

Posttraumatic stress disorder after minor trauma – A prospective cohort study



Katharina Angerpointner^a, Stefanie Weber^b, Karen Tschsch^b, Hannah Schubert^b, Tanja Herbst^a, Antonio Ernstberger^a, Maximilian Kerschbaum^{a,*}

^a Department of Trauma Surgery, University Hospital Regensburg, Regensburg, Germany

^b AARU Audi Accident Research Unit, University Hospital Regensburg, Regensburg, Germany

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ABSTRACT

Background: Posttraumatic stress disorder (PTSD) can arise as a reaction to a traumatic experience. While many data concerning PTSD in severely injured patients are available, little is known about this disease in slightly injured patients after road traffic accidents. It is rather assumed that PTSD does not exist after objectively slight injuries.

Methods: In total, 36 patients (Injury Severity Score < 16) after road traffic accidents were included in this prospective cohort study. Next to demographic and accident-specific data, the PDI (Peritraumatic Distress Inventory: individual experienced distress directly during or immediately after the traumatic event), THQ (Trauma History Questionnaire) and the BDI-II (Beck Depression Inventory-II: self-report measurement tool to examine the severity of depression) were assessed immediately after trauma (t0). Six weeks (t1) and 3 months (t2) after trauma the Impact of Event Scale – Revised (IES-R), a screening instrument for PTSD, and the BDI-II were collected.

Results: Overall 2 patients showed critical measurement values in IES-R after 6 weeks. A strong correlation between PDI and IES-R at t1 and t2 could be detected ($p < 0.05$). Furthermore, a significant correlation of BDI-II and IES-R after 6 weeks and 3 months was found ($p < 0.05$). Neither age or sex showed a significant correlation to IES-R ($p \geq 0.05$).

Conclusion: The present study showed that symptoms of PTSD can also occur after minor trauma. Especially high peritraumatic distress is associated with developing a PTSD. The occurrence of PTSD should be considered not only in severely injured patients, but also in slightly injured patients after road traffic accidents.

Background

Posttraumatic stress disorder (PTSD) is a widespread form of anxiety disorder. It arises as a reaction to the experience of a traumatic situation and a subsequent maladaptation. To diagnose PTSD according to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) [1], a patient has to experience a traumatic event and additional symptoms from each of the following four symptom clusters: intrusion (e.g. flashbacks, nightmares), sustained avoidance of trauma-associated stimuli, negative impact on cognition/mood and

hyperarousal. The symptoms have to last longer than one month, cause significant functional impairment and develop within the first 6 months after trauma [2].

Many studies investigated possible influencing factors for developing a PTSD [3–7]. The results showed that injury severity is not a good predictor of psychosocial outcome, whereas the subjective impact of trauma is much more important in this context [7]. Recent studies have shown that a traffic accident can be a triggering event for developing PTSD [2,8,9]. The prevalence of PTSD in severely injured patients ranges from 4.7% up to 34% within the first three months [10,11]. But

Abbreviations: AIS, Abbreviated Injury Scale; BDI-II, Beck Depression Inventory-II; DSM-5, Diagnostic and Statistical Manual of Mental Disorders, 5th edition; GCS, Glasgow Coma Scale; ICU, Intensive Care Unit; IES-R, Impact of Event Scale-Revised; ISS, Injury Severity Score; MAIS, Maximum Abbreviated Injury Scale; PDI, Peritraumatic Distress Inventory; PTSD, Posttraumatic stress disorder; SD, Standard Deviation; t, time; THQ, Trauma History Questionnaire

* Corresponding author at: Department of Trauma Surgery, University Hospital Regensburg, Franz-Josef-Strauss-Allee 11, 93053 Regensburg, Germany.

E-mail addresses: katharina.angerpointner@ukr.de (K. Angerpointner), extern.stefanie.weber@audi.de (S. Weber), extern.karen.tschsch@audi.de (K. Tschsch), schubertannah@icloud.com (H. Schubert), tanja.herbst@ukr.de (T. Herbst), toni.ernstberger@ukr.de (A. Ernstberger), maximilian.kerschbaum@ukr.de (M. Kerschbaum).

