





# Is post-traumatic stress disorder related to the severity of physical trauma?

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## SUMMARY

**OBJECTIVE:** Trauma can cause physical morbidity and even result in death. Besides, it can lead to serious mental problems as well. The most well-known mental health problem is post-traumatic stress disorder. Through this study, it was primarily aimed to find out whether the severity of physical trauma is effective on post-traumatic stress disorder and other risk factors if any.

**METHODS:** The reports of the patients who were transferred to the Turkish Council of Forensic Medicine Third Speciality Board between January 01, 2019, and December 31, 2020, for post-traumatic invalidity or disability evaluation and whose psychiatric examinations were performed were retrospectively analyzed in the electronic environment.

**RESULTS:** It was found that 34 (26.4%) of the patients had a diagnosis of post-traumatic stress disorder (under treatment for at least 6 months), while 76 (58.9%) of them did not have a psychiatric disease and 19 (14.7%) of them had mental disorders not associated with trauma (i.e., affective disorder, anxiety disorder, etc.). No significant correlation was found between trauma scores and post-traumatic stress disorder ( $p>0.05$ ).

**CONCLUSION:** Based on the results of our study, post-traumatic stress disorder and the severity of physical trauma are not significantly correlated. Being of female gender, sustaining a non-accidental injury, and witnessing a fatal event stand out as significant risk factors.

**KEYWORDS:** Injury severity score. Trauma severity indices. Post-traumatic stress disorder.

## INTRODUCTION

Traumatic events may lead to physical morbidities and even death. They may also result in serious psychological problems, such as post-traumatic stress disorder (PTSD), which is one of the most common mental health conditions.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), PTSD is a psychiatric disorder that can develop following exposure to a traumatic event involving actual or threatened death, serious injury, or sexual violence. The disorder is characterized by intrusive re-experiencing of the traumatic event through distressing memories, flashbacks, or nightmares, avoidance of trauma-related stimuli, negative alterations in mood and cognition, such as persistent negative beliefs or feelings, distorted blame, or diminished interest in activities, and alterations in arousal and reactivity, including hypervigilance, exaggerated startle response, and sleep disturbances<sup>1</sup>.

Some of the factors that facilitate PTSD development include adverse life experiences before a traumatic event, traumatic events during childhood, contact with a familiar and trusted individual experiencing a traumatic event,

insufficient social support, and pre-existing mental disorders<sup>2,3</sup>. There is also ongoing research into the impact of the severity of physical trauma<sup>4</sup>.

Several scoring systems have been developed to objectively determine the severity of physical trauma. Anatomic scoring systems have been developed based on the injured body region and injury types. The Abbreviated Injury Scale (AIS) is a scoring system that classifies each injury by body region on a 6-point scale. Scoring systems such as the injury severity score (ISS) and new injury severity score (NISS), which have been developed based on AIS, are commonly used in retrospective trauma studies.

ISS is considered the “gold standard” anatomic scoring system, which helps to determine the severity of injury<sup>5,6</sup>. The ISS is calculated as the sum of the squares of the highest AIS code in each of the three most severely injured areas in each of the six body regions. In 1997, NISS was introduced to improve its accuracy<sup>7</sup>. The NISS is calculated as the sum of the squares of the three highest AIS scores for each patient, regardless of body region<sup>8</sup>.

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The aim of this study was to determine whether the severity of physical trauma has an impact on PTSD and other risk factors. The findings of this study may facilitate the early identification of patients who might require psychiatric follow-up/treatment in the post-traumatic period.

## METHODS

A retrospective examination was made of the electronic records of patients referred to the (...) for disability assessment after trauma (i.e., occupational accidents, physical violence, and traffic accidents, among others) and who underwent psychiatric examinations between January 01, 2019 and December 31, 2020. The physical examinations of the patients regarding their medical conditions were conducted by various specialists (such as orthopedists, neurologists, and ophthalmologists) at our institution. Psychiatric evaluations were also performed by psychiatrists. Diagnoses were established according to the criteria of DSM-5. Psychiatrists did not possess detailed knowledge of trauma scores beyond the patients' medical history. The trauma scores for all patients were retrospectively calculated by a forensic medicine specialist following the examinations.

In line with the AIS, the ISS and NISS values were calculated based on a minimum score of 0 and a maximum of 75. Patients with psychiatric disorders who exhibited simulated behaviors (patients who simulate illness, express complaints incongruent with their clinical condition, and exhibit exaggerated symptoms during psychiatric or physical examinations, while lacking a trustworthy attitude during the interview) during the examination and those who had been diagnosed with trauma-related mental health conditions other than PTSD were excluded from the study.

Data analyses were performed using the SPSS version 24 software. The conformity of the data to normal distribution was tested using the Shapiro-Wilk test. The Mann-Whitney U test was used to compare non-normally distributed variables between the two groups. Relationships among categorical variables were tested using the chi-square test. A value of  $p < 0.05$  indicated statistical significance.

### Ethical declaration

This study was reviewed and approved by the Ministry of Justice Council of Forensic Medicine Scientific Research Committee (21589509/2021/307).

