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TRAUMA

Development of posttraumatic stress disorder and depression after open globe injury in adults

Ali Keles[1] · Ali Karayagmurlu[2] · Esat Yetkin[3] · Kenan Sonmez[4] · Mustafa Salih Karatepe[5] · Suleyman Korhan Karaman[4]

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Abstract

Purpose To investigate the prevalence of posttraumatic stress disorder (PTSD) and depression after open globe injury in adults.

Methods A total of 95 participants, 43 adult patients with open globe injury and 52 age-sex similar subjects (control group), were included in this cross-sectional study. Age, gender, education level, occupation, accident history, psychiatric history, trauma type, cause of trauma, and visual acuity were recorded. One to six months after trauma, PTSD and depression symptoms of the participants were evaluated with the Posttraumatic Stress Disorder Questionnaire-Civil Version Scale (PTSD-S) and Beck Depression Inventory (BDI), respectively.

Results Patients with open globe injury had a higher PTSD-S total score than the control group, but not significant (23.67 ± 20.41 vs. 18.56 ± 13.13, $p = 0.580$). Patients with eye trauma exhibited a much higher prevalence of PTSD compared to the control group (20.9% vs. 3.8%, $p = 0.010$). Patients with trauma had a significantly higher BDI total score than the control group (12.47 ± 10.08 vs. 7.69 ± 6.10, $p = 0.015$). Also, patients had a higher rate of depression symptoms than controls (25.6% vs. 7.7%, $p = 0.017$). A significant positive correlation was observed between PTSD-S and BDI scores in the trauma group ($r = 0.720$, $p < 0.001$).

Conclusion An increased prevalence of PTSD and depression was observed in adults after open globe injury. The significant relationship between PTSD-S and BDI scores indicates that patients with open globe injuries should be questioned in terms of both symptoms. For patients with open globe trauma, a holistic approach with psychosocial assessment in addition to physical intervention would be beneficial.

Keywords Adult · Depression · Open globe injury · Posttraumatic stress disorder

Key messages

- Many types of trauma have substantial effects on a casualty's physical, psychological, and social well-being. However, knowledge of the effects of open globe injury on psychological health is limited.
- A predisposition to posttraumatic stress disorder and depression has been observed in adults after open globe injury.
- A holistic approach to the biopsychosocial status of patients after open globe trauma would be beneficial.

✉ Ali Keles
alikeles06@gmail.com

[1] Department of Ophthalmology, Faculty of Medicine, Bilecik Seyh Edebali University, 11230 Bilecik, Turkey

[2] Department of Child and Adolescent Psychiatry, Faculty of Medicine, Istanbul University, Istanbul, Turkey

[3] Department of Ophthalmology, Faculty of Medicine, Adiyaman University, Adiyaman, Turkey

[4] Department of Ophthalmology, University of Health Sciences, Ulucanlar Eye Training and Research Hospital, Ankara, Turkey

[5] Department of Ophthalmology, Faculty of Medicine, Sivas Cumhuriyet University, Sivas, Turkey

Introduction

Today, open globe injuries are frequently encountered in ophthalmology clinics due to the progress of industry, the increase in traffic accidents, the increase in the use of firearms, the lack of adequate precautions in occupational safety, game accidents, and lack of education [1]. Open globe injuries can cause serious damage that can lead to severe vision loss. Corneal scars, hyphema, iris rupture, iridodialysis, lens subluxation, cataract, vitreous hemorrhage, retinal tear, retinal detachment, and endophthalmitis may develop depending on the object causing the trauma, the direction of the object, and the severity of the trauma. Even evisceration may be required [1, 2]. The consequences of open globe injuries require immediate treatment. The fact that a considerable portion of the affected patients are in the workforce is a medical, economic, and social problem [2, 3].

Posttraumatic stress disorder (PTSD), which includes fear and helplessness after death, threat of death, serious injury, or an event that threatens the physical integrity of the person or those around them, is a mental disorder featured by re-experiencing the traumatic event, avoiding stimuli reminiscent of the event, numbness in emotions, and increased arousal [4].

