Growing impact of Trauma on Mental Health across the Globe and the Existing Challenges associated with its Management

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Abstract:

Mental wellbeing is an important but largely ignored aspect of our health. The highly competitive nature of the world that we are living in forces us all to face quite stressful conditions. Coping with stress is hard for people of all ages but is especially challenging for children. In situations, stress can be so debilitating for the tender brain of young ones that it leads to life long impairment of their mental faculties. Trauma is an extreme kind of negative influence that leads to conditions such as PTSD (post traumatic stress disorder) which are very difficult to manage. Traumatic conditions are usually implicated in cases of suicides, drug addiction and such similar social vices.Here we take a closer look at the biology of trauma in the light of recent studies and discuss some important aspects of trauma which should be taken care of by people involved in its management.

Key words: *Mental health, Trauma, PTSD, Cognitive development, Stress management*

Introduction:

Our brains have been built to handle acute stress which is a life saving mechanisms in dangerous situations that threaten our survival. However, an overdose of stress acting for a longer duration takes a toll on the quality of life and has severe consequences for mental health. The chronic stress may be of diverse origins involving environmental causes, social or political factors (e.g; child labour, terrorism, unemployment etc), and personal traumatic experiences such as domestic violence or the loss of a close relative (Motzer & Hertig, 2004). The growing number of people affected with mental disorders such as anxiety, depression, schizophrenia and dementia is a worrisome thing and requires extended efforts at multiple levels by professionals, civil authorities and governments. The diagnosis of psychogenic conditions becomes particularly tricky because of the social taboos associated with such conditions. Not many people suffering from such conditions consult a psychiatrist because of their fear that doing so would lead to decreased social acceptance. Thus, the projected figures of incidence of psychiatric conditions

are gross underestimates of the actual figures. A lack of reliable data concerning psychogenic disorders poses a constraint for devising appropriate strategies to combat them.

Susceptibility to trauma:

Victims of trauma fall under all the possible categories of age, sex, and ethnicities but a number of studies point to the fact that children are comparatively more vulnerable to mental trauma (Chapman et al, 2004). The reason for this age related bias is that the brains of children are less adept at handling stress and therefore traumatic events leave a lasting impact on their tender brains. Grown up individuals possess brains that have learnt to cope with unpleasant experiences of life. One interesting observation is that not all individuals who are exposed to traumatic experiences end up with post traumatic stress disorder (PTSD). A study suggests that exposure to trauma in early childhood progresses to PTSD in 50 – 75% of cases whereas in adults this figure is 10-15% which highlights high vulnerability to trauma in childhood. People who develop PTSD may have to live with the nightmarish shadow of their traumatic experience for the rest of their lives and they report the incidence of having bad dreams, increased irritability, insecurity, hot flushes and complain of other behavioural symptoms as the traumatic memories keep haunting them wherever they go. A recent study (Hanson et al; 2008) has established a gender based difference in susceptibility to trauma. Insula of brain is implicated in differential response of boys and girls to trauma. Although there are no gender based differences in the insula of healthy subjects but the insula of traumatized males was found to have more volume and surface area compared to women. It suggests that the insula of traumatized women undergoes premature aging (Klabunde et al, 2017). Understanding the subjective differences in the degree of susceptibility is a vital aspect of trauma management.

Causes of trauma:

There is a great diversity of factors that lead to trauma and knowledge of these factors is key to understand its likely effects on an individual. Socio-psychological causes such as loss of parents or close relatives, domestic violence, divorce, rapes, molestations, unemployment, terrorist activities, and wars figure among the prominent causes of trauma. While some of these factors can be controlled or avoided there are other factors such as natural calamities (floods, tsunamis, earthquakes etc) which are beyond human control. The best one can do in such scenarios is to try to minimize the adverse effects of such untoward incidences and prevent them from taking a toll

on the psyche of affected individuals. In the modern technological era when industrial development is on the rise, environmental pollution is emerging as a leading cause of psychogenic problems. Environmental pollutants that can pass through the blood brain barrier after exposure often lead to cognitive impairment and behavioural changes. Even if the pollutants do not reach the brain directly they can still have a bearing on mental health by causing diseases elsewhere in the body. Ultimately, any disease condition invariably results in trauma and the severity of it depends on the threat perception of the ailment. Life threatening diseases such as cancer, liver or kidney failure, immunodeficiency etc severely jeopardize mental health which further complicates the prognosis of such conditions. In addition to the above causes, there are many others that may largely go unnoticed by the caretakers but lead to dire consequences at a later stage. This is exemplified by the stressful education of this highly competitive age which is responsible for anxiety and depression related to examinations and often culminates in suicidal tendencies among students. It has been observed that in all such stressful situations, the overall effect is not just objective but depends a lot on subjective experience too. This provides a rationale for personalized care and use of appropriate psychological strategies to treat trauma based on personality traits of the affected person.

