

Detection of Neuropsychological Changes in Traumatically Brain Injured Patients and Psychotherapeutic Interventional Strategies: A Scientific Review

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ABSTRACT

Traumatic Brain Injury or popularly known as TBI is a universal social and medical health problem most commonly caused by contact or mass forces acting on the head and neck regions. Traumatic Brain Injury causes not only on the physical level but also on the psychological level too. Physiological disturbances or difficulties cause psychological disturbances and sequentially these psychological disturbances again results physiological abnormalities and it is a kind of cyclic process. Anyone with Traumatic Brain Injury, regardless of medically stable, is liable to experience ensuing manifestations ranging from physical to psychological and cognitive to affective. At present, Traumatic Brain Injury comprehends pharmaceutical therapy, physiotherapy, occupational therapy and CBT. Nevertheless, psychological and effusive issues are frequently remaining unnoticed even when physiological and intellectual symptoms are treated. A lot of individuals with Traumatic Brain Injury, extremely those with liberal and severe Traumatic Brain Injury, are unnoticed with significant neurobehavioral disorientations. As soon as the Traumatic Brain Injury patient is stable with his/her physique, ensuing emotional, affective, behavioral, and difficulties in social programming may manifest, obstructing commitment with treatment and day to day activities.

Keywords: Traumatic Brain Injury (TBI), Neuropsychological changes, Mild Traumatic Brain Injury (m-TBI), Neuropsychological findings, Epidemiology, Diagnosis.

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I. INTRODUCTION:

In our nation, the correct aggregate of TBI and its subsequent mental health problems are unidentified. Meanwhile, in one study, it is calculated that more than 100,500 lives are dropped every year in our nation with over a million people are in pain from extreme physiological and psychological disorders as an aftermath of the trauma. If we focus on the global level, the statistical data shows the rate of an approximately 50 million injured in every year and an estimated loss of lives around 1.2 million. Except this data, it is estimated that more than half percent of the victims have been in pain from various kind of psychopathology since the accident took place. Again concentrating on India, in one study, it is predicted that a single death in India in every five to six minutes, will be lessened as every three minutes by 2021 and triple the number of related psychological issues. Traumatic Brain Injury and its following psychological problems are now under great concern. We can classify Traumatic Brain Injury by its severity, types and victims' age; such as pediatric TBI. m TBI or Mild Traumatic Brain Injury is also known as concussion. Now many Neuroscientists, Neuropsychologists, Neurosurgeons, Rehabilitation Psychologists and other agencies are also focusing concentrating on this peculiar field. Now, we need a multidisciplinary approach to control the lethal social and medical problem.

It has already been mentioned that TBI is not only a medical problem but it is also a sociological problem as well. Because TBI changes not only the victim's mental and social circumstances but also it will certainly alter the mental functions of people those who cares the victim. It is observed that, often the bystanders are unable to continue their jobs; because most of the time, they need to care the affected person. It compromises their daily income and their mental status. So in order to prevent it, we need to seek a helping hand from sociologists to deal with their social and cultural problem. It is also better to include the victim's family to the treatment plan and it will help the family members to how to satisfy the victim's needs without compromising their own duty; to make this idea possible, we can rely on Rehabilitation psychologists. The

actions from NGOs and government agencies are also suggestible. Because they can make people aware of their duties and responsibilities while using the road. It will prevent most of the accidents and thus TBIs. Government can also make the traffic law more strong and deploying extra securities at the locations where most often accidents happened.

TBI is one of the major causes of death and physical and mental incapacity not only in India but also in worldwide level too. It is the prime cause of elevated death rate of young adults and children. It is also observed that men are more capable of surmount TBI approximately twice the range of women. It is good to know that in the 20th century the scenario of treatment modalities have changed greatly and this decreased overall mortality rate and accelerated outcomes. But yet we need to focus on more area as well as more disciplines to study brain injury and its aftermath to produce much better outcomes.

1.1 FAMILY MEMBER'S ATTITUDE TOWARDS THE AFFECTED PERSON:

Before start to explain any area related to TBI, it is important to understand the attitude of victim's family, colleagues, society to the affected person. It is necessary to notice that most of the people who have been suffering from TBI are younger adults and children. As a first level, family members, society, and colleagues are very much active to help the victim to satisfy any of his /her needs. As time passes, family members and people those who are close to the victim, starts to feel the affected person as a burden. At first the most important priority of family and colleagues was to serve the TBI patient whereas day by day the importance given by the family members will decrease and they will concentrate on other matters moreoften, which affects the victims overall wellbeing. Communication between the affected person and the family members also affects the victim's mental well being. The victim might feel alone and uncomfortable even inside his family. Most of the affected people have been suffering from physical inability such as hemiplegia (complete or partial inability to move one side of the limb),quadriplegia (total paralysis of all limbs except neck) so that they have to rely on other persons to fulfill his/her needs. The affected person's self-respect decreases and their thought process goes in a way that they are completely useless and they are will even curse on their existence on earth. Family is incapable to protect their affected member all the time and plummet the caring. Both the, family and affected person feels burden. It will affect the mental and physical well beings of the overall family and the patient as well. In order to eliminate this situation, we need to seek help from a professional rehabilitation psychologist. In this modern era, the old needs and wants are changed and have been replaced by modern demands. So in order to satisfy that, today rehabilitation psychologists have been doing immense research on this area.

1.2 BRIEF OVERVIEW ABOUT TBI:

There are some uncertainties to assess the severity of TBI. Because in each and every hospital settings the clinicians use their own desired and comfortable scales though there are some universally accepted scales. When comparing all those scales together there comes the issues of reliability and confusion among each scale and starts to question the credibility of that particular scale. One of the globally accepted TBI assessment scale is Glasgow Coma Scale or popularly known as GCS. GCS is used during the victim's primary physical analysis. In this scaling system the highest score indicates the mild or simple Traumatic Brain Injury and the lowest scores indicate the increasing severity of the injury. In GCS a score of 13 to 15 indicates that it is a mild TBI, score from 9 to 12 pointing that it is a moderate level TBI and least a score of 3 to 8 indicates that it is a severe TBI.

Another way clinicians assess the condition of the patient is only by looking his or her physical conditions such as conscious level, ability to respond to stimuli, pupil dilation, swelling on face and neck region, difficulties with conversation, poor memory.

We can classify TBI into two main headings, which are, primary and secondary injury. Primary injury means, the damage or destruction of tissues at the time of injury. Secondary injury is, any problem related to the primary injury is comes under secondary injury. To be more specific, destruction of vein and tissues (primary injury) can leads to swelling of limbs and affected areas, accumulation of free radicals in the body and hypoxia or low level of oxygen in body, poor blood circulation on the affected area etc., (secondary injury) followed by the next day or after sometimes of the trauma is classified as secondary injury. TBI can be closed or penetrating injury as well. Penetrating injury means, any objects which causes wound or laceration of the tissues and closed injury occurs inside the cranium without having any hints of superficial injuries.

