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DEPRESSION AFTER TRAUMATIC BRAIN INJURY (TBI) A 0NE YEARS FELLOW UP BY CONVERSATION AND REVIEW ARTICLE AND LITERATURE SEARCH

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ABSTRACT

Introduction: Depression is not uncommon after trauma or surgery. The psychological strain of ill health, need for surgery, and financial implications of ill health all contribute to an episode of depression, or aggravate an existing diagnosis of depression. There is a known but poorly understood link between open heart surgery and depression, where many open heart surgery patients experience profound depression followingsurgery.This is predominantly due to SIRS following cardio-pulmonary bypass surgery. Pazooki, D. Granhed, H.January, 2018. Many different factors contribute to depression after TBI, with great individual variability.The end-point of depression is suicide, which is usually impulsive and extremely difficult to predict and prevent.Aggregate European datasuggests that 235 per 100,000 people sustain a TBI severe enough to warrant hospitalization annually. **Aim:** The aim of this study was to provide a comprehensive review of existing literature covering depression secondary to TBI.We included publications that provided a clear description of study participants and that used standardized tools and recognized approaches to identify depression. **Methods:** Our search included examination of results in 3 three databases: PubMed Medline, the PsycINFO database of psychological and psychiatric literature and Embase. Further, we included telephone conversations with TBI patients, including patients who returned toSahlgrenska hospitalfollowing TBI, From February 2013 to December 2014. **Result:** In our study 0,74% of our patients after six months post TBI are referred to psychiatry and 2,96% of our patients after six months post TBI are referred to psychologist. **Conclusion:** Depression is a very common experience after TBI. However, with the right support and information, and over time, some people can improve or learn to manage their depression on a day-to-day basis.

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INTRODUCTION

Duke University researchers report that patients who suffer from depression immediately before or after coronary artery bypass surgery face an increased risk of early death (Aug. 21, 2003).

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Depressed patients who were followed for an average of five years after bypass surgery were twice as likely to die as patients who were not depressed in the largest and longest study of its kind.

Causes of Depression following TBI: There are several mechanisms by which patientsmay develop depression following TBI including neuroanatomical pathway disruptions, neurochemical changes, as well aspsychological and social factors. Damage to the frontal and temporal lobes can disrupt the

circuitry between the prefrontal cortex, amygdala, hippocampus, basal ganglia and thalamus, leading to emotional dysfunction (Norup, 2014). Social factors such as lack of social support, loss of personal relationshipsand unrealistic expectations have also been associated with increased depression (Osborn, 2014). Psychological variables such aslow tolerance to frustration, impaired self-awareness, low self-esteem and poor coping strategies may also contribute to depression (Osborn, 2014). Several other factors may increase the riskof depression, including abuse,certain medications,interpersonal conflict,death or other loss, genetics, major events,other personal problems, serious illnesses, pregnancy, and substance abuse. Further, pre-injury depressive symptoms may be a risk factor for poor behavioural and mental health-related quality of life outcomes (Kumar, 2014).

Traumatic Brain Injury (TBI) is a major cause of disability worldwide, particularly with increasing trauma survivability rates (2). Major depressivedisorder (MDD) is reported to be the most frequent psychiatric complication after traumatic brain injury (TBI), with a prevalence of 14-77%(CIT). In the U.S., an estimated 1.4 million people sustain a TBI annually, and approximately 3.17 million Americans live with TBI-related disabilities (Zaloshnja, 2008). Psychiatric illness, particularly depression, has an increased incidence following mild traumatic brain injury, possibly as a result of damage to the frontallobes. Depression may result from injury to the areas of the brain that control emotions. Changes in the levels of neurotransmitters can cause depression. This damage may also lead to personality change and attentional problems. A number of treatment options, including psychotherapy and the use of medications, should be considered.Depressed survivors of TBI with MDD lasting more than 6 months exhibit deterioration in social functioning and performance of activities of daily living (Bourdon *et al*., 1992).

