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RESEARCH ARTICLE

NEUROBIOLOGY BEHIND CHOOSING A METHOD OF SUICIDE: A REVIEW

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Abstract

Suicidal tendencies and ideationsare not limiting up to the developing nations today making it more vulnerable for research as people of science around the world want to know about the neurobiology behind suicidal ideation. Which neurochemical pathway decide the method of suicide chosen, the fatality of the method chosen and the multiplicity of suicidal methods. Authors here reviewed the various databases on the related topic and tried to conclude various theories based on the cases reported.

Introduction:-

Defining the word suicide is just misconstruing the gravity, essence and biology behind the mood, thought and behaviour of developing it. Suicide is not an act but a complex behaviour. The neuroscience behind the suicide is also complex and with time, the people of science tried to expound it. As per literal meaning, it is just killing of oneself by himself. However, it is a complex behaviour precipitated by multiple social, mental and physical factors that presented as any harm caused to person's body or mind by oneself.Looking through a forensic expert's eyes; three things should be discussed when we are canvassing over the arena of suicidal behaviour and suicidal ideation and these are methods of suicide, outcomes of suicidal behaviour and neuropsychology behind it. As per the records taken from a tertiary apex medical facility in Haryana, India; ingestion of poisonous substance is the most common method chosen as a method of suicide followed by hanging, drowning and railway associated deaths. The method of suicide is itself depends on the easy availability, the gravity of suicidal ideation and threshold to not combat the thought of suicide. Various terms are there related to suicide like suicide attempt, active and passive suicidal ideation, deliberate self-harm which we will be defining and using later on. The outcomes of suicidal attempt can vary from a simple abrasion/skin deep incisions that are commonly designated as hesitation marks, which can be used to estimate the chronicity of suicidal ideation in a person's mind and up to the fatal throat cuts. The basic precipitating factors in a fatal attempt aredepression, hopelessness,any psychiatric disorders, impulsivity and any drug abuse. The authors comply with the theory of Diathesis model given for suicidal ideation that impinges upon the imperative causes of suicidal ideation in view of neural pathway insults or deficits and informed prevention of suicidal thoughts by pharmacological, cognitive therapies and neuro modulations techniques. The authors here will try to correlate the suicidal ideation theories comparing the autopsies conducted in cases with manner of death is suicidal and reviewing the available literature.

Autopsy Cases based evaluation

A dead body of a young adult, average built male individual was received in the mortuary of an apex medical institute, Haryana for medicolegal examination. The apparent cause of death as per police inquest papers was

