

Review Article

A Perspectives Approach to Suicide After Traumatic Brain Injury: Case and Review

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Background: Suicidal behavior after traumatic brain injury (TBI) is an increasingly recognized phenomenon. Both TBI and suicide are major public health problems and leading causes of death. The interaction between both of them is complex, and understanding it requires a multifaceted approach. Epidemiologic studies have shown a markedly higher incidence of suicide in individuals with TBI as compared with the general population, but imprecise definitions of suicide and suicidality as well as sample characteristics caution conclusive interpretation. Risk factors for suicide after TBI include male gender, presence of substance abuse or psychiatric disorders, and the severity of the injury. Evaluation of a suicidal patient with previous

TBI currently relies on careful clinical examination. Established assessment tools can be useful but have not all been validated in this population. Intervention strategies should stress a multidimensional approach incorporating neurologic, behavioral, psychologic, pharmacotherapeutic, and psychosocial factors.

Objective: This article serves to review the currently available literature on suicidal behavior after TBI.

Methods: It uses a case to illustrate how one might conceptualize this complex problem. **Conclusion:** It is hoped that this review stimulates further research in an area where there are still large gaps in our knowledge of this very important problem.

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INTRODUCTION

Suicide after traumatic brain injury (TBI) is an area of growing concern for mental health providers and others. Although the connection between brain injury and suicide has been suggested for decades, the association has recently become more apparent because of the dramatic rise in rates of suicide among returning war veterans with TBI.^{1–3} In the civilian population, rates of completed and attempted suicide in persons with TBI have been shown to be significantly greater when compared with the general population.^{4,5} Because of the increasing notoriety of suicide after TBI, there is currently a growing literature on the phenomenology, treatment, and prevention of suicide.

This article first describes a case of suicidal behavior after traumatic brain injury and then

provides a brief overview on suicide after TBI, including nomenclature, risk factors, and clinical and neurobiologic features and correlates of TBI suicide, and finally describes the evaluation and management of this multidimensional problem. In

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addition, we also provide a treatment model and review other management approaches.

THE CASE OF MR. H

Mr. H, a 31-year-old married, white man, presented with no formal prior psychiatric history before sustaining a traumatic brain injury (TBI) at the age of 16 years. At that time, he was struck by a car on a busy road while attempting to cross it. Found unconscious, he was taken to a nearby hospital where he was determined to have sustained a severe closed TBI. Neuroimaging showed left hemispheric (frontal, parietal, and cerebellar) contusions and diffuse axonal injury. After emerging from a 14-day coma, he demonstrated significant right hemiparesis and cognitive impairments. He underwent intensive neurorehabilitation therapies in acute and subacute settings and demonstrated functional improvements. He continued to demonstrate further improvements in his physical and daily life functioning, but he began exhibiting behavioral problems including disinhibition and hypersexuality and mood fluctuations ranging from depression and social withdrawal to overactivation and agitation. For these symptoms, he was prescribed mood stabilizers as well antipsychotic medications. While under the care of a psychiatrist, he continued to experience mood fluctuations with significant depressive episodes during which he expressed suicidal thoughts. As a result, he was psychiatrically hospitalized twice over 10 years. He also began abusing various illicit substances including alcohol and marijuana regularly. After getting married, he described his relationship as chaotic and noted periods of time when he had violent thoughts and punched walls, but he never harmed his family. His medical care also became inconsistent as he “fired” or was “fired” by a number of clinicians. He had frequent thoughts of death with minimal motivation or hope for the future. He continued having difficulty, including in the work setting where he was fired for sexually harassing a coworker. In the context of this turmoil, he attempted to stab himself in the chest. He later described the act as impulsive and as an attempt to gain attention from his wife during an argument with her.

Mr. H was adopted. He grew up in a middle-class home as an only child and reported no history of abuse. He was “the class clown” and got into trouble often but reported feeling alienated from his peers. Though he performed poorly, he graduated high school and completed a few college courses. He held predominantly

retail and janitorial jobs. His medical history was significant for obesity and hypertension. He is currently being treated with mood stabilizing medications and antipsychotics to treat impulsivity and labile mood. He is also receiving individual psychotherapy to address intense feelings of alienation and to help modulate his emotional reactivity to stressful situations.

