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Characteristics of polytrauma patients with posttraumatic stress disorder in a level 1 trauma center

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Abstract

Aims The aims of this study were to determine if the severity of injury is related to the prevalence of posttraumatic stress disorder (PTSD) in polytrauma patients and to review the personality traits of patients with PTSD.

Methods During 2006 and 2007, 252 polytrauma patients were treated at the Medical Centre Haaglanden in The Hague, The Netherlands. Of the 174 survivors, 53 adult patients were traced and sent questionnaires. They were screened for PTSD and personality traits, coping styles, and negative cognitions, and their level of social support were assessed.

Results PTSD was demonstrated in 22.6% of the patients.

Conclusions An increased level of neuroticism, negative cognitions regarding themselves, and active dealing were found to be significant predictors of PTSD. However, we found no relation between the injury severity score and the prevalence of PTSD

Keywords PTSD · Polytrauma · ISS · Personality traits

Introduction

Posttraumatic stress disorder (PTSD) is a psychiatric syndrome brought on by exposure to life-threatening trauma in which the physical integrity of the involved person or that of others was threatened and which was accompanied by feelings of intense fear, helplessness, or horror [1]. PTSD is characterized by intrusive thoughts, avoidant behavior, and irritability symptoms after exposure to a trauma that last longer than a month and lead to significant stress and/or limit normal social behavior. If the symptoms last up to 3 months, it is referred to as acute PTSD, but, often (33–54%), the symptoms are chronic, lasting up to 6 years or longer, and involve the high use and costs of both somatic and mental healthcare institutions [2].

The exact incidence of PTSD is unknown, but it is estimated to be around 1–9% in the general population worldwide [2]. Dutch research in 2009 showed a life time prevalence of 7.4% [3]. Previous research stated that about 10% of patients will develop PTSD after experiencing either mental or physical trauma [4], but more recent American research by Zatzick et al. [5] reported that 20% of patients admitted after suffering physical trauma showed symptoms of PTSD and another 25% showed symptoms of depression and acute stress disorder (ASD) in the weeks and months after their accident.

Although it is clear that survivors of a traumatic event in which physical injury was sustained are at a higher risk of developing PTSD, it is unknown whether a more severe injury, expressed by the Injury Severity Score (ISS), carries a higher risk than a less severe injury [6, 7]. Secondly,

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much of the available data about PTSD reflects victims of war or specific traffic accidents [8–10]. Data about a more general polytrauma population is much more limited.

Recent publications in the *Journal of Trauma* have highlighted the importance of PTSD in the outcome of physical trauma [11, 12]. These articles show that the outcome of complex orthopedic trauma patients is not only determined by obvious impairment, such as an amputation, but that pain and posttraumatic stress symptoms are very significant factors in determining outcome and quality of life. As a result, it has been suggested that, in order to improve the quality of life of trauma patients, early intervention therapy has to be started in the hospitals where these patients are admitted.

However, a recent Cochrane Review examining multiple-session interventions in preventing PTSD showed that no psychological intervention can be recommended for routine use following traumatic events and that multiple-session interventions, like single-session interventions, may even have an adverse effect on some individuals [13]. Thus, patients surviving physical trauma cannot be randomly debriefed and a better identification of patients at a higher risk of developing PTSD is necessary.

This study aimed to: (a) investigate the prevalence of PTSD in polytrauma patients ($ISS \geq 16$) and (b) assess whether the severity of the injury, according to the ISS, is related to a higher prevalence of PTSD. A secondary aim was to describe the differences between the patients who developed PTSD and the patients who did not in terms of personality traits, coping styles, and the level of social support experienced. With these results, we can hopefully make recommendations for developing a new or adjust existing screening instruments to identify patients at a higher risk for developing PTSD and making safe and early intervention possible.

Patients and methods

All patients with an $ISS \geq 16$ admitted at the Medical Centre Haaglanden in The Hague during 2006 and 2007 were analyzed. All patients younger than 18 years of age were excluded. The remaining patients were tracked down and sent information letters. All of these patients were then contacted by phone and asked for their participation. If they agreed, they were sent the following questionnaires: the OSLO Social Support Scale (OSS-3, Meltzer, 2003: social support), the Posttraumatic Cognition Inventarisationalist (PTCI, Emmerink et al., 2007: trauma-related cognitions), the NEO-Five Factor Inventory (NEO-FFI, Costa and McCrae, 1992: personality), the Utrecht Coping List (UCL, Scheurs et al., 1988: coping), and the Self-inventarisationalist (ZIL, Hovens et al., 2000: posttraumatic

stress). The diagnosis of PTSD was confirmed by a ZIL score above 52. The investigation took place between March 2008 and May 2009.