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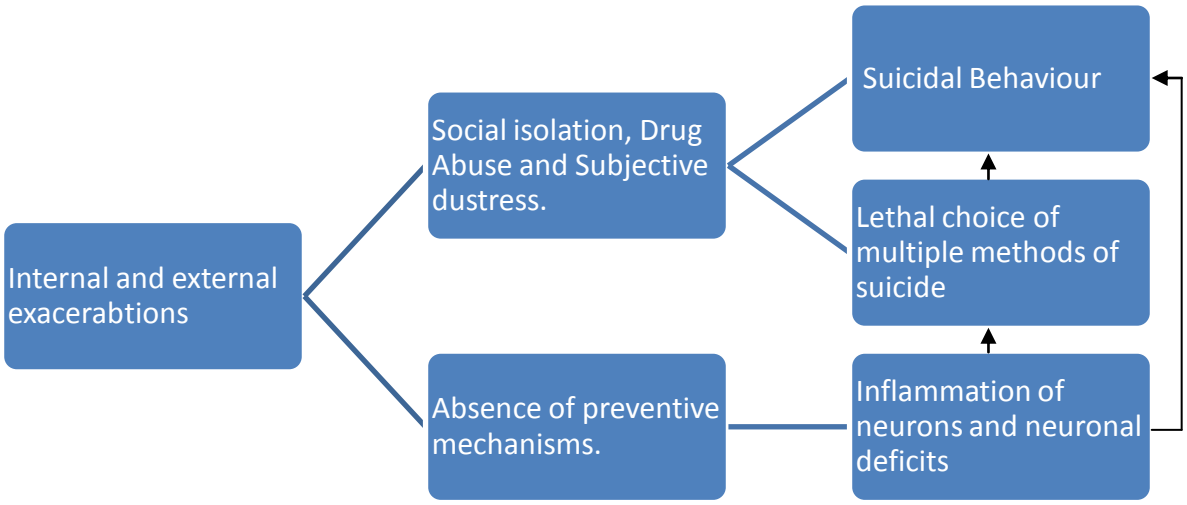
"Homicidal Cut Throat injuries" and the patient was found on road side. The clothes of the deceased were smudged with blood and a metallic shaving blade wrapped in its cover was recovered from left breast pocket of shirt. On examination, Rigor Mortis was present all over the body and was in developed phase. There are various injuries over the body that appeared to be homicidal cut throat injuries at first stance. However, on meticulous examination of the body the following pattern was noticed: Seven linear skin deep incised wounds of length varying between 3 cm to 5.5 cm and width varying between 0.1 cm to 0.2 cm were present obliquely over the anterior aspect of neck across midline. The wound margins were sharp and regular. Six linear skin-deep incised wound of length varying between 3.5 cm to 5 cm and width varying between 0.1 cm to 0.2 cm present obliquely and parallel one above another over right side of neck. Lateral ends of all of these incised wounds were higher compared to medial end. The wound was skin deep and margins were sharp and regular. A loosely stitched wound of length 7 cm with 1 stitch in situ was present obliquely over the right side of neck. On opening the stiches, the wound was muscle deep with superficial veins sharply cut. On dissection, surrounding soft tissues and muscles were found ecchymosed. A loosely stitched wound of length 17 cm with 7 stitches in situ was present obliquely over the anterior and left side of neck. On opening the stiches, the wound was found sternocleidomastoid muscle deep. A small sharp nick was also seen over the left external jugular vein. A stitched wound of length 7 cm with 4 stitches in situ was present obliquely over the anterior aspect of left. On opening the stitches, the wound was skin deep and margins were sharp, reddish and regular. A roughly square shaped skin-deep incised wound was present over the dorsum of right hand encircling a tattoo mark of symbol OM written in Hindi, reaching up to base of right index finger. The wound margins were reddish and regular. On dissection of the above-described wounds, underlying and surrounding soft tissues were found ecchymosed showing their antemortem nature. All the organs were congested on cut section and stomach contained about 80 cc of greyish pasty mucoid material. Mucosa was deeply congested and haemorrhagic at places which was preserved for chemical analysis along with its contents. After chemical analysis of viscera in laboratories, Aluminium Phosphide was detected in the exhibit containing stomach and its content.The opinion as to cause of death was given as suicidal cut throat injuries coupled with aluminium phosphide ingestion.(Figure 1 & 2)

Fig 1:- Showing Hesitational sharp cuts over and around the tatto.

Fig 2:- Showing Fatal Deep Cuts over the neck.

Interpretation and Analysis:



In our case, the exacerbations were low socioeconomic status and depression which resulted into social isolation of patient. He was also drug dependent. Absence of counselling on time and unavailability of treatment worked as an absence of preventive mechanism. All the factors described above precipitates as an unusual method of suicide in which patient had ingested the Aluminium phosphide and even after that cut his throat using a blade.

Review of Literature:-

Various cases have already been reported in which patient of psychological or neurological disorder had chosen an unusual method of suicide. The stress diathesis model are being proved by all these cases making it a practically operative tool that can be used as to prevent the suicidal behaviour and modulation of suicidal ideation.

Diathesis is just a vulnerability or predisposition of thought process of brain or mind which along with the stressful situation or circumstances lead to the suicidal behaviour or suicidal ideation. Suicidal ideations (SI), often called suicidal thoughts or ideas, is a broad term used to describe a range of contemplations, wishes, and preoccupations with death and suicide. There is no universally accepted consistent definition of SI, which leads to ongoing challenges for clinicians, researchers, and educators.[1]

In a case reported by Ateriya N et al. the deceased has chosen three methods of suicide altogether including the fatal sharp cut throat, Superficial wrist cut and also an attempt to drown himself. Similarly in our case, the deceased had attempted three methods including the fatal sharp cut throat, superficial cuts over the wrist and ingestion of aluminium phosphide poison.[2]

In a research article published by Cai Z et al, they searched Scopus, Web of Science, PubMed, ProQuest and Embase for studies reporting method-specific CFRs in suicide, published from inception to December 2020 and they found out that among all suicide methods examined, firearms were the most lethal, with more than 75% of suicide acts resulting in death. The least lethal methods were cutting, with less than 5% of suicide acts proving fatal.