## RESULTS

A total of 129 patients were included in the study, comprising 101 (78.3%) males and 28 (21.7%) females, in an age range

of 9–72 years (median age, 32 years; mean age,  $32.39 \pm 10.83$  years). Of the total patients, 86 (68.6%) were married and 43 (33.3%) were single.

Of the patients who had provided information on their educational level, 44 (34.1%) were primary-school graduates or lower, 20 (15.5%) were secondary-school graduates, 36 (27.9%) were high-school graduates, and 21 (16.3%) were university graduates.

The traumatic events were determined as 67 (51.9%) occupational accidents, 36 (27.9%) traffic accidents, and 26 (20.2%) were in the “other” category, which included injury caused by a sharp object, firearms injury, fall from height, and bomb explosion.

Physical trauma exposure resulted in 0–210 days of hospitalization (mean,  $19.02 \pm 27$  days; median, 9 days). A total of 37 (28.7%) patients did not undergo surgery, whereas the remaining patients underwent 1–13 surgical procedures (mean,  $1.47 \pm 1.80$ ; median, 1).

A total of 30 (23.3%) patients suffered trauma-induced head and neck injuries, 37 (28.7%) suffered face injuries, 28 (21.7%) suffered injuries to the thoracic region, 17 (13.2%) suffered abdominal injuries, 68 (52.7%) suffered injuries to the pelvis and extremities, and 39 (30.2%) suffered burns.

The severity of physical trauma exposure was scored using anatomic trauma scoring systems. The mean and median ISS and NISS were  $10.99 \pm 8.63$  and 9 and  $11.64 \pm 8.88$  and 9, respectively. In total, 27 (20.9%) patients lost consciousness at the time of the event, and 9 (7%) witnessed a fatal event.

The medical history, medications used, and the psychiatric re-examination by our board revealed that 34 (26.4%) patients were diagnosed with PTSD and it was determined that they had been under treatment for at least 6 months, 76 (58.9%) had no psychiatric disease, and 19 (14.7%) demonstrated mental health conditions (i.e., affective and anxiety disorders) that were not related to the trauma.

The comparisons of the sociodemographic and injury data of the groups with and without a diagnosis of PTSD are shown in Tables 1-3.

In our examination, the functionality of PTSD patients under treatment was evaluated for the determination of disability. Mild functional impairment was observed in 7 (20.6%) of the 34 patients diagnosed with PTSD, moderate functional impairment was observed in 7 (20.6%) patients, and severe functional impairment was observed in 1 (2.9%) patient. It was determined that the functionality of 19 (55.9%) patients was good with treatment.

**Table 1.** Comparisons of the sociodemographic data of the groups with and without a diagnosis of post-traumatic stress disorder.

	PTSD (n=34)	Other (n=95)	p
Age (years)	30.47±12.17	33.08±10.3	0.197
Duration of hospitalization (days)	20.52±39.06	18.48±21.22	0.650
Number of surgeries	1.42±1.71	1.49±1.85	0.877
Injury severity score	9.74±6.77	11.44±9.2	0.607
New injury severity score	10.65±6.86	12±9.52	0.784

Mann-Whitney U test.

**Table 2.** Comparisons of cases with and without a diagnosis of post-traumatic stress disorder in terms of epidemiological data.

		PTSD		Other		p
		n	%	n	%	
Sex	Male	21	61.8	80	84.2	0.006*
	Female	13	38.2	15	15.8	
Marital status	Married	22	62.8	64	68	0.458
	Single	13	37.2	30	32	
Educational status	Primary-school graduates and lower	9	30.0	35	38.5	0.737
	Secondary-school graduates	5	16.7	15	16.5	
	High-school graduates	9	30.0	27	29.7	
	University graduates	7	23.3	14	15.4	
Witnessed a fatal event	Yes	6	17.6	3	3.2	0.008*
	No	28	82.4	92	96.8	

\*p<0.05;  $\chi^2$  test.**Table 3.** Comparisons of cases with and without a diagnosis of post-traumatic stress disorder in terms of injury sites, type, and treatment.

		PTSD		Other		p
		n	%	n	%	
Head and neck injury	Yes	4	11.8	26	27.4	0.065
	No	30	88.2	69	72.6	
Facial injury	Yes	11	32.4	26	27.4	0.581
	No	23	67.6	69	72.6	
Thoracic injury	Yes	10	29.4	18	18.9	0.204
	No	24	70.6	77	81.1	
Abdominal injury	Yes	4	11.8	13	13.7	0.774
	No	30	88.2	82	86.3	
Pelvic and extremity injury	Yes	18	52.9	50	52.6	0.975
	No	16	47.1	45	47.4	
Other injuries**	Yes	10	29.4	29	30.5	0.903
	No	24	70.6	66	69.5	
History of at least one surgery	Yes	9	26.5	28	29.5	0.740
	No	25	73.5	67	70.5	
Event type	Accident	23	67.6	80	84.2	0.039*
	Non-accidental trauma***	11	32.4	15	15.8	

\*p<0.05;  $\chi^2$  test. \*\*Injuries involving the skin, such as burn trauma, as defined by the injury severity score. \*\*\*Physical violence, stab wounds, explosion-blast injury, and firearm injury.

