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POST-TRAUMATIC STRESS DISORDER: A FREQUENT WORK-RELATED ILLNESS

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SUMMARY

Post-traumatic stress disorder (PTSD) is an anxiety disorder that results from exposure to a traumatic event, and is characterized by hypermnesia of the traumatic event with frequent re-experiencing of the tragic occurrence, hyperarousal, and avoidance behaviour. Depression, anxiety, sleep dysfunction and substance abuse are also commonly reported. PTSD is highly prevalent both in the general population and in certain occupations that are particularly exposed to life-threatening situations, physically and psychological demanding activities, and physical assault, such as rescue workers, firefighters and paramedics. Recent advances in the comprehension of the epidemiology, physiopathology and clinical presentation of PTSD could push toward increased identification of this common psychiatric disorder with significant reflections on the chances of successful treatment.

Introduction

Post-traumatic stress disorder (PTSD) is a common psychiatric outcome after many types of traumatic events, from life-threatening accidents to exposure to natural disasters, and it can develop even in people with no history of psychiatric disorders. Traumatic stress can be caused by many different conditions, such as exposure to physical assault, infliction of life-threatening injury, exposure to severely mutilated bodies, the impact of life-threatening situations, physically demanding activities, and great material destruction. Nearly all people have the acute form of the disorder at some time in their lives, but they recover rapidly. If it persists, PTSD can be debilitating and require psychotherapeutic and pharmacologic intervention. Individuals diagnosed with PTSD experience significant functional impairment, including increased risk for unemployment, decreased job satisfaction, work absenteeism, early retirement, disrupted relationships, and diminished physical health.

Studies investigating the effects of traumatic stress on certain occupations, such as rescue and health care workers, professional firefighters, police officers, bus and train drivers, paramedics and military personnel, confirm that PTSD is a probable outcome for many people who are directly exposed to traumatic events and/or are involved in helping other people in emergency situations. Thus, PTSD is a common psychiatric disorder not only in the general population, but also in specific categories of workers, worldwide. Recognition of the disorder is of outmost importance in order to initiate appropriate treatment and support, thus limiting social dysfunction and disability.

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Definition of PTSD

According to DSM-IV, the essential feature of PTSD is the development of characteristic symptoms following exposure to an extremely traumatic stressor (i.e. capable to provoke fear, helplessness, or horror in response to the threat of injury or death) (1). PTSD symptoms are divided into three distinct categories consisting of hypermnesia of the traumatic event, avoidance behavior, and increased emotional arousal (1). PTSD should be diagnosed if the symptoms persist for at least 1 month, whereas if the symptoms remit within 4 weeks after the traumatic event, the diagnosis of an acute stress disorder is indicated (1). Hypermnesia consists of frequent re-experiencing of the traumatic event in form of nightmares and flashbacks. Avoidance behavior is characterized by avoidance of remainders associated with the trauma, including persons, places, or even thoughts associated with the traumatic event. Symptoms of hyperarousal are characterized by exaggerated startle, insomnia, hypervigilance and irritability (1,2).

PTSD, however, is not the only trauma-related disorder, or perhaps even the one most common, and people who are exposed to tragic events are also at increased risk for major depression, panic disorder, generalized anxiety disorder, sleep dysfunction and substance abuse (2). They may also complain of somatic symptoms and physical illnesses, particularly hypertension, asthma, and chronic pain syndromes (2).

Epidemiology and work-related PTSD

Studies of the prevalence of PTSD in the general population demonstrated that 5 to 6 percent of men and 10 to 14 percent of women had had PTSD at some time in their lives, making it the fourth most common psychiatric disorder (2,3). The conditional risk for PTSD following trauma exposure ranges from 5 to 31% with interpersonal (sexual assault and physical attack) and combat trauma associated with relatively greater risk (4,5). Factors that contribute to the intensity of the response to a psychologically traumatic experience include the degree of controllability, predictability, and perceived threat; the relative success of attempts to minimize injury to oneself or others; and actual loss (2). If the patient is wounded or exposed to pain, heat, or cold, the biologic and psychological experience can be intensified (2). Although PTSD can appear at any age, it is more common in young adults, because they are more likely to be exposed to precipitating situations. Children can also develop PTSD. Women have a higher lifetime prevalence of PTSD, although it is not clear whether this finding reflects an increased vulnerability to the disorder or the fact that seemingly similar events are experienced differently by men and women (2).

