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Subacute posttraumatic complaints and psychological distress in trauma patients with or without mild traumatic brain injury

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ABSTRACT

Objective: To identify the frequency, nature and profile of complaints for trauma patients with and without mild traumatic brain injury (mTBI), and to assess their relation to anxiety and depression.

Methods: A prospective cohort study in a level-one trauma centre was conducted. Mild traumatic brain injury patients and trauma controls were approached for participation. Two weeks after injury, The Head Injury Symptom Checklist (HISC) and the Hospital Anxiety and Depression Scale (HADS) were administered.

Results: Two-hundred seventy two patients with mTBI and 125 TC patients completed the questionnaires. Differences were demonstrated between the two trauma populations on frequency and nature of reported complaints. Ordinal common factor analysis on the mTBI scores yielded three factors: mental distress, physical discomfort, and sensory disbalance, which were all significantly correlated to anxiety and depression scores. Discriminant analyses identified a subset of complaints which could allocate almost 80% of patients to the correct group.

Conclusions: Patients with mTBI showed a different pattern of complaints than orthopaedic control patients. A mental distress factor consisting of both somatic and cognitive complaints proved to be most discriminating and showed high correlations with anxiety and depression.

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Introduction

Traumatic brain injury (TBI) is considered a leading cause of death and disability worldwide. The majority of injuries consist of mild traumatic brain injuries (mTBIs), which is defined as a head injury caused by external physical force, resulting in a Glasgow Coma Scale Score of 13–15, with a short period of loss of consciousness (<15 min) and/or posttraumatic amnesia (<24 h) [1]. The incidence of mTBI is estimated at 100–200 per 100,000 individuals per year, with an increase in Emergency Department (ED) visits over the last years [2,3]. This increase in TBI related ED visits underlines the importance for physicians working at the ED to be aware of risk factors and outcome for mTBI. Most mTBI

patients initially report posttraumatic complaints like headache, dizziness or forgetfulness, but recover within the first three months after injury without residual complaints. However, a subgroup of approximately 15–20% of cases continues to experience posttraumatic complaints up to several months after sustaining an injury [4–6].

Although these posttraumatic complaints are often attributed to brain injury, similar complaints are also commonly reported by uninjured individuals [7–9] and non-head injured trauma patients [10,11]. Several studies yielded evidence that experience of posttraumatic complaints might be influenced by several non-brain injury related factors including stress [12], illness perception [13], and symptom expectation [14]. It has been established that early psychological distress such as anxiety and depression is common after mTBI, and is associated with posttraumatic symptoms [15,16]. However, to which extent this relation between such complaints and anxiety and depression is also present in non-head injured patients has been poorly examined.

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To obtain a better understanding of the construct of posttraumatic complaints, various research groups have performed factor analysis. Several studies have identified domains in which complaints tend to cluster, the ‘complaint factors’. Yet the results of these studies failed to generate consistent results. Models of two, three or even four complaint factors have been suggested. Most studies describe at least one somatic/physical domain, other proposed domains are related to cognitive or emotional/affective complaints [10,17–19]. Apart from differences in identified domains, difficulties arise with complaints that fit in the cognitive as well as the emotional and somatic domain (e.g. sleep disturbances and fatigue). These inconsistencies with allocating complaints to certain domains indicate an overlap between complaints and clusters, which suggests that there might be a more general underlying construct. Complaints in the subacute phase after mTBI could be the result of a form of general (psychological) distress, instead of disturbances in cognitive or physical capacities. However, the relation between anxiety, depression and complaints in different domains remains largely unexamined in studies so far. The aforementioned findings illustrate the proposed non-specific nature of posttraumatic complaints, and warrant further exploration of other underlying aspects.