Statistical analysis

The data were analyzed using SPSS version 17.0 (SPSS, Chicago, IL). Distributions were tested for normality with the Kolmogorov–Smirnov test and inspection of the histograms. The independent *t*-test or the Mann–Whitney test was used to compare each personality facet of the NEO-FFI, the social support score, the PTCI scores, and the UCL scores of the polytrauma patients who had developed PTSD with the scores of the patients who did not develop PTSD. Of all these scores, Spearman's correlation coefficients were estimated with the total score of the ZIL. These correlations can be considered as effect sizes of these variables on the ZIL score. A correlation of 0.10 is considered as a small, 0.3 as a moderate, and 0.5 as a large effect size. In a multiple regression model, all outcome variables which were significant in the univariate analysis were entered as independent variables with the ZIL total score as the dependent variable. Non-significant variables were removed one by one, starting with the variable with the largest *p*-value, until all variables in the model were significant (backward method). A *p*-value of <0.05 was taken as statistically significant.

Results

A total of 252 patients with an $ISS \geq 16$ were treated in our center in 2006 and 2007. Of these patients, 11 were younger than 18 years of age and were excluded. Seventy-eight patients (31%) had died because of the accident or in the intervening years. The Abbreviated Injury Scale (AIS) score regions of these 78 deceased patients are shown in Table 1. Of the remaining 163 patients, 86 gave consent to participate in the study and were sent questionnaires. Of the other 77 patients, 12 actively refused consent, ten could not participate because of neurological impairment, and the rest could not be reached. Of the 86 patients who gave their consent to participate, 53 patients (33% of 163) sent in complete questionnaires and this made up the final study group (Fig. 1).

Of the 53 patients, 32 were men (60%), the median age was 58 years (18–88), and the median ISS was 20 (16–45). The majority were Dutch (81%). Almost all patients suffered blunt trauma, except for three, who suffered penetrating trauma (5.6%). The non-responders of the original study group did not differ from the responders in ISS and also did not differ in age and sex (Table 2). PTSD was demonstrated in 22.6% ($n = 12$) of the 53 patients (ZIL

Table 1 Abbreviated Injury Scale (AIS) score per body region of the 78 deceased patients

	Minor	Moderate	Serious	Severe	Critical	Unsurvivable	Unknown
Head/neck	0	3	4	21	36	1	1
Face	15	3	0	0	0	0	0
Chest	2	2	5	6	6	0	1
Abdomen	0	1	1	3	1	0	1
Extremities	8	8	11	0	1	0	0
External	3	0	0	0	5	0	0

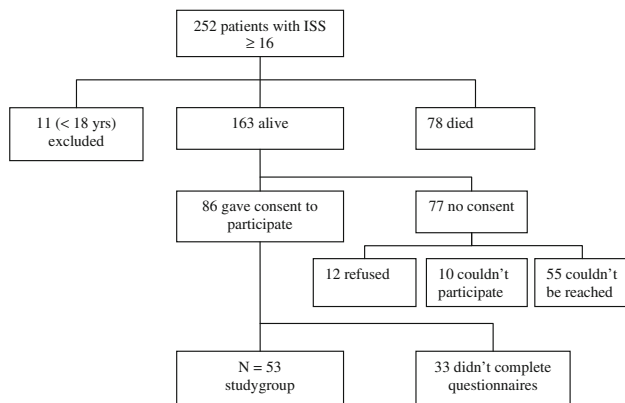


Fig. 1 Flowchart of the recruitment of the patients examined in this study

score >52). The distribution of the outcome measures were non-normal. The different continuous outcomes for patients with or without PTSD and the correlation with the total ZIL score is shown in Table 3. Statistical analysis showed no relation between the Injury ISS and the prevalence of PTSD (Table 3). There was also no relation between sex and the prevalence of PTSD (Table 4). However, we did find that patients who developed PTSD were significantly younger (median 43 years, interquartile range [IQR] 40) than patients who did not develop PTSD (median 60 years, IQR 70, $p = 0.02$) (Table 3). A high level of neuroticism and a low level of altruism were

significant variables linking to PTSD in this group of polytrauma patients. Openness and conscientiousness were not significant personality traits on the univariate analysis. Expression of emotions, passive and avoiding coping styles, and an active approach and palliative response were significantly different. However, seeking social support and reassuring thoughts were not. Also, negative cognitions about the world and themselves, as well as a high level of self-reproach, were found to be significant variables with PTSD. In contrast to the coping style seeking social support, we did find a significant relation between the development of PTSD and the level at which the presence of social support was reported. The following variables had a large effect size on the ZIL score: neuroticism, PTCI subscores, avoiding and passive coping styles, palliative and passive reaction patterns.