LITERATURE REVIEW

Suicide Definitions and Nomenclature

One of the challenges of the literature has been a lack of agreement on the definition of suicide and associated terms. Recently, The Self-Directed Violence Classification System has provided a comprehensive approach to defining terms associated with suicide.⁶ This new system addresses a need for improved clarity and communication at both the individual and population level when referring to suicidal behavior. A myriad of terms including suicidal ideation or attempt, “cry for help,” “parasuicide,” “nonfatal suicide attempt,” and others have contributed to a lack of conceptual clarity about suicidal behaviors. Moreover, the variability in the meanings of these terms was often pejorative and based on incorrect notions about seriousness and lethality of methods. These difficulties make interpreting the meaning of suicidal occurrences more difficult and hamper precise communication, often missing some suicidal occurrences or misclassifying others. The Self-Directed Violence Classification System first distinguishes between suicidal thoughts and suicidal behaviors. Suicidal ideation is defined as thoughts of engaging in suicidal behavior where the individual has thoughts of suicide (a) without intent, (b) with an undetermined degree of suicidal intent, or (c) with some suicidal intent. Suicide (referred to as suicidal self-directed violence) is defined as any death caused by self-inflicted injurious behavior performed with any intent to die as a result of that behavior. Awareness of this nomenclature and consistent use adds to clarity of communication in clinical practice, enhances applicability in research settings, and can be used to develop policies and procedures to prevent death by suicide.

Suicide Rates After TBI

Much of the earliest work in the field had gone into describing the prevalence and frequency of TBI-related

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suicide in the community. There are studies showing discrimination between suicide after TBI and background suicide rates but also ones that showed no difference. Certainly, lack of precise definitions of either suicide or TBI, small sample sizes, and the variable time duration since injury were and continue to be some of the challenges with these studies. Two studies, a study of 2320 people with TBI by Shavelle et al.⁷ and a study of 2178 patients in the TBI Model Systems National Database by Harrison et al.⁸ did not find any differences in rates of suicide in persons with TBI compared with normal population data. However, an early study by Simpson and Tate⁹ on persons with TBI ($N = 172$) who were followed up in an outpatient clinic noted that 35% of them reported hopelessness, 23% reported suicidal ideation, and 18% had made a suicide attempt following injury. In an epidemiologic study by Silver et al. using the New Haven portion of the National Institute of Mental Health Epidemiologic Catchment Area program, persons with a history of TBI, when compared with those without TBI, had higher percentages of suicide attempt (8.1% vs 1.9%). TBI and alcohol abuse in combination increased the odds ratio for suicide attempts by 5.7 times, relative to that of the general population, and even after controlling for alcohol abuse, the odds ratio for suicide attempts remained elevated (4.5 times).¹⁰ A review study of 48 articles by Simpson and Tate¹¹ concluded that the risk for suicide, suicide attempts, and suicidal ideation is increased in TBI survivors when compared with the general population, even after adjustment for psychiatric comorbidities. Suicidal ideation occurred in 21%–22% of persons with TBI across all severities, and the suicide attempt rate was approximately 18% in persons with severe TBI. The risk of completed suicide in men and women with TBI was elevated in comparison with that of the general population, with standardized mortality ratios of 3.9 and 4.7, respectively. They also noted that suicide risk increased with injury severity and substance abuse increased the risk of suicide in persons with TBI.

Risk

There has been great interest in identifying the risk factors of suicide after TBI. An area of focus has been the association between injury severity and suicide. Teasdale and Engberg's⁵ population study reported

increased rates of suicide in patients with relatively severe TBI. Concussion was associated with standardized mortality ratios of 3.02, and injury involving cerebral hemorrhage (i.e., complicated mild or greater severity) was associated with standardized mortality ratios of 4.05. Substance abuse dramatically increased (nearly doubling standardized mortality ratios) the risk of suicide across all levels of TBI severity. However, when substance abuse was added in the multivariate analysis, only injury severity was found to be the strongest predictor.⁵ Brenner et al.¹² compared suicide rates in veterans with and without TBI. Even after adjusting for psychiatric comorbidities and demographics, they noted that veterans with a history of TBI were 1.55 times more likely to die by suicide than those without a history of TBI. Veterans with a history of TBI involving concussion or fracture were 1.98 times more likely to die by suicide than were veterans without a TBI history, and veterans with a history of TBI involving contusion or traumatic intracranial hemorrhage were 1.34 times more likely to die by suicide. This finding is different from that by Teasdale and Engberg who noted a relationship between TBI severity and suicide risk with more severe TBI increasing risk. However, Brenner et al.¹² noted that other covariates (e.g., pain) may have contributed to the increased risk in the concussion group.