Effective surgical management can decrease the complications of further prognosis. In most cases an emergency surgery is needed for managing intra-cranial pressure (ICP) and bleeding inside the cranium etc. It is also observed that early intervention on behavioral and psychological difficulties is a good approach to improve the quality of life (QoL)

AN EPHEMERAL OVERVIEW OF EPIDEMIOLOGY OF TRAUMATIC BRAIN INJURY:

Traumatic Brain Injury is also known as the “silent epidemic” only because of the fact that the limited or inadequate knowledge regarding TBI and its related consequences. Most of the aftermaths of TBI do not occur suddenly after the incident. It will take some time to manifest its related problems such as complete or partial loss of memory, depression, post traumatic stress disorder (PTSD), anxiety etc. In India, one of the most important or apex reasons of Traumatic Brain Injury is road traffic accidents (RTA). Due to RTA more than 60% of people have been suffering from serious TBI. In each 10,000 vehicle accidents, the mortality rate is estimated around 38% to 43% which is 25 times elevated rate than in whole developed countries. It has also been estimated that Asia is the prime center of the higher rate of trauma for pedestrians and two-wheeler operators (Indian Head Injury Foundation 2007). In another study, it has been identified that the prime cause of TBI is remained same RTA and the second important reason of the trauma is due to falls and crimes producing 25% and 10% in a relative manner. The financial leakage of India is not estimated yet, but in a commonsense manner we can assume that amount and it is phenomenal (A Agarwal. 2016) [1].

The epidemiological statistics pertaining to psychological or psychiatric issues after Traumatic Brain Injury fluctuate generally in the literature article. A study conducted in United Kingdom (UK) (Deb and colleagues. 1999) [2], based on their clinical interview, it has been identified that 21.3% of the population have been suffering from any of the psychological disorders. From that statistical analysis regarding to psychological or psychiatric pathologies, it has been also been identified that the rate of depression among all these victims were very high, to be specific the acquired rate of depression was 13.9% which was the highest prevalent disorder. And the second most frequent seen diagnosis among Traumatic Brain Injury victims was panic disorder 9%. In order to conduct this study, they considered some risk factors in order to identify psychological or psychiatric diagnosis and that were: poor education, adult age, alcohol or any drug abuse, past history of Traumatic Brain Injury, low score in Glasgow Coma Scale, history of any psychiatric disorders etc. Meanwhile, most of the sample population included in that study had concussion or Mild-Traumatic Brain Injury (m-TBI). And potentially we can question the inclusion and exclusion protocol may have omitted those victims portray the largest portion of general head injury cases, for whom clinical admission is not needed.

Depression

A brief scrutiny of diagnosis and epidemiology

Depression is considered as one of the most common aftermaths of Traumatic Brain Injury. In one study, it has been observed that after the trauma, the epidemiology of depressive disorder incidence rates of 15.3 to 33%. And the statistics of the prevalence rate indicates 18.5 to 61%. The reasons to this immense statistical score indicates us that among Traumatic Brain Injury survivors the major psychological issue what they have been suffering since the incident is problems related to depressive disorder. Many reasons for this elevated prevalence rate can be measured. In most of the studies the researchers use a verity of tools and techniques at the different time periods after their head trauma. Most often, Traumatic Brain Injury studies are limited by inadequate samples, loss to follow-up and bias. Not only these reasons, after a fatal situation, boundaries between depressive disorder and other psychological problems such as grief, agony and other adjustment problems may become less delineated (Rosenthal et al 1998) [3].

Neuropsychological findings

There are some researches which examined the connection between depressive episodes after Traumatic Brain Injury in connection with some changes in specific brain areas. In a research conducted by Jorge and colleagues (2004) [4], a connection between decline of the left prefrontal grey matter size specifically in the ventrolateral and dorsolateral region of the brain and its relation with depression was identified. This study was conducted with modern imaging techniques. Another research conducted by Fedeoroff and colleagues (1992) [5], discovered a connection between depression and wound or lesions in the dorsolateral prefrontal cortex and the left basal ganglia in the mild stage of Traumatic Brain Injury. In this study, 66 samples of Traumatic Brain Injury victims were taken. In one study, a theory has been upheld by Jorge and Starkstein 2005 [6], that due to Traumatic Brain Injury some neural circuits in the prefrontal cortex, hippocampus, amygdale, thalamus and basal ganglia will be destroyed, and consequently it will leads to depression.

Posttraumatic stress disorder

Neuropsychological discovery

No any research studies have identified any clear link or connection between posttraumatic stress disorder (PTSD) and lesion or damage in the special brain regions after Traumatic Brain Injury. An another study conducted by Sojka and colleagues (2006) [7], it has been identified that an elevation of a brain biochemical marker of the brain called astrocytic protein S-100B (it is a marker of brain cell or tissue injury) is connected with the onset of Posttraumatic Stress Disorder (PTSD)

In the area of Posttraumatic stress Disorder, most of the research studies are more concentrated on posttraumatic amnesia. Meanwhile, we can understand the pathophysiology of any traumatic residual memories (Gill et al 2006) [8]. If we focus on the area of declarative memory, it is often identified that, a lot of patients keeps or preserve information particularly during the time of the traumatic situation, for a short span of a period. After, these memories would produce next traumatic reminiscences.

Clinical data and literature reviews shows that at any point of time individuals are capable of recollect the traumatizing memories of that particular situation (Bryant 1996) [9]. In conclusion, a PTSD patient can have knowledge or intuitive memory of that particular event or in another situation, he or she can have knowledge from any stories that have been expressed by anybody else, even if it do not specific to what truly happened.

Mania

Neuropsychological findings

Research studies pertaining to mania is relatively very less. It is because of the fact that, after Traumatic Brain Injury, the manifestations of mania is very less. So there are not enough research studies regarding to mania in relation to Traumatic Brain Injury. A research conducted by Jorge and colleagues (1993b) [10], it has been observed that the lesions on the temporal basal poles is associated with manic episodes after Traumatic Brain Injury. Multifocal injuries on this particular brain region make the situation more complex.

Another research conducted by (Starkstein et al 1988; Robinson et al 1999) [11], [12], it was found that the lesions in temporal region of the brain and the orbitofrontal cortex especially on the right side is also associated with mania in Traumatic Brain Injury victims. Again, in a research, conducted by (Starkstein and colleagues 1987) [13] it was identified that the neuroanatomical distortion is connected with mania.

A study conducted by (Van Reekum and colleagues 1996) [14] found a great difference in the dimension of gender. Males are more prone to develop mania after Traumatic Brain Injury. The onset of mania in males was 4 out of 8 whereas in females it was only 1 out of 10.

Treatment

There are only limited studies the effectiveness of pharmacotherapy for manic patients after Traumatic Brain Injury. A research conducted by (Warden et al 2006; Oster et al 2007) [15] a positive result was found. In their study valproic acid, lithium was found effective in mania. In another study, it was also found that lithium is capable of controlling manic episode due to its neural protecting effect. Continuous and intermittent psychotherapy effect on this particular area found not enough effective to treat mania but as a comprehensive sense it was found more useful. In general, holistic or comprehensive support can benefit the victim.

Obsessive-compulsive disorder

Diagnosis and epidemiology

In order to rule out whether it is Obsessive-compulsive disorder or not clinician have to be more careful if the patient is a Traumatic Brain Injury survivor. Due to their memory loss they are more vulnerable to do any actions many times. When a layman observes this repetitive behavior we tend to believe that it is Obsessive-compulsive behavior (Coetzer 2003) [16]. In a different dimension, patients with impaired self-awareness may manifest the same symptoms.