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so far, this research was only focused on PTSD after severe injury and polytrauma. The aim of the following study was to determine whether PTSD is likely to develop in lightly injured patients after road traffic accidents and to determine possible predictive factors to detect high-risk patients in clinical practice.

Hypothesis

Patients can develop Posttraumatic Stress Disorders (PTSD) even if they are only slightly injured after a traffic accident. The subjective experience of the accident seems to be mainly relevant to the development of an affective disorder like PTSD – regardless of the severity of the injuries.

Methods

Study population

Adult trauma patients (18–65 years) with minor injuries (Injury Severity Score: ISS < 16 [12]) after road traffic accidents were included in this prospective cohort study. Trauma room patients were excluded.

For inclusion, the patients had to remember the sequence of events and the cause of accident. The Glasgow Coma Scale (GCS) [13] had to be 15 at all times. Patients under the influence of drugs or alcohol and ones who lost consciousness, had to be intubated or with Intensive Care Unit (ICU) stay after trauma, were excluded. Table 1 summarizes the in- and exclusion criteria.

In total 69 patients met the in- and exclusion criteria. Due to incomplete data (participation declined, missing accessibility, contradictory information in the questionnaires) 33 patients were not available for follow-up. In total, 36 patients were included in this study.

Data collection

In this prospective cohort study data collection was performed within 4 days, 6 weeks and 3 months after trauma [10]. Immediately after trauma (t0) demographic and accident-specific data were recorded. Additionally, the Peritraumatic Distress Inventory (PDI), the Trauma History Questionnaire (THQ) and the Beck Depression Inventory (BDI-II) were collected. After 6 weeks (t1) and 3 months (t2) the patients had to complete the Impact of Event Scale – Revised (IES-R) and the BDI-II. The questionnaires used are explained below. Table 2 shows the timetable for data collection and questionnaire.

Demographic and accident-specific questionnaire

Age, sex, graduation, current employment situation, medical history including psychological disorders and regular medication and drug or alcohol consumption were collected. Additionally, details concerning the accident, the injury pattern (Maximum Abbreviated Injury Scale (MAIS) [14]; Injury Severity Score (ISS) [12]) as well as the estimation of recovery chances and the issue of guilt were recorded.

Table 1
In- and exclusion criteria.

Inclusion	Exclusion
18–65 years	GCS < 15
ISS < 16	Anterograde or retrograde amnesia
Road traffic accident	Unconsciousness
Full memory of the accident	Influence of drugs or alcohol
	Intubation
	ICU stay

ISS: Injury Severity Score; GCS: Glasgow Coma Scale; ICU: Intensive Care Unit.

Table 2
Timetable for data collection and questionnaire.

t0: Immediate after trauma	t1: 6 weeks after trauma	t2: 3 months after trauma
PDI	IES-R	IES-R
THQ	BDI-II	BDI-II
BDI-II		

PDI: Peritraumatic Distress Inventory; THQ: Trauma History Questionnaire; BDI-II: Beck Depression Inventory; IES-R: Impact of Event Scale – Revised.

Peritraumatic Distress Inventory (PDI) [15]

The PDI is used to estimate the individual experienced distress directly during or immediately after the traumatic event [15]. The 13-items test concerns fear or helplessness and physical response reactions. A result of 23 points or more is considered as critical threshold [16].

Trauma History Questionnaire (THQ) [17]

This 24-items questionnaire is used to examine individual experiences with potentially traumatic events like crime, general disaster and sexual or physical assault prior to the accident using a yes/no format [17]. As the THQ is considered to be a history data collection instrument, the THQ has a qualitative result and there is no standard scoring method.