Depression is one of the widespread psychiatric disorders that may lead to disability. It differs from a normally seen depressed mood with marked deterioration in bodily functions, decreased functionality, occurrence of suicidal thoughts or attempts, and deterioration in assessing reality [5]. The risk of death is around 15% by suicide in untreated depression. In addition, patients cannot continue their activities in life and their work, family, and social lives are adversely affected [4].

As trauma has significant effects on patients' physical, psychological, and social well-being [6], open globe injury is not only a condition with negative physical consequences but also a situation with significant psychosocial effects. Posttraumatic stress disorder and depression symptoms can be seen in some of the cases after open globe injury that can cause momentous sequelae. However, there is only one study without a control group in the literature [7]. To the best of the researchers' knowledge, this is the first study to comprehensively evaluate the relationship between open globe injury and PTSD and depression.

Materials and methods

In this cross-sectional study, 43 patients diagnosed with open globe injury treated and followed up in an eye clinic of a tertiary referral hospital and 52 healthy individuals who applied to the outpatient clinic for routine controls were included. Ethical approval was obtained from the local ethics committee. The study was executed in accordance with the principles of the Declaration of Helsinki. Questionnaires were administered to patients in the open globe injury group 1–6 months (mean 2.36 months) after trauma.

Sociodemographic data such as age, gender, education level, occupation, previous accident history, psychiatric history, type of trauma, cause of trauma, and visual acuity were recorded. Patients with intellectual disability, active psychosis, and illiteracy were excluded from the study. Complete anterior segment and dilated fundus examination of patients with eye trauma were evaluated with slit lamp biomicroscopy. Visual acuity was obtained using a Snellen chart and converted to logarithmic minimum angle resolution (logMAR). Open globe injury was defined as an injury in which a foreign body caused a full-thickness incision in the cornea and/or sclera and may include subconjunctival hemorrhage, shallow anterior chamber, hyphema, iris deformities, traumatic cataract, lens dislocation, vitreous hemorrhage, retinal hemorrhage, retinal tear, and detachment. All of the controls were healthy individuals without acute eye trauma and applied to the ophthalmology clinic for routine eye examination. The controls did not have ocular diseases, such as monocular or binocular corneal scarring, cataract, glaucoma, uveitis, and retinal detachment, which caused visual loss. Posttraumatic Stress Disorder Questionnaire-Civil Version Scale (PTSD-S) for PTSD symptoms and Beck Depression Inventory (BDI) for depression symptoms were administered to all participants.

Posttraumatic Stress Disorder Questionnaire-Civil Version Scale

"Posttraumatic stress disorder checklist-civilian version" used in the diagnosis of posttraumatic stress disorder, Turkish version of DSM-IV, was used. It questions all the symptoms of posttraumatic stress disorder, and the validity and safety of Turkish version has been proven [8]. The seventeen-item questionnaire is administered by the individuals themselves. The first five questions are about reliving, seven about avoidance, and five about increased arousal. Responses range from none to extreme and are scored between 0 and 5. The total score is found as a value between 0 and 85. The cutoff value used was 44 [9].

Beck Depression Inventory

"Beck Depression Inventory" is a self-assessment scale that determines the risk of depression in individuals and measures the level and severity of depressive symptoms. The aim of the scale is not to diagnose depression, but to objectively identify the degree of depression symptoms. It

contains a total of 21 self-evaluation sentences. It provides a 4-point Likert-type measurement. Each item gets an increasing score between 0 and 3, and the total score is obtained by summing them up. It varies between 0 and 63 points in total. The validity and reliability of its Turkish adaptation were confirmed by Hisli [10]. The cutoff point of the scale was accepted as 17. In the reliability study, the Cronbach alpha coefficient was determined to be 0.80. In split-half reliability, $r=0.74$. Factor analysis was applied for construct validity and six factors were obtained.