Symptoms of Obsessive-compulsive disorder are very rare in Traumatic Brain Injury patients. In a study it has been found that an increased level of prevalence of 1.6%, which is very close to the rate of general population's one (Deb and colleagues 1999) [17]. Another research conducted by (Van Reekum and colleagues 1998) [18], among 18 diagnosed patients only 1 patient manifested the symptoms of Obsessive-compulsive disorder. Meanwhile, we can able to see that there are plenty of data were found in literature review even though they are very much isolated from main stream.

Neuropsychological findings of Obsessive-compulsive disorder

Associated with Traumatic Brain Injury, only small or limited case studies pertaining inclusively to Obsessive-compulsive disorder are available. Ample of cases presented with the patient's lesions on certain brain regions, such as, lesions in orbitofrontal cortex, caudate nucleus where most lesions found and due to this, abnormalities in functioning was also identified (Berther et al 2001;14:23-31; Bilgic et al 2004;17:118-20; Ogal et al 2005;111:74-6) [19], [20], [21]. In one another study, it was found that impairment in the executive function is closely associated with primary as well as secondary Obsessive-compulsive disorder.

Other related findings

As far as our knowledge goes, there are no any studies connected to psychosocial behavior in Obsessive-compulsive disorder patient after Traumatic Brain Injury. No wonder, it is because of the fact that there is relatively less chance to develop Obsessive-compulsive disorder after Traumatic Brain Injury. As a general

apprehension, OCD is considered, a disorder with very much biological basis. Even so, Obsessive and compulsive symptoms are capable of hindering the rehabilitation process (Grados 2003; 15: 350-8) [22]. Any other psychological disorders are also likely to presents in patients with Obsessive-compulsive disorder after a Traumatic Brain Injury.

Psychotic disorders

Brief overview of diagnosis and epidemiology

Psychosis after a head injury seems to be very uncommon. In 2007, two scientists namely David and Prince went through various sources of literatures pertaining to this topic and first studies of Psychosis in various settings. After a Traumatic Brain Injury, the occurrence rate of Psychosis fluctuated from 0.1 percent to 9.8 percent. A study conducted by (Van Reekum and colleagues 2000; 12:316-27) [23] it was found that a chance (0.7%) of developing Psychosis after Traumatic Brain Injury. The most important problem faced by the study was, lack of a standardized operational criteria to define TBI as an etiology for this particular disorder. Genetic base of schizophrenia is a powerful thing to increase the likelihood of Traumatic Brain Injury and in return this trauma would elevate the risk of manifestation of this particular disorder later on.

In DSM-IV-TR, a relation between Traumatic Brain Injury and Psychosis was mentioned. A study conducted by (Sachdev et al 2001; Fugii and Ahamed 2001) [24], [25], it was observed a latency time period of a 50 months in order to manifest psychosis after Traumatic Brain Injury. Meanwhile, in the mild/acute stage of Traumatic Brain Injury, symptoms of Psychosis are usually delirium manifestations.

Neuropsychological findings

A comparative study conducted by Fujii and Ahamed (2004) [26], between schizophrenic patients and patients with psychosis after a Traumatic Brain Injury gives an important knowledge pertaining to the functional difference of patients with schizophrenia and patients with psychosis after a TBI. In this study, above mentioned both groups were sent for a neuropsychological assessment. In that assessment, both groups manifested some deficits. But patients with psychosis after a Traumatic brain injury were manifested more functional changes in a more universal manner. Almost 70% of these clients had electroencephalographic (EEG) alterations in their temporal lobes and almost 30% of the patients had epileptic seizures due to Traumatic Brain Injury. Other research had already discovered a elevated rate of frontal and temporal lobe lesions in psychotic patients after their Traumatic Brain Injury (Achte 1969; 45: 1-18. Buckley et al 1993;150: 146-8. Sachdev et al.2001; 31: 231-9) [27], [28], [29]. An another study conducted by (Fujii and Ahamed 2001; 13: 61- 9) [30], it was found that a patient with an existing neurological disorder or a history of Traumatic Brain Injury will increase the risk of psychotic manifestations after the new Traumatic Brain Injury.

Alcohol related disorders

Diagnosis and epidemiology

Abuse of alcohol is one of the most important causes of Traumatic Brain Injury. It is considered as one the most frequently and commonly used psychoactive property. Alcohol is directly connected with Traumatic Brain Injury and its notorious involvement in road traffic accidents. In order to identify the involvement of alcohol in Traumatic Brain Injury, globally standardized assessment instruments like the CAGE and SCID questionnaire techniques can be utilized in order to understand alcohol related issues for Traumatic Brain Injury victims (Ashman et al. 2004;18:191-202) [31].

In order to understand the alcohol abuse rate of Traumatic Brain Injury patients, one year after their head injury, (Horner and colleagues 2005; 11: 322- 30) [32] conducted a telephonic interview. In that interview, it was found that most of the victims are consuming alcohol. Heavy alcohol consumption were identified for 15.4% of the patients, a moderate consumption of alcohol was reported 14.3% of the patients, and an infrequent or occasional alcohol consumption was identified for 70.3% of the traumatic brain Injury patients.

Neuropsychological findings

In a study conducted by (Jorge and colleagues 2005; 62: 742-9) [33], it was found, victims with history of alcohol consumption had a declined volume of prefrontal grey matter in the brain. Research conducted by (Harper 1998; 57: 101- 10) [34], significant damage or loss of neurons in the frontal cortex, cerebellum, hippocampus, locus coeruleus, hypothalamus and amygdale was observed. So we can understand one thing from this study that, Traumatic Brain Injury affect more adversely people those who have previous history of alcohol consumption and from an another view, after Traumatic Brain Injury, consumption of alcohol increase the morbidity of the patient. Consumption of alcohol disturbs the patient's nerves systems which have already been destroyed by the Traumatic Brain Injury [35].

II. OBJECTIVE OF THE PAPER:

The main objective of this study is to throw some lights in the area of Traumatic Brain Injury (TBI) and its psychological problems. Not only that, the identification of neuropsychological problems caused by TBI, but its psychological treatments also. Because we need more adequate, comprehensive and a holistic level of intervention in order to treat Traumatic Brain Injury victims. Most of the people are unaware of the fact that any kind of head injury is capable of alter our behavior and mental functioning. In a general sense, we need to have knowledge regarding what is meant by Traumatic Brain Injury, various kinds of brain injuries, its effects on physiological and psychological level, and its psychological interventions. Even though the core objective of this research is to identify Traumatic Brain Injury related psychological changes and its holistic intervention through psychological means, we are also focusing to understand about, how to combine psychological and rehabilitation services effectively.

Most of the researches are focused only on trauma related brain changes or psychological assessment or psychological management of behavioral and cognitive deficits. So in this study, we are focusing on victim's overall wellbeing, by analyzing all the related areas in order to provide more results to the victims.