Another study by Brenner et al.¹² addressed precipitating events, protective factors, and prevention strategies. In this study, 13 veterans with a history of TBI and clinically significant suicidal behavior were interviewed. Shared precipitants included "loss of self" following TBI, cognitive difficulties, and psychiatric and emotional difficulties. Protective factors included strength of social support from family, friends, peers, and even pets; sense of purpose regarding the future; religion and spirituality; and access to mental health care. Prevention strategies, including improving access to services and improving mental health professionals' knowledge of TBI, providing more structured treatment were also suggested.

Psychiatric Comorbidities

Another area of interest has been the presence of psychiatric comorbidities with increased risk of suicide in those with TBI. In community-dwelling adults with TBI, Tsaousides et al.¹³ observed a robust relationship between post-TBI suicidal ideation and emotional

distress, psychopathology, and relatively poor psychosocial functioning. However, they did not find any relationship between suicide and demographic factors such as age, race, income, education, or injury severity. A study by Oquendo *et al.*¹⁹ on 325 subjects with major depression found that in regression analyses, mild TBI did not predict suicide attempter status, but rather aggression and hostility were predictors. In this study, men with a history of mild TBI had an increased likelihood of being suicide attempters. A Finnish study by Mainio *et al.*¹⁴ examined records of all those who had committed suicide during a 16-year period. Of the 1877 records examined, 103 (5.5%) were noted to have had TBI. Compared with those without TBI, those with TBI had significantly more hospital-treated psychiatric and alcohol disorders.

More recently, attention has turned to the number of TBIs as an independent risk factor for suicide. In a recent study, Bryan *et al.*² reported that the number of TBIs was associated with greater suicide risk when the effects of depression, posttraumatic stress disorder, and TBI symptom severity were controlled for ($\beta = 0.214$; $P = 0.03$).

Finally, neurobiologic and neurocognitive theories of suicidal behavior after TBI have been investigated as well. A study by Yurgelun-Todd *et al.*¹⁵ using diffusion tensor imaging to study the correlates of suicidal ideation in persons with TBI found a relationship between decreased integrity in the frontal lobe white matter and increased suicidality. A recent pilot study by Homaifar *et al.*¹⁶ comparing TBI subjects with and without suicide attempt noted that the 2 groups differed in their performance on the Wisconsin Card Sorting Test (WCST) perseverative errors, thereby suggesting that the cognitive domain of executive function is closely related to suicide attempt in those with TBI.

Neurobiologic and Neurocognitive Theories of

Suicide After TBI

Proposed neurobiologic mechanisms have included disruptions of the central nervous system and serotonin and neuroendocrine systems and the recent endophenotypic hypotheses of suicidal behavior have suggested a heritability of suicidal behavior.¹⁷ Recent work in neuroimaging reports associations of brain regions such as the prefrontal cortex and anterior cingulum with suicidal behavior.¹⁸ Poor efficacy of

cognitive functioning, particularly executive processes such as problem solving, flexibility, and generativity, has been associated with elevated levels of suicide risk in non-brain-damaged populations.¹⁹

EVALUATION

Most studies have employed clinical suicide assessment strategies and standardized instruments developed for the general population and used them in the evaluation of patients with TBI. However, Desseilles *et al.*²⁰ adapted 2 depression scales (Beck Depression Inventory and Hamilton Depression Rating Scale) to assess suicidal ideation in individuals with TBI by validating pertinent components of these scales in 356 community-dwelling adults with TBI.