Table 1. Documented Search Protocols for Treating Depression in Persons with TBI

Database	*Search terms*
PubMed	In PubMed, terms weresearched askeywords and subject headings simultaneously, and bbreviations wereused for the scale names when appropriate.
PsycINFO	Traumatic brain injury and Beck Depression Inventory or Zung
SS/SU (2012-2015)	11 female and 33 males

Background: TBI is a brain injury that occurs as a result of a blow to the head or other force from an event such as a motor vehicle crash, sports injury, fall, assault, or explosive blast. TBI is responsible for over 1.2 million emergency department visits a year. We do not know the extent to which depression contributes to long-term disability following traumatic brain injury (TBI), however depression is one of several potential psychiatric illnesses that may commonly follow TBI.The societal cost of TBI, including direct medical costs and indirect costs, has been estimated at $60 billion in the year 2000 in the U.S. alone (Finkelstein *et al.,* 2006). Major depressive disorder (MDD) appears to be the most prevalent psychiatric disorder after TBI, with a point prevalence rate over 25% (Rutherford, 1997). The reported period prevalence of MDD within the first year is 42% and within the first 7 years is 61%. The prevalence of MDD after TBI represents a marked increase over the prevalence of MDD found in general population surveys. The increased risk of depression is not limited to those with moderate or severe TBI but is also present among those with mild TBI (Rutherford, 1997). Psychiatric disorders seem to be a major cause of disability after traumatic brain injury (TBI) (Bowen, 1999 and Silver, 2001).The prevalence of post TBI psychiatric sequelae ranges from 34% to 50%, depending on the severity of the trauma (Jorge , 2004 and O'Donnell , 2004). Many different biological and psychosocial factors contribute to depression after TBI and questions remain about which treatment approaches are most effective.

Review of the literature

Table 2.

(MDD) is the most widely studied psychiatric disorder after TBI.

Disorders	%	References	Date of publication
disorders in patients with **TBI**	14-77%	11-9	1999,2004
dysthymia	2-17%	12-14	19921995,1998
bipolar disorder	3-28%	13,15,16	1995,1996,1998
generalised anxiety disorder	4-17%	11-16	1992,93.95,96,98,1999
panic disorder	1-10%	13,15,16	1995,1996,1999
phobic disorders	2-15%	11,13,15	1999,1995,1996
obsessive-compulsive disorder (**OCD**)	3-27%	11,13,15	1999,1995,1996
post-traumatic stress disorder (**PTSD**)	5-28%	11,13,15-17	1999,1995,1996,2000
substance abuse or dependence	1%	11,13,15	1999,1995,1996

Aetiology and Significance of TBI: TBI occurs when external force from an event such as a fall, (Granhed H, Pazooki D Injuries Sustained by Falls - A Review Trauma & Acute CareApril 03, 2017) sports injury, assault, motor vehicle accident, or blast injures the brain and causes loss of consciousness or amnesia (American Congress of Rehabilitation Medicine, 1993). TBI can result from direct impact to the head as well as from rapid acceleration ordeceleration of brain tissue, which injures the brain by internal impact with the skull. Both mechanisms can cause tissue damage, swelling, inflammation, and internal bleeding (Okie, 2005). Among individuals who sustain a TBI, approximately 50,000 die each year of their injuries and 80,000 to 90,000 will suffer long-term disability. More than 5 million survivors of TBI live with chronic disability (Comparative Effectiveness Review Number 25 Effective Health Care).

Depression: Depression is composed of a heterogeneous set of symptoms. While no single feature is seen in all depressed patients, common features include sadness, persistent negative thoughts, apathy, lack of energy, cognitive distortions, nihilism, anhedonia. Patients and their families may not recognize the symptoms, making identification and self-reporting of the condition challenging. Active screening is essential to recognition, treatment, and prevention of recurrence (Comparative Effectiveness Review Number 25 Effective Health Care). Depression is a feeling of sadness, loss, despair or hopelessness that does not get better over time and is significantenough to interfere with daily life. Low mood or anhedoniaoccurring at least several days per week and lasting for more than two weeks is indicative of depression. At least half of suicides occur in the context of a mood disorder (Mann, 2005). Depression reduces quality of life, impairs ability to function in social and work roles, and causes self-doubt and difficulty functioning, all of which can delay recovery from TBI.Moreover, patients are at high risk of developing depression not only during the acute phase, but also for decades following TBI (Koponen, 2002). Jorge *et al.* (1993), investigated the effects of TBI in 66 patients, who were followed up for more than one year (Jorge , 1993). Using