Expected outcome: After the successful completion of the research, people can be able to understand more about what is meant by Traumatic Brain Injury, what are its effects on human psychological status and especially, how it can be managed through a better psychotherapeutic means, will be identified. Another result of this study is that in the field of rehabilitation. Because, in people with Traumatic Brain Injury, one special case we need to keep in mind that, each and every patients needs a special attention or special treatment modalities and training which are very much specially tailored for their own personal demands. So, inclusion of more comprehensive and comfortable psychotherapeutic strategies with or without conventional rehabilitation methods can also be established through this research.

Regulating all these issues needs a comprehensive methodological approach. So, the objectives of this study are to:-

1. Identify various neuropsychological changes of Traumatic Brain Injury regardless of impacted brain region.
2. Throw light on a better and more comprehensive psychotherapeutic approach to manage TBI related psychopathologies.
3. Identification /Implementation of a holistic approach in rehabilitation for brain injured patients.

III. METHODOLOGY OF DATA COLLECTION AND ANALYSIS:

This study is conducted based on collection and analysis of secondary data pertaining to traumatic brain injury, neuropsychiatric/neuropsychological findings, rehabilitation, and treatment. More than hundred and fifty unpublished and published data have been scientifically and systematically analyzed and various theories/ principles pertaining to brain plasticity also taken into consideration to determine difference in age and traumatic brain injury related neuropsychological recovery. Data and information related to traumatic brain injury and its neuropsychological outcomes have also been taken from experts through telephonic interview and meet.

GENERAL OUTLINE OF RESEARCH:

The main methodologies or tools that can be applied to conduct this research: collection and analysis of clinical data, interviewing subjects' family members and clinicians, field study/ comparative effectiveness research (CER), all these methods are capable to provide different source of evidences that can be acquired in a more reliable and cost-efficient way. The description which has been given here is primary basic general outline of the research in the concerned topic. While conducting scientific research it can be amended or any other novel scientific strategies can be applied for better reliability, validity and convenience. This research is divided into many phases or stages for a better understanding and convenience. And they are-

Phase 1-

In the phase one or first stage, the prime aim of this research is specially pointed on to understand different kinds of traumatic brain injury such as mild, moderate and severe brain injuries and its effects on human cognition and behaviors. In order to identify this, collection of clinical records, various literatures pertaining to this specific subject, interview with clinicians who are specialized to manage these problems such as psychologists, neuropsychologists, psychiatrists, neurologists, neuroscientists, emergency medicine or trauma care specialists can be utilized. At this stage, the study is inclusively focuses on different types of head traumas such as open head injury, closed head injuries and its sub categories and different lesions or hematomas in the brain, such as subarachnoid hemorrhage(SAH), epidural/extradural hematoma (EDH),and subdural hematomas (SDH).

Meanwhile, the aim is not to go so deep into the hematomas and lesions but to identify and understand its effects on our mental functions. In order to collect clinical data, we can rely on various online platforms such as pubmed and other forums of American Psychological Organization. For reviewing various clinical literatures, published papers and journals from various universities, government and non-governmental organizations can be reviewed systematically.

Phase 2 –

In phase two, the research is concentrated on selection of subjects. Selection of subjects is based on some variables and those variables are, age limit of the subjects, equal proportion of male and female subjects, severity of the head trauma, commonness of psychological disturbances, previous medical history about head trauma or any other psychological disturbances etc. on the basis of these variables, the subjects will be grouped. Sample size can be determined by the availability of the subjects'. Pediatric and geriatric traumatic brain injury will be omitted. We are not focusing to study behavioral issues of the people those who are very younger and very elder. So, in this particular research, we are only focusing to select our samples between the ages of 16 to 45 since it is the more vulnerable ages to meet with traumatic brain injury.

At this stage also collection of clinical data can be attained from various settings. Particularly, the data pertaining to the subjects' can be collected, both, archaic and present records pertaining to traumatic brain injury and its psychological complications from various platforms in order to identify pre and post-traumatic changes. At this point, taking interview would be very helpful to acquire information regarding subjects' pre and post-traumatic changes in order to conform whether the psychological disorganizations are due to traumatic brain injury or any other causes. Interview can be telephonic or direct one. This research is not meant to do with some fresh subjects' who had traumatic brain injury very recently. Because, suddenly after the injury, no any significant disorganization can be identified since its onset is slow. Now all we are very much aware of the fact that, immediately after the head injury, only a part of the neurons get damaged (primary injury) and this damage may advance during time passes. It may be the ensuing seconds of the trauma or hours, days, weeks, months or years. Here comes the importance of collection and analysis of archaic data of the similar subjects'.

Phase 3 -

Field visits to various settings, such as clinics, rehabilitation centers, hospitals, can be done in order to understand different techniques which different clinicians are being used to treat or manage psychological disturbances. In order to identify a more advanced psychological technique to manage traumatic brain injury, it is essential to understand various therapies which therapists conduct on the subjects' from their own experience or from their advanced knowledge, which can be range from infusing more than one or two therapeutic techniques to attain more desirable results or spending more time with patients in order to lessen their psychic pain so on. Conversation with the efficient and experienced clinicians would also be set to work. In this new era, we all are familiar with online meetings and all, at this point, if we needs, this visits can also be conducted by means of technology.

Phase 4 –

Next, a comparative analysis between various psychotherapeutic techniques which are being used to manage a same issue will be done in contrast with another technique. The very purpose of this comparative analysis is to gain better information pertaining to the outcome of the subjects' symptom relief in order to substantiate the fact that whether this particular therapy is more effective than the other therapy to manage or to treat this specific problem or not. The obtained data will be compared with various subjects'/groups which have been selected earlier in order to ascertain the findings. At this point, we can also understand and thus put forward less time consuming, more reliable, accurate strategies to deal with traumatic brain injury related psychological distress or to incorporate any other technique with the conventional therapeutic strategies to fortify or enhance the outcome.

Phase 5 –

Once the desirable outcome has been achieved, at this stage, the research results can be edited in order to remove any errors and classification of the results can also be done once the errors are removed. Tabulation or codification of achieved results can be performed in order to provide a more structural form.

Phase 6 –

At this phase, the research is planned to examine the strategies and techniques to rehabilitate patients with traumatic brain injury and related psychological issues in a comprehensive and holistic manner. Seeking possibilities to provide physical and psychological rehabilitation plans under one roof would be under great consideration. In order to attain this goal, seeking opinion from experts such as rehabilitation psychologists,

psychiatrists, physiotherapists, families of the patients can be utilized. And even at the time of the research itself, it is possible to understand that which point or which issue should be stressed more for the traumatic brain injury victims while carry out the plan to rehabilitate them; for example, train them about how to perform their daily activities and needs at most satisfaction; on the psychological level, filling them with confidence, teaching how to effectively cope up with their daily problems, performing better social relationships, etc. in total, the aim would be how to provide physical and psychological satisfaction or comfort to the patient. The greatest aim of rehabilitation is to assist the affected person to achieve the highest level of cognitive, physical and functional capacity to maximize an independent and a fruitful post-traumatic injury life.