Assessing suicidal risk is a fundamental first step in the evaluation process of a patient with previous TBI. Dennis *et al.*²¹ recently outlined concrete steps for suicide assessment: (1) thoughts of killing oneself; (2) desire of killing oneself; and (3) formation of a specific plan for killing oneself. Once a patient has expressed a plan for suicide, the next step is to assess for the level of lethality and the presence of firearms. Although the clearly laid out approach given by Dennis *et al.* is appealing, we caution that because of cognitive deficits as well as frequent dissociation of mood from affect, the importance of obtaining collateral information from informants cannot be underscored enough.

In addition to these fundamental questions, a number of standardized interviews have been developed to assess suicidality and other psychopathology. Structured clinical interviews, such as the Columbia Suicide Severity Rating Scale, which operates as a summary measure, have recently been developed to assess for suicidality.²² The most common structured interview to assess for Axis I and Axis II psychopathology is the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders-IV.²³ The Suicide Potential Index and Suicide Ideation scales of the Personality Assessment Inventory have also been shown to be useful as predictors of suicidal behavior in military veterans with TBI.²⁴ Although psychometric instruments are helpful in the assessment of suicide, they do not replace comprehensive psychiatric evaluations with regular close follow-up and therapeutic interaction between the clinician and patient.

MANAGEMENT

Given that the current literature is replete with often confounding and conflicting data, the clinical story remains the richest repository of information. It forms the cornerstone of understanding the complex interplay between physical, social, and behavioral phenomenon in any patient.

Strategies at suicide prevention in patients with previous TBI have stressed a multifaceted approach involving neurologic, psychologic, psychopharmacotherapeutic, and psychosocial factors. Unfortunately, there has been limited work done on applying conventional suicide prevention strategies to the post-TBI population. For example, relying solely on psychotherapeutic interventions is less likely to be an effective intervention particularly for individuals with post-TBI cognitive-behavioral deficits. Tailoring suicide prevention strategies to the specific needs of these patients, such as improving psychosocial functioning and daily life management skills through further rehabilitation therapies in addition to employing pharmacotherapeutic and psychotherapeutic interventions, are likely to result in better physical, cognitive, and emotional outcomes. The role of carefully tailored psychoeducation to persons with TBI and their families is also likely to play an important role in building insight into the relationship between mood states, cognition, acts, and behaviors. It is also important to educate the patient's support network including family, friends, and peers.

We first stress that an actively suicidal patient, especially one with a plan and intent, is considered a psychiatric emergency. As such, a patient in this state should be strongly considered for inpatient psychiatric hospitalization. Although psychiatric hospitalization is considered the standard of care in these situations, there is little scientific evidence that it reduces suicides after or even during the hospitalization.²⁵ In the post-TBI population, Gutierrez et al.²⁶ showed 27% of patients with previous TBI attempted suicide at the time of inpatient psychiatric hospitalization. All other studies of psychiatric hospitalization were conducted in the general population with no TBI.

Psychopharmacologic interventions have largely not been studied in reducing suicidal behavior following TBI. The only level 1 pharmacotherapy trial to date (sertraline) by Ashman et al.²⁷ did not find a significant difference in improvement between the

treatment and placebo groups. However, it was observed that both groups improved significantly pretreatment to posttreatment. However, there have been several clinical trials that support the use of sertraline²⁸ and fluoxetine²⁹ (with better evidence for the use of sertraline) for the treatment of depression in patients with previous TBI. Moreover, these medications have been used off-label for the treatment of other neuropsychiatric symptoms, such as aggression, impulsivity, and disinhibition, all of which place the patient at increased risk for suicidal behavior.

Psychotherapeutic strategies have been even less frequently studied in patients with previous TBI. In the general population, combining psychotherapy with pharmacotherapy has been shown to reduce suicidal behavior. An NIH consensus statement recommended the use of psychotherapy to treat depression as part of the rehabilitation of persons with TBI.³⁰ This study is important because the treatment was found to be effective despite the presence of cognitive deficits. More longitudinal studies specifically designed to assess levels of suicidal behavior after treatment with these and other psychotherapeutic interventions are needed. Cognitive-behavioral therapy, specifically, has been applied to the TBI population for the treatment of hopelessness. Another study by Simpson et al.³¹ showed a group-by-time interaction for the reduction of hopelessness between 2 time points and at 3-month follow-up. However, secondary outcome variables including suicidal ideation did not show similar interactions or main effects. A small qualitative study conducted by Kuipers and Lancaster³² to determine perspectives of persons with brain injury and their family members in preventing suicide noted that the patients favored informal relationships as a key factor and the families stressed the need for specialist brain injury rehabilitation services and education about brain injury to family and friends. This study underscores the importance of developing a comprehensive approach and working with both patients and their families.