the DSM III-R diagnostic criteria, 42.4% of the patients were diagnosed as having MDD, and this finding was supported by a large-scale study conducted by Kreutzer *et al*. (Kreutzer, 2001), who found that 41.9% of 722 patients had MDD on the basis of the DSM IV criteria. Levin at al. (Kreutzer, 2001), studied a cohort of 125 adults with mild TBI and, reviewing their own earlier work in which they cited a 17% incidence of MDD in subjects with mild TBI one-year after injury, they noted an increased incidence of depression by age, and that this increased by a factor of 7 if there were abnormal computed tomography (CT) findings (Levin, 2005).

Symptoms of depression include:

- Feeling down, sad, blue or hopeless.
- Loss of interest or pleasure in usual activities.
- Feeling worthless, guilty, or that you are a failure.
- Changes in sleep or appetite.
- Difficulty concentrating.
- Withdrawing from others.
- Tiredness or lack of energy.
- Moving or speaking more slowly or feeling restless or fidgety.
- Thoughts of death or suicide.

Relationship betweenTBI and Depression

TBIs are associated with a range of short- and long-term outcomes, including physical, cognitive, behavioural, and emotional impairment (Rehabilitation of persons with traumatic brain injury , 1998). Prior estimates, not derived systematically, of depression among individuals with TBI range widely, from 15 percent to 77 percent (Kim, 2007; O'Donnell, 2004 and Varney, 1987). Depression associated with TBI can manifest shortly after injury or well into the future (Jorge, 1993 and Holsinger, 2002). In their review of rehabilitation for TBI patients, Gordon and colleagues identified 74 studies of psychiatric functioning after TBI (Gordon, 2006). The risk of depression after a TBI increases whether the injury is mild, moderate, or severe. Researchers cannot say if age, gender, the part of the brain that was injured, or the type of injury makes depression more likely. (Jorge, 1993 and Holsinger, 2002). Research has found that patients with TBI are more likely to experience depression than those who have not had a brain injury.About half of all patients with (TBI) are affected by depression within the first year after injury.

Even more (nearly two-thirds) are affected within seven years after injury (Jorge, 1993 and Holsinger, 2002). By comparison, in the general population, the rate of depression is much lower, affecting fewer than one person in 10 over a one-year period. For every 10 people who do nothave a brain injury, approximately one person will have depression. While For every 10 people who have sustained TBI, approximately three people will have depression (Fann, 2009) More than half of the people with TBI who are depressed also have significant anxiety (Fann, 2009). Depressed TBI patients also report more severe post-concussive symptoms such as headache, blurred vision, dizziness, and memory impairment compared to non-depressed TBI patients (Fann, 1995). As mentioned, depression can affect a person's ability to feel motivated; this in turn may have a negative impact on their ability to take part in rehabilitation activities, which may lead to a slower recovery.

Patientsmay experience depression after brain injury following changes in the brain itself, for instance if the parts of the brain that control emotions are injured. Depression can also develop as the brain injury survivor faces post-TBI loss of function. In patientswith neurological and medical conditions, depression may exacerbate neuropsychological impairment and slow the pace of cognitive recovery (Chen, 1996).

How can we know if we are depressed?

Symptoms listed in ***tab -2,****: We may not notice some of these symptoms, but people living and working around us may see them. We may want to ask the people close to us if they notice these signs in us*

Table 3. Symptoms of depression

1-	Feeling down, depressed, or sad most of the day.
2-	Changes in your sleeping habits, such as sleeping poorly or sleeping more than usual.
3-	Losing interest in usual activities such as favourite hobbies, time with family members, or activities with friends.
4-	Increasing your use of alcohol, drugs, or tobacco.
5-	Not eating as much or eating more, whether or not you are hungry.
6-	Strong feelings of sadness, despair, or hopelessness.
7-	Thoughts of suicide.