Multiple regression analysis showed the following positive predictive variables of developing PTSD: negative cognitions about themselves, neuroticism, and active dealing (Table 5). This model explained 85% of the variance.

Discussion

This study shows very important differences in personality characteristics which identify patients at a higher risk of developing PTSD. The high prevalence of 22.6%

Table 2 Injury Severity Score (ISS), age, and sex of the responders and non-responders

Variable	<i>n</i> (%)	Inclusion	Median	25th percentile	75th percentile	<i>p</i> -value	Test
ISS	110 (67%)	No response	20.5	17	25	0.56	Mann–Whitney test
	53 (33%)	Included	20	17	24		
Age (years)	110 (67%)	No response	46.5	32	64	0.066	Mann–Whitney test
	53 (33%)	Included	58	40	65		
Sex	Inclusion	<i>n</i>	%	<i>p</i> -value	Test		
Female	Included	21	40	0.09	Chi-square test		
Male	Included	32	60				
Female	No response	29	26				
Male	No response	81	74				

Table 3 Different continuous outcomes for patients with or without posttraumatic stress disorder (PTSD) and the correlation with the total Self-inventarisation list (ZIL) score

Variable	PTSD	Median	IQR	<i>p</i> -value	Correlation with ZIL
Age	No PTSD	60	70	0.02	−0.260
	PTSD	43	40		
ISS	No PTSD	19	5	0.12	0.260
	PTSD	21	9		
NEO-FFI					
Neuroticism	No PTSD	4	4	<0.001	0.787**
	PTSD	7.5	2		
Extraversion	No PTSD	5	3	0.872	−0.284*
	PTSD	5	5		
Altruism	No PTSD	4	3	0.024	−0.468**
	PTSD	2.5	4		
Openness	No PTSD	5	2	0.675	−0.006
	PTSD	5.5	7		
Conscientiousness	No PTSD	4	3	0.636	−0.204
	PTSD	5	5		
OSS-3	No PTSD	10	3	0.044	−0.465**
	PTSD	9	4		
PTCI: total score	No PTSD	63	37	<0.001	0.892**
	PTSD	152	32		
Negative cognitions about themselves	No PTSD	35	28	<0.001	0.888**
	PTSD	88.5	30		
Negative cognitions about the world	No PTSD	19	9	<0.001	0.729**
	PTSD	42.5	10		
Self-reproach	No PTSD	9	11	<0.001	0.442**
	PTSD	19.5	9		
UCL					
Active approach, confrontation	No PTSD	3	0	0.008	0.181
	PTSD	4	1		
Palliative response	No PTSD	3	0	<0.001	0.503**
	PTSD	5	1		
Avoidance/wait-and-see	No PTSD	3	1	0.003	0.589**
	PTSD	4	2		
Passive/depressive response pattern	No PTSD	3	1	<0.001	0.802**
	PTSD	5	1		
Expression of emotions, anger	No PTSD	3	2	0.027	0.429**
	PTSD	4	1		
Seek social support	No PTSD	3	1	0.733	−0.085
	PTSD	3	2		
Reassuring/consoling thoughts	No PTSD	3	0	0.483	−0.048
	PTSD	3	1		

IQR interquartile range

* $p < 0.05$; ** $p < 0.01$

underlines the necessity of recognizing the importance of this syndrome in the treatment of polytrauma patients. However, this study also has some limitations. There was a very high rate of drop-out (67%), which is a potential risk

for bias by possible selection. We were only able to retrieve current addresses from 86 patients. This reflects the mobility and diversity of the (poly)trauma patient population. High drop-out rates are not uncommon in the trauma

Table 4 Number of females and males with or without PTSD and the correlation between sex and the total ZIL score

Variable	PTSD	<i>n</i>	%	<i>p</i> -value	Correlation with ZIL
Male	No PTSD	25	78	1.000	−0.154
	PTSD	7	22		
Female	No PTSD	16	76		
	PTSD	5	24		

literature, as previous studies with follow up rates of only 10% have been accepted [11]. Also, the mortality rate was high in our study. In the literature, mortality rates of 22–37% are described in polytrauma patients, with a more recent drop to 18–23% in the last several years. This drop in mortality is mainly seen in the group that dies because of major bleeding [14]. Severe neurotrauma still remains a major cause of death. Unfortunately, we did not register the cause of death in our database. However, Table 1 does show that most of the deceased patients are, indeed, neurotrauma patients, with injuries to the head/neck and face making up 56.4% (84/149) of the total of the codes. Since our center is a referral hospital for neurosurgery, this is to be expected. Selection is also possible by response bias: only those patients who perceived benefit from the study may have participated. However, the responders were comparable to the non-responders in ISS, age, and sex.