Psychosocial intervention is a broad category of measures used to shore up environmental and community resources as well as identify and mobilize personal support networks. Although there has been little research specifically investigating its use in patients with previous TBI, conventional measures that have proved successful have been improving social support, problem-solving skills, and teaching coping skills to

family members. For example, Holley *et al.* suggest the use of befriending to reduce social isolation.³³ Even though there are several individual approaches to treat suicidal thought and behaviors, it is important to have an organized comprehensive approach so as to address the multiple risk factors associated with suicide. Certainly, further research is needed, particularly with the use of psychosocial interventions because of its likely effect and burden not only on the patient but also on families and caregivers.

Applying the Perspectives Approach to Suicidality in

TBI

Here, we discuss the approach we used in this case, which is through the 4 perspectives of psychiatry first described by McHugh and Slavney.³⁴ This approach provides 4 explanatory methods: disease, dimensional, behavior, and life story to describe the patient's problems and a rationale for treatment. Each of the 4 perspectives highlights a unique view point for understanding the person's neuropsychiatric disturbances and offers guidance for management. The disease perspective asks the question if there is a "broken part" in the brain. In the case of Mr. H, the trauma to his head resulting in structural changes is good evidence of damage to the brain. The treatment approach using this perspective is predominantly biologic, *i.e.*, to cure the disease or reduce frequency and intensity of symptoms. As there are no medications (or other interventions) to "cure" the brain injury, Mr. H received psychiatric medications to treat the sequelae—symptoms of mood and impulsivity. The dimension perspective focuses on the person's vulnerabilities (cognitive or personality or both) and suggests support and guidance as strategies to reduce distress and improve productivity. Mr. H's history of poor scholastic performance and behavioral problems as a youth added to his post-TBI behavioral and cognitive problems and placed him at risk to act impulsively on his thoughts and feelings. Psychotherapy using a combination of strategies geared toward illness education and skill development aimed at reducing negative thinking, accepting, and adapting to illness are appropriate interventions. Mr. H's history of substance abuse as well as the role of violence and aggression in the context of his family played significant roles in guiding future behavior.

Treatment includes interrupting the problematic or destructive behavior using approaches such as gentle confrontation, challenging the patient's reluctance to change, and helping him to acquire adaptive behaviors to replace the destructive behaviors.

The life story perspective is based on the logic of the narrative and explains a patient's feelings and behavior to be secondary to disturbing life experiences. "Rescripting" the person's life helps boost morale and provides a better understanding of life's problems. Mr. H's life story was marked initially by being adopted, growing up without siblings, and having feelings of alienation. Moreover, Mr. H shares many of the features that are present in individuals at high risk of suicide after TBI. Individual and group psychotherapy are often helpful in "reinterpreting" negative life situations and bolstering coping skills and compensatory strategies to modify the outcome. Support and inclusion of family and other supportive networks in this effort is an essential piece to "rescripting."

It is important to note that though we have used The Perspectives of Psychiatry as a framework, this is not the only approach; clinicians can use other multifaceted approaches that focus on the predisposing, precipitating, perpetuating, and protective factors. Other comprehensive approaches are also available. Wortzel and Arciniegas³⁵ have offered an excellent guide for evaluation of persons with TBI, aggression, and violence in which a heuristic method is offered to clinicians attempting to characterize the relationships between TBI and externally or internally directed violent acts. This approach emphasizes paying attention to the myriad of factors that may contribute to aggressive and suicidal behavior in an individual with a history of TBI and not merely on generalized behavioral tendencies observed in groups of persons with TBI. Such pertinent factors include but are not limited to details about the TBI (*e.g.*, location, severity, time since injury), preinjury and postinjury psychosocial factors and neuropsychiatric comorbidity, contexts in which the violent acts occurred, and any possible precipitants and possible objectives of the act.