Therefore, the purpose of this study was to investigate which complaints are more specific for mTBI patients in comparison to orthopaedic trauma control patients in the subacute phase (i.e. two weeks post-injury) and in particular to determine which combination of complaints indicates a disease specific profile for mild traumatic brain injury. In addition, test–retest reliability analyses were performed on data of healthy controls to assure the use of a stable measurement tool to assess posttraumatic complaints. We applied factor analysis to establish the underlying factors determining performance on the complaints list. Lastly, we examined the extent to which these factors were related to anxiety and depression to better understand the underlying construct of these disabling complaints.

Methods

Participants

Mild traumatic brain injuries (mTBI)

Patients were recruited from a prospective follow-up study on outcome in mTBI (UPFRONT-study), conducted in the University Medical Center Groningen (UMCG), a level I trauma centre. Patients were included at the ED between May 2013 and December 2014. MTBI was defined by the attending neurologist or ED physician by the following criteria: A head injury caused by external physical force resulting in a Glasgow Coma Scale (GCS) score of 13–15, loss of consciousness (LOC) of ≤ 15 min (documented, reported or self-reported) and/or posttraumatic amnesia (PTA) of ≤ 24 h [1].

Trauma controls (TC)

Non-head-injured patients were recruited at the outpatient surgical clinic of the UMCG between June 2013 and October 2013. All patients who sustained a minor injury to an extremity (e.g. sprain or uncomplicated fracture of wrist or ankle), for which they had visited the ED less than 31 days previously were invited to complete the questionnaires at the outpatient clinic. Injury characteristics were gathered from medical records.

Healthy controls (HC)

The volunteers for the healthy comparison group were recruited among working and social environment of the authors.

Participants were asked to complete the questionnaire twice, with a two week time interval, to determine test–retest reliability.

For all subgroups inclusion criteria were: age from 16 to 65 years and comprehension of the Dutch language. Participants were excluded based on the following criteria: a history of head injury (and concomitant head injury for the TC-group) requiring hospital admission, drug or alcohol addiction, psychiatric comorbidity or unavailability for follow-up.

This study was approved by the local ethical committee of the UMCG.

Measures

Posttraumatic complaints

The Head Injury Symptom Checklist (HISC) [20] contains 19 frequently reported complaints after traumatic brain injury. In addition, two non-posttraumatic complaints (itchiness and dry mouth) are assessed as an indicator of tendency to complain. The HISC scores each posttraumatic complaint on the pre-injury and current level with values ranging from 0 to 2 (never = 0, sometimes = 1, and often = 2). For each symptom a difference score is calculated by subtracting the pre-injury score from the current score. All resulted scores, to be denoted as complaints, were dichotomized into 0 (no increase in complaints) and 1 (any increase in complaints).

Depression and anxiety

Symptoms of depression and anxiety were assessed by means of the Hospital Anxiety and Depression Scale (HADS) [21]. The HADS is a 14-item questionnaire, measuring 2 subscales (depression and anxiety) of 7 items each, resulting in a subscale score ranging from 0 to 21. A cut-off score of ≥ 8 is recommended for establishing the presence of both depression and anxiety.

Statistical analyses

The data were analysed using SPSS (version 22.0). Demographic variables and injury characteristics of mTBI and TC patients were compared using parametric (Student's *t*-test) and non-parametric (Mann–Whitney *U*-test, χ^2 -test) testing when appropriate. Test–retest analyses were performed by calculating kappa scores. Factor analysis was performed on the mTBI group. Because the data on complaints were dichotomous, we applied an exploratory ordinal common factor analysis with the software programme FACTOR [22]. A polychoric parallel analysis with 95% boundary was used to indicate the number of factors, unweighted least squares as the method of extraction, with oblique rotation (Promin). Performing a separate analysis on the data of the TC patients does not allow a direct comparison between the factors found in both groups [23]. A discriminant analysis was performed to assess which complaints contributed most to group prediction. A cut-off of 0.4 was applied to determine which complaints were most discriminant in the function. With the most discriminating complaints an unweighted scale was constructed. A Receiver Operating Characteristic (ROC) analysis was performed to see how well group membership could be predicted. For all analyses, alpha was set at 0.05 two-sided.