Impact of Event Scale – Revised (IES-R) [18]

The IES-R is a screening instrument for PTSD and consists of 3 components: *intrusion (7 items), avoidance (8 items) and hyperarousal (7 items)* [18]. Based on a formula published by Maercker and Schützwohl [19], a cumulative score can be formed from the three components to estimate the probability of developing a PTSD. The single dimension values lie within a range of 0–35 points and the total score is calculated from the dimensions following a rather non-linear principle. In case of values higher than 0.0, PTSD can be expected. It should be noted that IES-R is a screening tool to facilitate the assessment of typical PTSD symptoms and cannot be used to determine the actual existence of PTSD. Nevertheless, a high degree of intercorrelation and internal consistency have been reported for this questionnaire [20,21]. Different studies describe the IES-R as an appropriate tool for PTSD screening with a high predictive value [19,22–24].

Beck Depression Inventory-II (BDI-II) [22]

The Beck Depression Inventory-II is a widely used self-report measurement tool to examine the severity of depression in adolescents and adults. The 21-item self-report inventory indicates severity of depression, with higher scores indicating greater depression. Values from 14 to 19 points indicate a mild, 20 to 28 points a moderate and 29 to 63 points a severe depression [22,23].

Ethical considerations

The study has been approved by the Ethics Committee of the University of Regensburg (number 16-101-0113). The study database was completely anonymized at the end of the investigation.

Statistical analysis

All analyses were performed by using IBM SPSS Statistics 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). A p-value < 0.05 was considered statistically significant. The results were evaluated by t-test for paired samples to detect differences between t1 and t2 after determining the distribution

Table 3
Patient characteristics.

n	Age [mean ± SD]	Sex	MAIS [mean ± SD]	ISS [mean ± SD]
36	39.8 ± 16.0	♀ 9 (25%); ♂ 27 (75%)	1.9 ± 0.8	4.9 ± 3.8

MAIS: Maximum Abbreviated Injury Scale; ISS: Injury Severity Score.

was appropriate for parametric testing. Using ANOVA with repeated measurements, differences between the three measurement points were calculated.

Results

Study population and demographics

In total 36 patients were included into this prospective cohort study. Demographic characteristics and details on injury severity are shown in Table 3.

Questionnaires

Peritraumatic Distress Inventory (PDI)

Within the study population the mean PDI value was 14.5 ± 9.3 points (1–36).

27.9% (n = 10) of the evaluated patients exceeded the critical threshold of 23 points. 2 of the 10 patients (20%) also reported conspicuous values in IES-R score.

Trauma History Questionnaire (THQ)

41.7% (n = 15) patients had not yet experienced traumatic situations. 58.3% (n = 21) reported at least one potential traumatic experience. The mean value of the THQ was 1.8 ± 2.0.

Impact of Event Scale – Revised (IES-R)

The results of the IES-R questionnaire (subscales and calculated total score) are shown in Table 4. Six weeks after trauma 5.6% (n = 2) of the patients reported critical measurement values with total scores of 0.16 and 0.42. One patient subsequently underwent psychiatric treatment. Three months after trauma, the threshold value was still exceeded by the latter patient with a total score of 0.13 (Fig. 1). Regarding the subscales, the highest mean values were found in intrusion, followed by hyperarousal and avoidance both 6 weeks and 3 months after trauma. All IES-R mean values after 6 weeks were significantly higher than the respective mean values after 3 months (p < 0.001). Furthermore, a significantly positive correlation between the scores at t1 and t2 could be observed (r = 0.94, p < 0.001) (Fig. 1).

Beck Depression Inventory-II

The results of the BDI-II questionnaire are presented in Table 5. The mean values significantly decreased over time (p < 0.001). The majority of participants reported 0 points three months after trauma. One patient with a pathological value in the IES-R, showed 18 points in BDI-II

Table 4
Results of IES-R questionnaire.

mean ± SD (min–max)	t1 (6 weeks after trauma)	t2 (3 months after trauma)
intrusion	7.1 ± 6.5 (0–28)	4.3 ± 6.1 (0–27)
avoidance	4.3 ± 5.4 (0–19)	2.6 ± 4.9 (0–20)
hyperarousal	4.5 ± 5.9 (0–25)	3.1 ± 5.6 (0–23)
calculated total score	–3.5 ± 1.1 (–4.4 to 0.4)	–3.8 ± 1.0 (–4.5 to 0.1)

IES-R questionnaire (subscales and calculated total score) after 6 weeks (t1) and 3 months (t2).