RELATED WORKS:

In this related work section, various textbooks have been analyzed, that are very much valuable to provide data pertaining to Traumatic Brain Injury, neuropsychological changes and its scientific management. In this section, most texts which have been referred are published and written by United States citizens and most are related to brain I jury, neurosciences, neuropsychological outcomes due to brain trauma and rehabilitation of patients with traumatic brain injury. Very purpose of this related work analysis is to find out new area and the areas which are yet covered.

“Neurobehavioral Changes After Acquired Brain Injury” in this comprehensive book, various levels of chronic psychological disorders are indicated. Not only behavioral changes, but also physiological problems of traumatic brain injury also indicated. How to manage behavioral problems, especially mood and emotional distresses and its prognosis are some of the main focus areas of this book. How the samples have collected and the peculiarity of sample population is also mentioned in it. In this book, it is identified that the uncommon and early symptoms of neuropsychological issues are less focused [36].

In order to understand the physiological and molecular aspects of traumatic brain injury, textbook called *“Brain Neurotrauma: Molecular, Neuropsychological, and Rehabilitation Aspects”* has been analyzed thoroughly. Frontal lobe injuries are common and its connection with personality disorders and emotional incongruity has been noticed. This textbook suggests the intense need to do research on traumatic brain injury and its neurobehavioral sequels. It has vivid explanation of frontal lobe, parietal lobe, occipital lobe and temporal lobe injuries and its correlation with neuropsychological outcomes [37].

Rehabilitation is one of the important strategies to manage the outcomes of traumatic brain injury. *“Rehabilitation strategies supports the physiological and psychological well-being of an injured person”* explains various neurorehabilitation strategies to improve the life satisfaction of a brain injured person. It also explains the need to concentrate the patient more rather than giving attention to follow the clear cut procedure of rehabilitation strategies. A person centered rehabilitation approach is essential [38].

Physiological problems due to traumatic brain injury can be treated through surgical and pharmacological means. But what are the long term effects of traumatic brain injury on our thought process, behavior, emotions, moods and personality. *“The Late Effects of Head Injury”* deals with the topic late effect of brain trauma/injury on our daily living and activities. It also indicates the development of neurodegenerative diseases and poor memory [39].

“Textbook of Traumatic Brain Injury” explains mood and lack of self-motivation among brain injured patients. It also covers the physiological problems of traumatic brain injury and its relation to generate psychological distress. It has also covered the personality disorders originated from brain injury [40].

In order to understand the pathophysiology and pathobiology of traumatic brain injury, a textbook named *“Traumatic Brain Injury: Pathobiology, Advanced Diagnostics and Acute Management”* has been analyzed. Changes in the neural connections in brain and the variations in transmitting signals have been noticed. Various techniques to manage mild to moderate level of traumatic brain injury have been pointed out [41]. It lacks the comprehensive approach in the area of rehabilitation. In order to analyze the therapeutic strategies of neurotrauma, *“Cognitive Rehabilitation Therapy for Traumatic Brain Injury: Evaluating the Evidence”* has been reviewed. This particular text concentrates only on how cognitive rehabilitation therapy improves the life satisfaction of a person with injured brain [42]. It analyses the pros and cons of cognitive rehabilitation therapy. What are the common and evident neuropsychological changes of traumatic brain injury, how it can be identified properly, management of these neurobehavioral sequels, and its prognosis have been reviewed from the text *“Neurobehavioural Sequelae of Traumatic Brain Injury”*[43] and it has noticed that the text has vivid explanations about common and severe neurobehavioral outcomes of a brain injury but lacking early symptoms of TBI related psychological distress. Neurosensory disorder can occur due to many reasons including organic and non-organic reasons. In day to day clinical practice also it is common that a lot of brain injured patients develops neurosensory disorders. Sometimes the clinician may not be able to rule out the origin of the disorder. So, *“Neurosensory Disorders in Mild Traumatic Brain Injury”* reviewed to set the record straight [44]. *“Handbook on the Neuropsychology of Traumatic Brain Injury”* explains how brain trauma affects

military personals, sports players etc. it gives information about traumatic brain injury and its neuropsychological outcomes in a great way. This text also focuses how it can be treated through pharmacological means and the various methodologies in rehabilitation of patients with traumatic brain injury [45].

In the text, *“Psychotherapy after Brain Injury, principles and techniques”*; written by Pamela S. Klonoff, comprehensive information are provided in the area of Traumatic Brain Injury and its managements. The text is published by “The Guilford Press” (A Division of Guilford Publications, Inc) New York, in the Year of 2010 [46]. This text has been divided into ten chapters including ‘Introduction and overview’, but the text has not mentioned anything regarding the types of Traumatic Brain Injury and its related neurobehavioral changes after Traumatic Brain Injury, especially all these could capable to provide a comprehensive idea regarding traumatic brain injury. But in the first chapter, 2nd page, the author has ascertained the need of a multidimensional approach to manage traumatic brain injury (TBI) or Acquired Brain Injury (ABI).

In an another text, *“Principles of neurological rehabilitation”*, written by George P Prigatano, explained about the vast area of rehabilitation techniques after Traumatic Brain Injury. The text has been published by *Oxford University press*, in the year 1999 [47]. Through modern way, the text has been cited by seven hundred and thirteen people. In the first section or first chapter itself he has mentioned thirteen principles that related to Traumatic Brain Injury and its effective management through scientific way. But the main focus of those principles were, to concentrate only on some specific conventional areas such as a patient centeredness, only on disease oriented rather than to provide a comprehensive and at maximum satisfaction to his daily events. In other words, it was only concentrated to the patient only. No any significant comment was made to improve the familial issues. Around more than a decade has passed, so it would be very informative to study a multidimensional approach to deal with a traumatic brain injury patient.

In another publication, *“Psychotherapeutic interventions with traumatically brain-injured patients”*, written by Keith D Cicerone, she has mentioned about personality changes followed by traumatic brain injury. It was published in the year 1989, *Springer Publishing* 34 (2), 105 [48]. Here the author has described about the personality or character changes after a traumatic brain injury and its causes with its organic and social roots as well. In this area, the author has also been noted some of the classical psychotherapeutic methods to treat the affected person but the study lacking to introduce a new method or combining more than one or two methods to improve its result. Nowadays following only some conventional system is not much patient and their family friendly. Moreover, in the area of traumatic brain injury, following or concentrating only on a conventional methodological system considered to be less effective. So in order to make this area more approachable or much effective we need to study new areas and new methodologies to treat or manage traumatic brain injury.

Another published content, namely, *“Neuropsychological rehabilitation after closed head injury in young adults”*, written by George P Prigatano, David J Fordyce, Harriet K Zeiner, James R Roueche, Mary Pepping and Beth Case Wood mentioned the significance of a comprehensive rehabilitation method to provide a fruitful lives among the victims of traumatic brain injury [49]. It was published in the year 1984 by *Journal of Neurology, Neurosurgery & Psychiatry*. In this journal, from the page number of 505 to 513, it has clearly been disclosed the consequences of inadequate or poor rehabilitation techniques among traumatic brain injured victims. In this journal, the authors have clearly described the value of Neuropsychological Rehabilitation Program (NRP). But in this journal, they did not give any description pertaining to a holistic approach. It was clearly concentrated on the area of closed brain injury victims. The study was patient centered rather than to provide adequate importance to their family as well. If we teach or train some psychological rehabilitation methods to their family, the affected person and his/her family can join with each other more closely to overcome the situation easily and moreover, in a critical situation, as a primary care, the family members can assist the victim. So if someone conduct a study about rehabilitation among TBI victims comprehensively, it would be helpful to the society.