There is growing interest in the consequences of work-related stress and trauma in populations at a high risk of PTSD because of their occupation, such as emergency services personnel, military personnel and other categories of workers.

Rescue workers are the most studied category. A recent systematic review by Berger et al. showed that the worldwide pooled current prevalence was 10% (6). Ambulance personnel and rescuers from Asia were more susceptible to PTSD than firefighters, police officers, and rescuers from Europe and North America. What clearly emerged was the need for improving pre-employment strategies to select the most resilient individuals for rescue work, to implement continuous preventive measures for personnel, and to promote educational campaigns about PTSD and its therapeutic possibilities (6).

Another occupational category that has been frequently investigated is the firefighter. McFarlane found prevalence rates of 32%, 27%, and 30% in a sample of firefighters 4, 11, and 29 months after an Australian bushfire (7). The prevalence of PTSD was 18.2% among professional firefighters in Germany (8), and 18.5% in Kuwait (9). Specific personality traits have been suggested as possible markers of vulnerability to the development of psychopathological symptoms after trauma exposure, as well as longer job experience and the number of distressing missions during the last month, low-perceived social support and high self-blame (8,10,11). Noteworthily, an increasing trend in the prevalence of PTSD was found in World Trade center-exposed firefighters over time (12).

Train drivers are also at risk for PTSD, especially when they experience a “person-under-the-train” accident (12,13). In a French study the frequency of PTSD in the exposed workers after three month was

4%, and vulnerability factors concerned prior traumas, acute and lasting life events, and the particular occupational situation (where the driver is not accompanied but drives the train away alone in the aftermath of the accident) (14).
An elevated prevalence of PTSD (up to 12%) has been observed in bus drivers, especially in large urban areas where they are frequently assaulted (15,16).
Paramedics are also exposed to an increased risk of PTSD (up to 8.5%) because they may encounter many work-related traumatic events, especially those working in emergency rooms or pediatric intensive care units, with physical and psychological distress and potential impact on quality of care (17-19). Moreover, clinical nurses working in healthcare settings frequently experience a high prevalence of physical assaults from patients and visitors (20,21).

The complexity of trauma response

The physiopathology of PTSD should be seen as a complex interaction between psychological and biologic factors in response to a traumatic event, in which the characteristics of both the event and the person involved are of outmost importance. The most relevant actors of this interaction are the hypothalamic-pituitary-adrenal (HPA) axis and two major brain structures: the amygdala and hippocampus, with their widespread interactions with multiple cortical areas of the brain.
The HPA axis, a major part of the neuroendocrine system that controls reactions to stress and regulates many body processes, involves a complex set of interactions among the hypothalamus, the pituitary gland and the adrenal glands. Briefly, the hypothalamus secretes the corticotropin-releasing hormone (CRH) that stimulates the production of corticotropin from the pituitary, which in turn stimulates the production of cortisol from the adrenal cortex. With a feedback interaction, cortisol inhibit the release of corticotropin from the pituitary and the release of CRH from the hypothalamus.
In normal subjects, brief or sustained periods of stress are associated with increased levels of both cortisol and CRH. Differently from patients exposed to other types of stress, patients with PTSD often show low basal cortisol levels, whereas, paradoxically, levels of CRH are high, suggesting HPA axis oversensitivity (2). Moreover, prospective studies have shown that patients in whom PTSD or symptoms of PTSD develop have attenuated increases in cortisol levels in the immediate aftermath of a traumatic occurrence, which may be related to prior exposure to a tragic event or other stressors (2). The causal role of these alterations is supported by the observation that people with reduced cortisol excretion in response to a traumatic event have a higher risk of developing subsequent PTSD (2). Moreover, it has been shown that cortisol acts in the medial temporal lobe to reduce memory retrieval, so that it could play a role in the process of enhancement of the traumatic memory trace over time thereby magnifying symptoms (22). In addition, the sensitivity of the negative-feedback system of the HPA axis is increased, as reflected by the exaggerated suppression of cortisol in response to dexamethasone administration and the increased sensitivity of lymphocyte glucocorticoid receptors (2).
Interestingly, the alterations in glucocorticoid receptor sensitivity seem to occur very early in development, and can possibly be related even to in utero factors, and it is now well established that the activity of genes regulating HPA activity can be programmed by pre- and postnatal early life events, and even by differences in maternal care (2). Such influences in rat pups have been demonstrated to result in permanent changes in hippocampal glucocorticoid receptor expression and HPA function that are transmitted intergenerationally and provide a clear molecular link between early environment and gene expression and function (23).
In addition to neuroendocrine dysfunctions, a neuroanatomical substrate for the symptoms of PTSD has been suggested and investigated by many researchers. Indeed, several functional neuroimaging studies have demonstrated hyperactivity of the amygdala and anterior paralimbic region in PTSD and hypoactivity in the medial prefrontal cortex, anterior cingulate cortex and hippocampus (24-28). In current models of PTSD, amygdalar hyperactivity is responsible for the persistently elevated fear response, and hypoactivity in frontal regions reflects impaired regulation of fear and fear extinction (27,29,30). On the other hand, the hippocampus provides