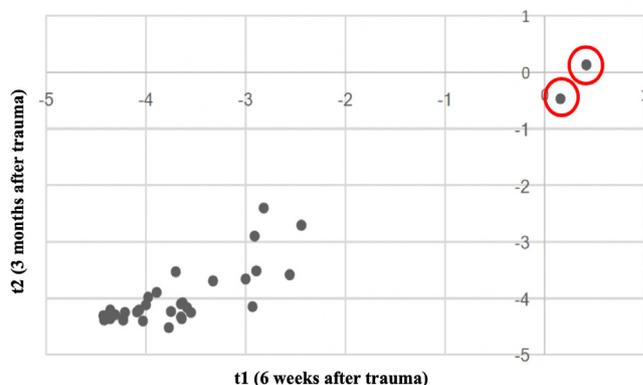


Fig. 1. Results of IES-R questionnaire: Correlation of calculated total values at t1 (horizontal axis) and t2 (vertical axis); Red circles highlight the two patients with critical measurement values at t1. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 5
Results of Beck Depression Inventory-II (BDI-II).

	t0 (immediate)	t1 (6 weeks)	t2 (3 months)
Mean ± SD	5.4 ± 5.3	4.4 ± 4.4	2.4 ± 3.9
Total score max.	18 points	16 points	17 points
Total score = 0 [n (%)]	10 (27.8%)	14 (38.8%)	23 (63.9%)

BDI-II at all three measurement times.

II (t0) while in the other patient with conspicuous IES-R values a total score = 0 in the BDI-II was detected.

Correlation of PDI and IES-R

A positive correlation of PDI and IES-R at both measurement times, 6 weeks (t1) and 3 months (t2) after trauma could be detected (t1; r = 0.45, p < 0.005, t2; r = 0.38, p < 0.022). The results are illustrated in Fig. 2.

Correlation of depression (BDI-II) and IES-R

A significant correlation of BDI-II and IES-R after 6 weeks (t1; r = 0.69; p < 0.001) and 3 months (t2; r = 0.81; p < 0.001) could be detected. These results indicate a strong correlation of depression and PTSD.

Influence of other variables

No significant correlation of age, sex, graduation, current employment situation, medical history, regular medication, drug or alcohol consumption and IES-R could be detected (p ≥ 0.05). Persons who had

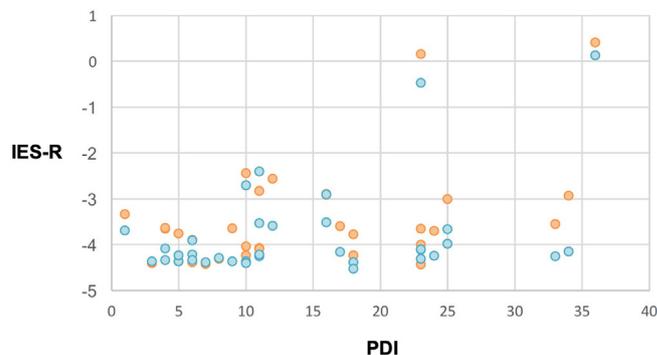


Fig. 2. Correlation of PDI and IES-R after 6 weeks (orange) and 3 months (blue). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

already experienced previous traumatic events showed symptoms of a stress disorder after a traffic accident more frequently ($p < 0.028$). A connection to the number of previous traumatic events could not be found. Estimation of recovery chances and the issue of guilt did not correlate significantly with the IES-R ($p \geq 0.05$).

Discussion

To our knowledge, this study is the first to examine only slightly injured patients after a traffic accident for PTSD. Current PTSD research focuses in particular on severely injured patients ($ISS \geq 16$) or patients with long intensive care stays [2,10,11,16,24,25], while little is known about PTSD after minor trauma. The prevalence of PTSD in severely injured patients ranges from 4.7% up to 34% within the first three months [10,11]. PTSD after mild trauma is a largely unknown trauma sequence, especially in the early phase, and is therefore currently underestimated by the attending physicians.