Statistical analysis

Statistical analysis was carried out using SPSS software version 22.0 (SPSS, Inc., Chicago, IL). Quantitative data of the study were described as mean and standard deviation with descriptive statistics. Qualitative data were presented with frequency and percentage values. Chi-square test was used in the analysis of categorical variables. The conformity of the variables to the normal distribution was investigated by visual (histogram) and analytical methods (Kolmogorov–Smirnov/Shapiro–Wilk tests). The Mann–Whitney *U* test was used to compare two independent groups with data not normally distributed. Correlation was evaluated with Spearman's correlation analysis. Statistical significance was expressed as $p<0.05$.

Results

The scales of 43 adult patients with open globe injury and 52 age-sex similar healthy individuals were included in this analysis. The case group consisted of 40 men (93%) and 3 women (7%), with a mean age of 35.88 ± 13.62 (18–65). There were 36 (83.7%) penetrating eye injuries, 1 (2.3%) perforating eye injury, and 6 (14%) globe ruptures. The causes of injury were falling (2.3%), sports injury (6.9%), physical fight (9.2%), work accident (39.5%), home accident (23.3%), and others (18.6%). The mean visual acuity at the time of admission due to trauma in the case group was 2.14 ± 1.12 logMAR. It was determined that 53.5% of the right eye and 46.5% of the left eye were affected by trauma. Objects that cause injury are metal pieces (30.2%), wood pieces (11.6%), nails (11.6%), blades (9.3%), stones (7%), horns (7%), tree branch injury (4.7%), glass (4.7%), and others (13.9%). Among the occupational groups of trauma patients, workers were found at a rate of 25.6%. The study and control groups had similar features in terms of age, gender, education level, income level, previous accident history, and psychiatric history ($p>0.05$). Sociodemographic characteristics of the cases are detailed in Table 1.

Compared to the control group, patients with eye trauma had a higher total PTSD-S score, but not significant (23.67 ± 20.41 vs. 18.56 ± 13.13, $p=0.580$). In addition, the rate of cases with a PTSD-S cutoff point above 44 was significantly higher in patients with eye trauma (20.9%) than in controls (3.8%) ($p=0.010$). On the other scale, the total BDI score of the patients with open globe injury was significantly higher than that of the control group (12.47 ± 10.08 vs. 7.69 ± 6.10, $p=0.015$). Additionally, the proportion of patients with a BDI cutoff point above 17 was remarkably higher in patients with eye trauma (25.6%) than in controls (7.7%) ($p=0.017$). Comparison of PTSD-S and BDI scores of trauma group and controls is presented in Table 2. A significant positive correlation between the PTSD-S and BDI scores was observed in patients with open globe injury ($r=0.720$, $p<0.001$) (Fig. 1).

Discussion

Injuries are a major public health problem and one of the important causes of morbidity and mortality [11]. The relationship between open globe trauma and PTSD and depression symptoms in adult patients was investigated in this study. In addition, sociodemographic characteristics that may be associated with eye trauma were examined. Study findings revealed that 93% of patients with eye trauma were male. Although there were only adults in this study, the mean age of our cases was 35.9 years. It was also observed that a significant portion of the trauma patients were workers, and their education and income levels were low. These results are parallel with the findings of previous studies showing that young males with low socioeconomic-educational levels are more frequently affected by ocular trauma [12–14]. Psychoeducation to increase the awareness of employees and protective interventions in places with low socioeconomic level may prevent further injuries.

Exposure to traumatic events is common and often has a profound and lasting impact. A substantial proportion of the population report experiencing trauma at a point in their life [15]. There are studies in the literature investigating the relationship between general traumas and PTSD and depression. Posttraumatic stress disorder is a prevalent, tenacious, and disabling consequence of both ordinary traumatic events, such as road traffic accidents (6 to 45%) [16], sexual assault (15.1%) [17], unexpected death of a loved one (11.6%) [17], and exposure to prolonged threats, such as wars (9 to 15% among warzone-exposed US military personnel) [18]. The psychological effects of disasters, terror, wars, and other traumatic life events can be deleterious and far-reaching. The relationship between the level of trauma experience and the severity of PTSD was found to be robust, and high comorbidity rates, particularly depression, anxiety disorders, and substance use disorder, were also reported [19].