information about the context of a situation and is involved in memory processes. Hence, the attenuated hippocampal response might underline difficulties in identifying safe contexts (29). Considered together, these abnormalities provide a neuroanatomical substrate for the intrusion of traumatic memories and associated cognitive deficits on tasks of attention, learning, and memory observed in patients with PTSD (31,32). In addition to a functional impairment, several structural changes have also been identified in the same brain regions, including the hippocampus, amygdala, and medial prefrontal cortex (27). Many neuroimaging studies revealed significantly smaller hippocampal and amygdale volumes in PTSD patients compared to control subjects, as well as a reduction of ventromedial prefrontal/anterior cingulate cortex (27). Since all these brain regions take part to memory process, stress regulation and fear responses, a failure in this integrated system could be responsible for most of the symptoms complained by patients with PTSD.

A number of changes in the neurotransmitter systems related to PTSD has also been discovered so far (33). Patients with PTSD seem to have alterations in the serotoninergic and dopaminergic system, both involved in the regulation of stress adaptation, and fear and anxiety behaviors. Interestingly, these alterations are influenced by very early life events (34-40), and could also have a genetic origin. In particular, there is evidence that the short (S) allele of the serotonin transporter-linked polymorphic region (5-HTTLPR) is associated with an increased sensitivity for anxiety and depression when a person is exposed to stressful life events, and that variation in the promoter region of the 5-HTT gene play a contribution to stress sensitivity and development of PTSD (41). Moreover, it has been recently shown that the 9-repetition allele (9R) located in the 3' untranslated region of the dopamine transporter (DAT) gene (SLC6A3) is more frequent among PTSD patients, providing some evidence for increased DAT density in PTSD (42). Increases in DAT sensitivity may reflect higher dopamine turnover in the central nervous system of these patients, which could contribute to the perpetuation and potentiation of exaggerated fear responses to a given event associated with the traumatic experience (42).

In summary, the psychological and biologic data support the hypothesis that the development of PTSD is facilitated by a failure to contain the biologic stress response at the time of the trauma, resulting in a cascade of alterations that lead to intrusive recollections of the event, avoidance of reminders of the event, and symptoms of hyperarousal. This failure may represent an alternative trajectory to the normal process of adaptation and recovery after a traumatic event (2).

Sleep disturbance in PTSD

Subjective sleep disturbances are one of the most frequent problems in the period immediately after trauma, and, as a consequence, sleep disorders are highly prevalent in PTSD, and are a cause of severe distress (43). The most frequently reported sleep disturbances are: nightmares, insomnia, sleep apnoea and periodic limb movements in sleep (PLMS). All these conditions reduce sleep quality and/or quantity, resulting in poor concentration, agitation/ irritability and impaired emotional coping. Poor sleep may lead to more frequent and intense negative emotions (e.g., anger, sadness, and anxiety) in the short term, and to more frequent emotional complaints (depression and anxiety) in the long term, which is perhaps why disturbed sleep is also a risk factor for depressive and other anxiety disorders (43).

