation, improve a person's resilience to cope after trauma, and reduce unhelpful interactions with the health system. In summary, pain management works by changing the person's relationship to the pain and the meaning of the pain in his or her life by re-regulating the nervous system. For these reasons, the biopsychosocial model should be used (Bengt et al., 2009). The biopsychosocial model views pain as an interaction among biological, psychological, and sociocultural variables. Intervention to address the process of nociception is the first component (Hanne, 2014) and that would not be reach till building safety with client, and support the person regulate nervous system by understanding trauma and its effect. The second component is recognition of pain at the cortical level as a consequence of nociception in this stage pain neuroscience PNE education is essential, PNE aims to increase pain thresholds during exercise, reduce fear that associate to movement and decreased brain activity in brain regions associated with pain. In practice, this often includes the use of metaphors and educational pain analogies, re-education of patient misconceptions regarding disease pathogenesis and guidance about lifestyle and movement modifications that can be introduced. It is important to address that pain and injuries are two separate phenomena. Beside that part, the collaboration with a psychologist to address the psychological side of trauma and PTSD, because PTSD and chronic pain have

a complex relationship that one of them lead to another. The third component is to address the negative impact of pain in all life aspects like depression or anxiety, and again increase their awareness about the biopsychosocial impact of pain suffering, and support the survivors to build their own empowerment and resilience. The fourth component is pain behavior, which can be influenced by history, environment and cultural factors and includes both verbal behaviors (specific common word in specific community in regard to pain) and nonverbal behaviors (specific action that correlate with specific pain type) like avoiding, being dependent on others because of pain, reduce physical activity for fear of re- injury (Hanne, 2014).

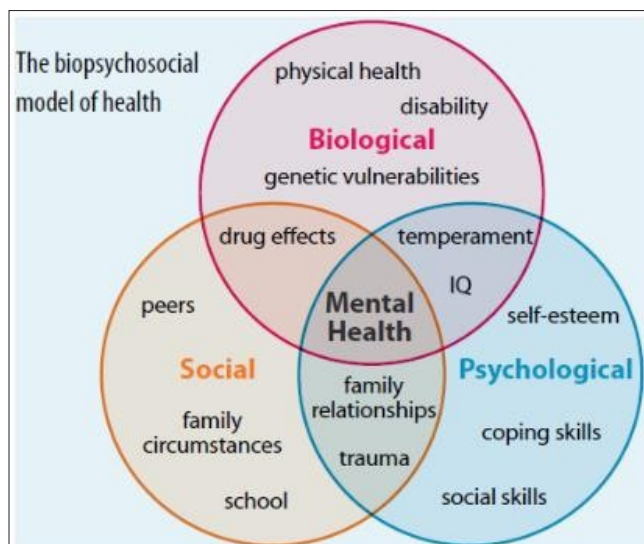


Figure 1: Center for Substance Abuse Treatment (US). Trauma-Informed Care in Behavioral Health Services. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2014. (Treatment Improvement Protocol (TIP) Series, No. 57.)

Available from: <https://www.ncbi.nlm.nih.gov/books/NBK207201/>.

International Classification of Functioning, Disability and Health ICF model to assess functionality

At the end of this study, we would like to highlight a practical way to use the biopsychosocial approach by using the International Classification of Functioning, Disability and Health ICF model.

Introducing the ICF and the aim from it

The International Classification of Functioning, Disability and Health (ICF) is a framework for describing and organizing information on functioning and disability. It establishes a common language and conceptual foundation for the definition and measurement of health and disability. The World Health Assembly approved the ICF for use in 2001. The ICF acknowledges the importance of environmental factors in the development of disability, as well as the importance of associated health conditions and their consequences.

In the ICF, functioning and disability are multi-dimensional concepts, relating to:

- The body functions and structures of people, and impairments thereof (functioning at the level of the body).
- The activities of people (functioning at the level of the individual) and the activity limitations they experience.
- The participation or involvement of people in all areas of life, and the participation restrictions they experience (functioning of a person as a member of society).
- The environmental factors which affect these experiences (and whether these factors are facilitators or barriers).

The ICF conceptualizes a person's level of functioning as a dynamic interaction between her or his health conditions, environmental factors, and personal factors. It is a biopsychosocial model of intervention represented in Figure 2.