A journal published by Maarten Milders, Sandra Fuchs and John R Crawford in the year 2003, describes the changes in psychological and social behaviors of the affected person. This journal, namely, *“Neuropsychological impairments and changes in emotional and social behavior following severe traumatic brain injury”*. It was published under *Journal of clinical and experimental neuropsychology*. In this journal it was mentioned that only less reason is known about traumatic brain injury related behavior and its underlying reasons. More than a decade has passed but still there are more facts and traumatic brain injury related behavior changes to be identified [50]. In their study, they assessed 17 severely brain injured people, but the number of candidates were very less to be reached a generalized conclusion pertaining to traumatic brain injury related behavioral and social changes.

Journal called *“Psychiatric and neuropsychological changes in growth hormone-deficient patients after traumatic brain injury in response to growth hormone therapy”*, written by Nadja P Maric, M Docknic, D Pavlovic, S Pekic, M Stojanovic, M Jasovic-Gastic and V Popovicin the year 2010, mentioned the importance of

growth hormone to control behavioral and mental status. In their study, they identified Growth Hormone Deficiency (GHD) in traumatic brain injury patients [51]. It was clearly mentioned *Journal of endocrinological investigation* from the page 770 to 775. The onset of growth hormone deficiency related cognitive dysfunction was after around a year after the incident. But the study was limited to concentrate only one hormonal imbalance rather than to find it in a comprehensive way. Moreover, they were concentrated mostly on the depression among the victims. So, beyond that, a comprehensive research is needed to analyze the overall neuropsychological changes after traumatic brain injury.

A paper, named, Holistic “*Holisticneuro-rehabilitation in the community: Is identity a key issue?*” published by Rudi Coetzer, in the year 2008; it has been mentioned about the personality change after the trauma. In this journal it was also mentioned that people those who are affected with traumatic brain injury, are possible to lack their self-awareness along with other related psychological and cognitive disabilities. In this journal, he has also mentioned about the inevitable need of a holistic and comprehensive approach to treat neuropsychological issues, (*Neuropsychological Rehabilitation 18 (5-6), 766-783*) [52]. The citation number of this journal is 51. In this journal it was also mentioned about the use of more conventional or traditional rehabilitation approach to manage or to treat traumatic brain injury. He stressed on this conventional or traditional rehabilitation method in order to treat mild traumatic brain injury as well as to testify the effectiveness of the traditional approach. And one more aim for this traditional rehabilitation approach was to assess the long-term effect on low-intensity traumatic brain injury. Above all, in this journal, the author stressed more about to conjoin multidisciplinary and a comprehensive rehabilitation method to treat traumatically brain injured persons.

“*Challenges and opportunities facing holistic approaches to neuropsychological rehabilitation*”, authored by George P Prigatano in the year 2013, it was mentioned the need of understanding the contemporary and historical approach or perspective to identify the challenges or applicability of rehabilitation faced by the domain of neuropsychological rehabilitation [53]. The background of his study was the increasing need of neuropsychological rehabilitation in traumatic brain injury patients and the need of holistic approach to neuropsychological rehabilitation. In order to conduct this study, he used selective literature review from neuropsychological rehabilitation studies, literatures from neurosciences and cognitive neuropsychology (*Neuro Rehabilitation 32 (4), 751-759*). The result of this study was, he has identified prominent ten challenges faced by the holistic neuropsychological rehabilitation domain. Yet, so many areas are left behind this study. If any researcher is interested to cover those areas, it would be very much helpful to the society.

Journal named, “*Neuropsychological and information processing performance and its relationship to white matter changes following moderate and severe traumatic brain injury: a preliminary study*” authored by JL Mathias, ED Bigler, NR Jones, SC Bowden, M Barrett-Woodbidge, GC Brown, DJ Taylor (2004); it has been observed that a noticeable reduction in analysis of information/ information processing speed after a traumatic brain injury [54]. They were able to observe the main reason of the low speed of information process, and it was due to the damage of white matter. Meanwhile, the corpus callosum is a prominent area which is more prone to diffuse injury or diffuse damage. But they did not concentrate much on corpus callosum and its advanced role in manifesting psychological distress. In order to identify the functions of white matter and corpus callosum, they inclined towards modern scanning techniques such as MRIs and CTs. In that study they observed tactile reaction time (RT) laps along with visual problems (*Applied Neuropsychology 11 (3), 134-152*). But in this study, they are lacking to produce a comprehensive data pertaining to trauma related behavior changes.

A journal named, “*Neuropsychological correlates of organic alexithymia*”, authored by Rodger LI Wood, Claire Williams in the year 2007, stated that there is a noticeable correlation between traumatic brain injury and alexithymia [55]. The aim of this study was to identify the severity of the trauma and its effects in forming alexithymia. In order to conduct this study, they used Toronto Alexithymia Scale-20 (TAS- 20) in a group of patients consisting of 121 candidates, and they successfully completed this test. And they were identified three different types of alexithymia manifestations and they are; poor sense of identifying feelings, difficulty in expressing feelings and last externally oriented thinking (*Journal of the International Neuropsychological Society: JINS 13 (3), 471*). In this study, they have also identified elevated depression in patients those who are suffering from traumatic brain injury. But in order to prove the severity of the trauma in relation to form alexithymia was not identified. So, through this study, it is now clear that head trauma causes not only in the daily activities and cognitive or behavioral functions but also it causes effects on emotional area as well. The study did not concentrate much on its effects in daily life and how can it be surmounted.

Journal named, “*Changes in neuropsychological performance after traumatic brain injury from inpatient rehabilitation to 1- year follow-up in predicting 2-year functional outcomes*” authored by Edwin L Bercaw, Robin A Hanks, Scott R Millis, Thomas J Gola (2011); studied the changing value of neuropsychological functioning or performance at various time periods (*The Clinical Neuropsychologist 25 (1), 72-89*). The first time period they selected was inpatient rehabilitation time, second is 1-year and the third is 2-year follow-up time [56]. They collected functional outcomes in the second year. They collected data and

processed it through linear regression and summarized that, changes in learning and the speed of comprehension of information during first year is very delicate or sensitive. In the second year of post injury it was also observed that an elevated level of functional disintegration. The study was able to identify the functional and emotional changes of patients those who are suffering from traumatic brain injury, but this study lacking to identify the environmental effects and familial approach to the patients in order to overcome their difficulties. In conclusion, the study was limited with one or two points rather than concentrating on more comprehensive and holistic area.