Table 1 Sociodemographic characteristics of trauma and control groups

	Trauma group ($n=43$)	Control group ($n=52$)	p value
Age, years	35.88 ± 13.62	33.48 ± 13.00	0.274
Gender			
Male	40 (93%)	47 (90.4%)	0.645
Female	3 (7%)	5 (9.6%)	
Educational status			
Under high school	31 (72.1%)	28 (53.8%)	0.068
High school and above	12 (27.9%)	24 (46.2%)	
Family income			
Minimum wage and less	36 (83.7%)	36 (69.2%)	0.101
Above minimum wage	7 (16.3%)	16 (30.8%)	
Previous accident history			
Yes	10 (23.3%)	10 (19.2%)	0.632
No	33 (76.7%)	42 (80.8%)	
Previous psychiatric history			
Yes	1 (2.3%)	3 (5.8%)	0.405
No	42 (97.7%)	49 (94.2%)	

Data are presented as mean ± standard deviation

Table 2 Posttraumatic stress disorder and depression scores of trauma and control groups

	Trauma group ($n=43$)	Control group ($n=52$)	p value
Posttraumatic stress disorder score			
Total	23.67 ± 20.41	18.56 ± 13.13	0.580
Cutoff and above	9 (20.9%)	2 (3.8%)	**0.010**
Under cutoff	34 (79.1%)	50 (96.2%)	
Depression score			
Total	12.47 ± 10.08	7.69 ± 6.10	**0.015**
Cutoff and above	11 (25.6%)	4 (7.7%)	**0.017**
Under cutoff	32 (74.4%)	48 (92.3%)	

Data are presented as mean ± standard deviation. Bold values are statistically significant at $p<0.05$ level

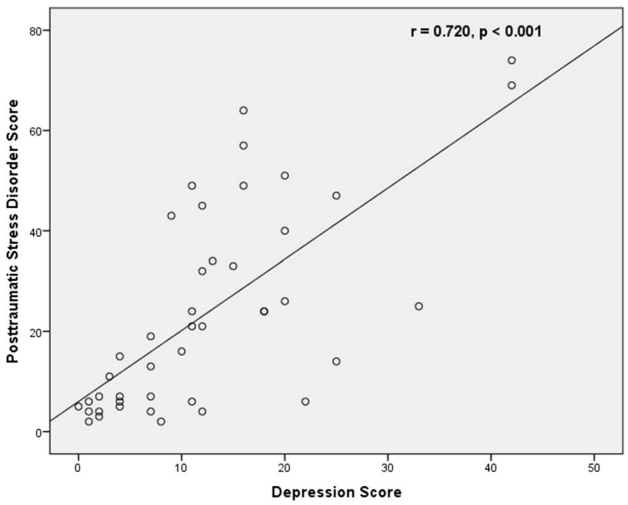

Fig. 1 The relationship between posttraumatic stress disorder and depression scores in patients with open globe injury according to Spearman's correlation analysis

The literature has shown that exposure to multiple traumatic events in adults is associated with high levels of PTSD and depression [20]. Large et al. [21] reported 6.45% of 4602 major trauma patients had a pre-existing diagnosis of depression. Shalev et al. [20] reported that major depression and PTSD can develop as sequelae of trauma, and these two conditions developed independently following trauma. Suliman et al. [22] also revealed that multiple trauma exposure was associated with a significant increase in PTSD and depression scores in adolescent participants. Depression and PTSD following orthopedic trauma is a well-described condition in the literature [23–26]. It has been determined that the presence of global disability and open fracture increases the risk of depression [24]. Also, severe lower extremity injury was associated with significant psychological distress [25].