The results of our study point out that symptoms of PTSD can also occur after minor trauma. In our collective 5.6% of the included patients showed conspicuous values in IES-R, the PTSD screening tool used in the present study. One participant suffered from these symptoms even 3 months after trauma. As the IES-R questionnaire is designed as a screening-tool, the values can only predict the probability of developing a PTSD. However, former studies showed, that patients reporting positive scores in the IES-R scales are more likely to be diagnosed with PTSD [18,19,23]. In the present study, one patient with conspicuous values in IES-R subsequently underwent psychiatric treatment. The decrease in IES-R values over time suggests a reduction of typical PTSD symptoms 3 months after trauma. Simultaneously, we could observe a strong positive correlation among total scores, both 6 weeks and 3 months after trauma. The score after 6 weeks could therefore be predictive for the score after 3 months and it seems unlikely, that patients with a low total score 6 weeks after trauma will report higher scores 3 months later.

It should be noted, that the occurrence of the so called “delayed new onset” PTSD, emerging more than 6 months after trauma, cannot be detected in this study with a limited follow-up of 3 months. Even though no patient showed an increase in IES-R scores over time, the occurrence of PTSD symptoms after the study period remains possible [26]. Furthermore, our results show a positive correlation between the degree of depressiveness and posttraumatic stress symptoms. This finding confirms former studies, that already demonstrated the comorbidity of depression and PTSD [27,28].

In addition, different factors seem to influence the increased psychological stress level after road traffic accidents. Our results show that the perceived intensity of stressful experience during the critical event could be a predictor for manifestation of PTSD symptoms. Due to the high correlation of PDI and IES-R scores, both might be reasonable indicators for PTSD which has been postulated in previous studies [29]. Especially immediately after trauma the PDI might be a suitable screening tool to detect PTSD, even in slightly injured patients. Further studies with larger patient collectives will be needed to evaluate the quality of the PDI as screening tool for PTSD.

In contrast to other studies, age and sex were not correlated with the IES-R score. However, previous studies mainly focused on severely injured patients [8,30].

The analysis of correlation between previous trauma and PTSD showed that the occurrence of previous trauma is related to high IES-R scores. These findings agree with results of a former study [31]. In contrast, the frequency of previous trauma did not affect IES-R scores. The reason for this might be an individual rating of trauma severity, so type and frequency of previous trauma might not be good indicators for PTSD.

Limitations

Our study has several limitations which have to be mentioned. On the one hand, the collected data are exclusively based on self-reported questionnaires which only act as screening tools for PTSD symptoms. An objective analysis and valid diagnosis of PTSD was therefore not possible. To ensure privacy and data protection, the final diagnoses of the patients were not recorded. On the other hand, the study period of 3 months is too short to detect “delayed new onset” PTSD which can occur even 6 months after trauma.

Finally, the number of participants is too small to make reliable predictions or statements about PTSD after minor trauma.

As mentioned above, further studies with larger patient collectives are needed to learn more about PTSD even in slightly injured patients.

Conclusion

The present study showed that symptoms of PTSD can also occur after minor trauma. We found that peritraumatic distress and previous traumatic experience determine the extent of PTSD symptoms. Factors like sex and age showed no correlation. The occurrence of PTSD should be considered not only in severely injured patients, but also in slightly injured patients after road traffic accidents.

Declarations

Ethics approval and consent to participate

The study has been approved by the Ethics Committee of the University of Regensburg (number 16-101-0113). Data anonymity is guaranteed. Only patients who agreed to participate the study by giving their written content were included.

Consent for publication

Not applicable.

Availability of data and material

Not applicable.

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Authors' contribution

Participated in the idea, planning, data analysis and interpretation, statistical analysis and writing the manuscript: MK, HS, TH, AE, KA, SW. Participated in data interpretation and writing the manuscript: MK, AE, TH, KA. Participated in data acquisition: AE, HS, KT, SW. Have read and approved the final version: KA, SW, TH, KT, HS, AE, MK.

All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.mehy.2019.109465>.

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