Journal named, “*Meta-analysis of facial affect recognition difficulties after traumatic brain injury*”, authored by Duncan R Babbage, JackkiYim, Barbra Zupan, Dawn Neumann, Machiko R Tomita, Barry Willer, stated that, traumatic brain injury and facial affect recognition has clear connection [57]. In this paper it is clearly written that, patients with traumatic brain injury are more vulnerable to lack social affection or social relationships. In this journal, it has also been stated that, it is very difficult to diagnose facial affect recognition and nobody had ever made much importance to study the phenomena and its occurrence and prevalence in traumatic brain injured patients. In order to conduct the study, they used meta- analysis in order to examine the occurrence or magnitude of facial affect recognition. They calculated effect size from 13 scientific studies. The result of the study was positive. 296 adult patients with traumatic brain injury matched with control group and identified that between thirteen percent and thirty nine percent of people with traumatic brain injury may have noticeable difficulties with facial affect recognition. The study identified the relation between traumatic brain injury and facial affect recognition. But did not make any suggestions to overcome it or hoe to cope up with it. It is lacking comprehensiveness.

All the journals are having valuable information pertaining to traumatic brain injury, its types, its effects on memory and emotion and daily functioning, but in order to provide more holistic and comprehensive approach in the area of traumatic brain injury and its psychotherapeutic interventions we need more comprehensive and new approach.

Table1: Related works about Traumatic Brain Injury, Neuropsychological changes due to brain trauma and it's management

S. No.	Title of Journals/Articles	Focus Area	Reference
1	Depression after minor closed head injury: role of dexamethasone suppression test and antidepressants	Depression after a Brain Injury and its pharmacological treatment.	Saran AS. (1985). [58]
2	Social impairment and depression after traumatic brain injury	Social activity impairments and the development of clinically significant depression after a traumatic brain injury.	Gomez-Hernandez R. (1997). [59].
3	Natural history of depression in traumatic brain injury.	Pathological development of depression after a traumatic brain injury and its changes and prognosis.	Dikmen SS, et al. (2004). [60].
4	Mania following head trauma.	Development of manic episodes after traumatic brain injury. The prognosis of mania and its psychological and pharmacological management	Shukla S, et al. (1987). [61].
5	Neuropsychiatric complications of traumatic brain injury: a critical review of the literature (a report by the ANPA Committee on Research).	Neuropsychiatric development of disorders after a traumatic brain injury and its prognosis.	Kim E, et al. (2007). [62].
6	Mania after brain injury. A controlled study of causative factors.	Development of mania after a traumatic brain injury and its biological and social factors.	StarksteinSE,et al. (1987). [63].
7	Traumatic brain injury in individuals convicted of sexual offenses with and without bipolar disorder.	Relationships of hypersexual impulses, sexual crimes with or without bipolar disorder after a traumatic brain injury.	DelBelloMP,et al. (1999). [64].
8	Obsessive-compulsive disorder associated with brain lesions: clinical phenomenology, cognitive function, and anatomic correlates.	Psychopathological development of cognitive, behavioral and emotional illness after a traumatic brain injury and identification of its phenomenology and clinical manifestations.	Berthier ML, et al. (1996). [65].
9	Axis I psychopathology in individuals with traumatic brain injury.	Discussion about anxiety disorders and post-traumatic stress disorder. It also discusses about the development of dissociative disorder after traumatic brain injury. Main concentrations on panic disorder, social anxiety. disorder and other emotional and cognitive disorders	Hibbard MR, et al. (1998). [66].
10	Psychiatric consequences of road traffic accidents.	Various behavioral and cognitive changes after road traffic accident such as, panic disorder, anxiety, depression and its management.	Mayou R, et al. (1993). [67].

12	Relationship between acute stress disorder and posttraumatic stress disorder following mild traumatic brain injury.	Development and prognosis of posttraumatic stress disorder after a traumatic brain injury and its relationship with acute stress disorder.	Bryant RA, et al. (1998). [68].
13	Elevated resting heart rate as a predictor of posttraumatic stress disorder after severe traumatic brain injury.	The relationship between elevated resting heart rate and vulnerability of an impending posttraumatic stress disorder. This article also discusses the other psychological and physiological correlates of post traumatic brain injury.	Bryant RA, et al. (2004). [69].
14	Psychosis following traumatic brain injury.	This article discusses the development of significant symptoms of psychosis after traumatic brain injury. It also focuses the correlates of traumatic brain injury and psychosis.	Arciniegas DB, et al. (2003). [70].
15	Characteristics of psychotic disorder due to traumatic brain injury: an analysis of case studies in the literature.	Various typical and atypical symptomatic manifestations of psychotic disorder after a traumatic brain injury.	Fujii D, et al. (2002). [71].
16	A neuropsychological comparison of psychotic disorder following traumatic brain injury, traumatic brain injury without psychotic disorder, and schizophrenia.	Comparative study on the relationship between traumatic brain injury and psychotic disorder and in other hand traumatic brain injury without any psychotic disorder.	Fujii D, et al. (2004). [72].
17	Traumatic brain injury and substance misuse: a systematic review of prevalence and outcomes research (1994-2004).	Discusses the significant correlates between traumatic brain injury and psychoactive substance abuse. It also discusses the pre and post traumatic brain injury scenario of substance misuse.	Parry-Jones BL, et al. (2006). [73].
18	Disorders of diminished motivation.	Discusses the mood disorders after the traumatic brain injury and especially it discuss the development, symptoms and prognosis of apathy after a brain trauma.	Marin RS, et al. (2005). [74].
19	Nosologic aspects of personality change due to head trauma.	Various behavioral and personality changes due to traumatic brain injury. Discusses the typical and atypical symptoms of various personality disorders and it prognosis. This journal also focuses on its treatment through psychological methods and emphasizes the use of medications also.	Pelegrín-Valero CA, et al. (2001). [75].
20	The differential diagnosis of pseudobulbar affect (PBA). Distinguishing PBA among disorders of mood and affect. Proceedings of a roundtable meeting.	Focuses on the development of pathological illogical laughing and crying after the exposure of traumatic brain injury. It also discusses the differential diagnosis of pseudobulbar (PBA) affect with some other neurological disorders/dysfunctions other than traumatic brain injury.	Arciniegas DB, et al. (2005). [76].
21	Pathophysiology of involuntary emotional expression disorder.	Discusses the sudden mood and emotional changes after a traumatic brain injury. It also discusses the symptomatic manifestations of traumatic brain injury related mood and emotional disturbance.	Rabins PV, et al. (2007). [77].
22	Neuropsychiatric complications of traumatic brain injury: a critical review of the literature (a report by the ANPA Committee on Research).	Various behavioral changes after traumatic brain injury. In particular, it discusses the development and course of aggression after a brain injury.	Kim E, et al. (2007). [78].
23	Clinical correlates of aggressive behavior after traumatic brain injury.	Focuses on the development of various aggressive behaviors and thoughts. Also focuses the special brain region which causes to develop aggressive behaviour after a traumatic brain injury.	Tateno A, et al. (2003). [79].
24	Neuropsychological and neurobehavioral correlates of aggression following traumatic brain injury.	Discusses various neuropsychological changes of traumatic brain injury, especially this article gives more attention to how aggression develops after a brain trauma. It also discusses the prognosis and management of aggression.	Wood RL, et al. (2006). [80].
25	The role of injury severity in neurobehavioral outcome 3 months after traumatic brain injury.	This clinical article discusses the development of various neuropsychological problems after three months of traumatic brain injury. It also discusses the need to identify those	Rapoport M, et al. (2002). [81].