In addition, symptoms of depression, destructive thinking, and PTSD have been shown to consistently adversely affect patient outcomes following the treatment of traumatic injuries. Specifically, patients with higher levels of psychosocial dysfunction showed increased levels of pain, disability, and complications throughout their recovery [26].

There are very few studies examining the relationship between psychiatric conditions in patients with eye injuries. In the study of Singh et al. [7], involving 46 patients with open eye injuries, none of the patients achieved a score within the clinical range on the Short Post Traumatic

Diagnostic Scale and Beck Depression Inventory Scale administered 4 months after the initial surgery. Although both PTSD and major depression were detected 2 months after the provocative event in the studies, Singh et al. [7] attributed this to the early application of the questionnaires in the treatment process and high success rates in the treatment. They stated that patients would be likely to score significantly higher 1 year after injury [7]. Unlike the studies of Singh et al. [7], we found a remarkable frequency of PTSD and depression in patients. Our results are compatible with other general trauma studies in the literature in this respect. This result may have emerged depending on the type and severity of the injury, the visual acuity obtained after corrective surgery, and the social support received by the patients. In addition, this difference between studies can be due to the gradual tendency of posttraumatic reactions, as stated in the ocular trauma study of Alexander et al. [27]. According to them, adjustment problems can occur even months after the trauma, and it should be noted that prominently higher levels of psychopathology and adjustment problems are found, especially for victims with certain characteristics, such as having a psychiatric history, susceptibility to mood swings, and difficulty understanding what is happening at the time of the event [27]. Additionally, we detected a significant correlation between PTSD and depression symptoms. It is not clear from our data whether PTSD plays a facilitating role in the development of a high depression score or this situation develops independently of PTSD. Because of the cross-sectional design of the study, it may not exhibit a casual relationship between these disorders as bidirectional relation is quite possible. Considering that comorbidity is the rule, not the exception, in psychiatric disorders, it may be best explained by the fact that traumatic events predispose the same person to different psychiatric disorders.

Currently, studies focus heavily on physical and technical factors in the treatment of open globe injury. However, more research is required to address the biopsychosocial aspect of health and evaluate the impact of psychological and social factors on recovery from trauma. The outcomes of our study draw attention to the psychosocial dysfunction in patients with open globe injuries. Depression and PTSD symptoms may have negative effects on posttraumatic treatment processes in trauma patients. Changes in the psychological state of patients after trauma can be decisive in decision-making processes in treatment processes. A holistic approach to the biopsychosocial status of patients after open globe trauma will be beneficial in overcoming the rehabilitation process.

The cross-sectional nature of our study and the limited number of patients are the shortcomings of the study. Due to the design of our study, we could not compare the initial reactions to trauma and the psychiatric status of the injured in the later period. Also, since the time elapsed after trauma was not categorized, the relationship between the duration and psychiatric symptoms was not examined in this study. All questionnaires were screening tests, and our patients were not clinically evaluated by a psychiatrist or clinical psychologist. Patients with a low level of education may have filled in the questionnaire more carelessly. Again, since these questionnaires were administered early in the treatment process, the psychological effect of the injuries may not have settled. However, the results of the mentioned study will be different in places where early intervention is not made for injuries, potent visual rehabilitation services are not provided, and therefore a significant part of the patients do not get positive visual results.

Consequently, an important increase was found in the frequency of PTSD and depression after open globe injuries in adults. The strong relationship between PTSD and depression symptoms shows that the coexistence of these two symptoms should not be ignored. Larger and longitudinal follow-up studies should be performed in the future to evaluate the effect of PTSD and depression on ocular trauma. Having longitudinal information (how their attitudes have changed) and relating it to the severity of the injury (e.g., vision loss) may contribute to the literature. Further research under the supervision of a psychiatrist may provide more comprehensive data on psychiatric disorders.

Declarations

Ethics approval The study was approved by the Institutional Review Board/Ethics Committee of Ankara Training and Research Hospital, Ankara, Turkey (protocol no.: E-20–270). All procedures conducted in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent for publication Obtained.

Conflict of interest The authors declare no competing interests.

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