The causes of depression after TBI?

Many different factors contribute to depression after TBI, and these vary a great deal from person to person (Fann, 2009).

Physical changes in the brain due to injury: Depression may result from injury to the areas of the brain that control emotions. Changes in the levels of certain natural chemicals in the brain, called neurotransmitters, can cause depression (Fann, 2009).

Emotional response to injury: Depression can also arise as a person struggles to adjust to temporary or lasting disability, losses or role changes within the family and society.

Factors unrelated to injury: Some people have a higher risk for depression due to inherited genes, personal or family history, and other influences that were present before the brain injury (Fann, 2009).

Diagnosing depression after brain injury: Many of the symptoms of depression are similar to the effects of brain injury, such as fatigue or lack of motivation, so it might be hard to tell whether someone with a brain injury does in fact have depression. A constant low mood and lack of energy or interest in life might be telling of depression, among other symptoms listed earlier. Depression following TBI is associated with worse global outcomes (37 , worse social functioning during the first year post-injury (38), and lower health-related quality of life (39), even after controlling for medical, demographic, and neuropsychological factors.

Self-help tips for coping with depression: There are a few things that can help us to cope on a day-to-day basis. Two general important points to remember are:

Remind yourself that these feelings are normal: It is a completely natural response to feel grief, shock, fear and sadness following something as profound as brain injury.

There is help available: Don't be afraid to seek help from family, close friends, colleagues or supportive organisations. There are also professionals that can help in various ways.

The tips

Talk to your family or friends about how you are feeling. If it's too difficult to speak to them about how you feel, or if you are struggling to express yourself, try to find other ways of communicating such as writing a letter. This can allow you to take your time with finding words to describe your thoughts.

Try not to become socially isolated: It is important to spend at least some time socialising with people on a face-to-face basis. Alternatively, consider finding a local support or activity group that you can attend to meet new people and try out new activities.

Engage in activities that you enjoy doing: Research indicates that these activities can be useful ways of coping with depression. such as listening to uplifting music, creating art, or reading a book.

Educate yourself on the effects of brain injury: Understanding your brain injury may be the first step towards accepting it, which might help with managing depression.

Try to exercise for a few minutes every day: Exercise is a proven method of improving low mood. Try to set yourself a routine, for example taking a short walk around the neighbourhood in the morning or doing some gentle stretches for five minutes every afternoon.

Seek support from other services: There are also depression-specific support groups, where peoplecan get peer support from others who are also affected by

Table 4. The patient information n = 44

Patients	44	Fall	MVA	MC	GCS	BP	ATLS	CT	Observation	Neurology
Female	11	6	5		11-15	110-155	11	11	24/h	0
Male	33	23	4	6	13-15	90-160	33	28	24/h	0
Age/y	14-86									
Post Observation						Stable			Nausea, Dizziness	0
Diabetes II	17	14	3	0	13-15	Stable			*	0
MI	3	3	0	0	12-15	Stable			*	0
stroke	1	1	0	0	11-15	Stable			Headache+*	0
Bleeding	0	0	0	0	0	0				0
Symptom	*	*	*	*	Nausea	Dizziness			*	0

* Nausea, Dizziness, Headache

Table 5. The patient information n = 37 Two patients are referred to psychiatry, eight patients are remitted to psychologists

Patients	37	Male	Female	Neurology	Sick leave/W Post trauma
Female	9			0	
Male	28			0	
Phone call after 6 months	37	28	9	0	
Feeling down, depressed, or sad		1=	1=		More than 6 Weekes
sleeping poorly or sleeping more than usual.		0	1		More than 10 Weekes
Losing interest		0	0		
Increasing use of alcohol, drugs, or tobacco		1=	1=		More than 10 Weekes
Strong feelings of sadness, despair, or hopelessness.		1=	2=		More than 10 Weekes
Thoughts of suicide.		1=	1=		More than 9 Weekes
Referral to psychologist=8 and psychiatry=2		4=	6=		45 Weekes

Table 6. The patient information n=43 , Phone call after1, 3and 6 months. Six patients do not want to cooperate with research anymore and 0ne dead. *N=7*