Physiological mechanisms of trauma:

There is such an overwhelming amount of literature pertaining to biological effects and pathology of trauma that it is hard to present all the important findings in the limited space of this paper. The fact that some of the studies lead to contradictory results further complicates the task of presenting a thorough summary of the physiological determinants of trauma. It feels however convenient not to separate the neurological and endocrine effects involved in the progression of trauma simply owing to the fact that there is a lot of interdependence and cross talk between these two seemingly distinct but functionally related control systems of our body.

(a) Neuroendocrine factors: Neuroendocrine mechanisms originating from the hypothalamus are among the most important physiological regulators in the stress response of the body. Of these, hypothalamic-pituitary-adrenal (HPA) axis is the most important part coordinating the body's response to stressors. It starts with the release of corticotrophin releasing hormone (CRH) from the paraventricular nucleus (PVN) which in turn stimulates pituitary

corticotrophs to release adrenocorticotropin (ACTH) thereby inducing glucocorticoid release from the adrenal cortex. Although the normal response to stressors causes hypersecretion of corticoids but this finding is not consistent with studies performed on patients suffering from PTSD who have often been reported to possess low cortisol (Yehuda, 2006). This results in decreased feedback inhibition of hypothalamus and a consequent increase in CRH. Surprisingly, the elevated CRH does not result in increased ACTH release suggesting a downregulation of CRH receptors in trauma which also explains the observed reduction in the volume of hippocampus in such patients (Bremner et al, 2008). Besides HPA axis, the involvement of hypothalamic-pituitary-thyroid axis is also implicated in pathology of trauma and an altered thyroxine profile is possibly the reason leading to stress related anxiety.

(b) Neurochemical factors: The experimental data pertaining to changes of neurotransmitters in cases of psychological trauma is enormous. Despite the equivocal nature of some findings, a few general conclusions can be drawn about the neurotransmitter profile in traumatic patients. Increased cardiac activity and arousal suggests an elevation of noradrenaline due to higher activity of neurons in locus ceruleus. Besides, increased dopamine levels are an indication of altered fear conditioning by mesolimbic pathways in patients coping with stress. Stress-induced analgesia which is a widely reported pathological feature of PTSD and associated conditions correlates well with possible elevation of β-endorphins in the cerebrospinal fluid. Similarly, abnormal feeding response is attributed to altered regulation of appetite in PTSD which is closely linked to decreased levels of neuropeptide Y in such conditions. Decreased activity of raphe nuclei leading to a dip in serotonin levels is also of common occurrence in trauma and this reflects in increased alacrity and modulations in memory formation. Finally, a decrease in γ-amino butyric acid (GABA) alters the irritability of neurons and interferes with regulation of anxiety in stressed subjects.

Genetics of trauma:

Heredity has a huge bearing on a person's ability to handle stress. This makes sense because many of the molecular regulators of stress physiology happen to be proteins synthesised in the body under the influence of their corresponding genes. The examples of such molecules are hypothalamic factors, pituitary hormones, neuropeptides, hormone receptors, transcription factors, and signalling molecules. Any defect in the nucleotide sequence of such genes leads to

abnormal regulation of mental states. Moreover, any change in the regulatory regions of the genes involved leads to their overexpression (gain of function) or underexpression (loss of function). Any change in the transcription profile of these genes seriously impairs the normal functioning of neurotransmitters and results in neuropathological conditions.

Epigenetic causes of trauma:

Epigenetics is one of the most happening fields of biology today and the ongoing studies in this discipline are leading to truly spectacular and even unexpected results. Studies of epigenetic regulation of biological processes are unravelling the mysteries of chromatin condensation which is such a widespread mechanism that it accounts for differential expression of every single gene in our body. The most commonly studied epigenetic mechanisms involve DNA methylations, histone deacetylations, and micro RNAs. One recent finding implicates epigenetic mechanism in transferring traumatic experiences of one generation to the next generation. Transgenerational transmission of trauma has been demonstrated in holocaust survivors (Fonagy et al, 1999; Braga et al, 2012). Similar cases of transmission of trauma through generations and their possible mechanisms have extensively been reviewed in medical literature (Kellermann et al, 2001; Yahiyavi et al, 2014). Howsoever counterintuitive it may sound but it has been experimentally proved that we inherit the ill effects of trauma which our fore fathers might have faced further back in time.