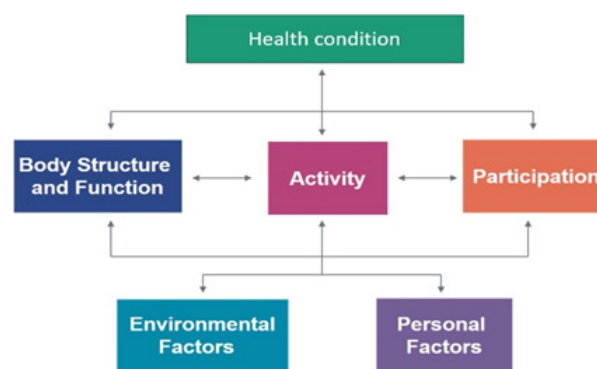


Figure 2: Example of ICF model

ICF Model for Torture Survivors

(Bengt et al., 2019) advocated an International Classification of Functioning, Disability and Health (ICF) approach to rehabilitation of torture survivors, and he mentioned in his study the following: “When assessing survivors to determine the needed intervention, it may be much more meaningful and truer to use the ICF approach, rather than speculating whether a particular organ system is affected with an uncertain etiology and adding symptom diagnoses or an empirical psychological categorization.” The ICF approach can appropriately derive rehabilitation signs by assessing impairments in body structure and function, activity limitations and participation restrictions, and focusing rehabilitation on those limitations. And in a new study done by (Jørgensen et al., 2010) about Using the International Classification of Functioning, Disability and Health (ICF) to describe the functioning of traumatized refugees, he concluded that “It seems fair to conclude that ICF is a suitable instrument to document and monitor achievements of the rehabilitation of traumatized refugees. By focusing on five very important components of functioning: body Functions, body Anatomy, activity and participation, environmental Factors and personal factors, ICF offers an overall view of the human aspects of functioning”. Considering the very complex situation of traumatized refugees, this perspective seems crucial, since traumatization of refugees impacts the mental, physical, and social functioning. This advocates for an interdisciplinary approach emphasizing rehabilitation, which includes treatment, as a part of the effort. ICF seems to be an appropriate instrument to describe the overall health condition of a patient or client and to document

and monitor rehabilitation. ICF focuses on functioning, rather than symptoms and diagnosis. It considers impairment as well as resources of the person, which creates a good basis for an assessment of all aspects of the person's health conditions.

Results

Following a database search, records identifying 300 studies were discovered. For 210 studies, studies were excluded based on title or abstract reviews. After screening, 185 studies were excluded. The authors selected 25 articles and chapters to include and review. The following parts represent the main sections of this study and the main 14 articles that were reviewed under each section.

Structure and Function changes in the Brain

In this section, after reviewed the studies that done by (Liddell et al., 2021) who studied the impact of torture on interpersonal threat and reward neurocircuit by applying the study on male refugees with (N=31) and without (N=27) torture exposure, and the literature review by (Sherin & Nemeroff, 2011) on post-traumatic stress disorder, and the literature review by (Liddell, & Bryant, 2018) on A neurobiological perspective of mental health following torture trauma, (Mollica et al., 2009) on brain structural abnormalities and mental health sequelae in South Vietnamese ex-political detainees who survived traumatic head injury and torture that done on subsample of Vietnamese ex-political detainees (n = 42) and comparison subjects (n = 16) selected from a community study of 337 ex-political detainees and 82 comparison subjects. And the study by (Steel, 2009) on association of torture and other potentially traumatic events with mental health outcomes among displacement people that done as systematic review and meta-analysis study. Selection surveys were limited to those of adult populations (n ≥ 50) reporting PTSD prevalence, depression prevalence, (Shahin et al., 2016) on Analysis of the Metabolic and Structural Brain Changes in Patients with Torture that done by evaluated 9 subjects suffering from TR-PTSD: 7 men and 2 women (age range, 20–47 years; mean age ± standard deviation. According to the findings of these articles, dealing with torture as a complicated traumatic event and its unique characteristics may cause long-term, and often permanent, changes in the brain's functioning architecture and structure. Understanding the effects of torture on the brain and its functional networks is regarded as a critical step toward identifying core mechanisms and interventions that could be used to develop new rehabilitation approaches for survivors. Torture survivors also had lower left hippocampal activation than controls. During fear processing, there was stronger coupling between the hippocampus and frontal, temporoparietal, and subcortical regions, with pathways predicted by avoidance and hyperarousal symptoms.

Neuroscience of Pain, and Pain for Torture Survivors

After reviewed the study of Pain from torture: assessment and management which done by (Amris, 2019), and the narrative review study on torture and pain between 2005 and 2019 that done by (Dibaj et al., 2020) on Painful memories: Challenges in trauma-focused therapy for torture survivors with PTSD and

chronic pain, and the study by (Liu et al., 2019) on Reward Processing under Chronic Pain from the Perspective of “Liking” and “Wanting”: A Narrative Review. And the review that done by (Yang & Chang, 2019) on Chronic Pain: Structural and Functional Changes in Brain Structures and Associated Negative Affective States.