Results

Participants

During the inclusion period, 416 mTBI patients participated in the UPFRONT-study, of whom 272 patients completed both questionnaires. In the TC group, 205 non-head-injured patients were approached for participation, of whom 125 patients completed the questionnaires. Trauma control patients were most

commonly treated for uncomplicated fractures (50%) and sprains (16%) in the upper (51%) or lower (46%) extremity. The mean interval between injury and follow-up was 16 days (SD 8.5 days), with a mean difference of 2 days between groups (mTBI 16 days vs. TC 14 days, $p = 0.001$) Two weeks after injury, fifty percent of the mTBI patients had resumed their work or study, compared to 57% of the TC patients. Patient demographics and injury characteristics for both groups are summarized in Table 1.

Table 1

Characteristics of patients with mild traumatic brain injury (mTBI) and trauma controls (TC).

	(1) mTBI (N = 272)	(2) TC (N = 125)	Difference 1–2 p-value
Patient characteristics			
Age, years, mean (SD)	40.0 (15.4)	35.8 (15.0)	0.013 ^a
Male gender	171 (62.9)	77 (60.6)	0.809 ^b
Employment status			0.239 ^b
Working/student	223 (82.0)	97 (77.6)	
Not working	47 (17.3)	28 (22.4)	
Injury characteristics			
Cause of injury			<0.001 ^b
Motor vehicle accident	65 (23.9)	5 (4.0)	
Fall/jump	170 (62.5)	45 (36.0)	
Violence	13 (4.8)	7 (5.6)	
Sport injury	11 (4.0)	25 (20.0)	
Other	11 (4.0)	43 (34.4)	
Day of injury alcohol intoxication	102 (37.5)	5 (4.0)	<0.001 ^b
Hospital admission	143 (52.8)	20 (16.0)	<0.001 ^b
Days admitted, median (range)	2 (1–60)	4 (1–18)	0.002 ^c
Posttraumatic amnesia			
None	30 (11.0)	–	
<1 h	108 (39.7)	–	
1 h–1 day	91 (33.5)	–	
Unknown	43 (15.8)	–	
Loss of consciousness (yes)	189 (82.2)	–	

Data are represented by numbers (percentages) if not specified otherwise.

^a Student's *t*-test.

^b Pearson's χ^2 test.

^c Mann–Whitney *U* test.

Posttraumatic complaints

Fig. 1 depicts the percentage of patients reporting complaints two weeks after injury, expressed as percentages of the total groups. All complaints, except for itchiness (12% vs. 15%; $p = 0.342$), arm pain (25% vs. 18%; $p = 0.119$), trouble falling asleep (23% vs. 16%; $p = 0.120$), and trouble sleeping through the night (27% vs. 22%; $p = 0.264$) were reported significantly more often in the mTBI group. Missing scores varied from 0 to 2%, with the exception of alcohol intolerance, which was missing in 11% of the mTBI group.

Healthy controls

Healthy controls ($n = 100$) were invited to complete the HISC twice with a two-week time interval, in order to assess its test–retest reliability. Eighty percent of the participants returned two questionnaires within the given time frame. No significant differences were found in age, gender, and time interval between the healthy controls and the mTBI and TC group. Table 2 shows findings from test–retest analyses for each complaint.

Factor analysis

Factor analysis was performed on HISC scores of 272 mTBI patients. Due to the high number of missing values on the question of alcohol intolerance, we excluded this question from the analysis. The remaining 20-symptoms formed a three-factor solution with eigenvalues of 7.27, 2.00 and 1.77. An oblique promax rotation was performed, which led to a 48.4% explanation of total variance. Table 3 provides factor loadings, explained variances, and inter-factor correlation coefficients. The factors were labelled as sensory disbalance, physical discomfort, and mental distress. Controlled severity scores for the mTBI and TC group were calculated for the factors, which were all significantly higher in the mTBI group.