Patients	44	Sickleve/D Post trauma = 10	Revisit 30 d/post Trauma	Phone call after 3 months	Phone call after 6 months	Phone call after 12 months	Total	Referral to psychologist
Female	11	3	11	9	9	9	9	6
Male	33	19	32	28	28 *0ne dead*	28	28	4
Age/y	14-86							
Total Symptom	44		43 Headache=9	37 20=fatigue	37 Fatigue=11	37 Fatigue=3	37	10
Diabetes II=3		3 patients =14/d	3=Fatigue, sad, Headache	3=Fatigue, sad	3= Fatigue, sad	1= Fatigue, sad		
MI=3		3 patients =14/d	3 =Headache Nausea, Dizziness	3=Fatigue, sad Feeling down, depressed, or sad most of the day	3=Fatigue, sad	1= Fatigue, sad		
Stroke=1		3 patients =14/d	1= Headache Nausea, Dizziness,	1= Strong feelings of sadness	1= Strong feelings of sadness	1= sadness		
Others	31		23=Headache Nausea, Dizziness,	16=Fatigue 9= Dizziness	3= Strong feelings of sadness	1= sadness		10

depression, although these tend to be non-brain injury specific.

Identify issues in your life that may be causing or contributing to the depression, for example if you are experiencing financial or relationship problems and seek support for these.

Consider putting together a 'soothe box': This is a box that contains personal items that may make you feel better and cope when you are feeling depressed.

Consider wellbeing techniques: Although there is limited research to prove their effectiveness, brain injury survivors often report benefiting from them. Wellbeing techniques such as mindfulness, yoga, meditation or other relaxation techniques. Speak to a therapist if you are considering trying any of these techniques out, as they may be able to guide you through learning how to effectively use them.

Maintain a healthy lifestyle: This involves maintaining a healthy diet, drinking plenty of water, avoiding alcohol and trying to ensure that you have a good night's sleep.

Professional support: It is best to seek support from a professional who specialises in brain injury. The professionals best suited to this are Clinical Neuropsychologists or Clinical Psychologists who specialise in brain injury; these professionals specialise in the assessment and intervention of behavioural, emotional and cognitive problems caused by brain injury.

Medication: There are various different types of antidepressants that work by targeting different types of chemicals in the brain or altering chemical activity in different ways. The two most commonly prescribed types of antidepressants are *selective serotonin reuptake inhibitors (SSRIs)* and *serotonin-noradrenalin reuptake inhibitors (SNRIs)*.

Selective serotonin reuptake inhibitors: these are one of the most commonly prescribed types of antidepressants. They work by increasing levels of serotonin, a chemical in the brain that is responsible for feeling good. SSRIs are commonly prescribed because they have fewer side effects than other antidepressants.

Serotonin-noradrenalin reuptake inhibitors: These antidepressants are similar to SSRIs although they alter the activity of serotonin and another chemical called noradrenalin. One of the most widely recognized psychological problems following brain injury is depression. Brain injuries can cause a variety of cognitive, physical, and psychological changes that can affect a person's life.Studies have found that depression after brain injury leads to worse functional and psychological outcomes and worse quality of life (Haagsma, 2014). Studies pertaining to long-term outcomes and results of depression treatment in patients with TBI are needed to facilitate further comparison of the safety and effectiveness of treatments for TBI-induced depression.

DISCUSSION

Our study is a Scandinavian model and our results are not necessarily similar to the United States. Because we believe, this depends on Scandinavia's economy and social welfare, which has major differences between two countries.

Conclusion

Depression is an important problem due to its effects on health, productivity, and quality of life.Depression is a very common experience after TBI. However, with the right support and information, and over time, some people can improve or learn to manage their depression on a day-to-day basis.While the depression may be triggered by TBI, it should be treated just like depression that occurs without trauma.This type of depression should be treated by a healthcare professional familiar with clinical depression. Close friends and family can also be key sources of support. Additional research is also needed to determine whether patient factors such as area of the brain injured, severity of the injury, mechanism of injury, age, and gender are predispositions for depression in patients with TBI.

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