Combating trauma:

Dealing with trauma is not easy for the persons affected as well as for the care takers and therapists. Given the multiplicity of causes of trauma it requires careful diagnosis of the condition to know its origin and devise appropriate strategy against it. As mentioned above it is recommended to consider peculiar personality traits of the patient and adopt a personalized approach in treating trauma at the level of individuals. Trauma management in the society, however, calls for an integrated work plan involving neurologists, clinical psychologists, statisticians, administrators, and law enforcing agencies. What makes trauma management a priority is that it is implicated in many serious medical conditions such as immunological problems (Dube et al, 2009), cardiac diseases (Murphy et al, 2017), and even in lung cancer (Brown et al, 2010). There are situations in which stressful situations can be avoided altogether by pre-empting their occurrence. Farmers in our country, for instance, resort to committing

suicides because of their inability to repay agricultural loans. This can be prevented though a government initiative by providing financial assistance to such farmers. Stress at work places can be reduced if employers are educated about the positive impact of employee satisfaction on their performance. Likewise, appropriate reforms can be introduced in educational institutions to keep students from anxiety and depression. Social vices such as drug addiction, domestic violence, and criminal activities that lead to traumatic situations can be avoided by framing appropriate laws to punish drag trafficking, dowry, and child abuse.

What lies in store?

The rate at which the incidences of trauma are growing worldwide is quite high. However, like every cloud has a silver lining, the increased incidence of stress related cases is also leading to an increased awareness about the problem and is contributing to better understanding of socio-psychological and biological mechanisms of trauma. The exponential growth in drug designing has given us a great variety of anxiolytics, antidepressants, and other such drugs which can rescue the traumatized patients by improving their mental health. Highly selective agonists and antagonists of various neurotransmitters can achieve very precise therapeutic goals paving way for better prognosis of stress. The evolution of various gene editing techniques such as RNA interference (RNAi), CRISPR-Cas9 etc kindle hope of applying gene therapy to behavioural problems.Techniques such as chromatin immunoprecipitation (ChIP) make it possible to understand and alter the patterns of gene expression and it can be of immense use in targeting genes related to neurological control of behaviour. It is true that we have come a long way in understanding trauma but still there is a lot to explore and experiment in this important field of stress physiology.

References:

1. Braga, L.L., Mello, M.F., & Fiks, J.P. (2012). Transgenerational transmission of trauma and resilience: a qualitative study with Brazilian offspring of Holocaust survivors. *BMC Psychiatry*, ***12*****:** *134-145.*
2. Brown, D.W., Anda, R.F., Felitti, V.J., Edwards, V.J., Malarcher, A.M., Croft, J.B., Giles, W.H. (2010). Adverse childhood experiences are associated with the risk of lung cancer: a prospective cohort study. *BMC Public Health. **10**: 20.*

3. Chapman, D.P., Whitfield, C.L., Felitti, V.J., Dube, S.R., Edwards, V.J., Anda, R.F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders.* ***82(2):*** *217–25.*
4. Dube, S.R., Fairweather, D., Pearson, W.S., Felitti, V.J., Anda, R.F., Croft, J.B. (2009). Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine.* ***7(2):*** *243-50.*
5. Fonagy P., et al. (1999): The transgenerational transmission of holocaust trauma. Lessons learned from the analysis of an adolescent with obsessive-compulsive disorder. *Attach Hum Dev.* ***1:*** *92-114.*
6. Hanson, R. F., Borntrager, C., Self-Brown, S., Kilpatrick, D. G., Saunders, B. E., Resnick, H. S., Amstadter, A. (2008). Relations among Gender, Violence Exposure, and Mental Health: The National Survey of Adolescents. *The American Journal of Orthopsychiatry,* ***78(3):*** *313 - 321.*
7. Kellermann NP, et al. (2001). Transmission of Holocaust trauma--an integrative view. *Psychiatry,* ***64(3):*** *256-267.*
8. Klabunde, M., Weems, C. F., Raman, M., & Carrion, V. (2017). The moderating effects of sex on insula subdivision structure in youth with posttraumatic stress symptoms. *Depression and Anxiety,* ***34:*** *51 - 58.*
9. Motzer, S.A., Hertig, V. (2004). Stress, stress response, and health. *The Nursing Clinics of North America.* ***39(1):*** *1–17.*
10. Murphy, M.O., Cohn, D.M., Loria, A.S. (2017). Developmental origins of cardiovascular disease: Impact of early life stress in humans and rodents. *Neuroscience and Biobehavioral Reviews.* ***74(Pt B):*** *453–465.*
11. Shaw, P., Kabani, N. J., Lerch, J. P., Eckstrand, K., Lenroot, R., Gogtay, N., Greenstein, D., Clasen, L, Evans, A., Rapoport, J. L., Giedd, J. N., Wise, S. P. (2008). Neurodevelopmental Trajectories of the Human Cerebral Cortex. *Journal of Neuroscience,* ***28(14)*****:** *3586 - 3594.*
12. Taylor, S.E., Lerner, J.S., Sage, R.M., Lehman, B.J., Seeman, T.E. (2004). Early environment, emotions, responses to stress, and health. *Journal of Personality.* ***72(6):*** *1365–93.*