Anxiety and depression

Scale scores were compared with anxiety and depression scores, for further exploration of the constructs of complaints. Mean HADS

Fig. 1. Posttraumatic complaints two weeks after injury for mTBI and TC patients in percentages of the total group.

Table 2

Test–retest analyses in healthy control subjects with a two-week time interval ($n=80$).

Complaint	Kappa
Fatigue	0.70**
Headache	0.47**
Dizziness	0.68**
Increased need for sleep	0.62**
Poor concentration	0.53**
Neck pain	0.49**
Balance disorders	0.61**
Slowness	0.29**
Neck stiffness	0.52**
Trouble sleeping through	0.63**
Arm pain	0.71**
Trouble falling asleep	0.66**
Forgetfulness	0.74**
Tinnitus	0.88**
Noise intolerance	0.60**
Dry mouth	0.73**
Alcohol intolerance	0.63**
Anxiety	0.31**
Irritability	0.65**
Itching	0.73**
Hearing loss	0.50**

** Significant on the <0.01 level.

Table 3

Factor analysis of the 20-item Head Injury Symptom Checklist for patients with mTBI 2 weeks after injury ($n=272$). Bold face loadings depict the complaints part of the three factors. Scale scores for each identified factor are provided for the mTBI and TC group.

Symptom	Mental distress	Physical discomfort	Sensory disbalance
Dizziness	0.940	−0.302	−0.060
Slowness	0.719	0.176	0.044
Noise intolerance	0.700	0.036	0.017
Balance disorder	0.679	−0.266	0.228
Fatigue	0.654	0.111	−0.045
Headache	0.645	−0.139	0.067
Poor concentration	0.619	0.142	0.070
Irritability	0.599	0.100	−0.063
Forgetfulness	0.572	0.069	0.176
Anxiety	0.530	0.194	−0.057
Increased need for sleep	0.450	0.208	−0.008
Neck pain	0.184	0.754	−0.127
Neck stiffness	−0.011	0.674	0.078
Trouble sleeping through	−0.077	0.592	0.468
Arm pain	−0.163	0.543	0.034
Trouble falling asleep	0.045	0.464	0.332
Hearing loss	0.010	−0.006	0.819
Tinnitus	0.274	−0.119	0.716
Dry mouth	0.284	0.105	0.319
Itching	−0.162	0.296	0.313
Factor characteristics			
Explained variance	25.8%	11.9%	10.7%
Reliability estimate	0.92	0.84	0.87
Inter-factor correlation matrix			
Mental distress	1.000		
Physical discomfort	0.520	1.000	
Sensory disbalance	0.336	0.064	1.000
Scale scores for the identified factors			
mTBI			
Mean (SD)	4.6 ± 3.3	1.4 ± 1.5	0.60 ± .94
Median (range)	4 (0–11)	1 (0–5)	0 (0–4)
TC			
Mean (SD)	0.9 ± 1.7	0.8 ± 1.3	0.20 ± 0.46
Median (range)	0 (0–10)	0 (0–5)	0 (0–2)
p-Value difference ^a	<0.001	<0.001	<0.001

^a Mann–Whitney *U* test.

scores were significantly higher for the mTBI group compared to the TC group: anxiety (4.3 vs. 2.8; $p < 0.001$) and depression (3.5 vs. 2.3; $p = 0.002$). When applying the cut-off score of 8, 13% of patients with mTBI were defined as depressed, and 16% as anxious. In the TC group, 5% scored above the cut-off for depression and 5% above the cut-off for anxiety. Fig. 2 illustrates the correlations between the three factors and symptoms of anxiety and depression, for the mTBI and the TC group separately. Correlations with anxiety and depression scores did not differ significantly between the two groups for the first two factors, i.e. sensory disbalance (anxiety Z-score 0.22, $p = 0.83$; depression Z-score 0.59, $p = 0.56$) and physical discomfort (anxiety Z-score 1.43, $p = 0.15$; depression Z-score 1.07, $p = 0.29$), nor for anxiety with mental distress (Z-score 1.81, $p = 0.70$). Only for the correlations between mental distress and depression a difference was found: the correlation was higher in the mTBI group (Z-score 3.15, $p = 0.002$).