The finding was that the opportunity to investigate how the mind-body relationship relates to pain experience and view pain through a biopsychosocial lens, which has become the most heuristic approach to truly understanding the concept of pain and is widely adopted by modern pain schools, was provided by gate control and neuromeric theories. This viewpoint regards a physical issue as the outcome of a dynamic interplay between biological, psychological, and social elements, all of which might play a part in the pain situation (Robert et al., 2021).

Understanding this notion by health professionals working in a multidisciplinary team is critical for successful treatment outcomes. There are no systematic studies that address the risk and protective variables related with the development of chronic pain following torture. Torture, on the other hand, inflicts pain often under harsh circumstances of great stress, which may have substantial impacts on neurophysiology and pain processing.

Pain Rehabilitation of Torture Survivors

In this part of the study, the main articles that have been reviewed are the one by (de C Williams & Baird, 2016) about Special Considerations for the Treatment of Pain from Torture and War Torture, and the randomize control trial study by (Baird et al., 2017) about Interventions for treating persistent pain in survivors of torture, and the study by (Patel & Williams, 2022) about Rehabilitation for torture survivors: Six evidence myths and their implications for future research. Patel and William studied the evidence of effective psychological interventions that may underpin and skew services funded and provided to torture survivors. In this paper, the authors challenge some of those assumptions, and discuss the conceptual, theoretical, epistemological, and methodological limitations, also in this section of the study, the review involves the research paper published by (Robert et al., 2021) about The Biopsychosocial Approach. Practical pain management, and the study that was done by (Jørgensen et al., 2010) about using the International Classification of Functioning, Disability, and Health (ICF) to describe the functioning of traumatized refugees, were part of a project to use the ICF to develop an interdisciplinary instrument consisting of a Core Set, a number of codes selected from the ICF, to describe the overall health condition of traumatized refugees. In 2007, eight rehabilitation centers for traumatized refugees in Denmark agreed on a joint project to develop a tool for interdisciplinary documentation and monitoring, including physical, mental, and social aspects of the person's health condition. The project selected a Comprehensive Core Set of 106 codes among 1,464 possible codes used by an interdisciplinary group of international and national experts in the rehabilitation of traumatized refugees. Following these reviews, the study found that the target

group of survivors is complicated and has a wide range of experiences. They have been psychologically and physically affected by the sort of torture, its severity, and the trauma it caused. Correlated symptoms include PTSD, ongoing stress, terror, sleeping problems, sadness, and chronic pain. For those who have experienced trauma, using trauma-informed techniques during therapeutic procedures for chronic pain and intervention in several disciplines may reduce the risk of re-traumatization and enhance treatment results. By re-regulating the nervous system, pain management alters how an individual views and interprets his or her own experience of pain. The biopsychosocial model should be used because of these factors (Bengt et al., 2009). The bio-psycho-social paradigm sees the combination of sociocultural, psychological, and biological factors as the source of pain. The ICF views a person's level of functioning as the result of a complex interplay between their personal circumstances, environmental circumstances, and health-related circumstances. It is plausible to infer that ICF is a suitable instrument for documenting and monitoring progress in the rehabilitation of torture victims. ICF focuses on five essential aspects of functioning: physiological functions, body architecture, activity and involvement, environmental influences, and participation. This gives users a complete view of the human elements of functioning.

Discussion

The literature review for this study focused on studies that looked at torture, and how this event raises people's risk for a variety of physical and mental health issues. The study focused on the biopsychosocial impact of torture and how it has been demonstrated that physical torture is a reliable predictor of mental suffering in those who experience it. The traditional fight-or-flight reaction to a perceived threat is a reflexive neurological phenomenon with clear evolutionary advantages for survival. The systems that coordinate the constellation of reflexive survival actions become dysregulated and hypersensitive when a person endures extreme situations, such as torture.

The signs and symptoms of PTSD, therefore, appear to reflect a persistent and the body's shifting to what is called "survivor mood." As a result, abnormal adaptation of neurobiological systems, including (The neurobiological systems that regulate stress responses include certain endocrine and neurotransmitter pathways as well as a network of brain regions known to regulate fear behavior), to the stress of torture survivors, has accrued. Several studies conducted to investigate the brain changes in torture survivors by using PET and MRI found that there were changes in hippocampal volume prefrontal cortex and amygdala activities for the torture survivors who have PTSD symptoms.