CONCLUSIONS

We have presented a case of attempted suicide in a patient who had a TBI so as to showcase the

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complexity and multidimensional nature of this problem. Because the literature is far from conclusive on the causal nature of TBI in suicidality, continuing to refine and characterize the elements of the clinical

presentation and history is necessary. Unique to the current literature, we have described a formulation according to the 4 Perspectives to underscore the importance of a multipronged approach.

References

1. Brenner LA, Ignacio RV, Blow FC: Suicide and traumatic brain injury among individuals seeking veterans health administration services. *J Head Trauma Rehabil* 2011; 26(4):257–264
2. Bryan CJ, Clemans TA. Repetitive traumatic brain injury, psychological symptoms, and suicide risk in a clinical sample of deployed military personnel. *JAMA Psychiatry*. 2013;1-6 [Epub 2013/05/17].
3. Nock MK, Deming CA, Fullerton CS, et al: Suicide among soldiers: a review of psychosocial risk and protective factors. *Psychiatry* 2013; 76(2):97–125 [Epub 2013/05/02]
4. Harrison-Felix CL, Whiteneck GG, Jha A, Devivo MJ, Hammond FM, Hart DM: Mortality over four decades after traumatic brain injury rehabilitation: a retrospective cohort study. *YAPMR* 2009; 90(9):1506–1513
5. Teasdale TW, Engberg AW: Suicide after traumatic brain injury: a population study. *J Neurol Neurosurg Psychiatr* 2001; 71(4):436–440
6. Brenner LA, Breshears RE, Betthausen LM, et al: Implementation of a suicide nomenclature within two VA healthcare settings. *J Clin Psychol* 2011; 18(2):116–128 [Epub 2011/06/01]
7. Shavelle RM, Strauss D, Whyte J, Day SM, Yu YL: Long-term causes of death after traumatic brain injury. *Am J Phys Med Rehabil* 2001; 80(7):510–516 [quiz 7–9. Epub 2001/06/26]
8. Harrison-Felix C, Whiteneck G, Devivo MJ, Hammond FM, Jha A: Causes of death following 1 year postinjury among individuals with traumatic brain injury. *J Head Trauma Rehabil* 2006; 21(1):22–33 [Epub 2006/02/04]
9. Simpson G, Tate R: Suicidality after traumatic brain injury: demographic, injury and clinical correlates. *Psychol Med* 2002; 32(4):687–697 [Epub 2002/07/10]
10. Silver J, Kramer R, Greenwald S, Weissman M: The association between head injuries and psychiatric disorders: findings from the New Haven NIMH epidemiologic catchment area study. *Brain Inj* 2001:935–945
11. Simpson G, Tate R: Suicidality in people surviving a traumatic brain injury: prevalence, risk factors and implications for clinical management. *Brain Inj* 2007; 21(13–14):1335–1351
12. Brenner LA, Homaifar BY, Adler LE, Wolfman JH, Kemp J: Suicidality and veterans with a history of traumatic brain injury: precipitants events, protective factors, and prevention strategies. *Rehabil Psychol* 2009; 54(4):390–397 [Epub 2009/11/26]
13. Tsaousides T, Cantor JB, Gordon WA: Suicidal ideation following traumatic brain injury: prevalence rates and correlates in adults living in the community. *J Head Trauma Rehabil* 2011; 26(4):265–275 [Epub 2011/07/08]
14. Mainio A, Kyllönen T, Viilo K, Hakko H, Särkioja T, Räsänen P: Traumatic brain injury, psychiatric disorders and suicide: a population-based study of suicide victims during the years 1988–2004 in Northern Finland. *Brain Inj* 2007; 21(8):851–855
15. Yurgelun-Todd DA, Bueler CE, McGlade EC, Churchwell JC, Brenner LA, Lopez-Larson MP: Neuroimaging correlates of traumatic brain injury and suicidal behavior. *J Head Trauma Rehabil* 2011; 26(4):276–289 [Epub 2011/07/08]
16. Homaifar BY, Brenner LA, Forster JE, Nagamoto H: Traumatic brain injury, executive functioning, and suicidal behavior: a brief report. *Rehabil Psychol* 2012; 57(4):337–341 [Epub 2012/11/28]
17. Courtet P, Gottesman I, Jollant F, Gould T: The neuroscience of suicidal behaviors: what can we expect from endophenotype strategies? *Transl psychiatry* 2011;1 [Epub 2011/09/29]
18. Jollant F, Lawrence NL, Olie E, Guillaume S, Courtet P: The suicidal mind and brain: a review of neuropsychological and neuroimaging studies. *World J Biol Psychiatry* 2011; 12(5):319–339 [Epub 2011/03/10]
19. Keilp JG, Sackeim HA, Brodsky BS, Oquendo MA, Malone KM, Mann JJ: Neuropsychological dysfunction in depressed suicide attempters. *Am J Psychiatry* 2001; 158(5):735–741 [Epub 2001/05/01]
20. Assessing suicide ideation in patients with traumatic brain injury (TBI) by using depression scales. *J Head Trauma Rehabil* 2013; 28(2):149–150 [Epub 2013/03/08]
21. Dennis JP, Ghahramanlou-Holloway M, Cox DW, Brown GKA: Guide for the assessment and treatment of suicidal patients with traumatic brain injuries. *J Head Trauma Rehabil* 2011; 26(4):244–256
22. Posner K, Brent D, Lucas CEA. Columbia Suicide-Severity Rating Scale (C-SSRS). New York, NY State Psychiatric Institute 2006.
23. Ventura J, Liberman RP, Green MF, Shaner A, Mintz J: Training and quality assurance with the Structured Clinical Interview for DSM-IV (SCID-I/P). *Psychiatry Res* 1998; 79(2):163–173 [Epub 1998/08/15]
24. Breshears RE, Brenner LA, Harwood JE, Gutierrez PM: Predicting suicidal behavior in veterans with traumatic brain injury: the utility of the personality assessment inventory. *J Pers Assess* 2010; 92(4):349–355 [Epub 2010/06/17]
25. Qin P, Nordentoft M: Suicide risk in relation to psychiatric hospitalization: evidence based on longitudinal registers. *Arch Gen Psychiatry* 2005; 62(4):427–432 [Epub 2005/04/06]
26. Gutierrez PM, Brenner LA, Huggins JAA: Preliminary investigation of suicidality in psychiatrically hospitalized veterans with traumatic brain injury. *Arch Suicide Res* 2008; 12(4):336–343