Discriminant and ROC analysis

A discriminant analysis was performed to assess which combination of complaints could optimally distinguish between the two groups. The most discriminating complaints appeared to be (with discriminant loadings): headache (0.73), dizziness (0.63), noise intolerance (0.60), fatigue (0.59), increased need for sleep (0.56), forgetfulness (0.52), poor concentration (0.47), and balance disorders (0.42). The predicted membership, as based on the classification equation, was correct for 78.8% of the patients, of which 77.6% of the mTBI patients, and 81.6% of the TC patients. The eight most discriminating complaints were used to construct an unweighted scale. The scale was added as a predictor for group membership in an ROC analysis. The ROC-curve is depicted in Fig. 3. The area under the curve was 0.845 ($p < 0.05$). With a cut-off value of three complaints, the sensitivity was 64% and specificity was 94%.

Discussion

The main objective of this study was to identify differences in posttraumatic complaints between two cohorts of trauma patients comprising a group with brain injury and a non-brain injured trauma control group, focusing on frequency, clustering and relation with symptoms of anxiety and depression in the subacute phase after injury. In particular we aimed to find a specific profile to characterize the complaints of mTBI patients. The main finding was that most complaints were not only reported more often after mTBI, but also that they showed in combination a clearly different pattern when compared to the trauma control group. Factor analysis on the complaints reported by mTBI patients revealed a three-factor structure with factors labelled as: mental distress, physical discomfort and sensory disbalance. Correlating these three factors with anxiety and depression in both groups showed that the relation was strongest in patients with mTBI, in particular the relation between symptoms of depression and mental distress. Based on discriminant analysis, a discriminant function combining several complaints could allocate almost 80% of patients to the correct group, with as most discriminating complaints those that were all part of the mental distress factor.

Previous studies on mTBI outcome have focused on nature, severity and specificity of posttraumatic complaints. Several cohorts of mTBI patients have been compared to orthopaedic trauma controls and healthy controls, with the consistent finding that complaints are common in all groups and thus not always mTBI specific [5,11,16]. These studies did not emphasize that although posttraumatic complaints occur also after non-head trauma, the pattern in this group is clearly different. We identified 15 complaints that were reported significantly more often in the

Fig. 2. Correlations between total factors scores and HADS scores in patients with mTBI and trauma controls 2 weeks after injury.

Fig. 3. Receiver operating characteristic curve for prediction of group membership (mTBI vs. TC) based on an unweighted scale constructed of most discriminating complaints.

mTBI group. The five most common symptoms in the mTBI group were fatigue (63%), headache (56%), dizziness (53%), increased need for sleep (53%), and noise intolerance (43%). A similar pattern of most frequent complaints was found in earlier research [24,25]. The pattern of most frequently mentioned complaints among trauma control patients was clearly different: this group scored highest on trouble sleeping through the night (22%), fatigue (19%), arm pain (18%), trouble falling asleep (16%), and itchiness

(15%). The only overlapping complaint in these top-five complaints was fatigue. It seems likely that the mental/cognitive complaints in the mTBI group result in a mental fatigue, whereas the physical complaints in the TC group contribute to trouble falling asleep and sleeping through the night, thereby causing a more physical fatigue, which are considered distinctive features of fatigue [26]. Although these patterns are clearly different, both patient groups are limited in their return to daily activities. This indicates that complaints, whether they are of mental or physical nature, are problematic for a large group of ED-visiting patients. Since previous studies showed that complaints in the (sub)-acute phase are relevant for predictors for mTBI outcome, identifying the nature and profile of these complaints is of the utmost importance.