The eventual low response rate and many variables we looked at in the 12 cases of PTSD in the study group of 53 polytrauma patients has consequences for the statistical analysis and whether the results can be generalized. Therefore, we need to practice more caution in interpreting the coefficients of the multiple regression analysis. When comparing our results with the literature, we did find the same differences in personality traits and cognitions that were described previously [15–20]. In addition, Lauterbach and Vrana showed that different personality traits are not only related to prevalence, but also to the severity of posttraumatic stress symptoms [21]. Also, different coping styles and the level of social support appear to be important factors in the development of PTSD [22–25], as we have

confirmed in our study for active approach and/or confrontation. The role of social support was not clear in our study. In the univariate analysis, having a lot of social support was associated with a lower chance of developing PTSD, but this was not confirmed in the multiple regression analysis. In our study, negative cognitions about themselves, neuroticism, and an active approach or confrontation were predictors of PTSD. Therefore, disputing the negative cognitions in cognitive behavior therapy and not stimulating an active approach and/or confrontation as the coping style could be possible targets in preventing PTSD. Coping styles differ between countries and cultures; therefore, attention to cultural factors is important in studying the relation between PTSD and coping styles. Cultures that value family connections and interdependence may provide social support that is not available in more individualistic cultures [26]. Jobson and O’Kearney showed that appraisals of personal responsibility, autonomy, and control have greater impact on the posttrauma psychological adjustment of trauma survivors from independent cultures than for trauma survivors from interdependent cultures, and that people with PTSD from independent cultures had significantly more appraisals of mental defeat and permanent change and tended to have less appraisals of control than those with PTSD from interdependent cultures [27]. Recently, Knight and Sayegh referred to the differences in coping styles between Korean on the one hand and African Americans and Whites on the other. The first group emphasized more cognitive coping strategies, while the latter showed more avoidant coping styles [28]. Research on social support by Taylor et al. showed that Asians and Asian Americans tend to seek social support less than European Americans and also find it to be less helpful in dealing with stress [29]. This was recently supported by Wang et al. [30].

In our study, we also found that patients that developed PTSD were significantly younger than patients that did not develop PTSD (Table 3). This is confirmed by the literature, stating that the lowest prevalence of PTSD is found at the age of 71–75 years for both men and woman, when they seem to be more resistant towards developing PTSD [31].

Table 5 Multiple regression with the ZIL total score as the dependent variable. Negative cognitions about themselves, neuroticism, and active approach were significant predictors in the model

Variable	Coefficient	95% CI	Standardized coefficient	<i>p</i> -value
Negative cognitions about themselves (PTCI)	0.33	0.23; 0.42	0.65	<0.001
Neuroticism (NEO-FFI)	0.43	0.17; 0.69	0.32	0.002
Active approach, confrontation (UCL)	0.80	0.37; 1.22	0.22	<0.001

The following variables were tested in the model: neuroticism, altruism (NEO-FFI), OSS-3, negative cognitions about themselves, about the world, self-reproach (PTCI), active approach, palliative response, avoidance, passive response pattern, and expression of emotions (UCL)

CI confidence interval

Despite the small patient numbers and the great number of variables in this study, it is very important to stress the differences in personality traits because it is these differences that can identify patients with a higher risk of developing PTSD. PTSD is a severe syndrome that can be effectively treated at an early stage [32]. However, as stated before, random intervention is not recommended and can even have adverse effects [13]. By using personality traits in the identification of patients at risk for developing PTSD, the incidence of adverse effects can hopefully be diminished.

This study underlines the high percentage of patients found in the literature that develop PTSD after suffering physical trauma. The influence of PTSD on the outcome of (physical) trauma patients and their quality of life has been described before. To our knowledge, this is the first time that a group of general polytrauma patients has been studied. This selection, in combination with the expected high drop-out rate, results in a small study group. Our results will, therefore, have to be validated in further prospective studies. We found no relation between ISS and the prevalence of PTSD. This was supported in other studies [11, 12, 33]. The ISS should not, therefore, be part of a screening instrument. Differences in personality traits such as a high level of neuroticism and negative cognitions about themselves were highly predictive and, therefore, should be part of a screening instrument. Hopefully, this screening instrument can then lead to a better identification of (physical) trauma patients at a higher risk of developing PTSD, making a safe early intervention possible.

Conflict of interest None.

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