## DISCUSSION

Physical and mental traumas may have numerous short- and long-term consequences. The prevalence of psychiatric morbidities following traumatic injury has been reported to vary between 17.5 and 42% in the first 6 months and between 2 and 36% in the first 12 months<sup>4,9</sup>. The most well-known trauma-induced psychiatric morbidities are PTSD and depression. In addition to the clinical diagnosis, follow-up, and treatment of these diseases, the medico-legal implications are also crucial. These mental health morbidities can also be the subject of criminal cases or disability assessments. The detection of PTSD risk factors may aid in the early follow-up of high-risk patients and disability assessments.

In this study, the relationship between various variables and the diagnosis of PTSD was examined. The median and mean ages of patients were 32 and  $32.39 \pm 10.83$  years, respectively, and the study group consisted of 101 (78.3%) males and 28 (21.7%) females. Although the mean age of the patients with PTSD was relatively lower than that of patients without a diagnosis of PTSD, there was no statistically significant difference (Table 1). There was a significant predominance of the female sex in the PTSD group (Table 2). PTSD typically affects females and young adults<sup>10</sup>. It has been stated that females (11–20%) are at higher risk of developing PTSD following trauma than males (4–8%)<sup>11</sup>. The results of this study are in line with the literature.

Several studies have reported that a low education level and socio-economic status are risk factors for PTSD. Furthermore, married individuals have been reported to exhibit a relatively low risk for PTSD owing to the presence of better social support<sup>12</sup>. However, no significant relationship between marital status and PTSD diagnosis was found in this study (Table 2). Similar results were obtained regarding educational status. A high or low education level was not found to be a significant risk factor for PTSD.

Owing to the fact that PTSD is a highly heterogeneous psychiatric disorder, investigating the relationships between trauma type and clinical findings is imperative to better understand disease etiology and improve treatment approaches<sup>13</sup>. The type of event responsible for causing the physical trauma and how it occurred are important factors for the development of PTSD. For example, sexual trauma is known to be a serious risk factor for PTSD<sup>13</sup>. Risk levels of PTSD have been specified for attack incidents and disasters<sup>14</sup>. A previous study reported that victims of physical violence exhibit subclinical presentations of PTSD and require treatment<sup>15</sup>. In this study, a significant difference was observed in terms of the development of PTSD between accidental incidents and non-accidental injuries, favoring non-accidental injuries (Table 3).

The relationship between lesion localization and PTSD was examined (Table 3). More than half of the patients suffered

injuries to the pelvis and extremities. Approximately a quarter (26.5%) of patients with fractures have been reported to experience PTSD<sup>16</sup>. In this study, 30.2% of the cases had a history of burns and scars. The prevalence of psychiatric complaints among burn patients has been shown to range between 28 and 75%<sup>17</sup>. The most common psychological disorders observed in the early period following burn trauma include acute stress reactions, anxiety disorder, depression, behavioral disorders, and delirium. Psychiatric conditions depend on both the primary effect of the burn trauma and the events that occur during treatment<sup>18</sup>. In addition, burns and scars after the treatment are considered possible causes of psychiatric conditions<sup>19</sup>. In some studies, burn lesions involving the hands and face have been shown to increase the risk of PTSD because they remind the patient of the trauma experienced<sup>20</sup>. However, in this study, no significant relationship between the injury region and the PTSD diagnosis was identified.

In this study, PTSD was significantly more frequently observed in patients who witnessed a fatal event (Table 2). This was considered a stand-alone risk factor for PTSD development, regardless of the physical trauma experienced.

The relationship between the severity of physical trauma exposure and PTSD has been examined in many studies using trauma scoring systems, such as AIS and ISS. In a study conducted on traffic accident victims, no significant relationship between PTSD and mean AIS values was reported<sup>21</sup>. Similarly, no correlation has been determined between ISS and psychiatric consequences<sup>4,22</sup>. In this study, the mean ISS and NISS were not significantly higher in the PTSD group (Table 1), thereby indicating that, contrary to expectations, severe trauma did not result in an increased probability of psychological conditions. In other words, trauma with low physical severity may also have an impact on the development of PTSD. Therefore, the effect of trauma on the victim and the psychological outcome should not be correlated with just the severity of the trauma.

## CONCLUSION

The prediction of post-traumatic conditions has the advantages of both close and remote follow-up and early rehabilitation of patients at risk. This study was conducted on a group of patients whose disability was evaluated as part of the judicial process and who had experienced trauma at least six months prior. The suitable identification of risk factors in this patient group might also be beneficial in establishing the relationship between post-traumatic mental health complaints and the traumatic event. The findings of this study suggest that PTSD is not significantly associated with the severity of physical trauma.

## ETHICAL DECLARATION

This study was reviewed and approved by the Ministry of Justice Council of Forensic Medicine Scientific Research Committee (21589509/2021/307). The study was conducted in accordance with the criteria of the Declaration of Helsinki.

## AUTHORS' CONTRIBUTIONS

**HIA:** Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration,

Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **YK:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **EC:** Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Supervision, Validation, Writing – original draft. **NNA:** Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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