Given the centrality of pain for torture survivors, the physiological and neurological changes brought on by this traumatic experience, and the numerous changes and challenges survivors face, particularly from the refugee community, it is entirely normal to anticipate that chronic pain will be a common result for survivors. The majority of survivors are subjected to

a variety of torture methods within a variety of time frames, frequency, at various times in their life span, and chronic pain is multi-faceted and complex. Rehabilitation teams are likely to confront torture survivors with multi-biopsychosocial changes like chronic pain, psychiatric disorders, and psychological problems. Post-torture pain can be undertested through nociceptive, neuropathic, neuroplastic, and psychological factors. Using the biopsychosocial lens to examine the pain, we discover that there are several factors that contribute to torture survivors' experiencing chronic pain. Continued emotional stress-continuous hyper arousal increases the sympathetic activation, which in turn sensitizes the nociceptors and adds to the nociceptive input. Poor sleep decreases the tolerance to pain and leads to a high degree of avoidance behavior. Pain can act as a reminder of the torture situation. Therefore, many torture survivors try to avoid pain-provoking activities. This behavior may lead to physical deconditioning and aggravation of pain. Long-lasting pain can lead to neuroplastic changes in the brain, pointing to central sensitization, which is a common comorbid factor with chronic pain, promotes cognitive distortions in which the pain is regarded as insurmountable. The understanding of chronic pain from torture is seriously lacking, and research is needed in all areas. Such research is essential to advance theory development and to ensure that pain is more effectively managed in the overall rehabilitation of torture survivors.

The study's strength was its information on the biopsychosocial approach's efficacy in managing pain, as well as how it relates to physiological symptoms and functional results that frequently co-occur in people who have experienced torture and war trauma. Despite the fact that torture survivors and victims of war trauma frequently experience pain, the majority of the literature that is currently available focuses on psychological symptoms and psychological interventions.

Additionally, this study's focus is on pain (assessment and managed as a problem in its own right alongside the psychological distress in the recommended interdisciplinary management.). Studies in the trauma field show the effectiveness of using a trauma-informed approach during the pain rehabilitation period. Using that approach can prevent re-traumatization and improve treatment outcomes for individuals who have experienced torture. The trauma-informed care model is a framework that acknowledges the understanding of the impact of trauma and its relationship to pain and ways to respond to the trauma. It also enhances the physical, psychological, and emotional safety of both service providers and patients and provides opportunities for patients to rebuild their self-control and empowerment. It focuses on the importance of patient-centered care and provides people with more opportunities to engage in services that reflect a compassionate perspective of their presenting problems and that by following the principles of this approach (safety, trustworthiness, collaboration, empowerment, and providing choices). Also, this study provides review of studies for researchers who debate using ICF model within the pain rehabilitation for torture survivors; in the ICF, functioning and

disability are multi-dimensional concepts, relating to the body functions and structures of people, the activities of people, the participation or involvement of people in all areas of life, and the environmental factors which affect these experiences. The ICF conceptualizes a person's level of functioning as a dynamic interaction between her or his health conditions, environmental factors, and personal factors. The study done by Bengt H. and Sjölund in using ICF within torture survivors shows the effectiveness of that module, and they concluded that "it may be much more meaningful and truer to describe a traumatized person using the ICF approach, rather than speculating whether a particular organ system is affected with an uncertain etiology and adding symptom diagnoses or an empirical psychological categorization." ICF focuses on functioning rather than symptoms and diagnosis. It considers the person's impairment as well as their resources, providing a solid foundation for an assessment and the development of a rehabilitation plan for all aspects of the person's health conditions, including chronic pain.

There are comparatively few studies on how to effectively treat pain in torture victims. Torture survivors may not always be recognized or treated appropriately, and that needs to be addressed in the training of doctors and other healthcare staff. Medical staff are often in a key position to try to prevent torture, and to help those who have survived (de C Williams & Baird, 2016).

Conclusion

Torture is an act which violently and intrusively attacks the individual's boundaries and leads to real changes in the brain and nervous system that manifest in the survivors as high PTSD symptoms, chronic pain, feelings of disempowerment, lack of control. As a result of the brain's critical anatomical, neurophysiological, and chronic changes in the pain system, the rehabilitation team must understand these changes that survivors experiencing and create a setting that takes these experiences into account.

According to reviews of the articles that were mentioned in this study, chronic pain is considered one of the highest symptoms for torture survivors. Torture can cause long-term changes to the way your body perceives and regulates pain. A large portion of the literature focuses on contextual factors in refugee mental health and how these can function to maintain psychological distress or as barriers to treatment at different levels. Nevertheless, a clinical perspective on how the relationship between PTSD and other psychological symptoms that are related to trauma and chronic pain might affect patients' potential for improvement after treatment is lacking. Pain rehabilitation for torture survivors requires understanding the bio-psychosocial effects of trauma and torture in the body and brain. This literature review study focused on addressing chronic pain by using biopsychosocial lenses in addressing comorbidity between chronic pain and bio-psychological symptoms from a neuroscience point of view and using the same lens of biopsychosocial approach for intervention.

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