Numerous factors have been found to influence the occurrence of suicide. Causes of suicide and suicidal behaviour are multifactorial, and this is reflected in responses to the problem. Choice of suicide means probably depends largely on availability and acceptability, although evidence on reasons for choice is quite limited. Availability of suicide means can influence suicide occurrence.[3]

In a study conducted by Harvard institute on the basis of emergency department data and death certificate data from 8 U.S. states. Firearms have the highest case fatality, and drug/overdose ingestion and cutting have the lowest. But

the question is what governs the lethality of method chosen? The answers are multiple i.e., inherent deadliness, ease of use, accessibility, **ability to abort mid-attempt andacceptability to the attempter. Immediate painless death is the most weighing criteria among them.**[4]

It appears that suicide occurs across diagnoses and stems from mood depression, hopelessness, severe anxiety, and increased impulsivity, often but not always related to histories of early abuse and a past history of suicidal behavior, as well as situational factors such as clinical worsening of symptoms, not infrequently in the context of a real or anticipated major loss. Chronic risk factors such as early childhood abuse, impulsivity, a past history of substance abuse, living alone, and a history of past or recent suicide attempts are important to elicit and take into consideration. Acute risk factors such as severe anxiety, insomnia, evidence of increased impulsivity, clinical worsening of symptoms, and an admission of suicide plan or preparation for a suicide attempt and recognition of situational factors such as a recent or anticipated major loss may allow for an intervention prior to a lethal attempt. Biological trait factors such as impulsivity often relating to a history of early childhood abuse, substance abuse and changes in HPA, adrenergic response, and serotonin systems seem to occur across diagnoses. In the presence of mood depression, which is seen across diagnoses and always present in mood disorders, suicidal ideas may occur that are translated into suicide attempts in the presence of the aforementioned factors, often triggered by adverse events or symptom worsening.[5]

There are anatomically specific alterations in the serotonergic system that are specific to suicide and consistent with a homeostatic brain response both in source 5-HT synthesizing neurons in the raphe nuclei and in postsynaptic target neurons in the cortex, to deficits in serotonergic neurotransmission. While the data from postmortem studies are compelling and define the molecular profile of the brain in suicide, further studies are necessary to pinpoint whether these changes define causality for 5-HT deficits or are alternatively a normal brain response to a preexisting hypo serotonergic environment.[6]

Suicidal behavior in children and adolescents correlates with several neurobiological evidences, independent of underlying psychiatric disorders. These include disturbances of the HPA axis as well as GH secretion irregularities. However, the serotonergic system disturbances, as manifested by postmortem findings, serotonin receptor abnormalities on platelets, and metabolite levels as well as genetic studies seem to be the clues for the mechanisms underlying suicidality that are most investigated and considered most critical.[7]

There were subtle differences in the abnormalities of PKA subunits and BDNF between teenage and adult suicides. However, the major difference between teenage and adult suicide appears to be abnormalities in the hippocampus. Since stress is a major risk factor for teenage and adult suicides, one would expect this area to be abnormal in both, but more so in teenage suicide. The observation that most of the biological abnormalities were not found in teenage suicide was thus intriguing.

Clinical predictors of suicide risk have poor effectiveness, genomics and brain imaging are the most promising new directions for detection of patients at high risk for suicide. Because serotonergic abnormalities can be detected in living patients, brain imaging might help to identify people at risk of a more lethal suicide attempt or suicide. Suicide prevention depends on detection of such patients. Since a third of people who die from suicide die from their first attempt, the aim for prevention is to detect these patients before any attempt is made. Neuroimaging could delineate brain regions and networks involved in suicide risk and could be a way to track the effect of interventions, which target such specific brain regions and neural networks. Imaging–genetic approaches, combining genomic study (eg, of serotonergic, glutaminergic, GABAergic, neurotrophic and apoptotic systems) and neuroimaging, might help to elucidate the association between circuitry-related changes and gene function and suicidal behaviour.[8]

Conclusion:-

The neuropsychology behind suicidal ideation can be well explained by the stress diathesis Model. In which there is stimulatory initiation by factors representing as stress and coupled with biochemical pathology inside the neuronal pathways results into the suicidal attempt. However, radio diagnosticfindings in the brain with suicidal tendencies can lead us to the specific area of brain which decides the method of suicide chosen.

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