Both the psychological and the biological alterations observed in patients with PTSD could be implicated in the development of sleep dysfunction. Indeed, nightmares after a traumatic event are often a replay of the original traumatic event, evoking the same fear, shock and/or disgust that accompanied the traumatic event (44). These nightmares cause sleep disruption and may lead to several counter-productive behaviours (such as getting out of bed, making something to eat or drink, delaying bedtimes, sleeping with lights on), that continue to disrupt sleep and may also result in insomnia (43).

Moreover, since sleep apnoea has been associated with nightmares in both the general and in a PTSD population, an etiological role for sleep apnoea in the development of nightmares has been postulated (45,46). Sleep apnoea could therefore be a risk factor for re-experiencing a traumatic

event during sleep and, via disrupting the sleep, for developing PTSD, even if this hypothesis has been recently questioned (43).

Finally, amygdala hyperactivity and increased noradrenaline levels, both conditions found in PTSD patients, could result in alterations of REM sleep, nightmares, and increased PLMS (47-49).

The frequency of nightmares in PTSD patients has been investigated in several large-scale epidemiological studies, in which a prevalence of around 50-70% was found (43). In those patients with PTSD in which nightmares and anxiety dreams have been documented in the sleep laboratory, such dreams arose from either REM or non-REM sleep, and they might take the form of a realistic reliving of the traumatic events or include only some elements of those events or the resultant trauma (50). Insomnia is also prevalent in PTSD patients, with estimates varying from 40% to 50%, including difficulties falling asleep, frequent awakenings from sleep with further difficulties returning to sleep, shorter duration of sleep, restless sleep, daytime fatigue, nonrestorative sleep (43). Sleep-disordered breathing (SDB) are observed in PTSD patients in more than 50%, as well as PLMS, especially during REM sleep (43). Finally, REM sleep behavior disorder (RBD), a REM sleep parasomnia characterized by an intermittent loss of muscle atony during REM sleep, accompanied by motor activity associated with dream mentation, has been reported in some patients with PTSD (51), and PTSD was shown to be a common finding in patients with RBD (52,53).

Although subjectively identified sleep disturbances are common, when sleep patterns in traumatized persons (persons with psychological or emotional damage as a result of traumatic events) are investigated with the use of objective sleep-laboratory techniques, far fewer disturbances of sleep are documented than would be expected. These objective laboratory findings conflict with the notion that sleep disturbances are universal under such circumstances, and are in sharp contrast to the significantly increased rate of subjective reports of sleep disturbances (43). As possible explanations for this discrepancy, it has been suggested that patients with PTSD misperceive their sleep states. It has also been suggested that PTSD patients might sleep better in the sleep laboratory, as this environment is perceived to be safe (54), with reduced levels of anxiety which in turn is related to nightmare frequency and insomnia complaints (55,56).

Apart from their increased frequency, a predictive role for disturbed sleep in the development and severity of PTSD (in addition to future psychiatric and physical symptoms) has been also reported. Indeed, several studies found an association between the presence of sleep disturbances immediately after a traumatic event and the later development of PTSD or its severity (57-59).

Notwithstanding, sleep disturbances are infrequently assessed in patients with PTSD and rarely treated. As a result, sleep impairment is a frequent residual complaint after successful treatment of other PTSD symptoms. In contrast, treatment focusing on sleep does alleviate both sleep disturbances and PTSD symptom severity, and should require careful attention.

Conclusion

In the last decades there has been increasing interest towards PTSD both in the general population and in specific working categories, such as rescue workers, firefighters and paramedics. Simultaneously, there has been an increased attention to its treatment both from a psychological and pharmacological point of view, that have outlined many different interventions that are especially useful in the immediate period after trauma exposure. These events have lead to a better comprehension of the epidemiology, physiopathology, associated factors, and clinical presentation of this common psychiatric disorder. Such scientific data represent the basis for further research related to conditions and consequences of PTSD, that could have important repercussion on its treatment.

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