27. Ashman TA, Cantor JB, Gordon WA, et al: A randomized controlled trial of sertraline for the treatment of depression in persons with traumatic brain injury. *Arch Phys Med Rehabil* 2009; 90(5):733–740 [Epub 2009/05/02]
28. Fann JR, Uomoto JM, Katon WJ: Sertraline in the treatment of major depression following mild traumatic brain injury. *J Neuropsychiatry Clin Neurosci* 2000; 12(2): 226–232 [Epub 2000/09/23]
29. Horsfield SA, Rosse RB, Tomasino V, Schwartz BL, Mastropaolo J, Deutsch SI: Fluoxetine's effects on cognitive performance in patients with traumatic brain injury. *Int J Psychiatry Med* 2002; 32(4):337–344 [Epub 2003/06/05]
30. Consensus conference. Rehabilitation of persons with traumatic brain injury. NIH consensus development panel on rehabilitation of persons with traumatic brain injury. *J Am Med Assoc* 1999; 282(10):974–983 [Epub 1999/09/15]
31. Simpson GK, Tate RL, Whiting DL, Cotter RE: Suicide prevention after traumatic brain injury: a randomized controlled trial of a program for the psychological treatment of hopelessness. *J Head Trauma Rehabil* 2011; 26(4):290–300 [Epub 2011/07/08]
32. Kuipers P, Lancaster A: Developing a suicide prevention strategy based on the perspectives of people with brain injuries. *J Head Trauma Rehabil* 2000; 15(6):1275–1284
33. Holley UA: Social isolation: a practical guide for nurses assisting clients with chronic illness. *Rehabil Nurs* 2007; 32(2):51–56 [Epub 2007/04/17]
34. McHugh PR, Slavney PR: *The Perspectives of Psychiatry*. Baltimore, MD: The Johns Hopkins University Press; 1998
35. Wortzel HS, Arciniegas DB: A forensic neuropsychiatric approach to traumatic brain injury, aggression, and suicide. *J Am Acad Psychiatry Law* 2013; 41(2):274–286 [Epub 2013/06/19]