Through factor analysis on the mTBI data, three symptom factors were identified, with the “mental distress” factor accounting for the largest number of complaints and the largest amount of explained variance. Earlier studies have described smaller, more distinguishable domains such as the cognitive, somatic, or affective ones. Combinations of these domains are also common, depending on time of measurement and study cohort [10,17]. Complaints that are commonly described as being of cognitive nature (e.g. poor concentration, forgetfulness, and slowness in thinking) might become more apparent as a separate subset of complaints when resuming previous activities such as work or study. For example, Lundin et al. [27] found that poor memory and concentration were the most commonly reported symptoms three months after injury, whereas headache and dizziness were more prominent in the early phase, i.e. 1, 7, and 14 days after injury. The present study suggests that mental distress is an important underlying factor and influences functioning in the subacute phase after injury, causing the wide range of somatic, cognitive and affective complaints of mTBI patients. This hypothesis is supported by our findings on the correlations between the identified factors and anxiety and depression scores. The mental distress factor correlates strongly with anxiety and depression scores on the HADS in the mTBI group, especially when compared to the other factors and to the

correlation within the TC group. The performed discriminant analysis provides additional support for the explanation of general mental distress causing complaints in the subacute phase: the participants of this study could be allocated to the correct group (i.e. mTBI or TC) in 79% of cases with the most differentiating complaints in this respect being all part of the mental distress factor. The most discriminating complaints were used to construct a scale for predicting group membership, which showed a good sensitivity and specificity in ROC analysis. These arguments all converge to the assumption that the subacute phase after mTBI is very different from the same period after a non-brain trauma. The differences are characterized by a distinguishable pattern of complaints and a stronger relation with symptoms of anxiety and depression in the mTBI group.

The physical discomfort factor consists of three complaints indicating soreness in the upper extremity or neck and two complaints of sleep disturbances. Neither the frequency of sleep disturbances nor arm pain differed significantly between the mTBI and TC group. However, more than half of the TC group suffered from an upper extremity injury which is most likely to explain the relatively high scores on arm pain, which is the third most common complaint in the TC group. The physical discomfort construct could explain the disturbances in sleeping (e.g. due to pain), which is supported by earlier research in which sleeping issues were found to be included in the general somatic factor, together with other physical complaints [17,19]. Caplan and colleagues [28], however, found difficulty falling/staying asleep to be part of the affective factor, indicating a psychological explanation. This study was performed in a sample of US military soldiers, among whom PTSD is more common. PTSD is often accompanied by feelings of intrusion during night time [29], which most likely provides the explanation for an affective factor including sleep disturbances.

We described a relatively new factor sensory disbalance, with itchiness, dry mouth, tinnitus and hearing loss. All four complaints were infrequently reported in both study groups, with a prevalence of zero in the TC group for the latter two. These two ear-related complaints had high loadings on this factor, whereas itchiness and dry mouth had low loadings. Itchiness and dry mouth were introduced in the HISC to assess an increased tendency to complain, since these complaints are not considered to be related to the sustained brain trauma. We hypothesized that these complaints would correlate strongly with depression and anxiety scores on the HADS. However, the correlations found with the HADS were weak, which might be explained by the presence of the other two complaints of which this factor consists, which can be likely but infrequent consequences of brain injury. Furthermore, itchiness was a common complaint in the TC group probably due to treatment of various fractures with plaster, which commonly leads to dermal irritation. Moreover, both dry mouth and itchiness show loadings of comparable magnitudes on the mental distress and physical discomfort factors also, making interpretation of the factor more difficult. Hence, it may be the case that the specific combination of itchiness and dry mouth might be of use in assessing an increased tendency to complain for mTBI patients, but this conclusion cannot be drawn based on our present results.