		pathological neuropsychological changes in order to treat it effectively.	
26	Brain injured patients versus multiple trauma patients: some neurobehavioral and psychopathological aspects.	Discusses the clinical correlates and differences in symptomatic manifestations of pathological neurobehavioral problems after a traumatic brain injury. It also makes differentiations of pathological neurobehavioral outcomes of multiple brain injury and a single brain injury.	Frénisy MC, et al. (2006). [82].
27	Disturbances of self-awareness and rehabilitation of patients with traumatic brain injury: a 20-year perspective.	The main focus of this journal is to explain the need of an effective rehabilitation for the people those who are suffering from brain trauma. It also throws light on the management/treatment of poor self-awareness or lack of self-awareness people those who are suffering from traumatic brain injury.	Prigatano GP. (2005). [83].
28	The association between awareness deficits and rehabilitation outcome following acquired brain injury.	Discusses the need of patient's awareness about their own health condition and the modules of rehabilitation program for them. It concludes that if the patient has great awareness about their health condition and the treatment they are going through has a positive outcome than patients those who have less awareness about their health condition.	Owensworth T, et al. (2006). [84].
29	Axis II psychopathology in individuals with traumatic brain injury.	Throws light on personality disorders caused by brain trauma. This paper correlates the relations of various personality disorders with traumatic brain injury.	Hibbard MR, et al. (2000). [85].
30	Axis I and II psychiatric disorders after traumatic brain injury: a 30-year follow-up study.	This article discusses the development of substance use disorders and personality disorders after traumatic brain injury.	Koponen S, et al. (2002). [86].
31	Neuroanatomic basis of impaired self-awareness after traumatic brain injury: findings from early computed tomography.	Discusses the changes in brain structure after a traumatic brain injury and its relationship with self-awareness.	Sherer M, et al. (2005). [87].

IV. RESEARCH GAP:

This study has referred various international and national level research articles in order to get a clear and accurate status of present situation of the concerned topic.

India is a developing country and even in the village side also it is evident that ample amount of brain injury is being occurred every minutes. The number of road traffic accidents and various other types of traumatic brain injuries such as atrocities falls are some common reasons of Traumatic Brain Injuries. Common people and even researchers are more centric to address the physiological problems of traumatic brain injuries. Area to treat psychological distress due to brain injury remains untouched literally. Researchers are more focused towards injuries effect on a particular brain region rather than providing a comprehensive or holistic view towards problems caused by traumatic brain injury regardless of its area of impact. Researchers are also failed to provide information pertaining to early manifestations of neuropsychological symptoms due to brain trauma. It has also been found that in most of the research articles, there is no emphasize to provide a custom tailored or custom made rehabilitation techniques. Because each and every patients' needs and wants are different, so collective or typical rehabilitation methods do not bring much effect on them. It needs custom build person centered approach, and in most research articles indication of this holistic patient centered approach is lacking. More research should be done in this area.

Research Questions:

- R₁. What are the neuropsychological issues followed by a traumatic brain injury?
- R₂. What is the significance/need to identify neuropsychological issues at its early level itself?
- R₃. Which is/are the common and most effective interventional strategies to manage Traumatic Brain Injury related neuropsychological problems?
- R₄. What are the effective rehabilitation methods to satisfy or facilitate the needs of a person with traumatic brain injury and whether the customized rehabilitation methods are more effective than the typical strategies?

V. RESULTS AND DISCUSSIONS:

In every country, traumatic brain injury is one of the main health concerns among health professionals. From various journals and research articles, it has been identified that, government, health professionals, care

givers or family members and even the patient himself neglects the behavioral problems caused by a brain trauma. Health care professionals are more concerned to treat even a minute physical disability or physical discomfort. Even in the present scenario itself, it is evident that people are ignorant to treat any psychological distress, in fact they are careless. From the literature survey, it was identified that there is no much studies or research has been done comprehensively to understand or analyze the pathologic behavioral outcomes of traumatic brain injury. It was also identified that a lot of literatures and clinical study findings are available in the area of traumatic brain injury and its neuropsychological problems. But they are lacking the comprehensive approach to identify general and common neuropsychological outcomes of traumatic brain injury. Scientists are more focused on specific brain regions and their dealings are more on the topic that if the trauma has affected any of the particular brain region and what neuropsychological outcomes can be expected and how that specific problems can be managed or treated. Studies are lacking in the area of general neuropsychological outcomes of traumatic brain injury regardless of considering specific brain regions and its psychopathological sequels.

Ample number of research studies indicates the necessity to conduct research on comprehensive explanations of brain trauma related neuropsychological issues [88]. And it is also identified that, rehabilitation strategies and techniques should be more popularized. More new and efficient person centered approach should be administered people those who are suffering from traumatic brain injury. In another study it has also been mentioned that even if the traumatic brain injury is mild, the patient may develop serious behavioral/ neuropsychological pathologies if he is lacking early detection and treatment of such neuropsychological issues [89]. Even researchers are more concentrated to detect serious behavioral problems caused by traumatic brain injury. A lot of explanations are given in this regard and even in the area of suggestion and limitation of the study also the same has been mentioned. The intense necessity to combine physical and psychological treatment for traumatic brain injury patients is depicted in various research journals and articles [90]. A prospective longitudinal study reveals that not only neuropsychological issues arise from traumatic brain injury but physiological symptoms also can be seen among TBI patients. Among all such psychosomatic symptoms, fatigue is more prominent among patients with brain damage [91]. Even in mild fatigue, physicians may neglect it as a normal thing and do not give much value to treat it. It is estimated that, it is a psychologist's/psychiatrist's duty to assess whether it is originated from any underlying psychological distress or any physiological problems. And according to that diagnosis, treatment should be started or modified. In general, it is identified from the literatures that a strong necessity to conduct a study on general and early detection of various neuropsychological changes due to traumatic brain injury.

VI. CONCLUSION:

In present condition, among laymen, mild to moderate brain injuries are considered as a normal case. Because, statistical data shows that, there is a significant amount of elevation in traumatic brain injury and in our daily life also we are getting exposure about brain injured people and their physiological conditions. Due to this continues exposure of this news, strange feeling of trauma and its related issues are being faded away. As everybody knows, family members, care givers and even medical health professionals are paying their attention only on physiological problems, such as pain, seizures, loco motor disabilities etc. Apart from that, physicians are paying less or no attention on their psychological problems due to the brain trauma. Psychological treatments are provided only if the patient develops very serious psychopathological issues. Otherwise generally no any special psychological intervention will be provided until the patient or family members ask for it. Common population is totally unaware about the fact that any traumatic brain injury, whether it is mild or moderate, can exert power on psychological problems. If we detect those neuropsychological issues in an earlier stage, accurate and effective treatment can be given and the fruitfulness of rehabilitation can also be elevated. Through which a high level of patient's satisfaction and quality of life can be achieved. It is necessary to provide information pertaining to traumatic brain injury and its relation with psychological disturbances. We do not have the lack of data and information about brain trauma and its consequences, but the hurdle is that it is not reaching in grass root level. Not only this, a comprehensive study or research should be conducted in order to rule out or detect the early neuropsychological symptoms. More holistic and multidimensional rehabilitation methods should be introduced through patient centric way to provide immediate relief and satisfaction.

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