This study was the first to relate different subsets of complaints (i.e. factors) with symptoms of anxiety and depression. Previous studies identified the importance of anxiety and depression in the development of complaints and outcome [30–33], but failed to identify to which complaints these mood disorders are most strongly related. The influence of symptoms of anxiety and depression in the early phase after injury seems to play the most important role in the mental distress factor, especially after a mild traumatic brain injury. This factor consists of somatic, cognitive as well as affective complaints, which are all frequently reported after

mTBI. Their co-occurrence with anxiety and depression indicates even stronger that mental distress is present in the sub-acute phase.

A high level of mental distress in the first few weeks after injury could in turn cause a delayed recovery and return to functioning. This post-acute mental distress should be signalled within the first few weeks after injury, to offer timely counselling or treatment that might prevent persisting complaints and problems with reintegration in work, study or community.

Limitations

Although our study provides new information into the development of complaints in two trauma cohorts, some limitations must be taken into account.

The primary goal of our study was to examine whether a specific subset of complaints could be identified for patients with mild traumatic brain injury. Therefore, we included a sample of orthopaedic trauma patients from the ED, with an expected full recovery within weeks as control patients. Even though we aimed at including a cohort as similar as possible, the cause of injury differed between our study groups, and mTBI patients were admitted to the hospital more often. However, other important parameters such as gender and pre-injury employment status did not differ between group, and the use of an orthopaedic trauma control group is widely accepted in mTBI research [5,10,11,34].

We used a different questionnaire than the widely accepted RPQ. Although the HISC is derived from the RPQ, some questions were added or left out. Applying a different questionnaire in another language could lead to challenges when comparing results with previous or future research. The list has, however, been used in a clinical and research setting for many years [20,30,35], and reported frequencies of complaints in our study were comparable to findings in similar study groups suggesting an adequate translation of complaints [11,4]. Lastly, test–retest analyses among healthy control subjects showed a high inter-item consistency, indicating a stable measurement tool. A cohort of mTBI or TC patients in the chronic phase after injury with stable complaints might have been more ideal to carry out these analyses on inter-item consistency. However former studies [7,8] have shown that healthy controls also report complaints in the posttraumatic spectrum and thereby may serve as a reliable group to investigate the consistency of the applied checklist.

Based on high rates of missing values on the question of decreased alcohol intolerance we decided to exclude this question for further analyses. The questionnaire does not offer a “not applicable” option and multiple patients indicated not to have drunk alcohol since their injury, making the tolerance impossible to assess. Furthermore, some questions might have been interpreted in different manners among patient groups. Slowness and fatigue could be viewed as either mental or physical complaints, which might provide for disturbed factors. Nevertheless, the general description of these common complaints could also be useful, as these complaints, whether they are of cognitive or physical nature, might both lead to disability and delayed return to work or study. An external independent validation in other study cohorts of the factors found in our analyses could give more insight into how robust these identified factor are, which could be the aim of future studies.

Another limitation in the interpretation of the reported complaints, which many mTBI researchers encounter, is the “good-old-days” bias, where patients perceive the pre-injury level of complaints on a lower level, leading to an overestimation of the difference with the current level [36,37]. Most studies only register the actual amount of complaints and with the use of the HISC we

attempted to correct for this bias by requesting the patients to actually score the pre-injury level.

Conclusions

This study demonstrated differences between two trauma populations on frequency, nature and pattern of reported complaints. The identified three-factor model in which complaints clustered in mTBI pertained to physical discomfort, mental distress, and sensory disbalance. The posttraumatic complaints that were most discriminating for the mTBI group were all part of the mental distress factor, which showed the highest correlation with depression. This indicates that the influence of especially depression but also anxiety is important after sustaining a trauma and that mental distress results in higher levels of complaints. Our findings provide valuable insight into a distinguishable subset of posttraumatic complaints occurring after a mild traumatic brain injury and might lead to intervention strategies aimed at decreasing psychological distress to enhance better functional outcome.

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Conflict of interest

None declared.

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