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Non-Hospitalized Patients with Mild Traumatic Brain Injury: The Forgotten Minority

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Abstract

Non-hospitalized mild traumatic brain injury (mTBI) patients comprise a substantial part of the trauma population. For these patients, guidelines recommend specialized follow-up only in the case of persistent complaints or problems in returning to previous activities. This study describes injury and outcome characteristics of non-hospitalized mTBI patients, and the possibility of predicting which of the non-hospitalized patients will return to the outpatient neurology clinic. Data from all non-hospitalized mTBI patients (Glasgow Coma Scale [GCS] score 13–15, $n=462$) from a prospective follow-up study on mTBI (UPFRONT-study) conducted in three level 1 trauma centers were analyzed. At 2 weeks, and 3 and 6 months after injury, patients completed questionnaires on post-traumatic complaints, depression, anxiety, outpatient follow-up, and resumption of activities. Most patients were male (57%), with a mean age of 40 years (range 16–91 years). Injuries were most often caused by traffic accidents (32%) or falls (39%). Six months after injury, 36% showed incomplete recovery as defined by the Glasgow Outcome Scale - Extended (GOS-E). Twenty-five percent of the non-hospitalized patients returned to the outpatient neurology clinic within 6 months after injury, of which one third had not completely resumed pre-injury activities. Regression analyses showed an increased risk for outpatient follow-up for patients scoring above the cutoff value for anxiety (odds ratio [OR]=3.0), depression (OR=3.5), or both (OR=3.7) 2 weeks after injury. Our findings underline that clinicians and researchers should be aware of recovery for all mTBI patients, preventing their transition into a forgotten minority.

Keywords: aftercare; follow-up; mTBI; outcome

Introduction

MILD TRAUMATIC BRAIN INJURY (mTBI) IS one of the most common neurological disorders seen in emergency departments (ED).^{1,2} After initial neurological examination to assess severity of injury and to identify possible risk factors for deterioration, approximately half of the patients are discharged home. In general, mTBI patients are expected to make a full recovery within weeks to months after injury, but ~15–20% develop persistent complaints and problems that interfere with resumption of previous activities.^{3,4} Most outcome studies lack differentiation between hospitalized and non-hospitalized patients,^{5,6} or only include hospitalized patients.⁷ Given the fact that non-hospitalized patients are among those with the mildest mTBI on the spectrum, it can be expected that they show a better and faster recovery than hospitalized patients; however, data supporting this assumption are not available.

Because of the expectation of good recovery, follow-up for non-hospitalized patients is only necessary in case of persistent complaints or problems in resuming pre-injury activities, according to

current guidelines.^{8,9} Conversely, these guidelines recommend that all admitted patients return at least once to the outpatient clinic, although it is acknowledged that only a part of this group will continue to experience persistent problems.^{3,4} Although it might seem reasonable to assume that persistent complaints are more frequent in the hospitalized group (considering the higher likelihood of a more severe injury), the dichotomy of hospital admittance can be regarded as a rather oversimplified way of deciding who is in need of aftercare. Currently, it is unclear which of the non-hospitalized patients might need aftercare or specific advice on management of complaints. Hence, there is a need for additional information to find arguments that might add to this discussion on the clinical practice of care for non-hospitalized mTBI patients.

To this end, the goal of the current study was to describe the characteristics of non-hospitalized patients with mTBI to gain better understanding of the milder end of the spectrum of the mTBI population. In particular, the aim was to investigate which of the non-hospitalized patients returned to the outpatient neurological clinic, to delineate this group of patients to identify the appropriate patient group in need for aftercare.

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Methods

Participants

This study was part of a prospective multi-center follow-up study (UPFRONT-study), comprising all mTBI patients >15 years of age who presented at the ED of three level 1 trauma centers covering major mixed urban and rural regions in the Netherlands. mTBI was defined by the attending neurologist or emergency physician by means of a Glasgow Coma Scale (GCS) score of 13–15, with post-traumatic amnesia (PTA)¹⁰ < than 24 h and/or loss of consciousness (LOC) <30 min.¹¹ Exclusion criteria were: injury >24 h before ED visit, addiction to alcohol or drugs, severe comorbidity, psychiatric history for which the patient was admitted to a psychiatric hospital, and inability to follow up (e.g., language barrier, homeless, living outside of referral region). For the current study, all patients admitted to the ward or intensive care unit (ICU) were excluded, leaving only those patients who were discharged directly from the ED. Hospital admission was based on clinical characteristics, defined by the European Federation Neurological Society (EFNS).⁸ In the ED, a brain CT scan was performed and classified according to the Marshall criteria,¹² scores were dichotomized into normal CT (score 1) and abnormal CT scan (score 2–6). Injury Severity Scores (ISS) were calculated based on hospital records.¹³

Measures

All participants of the UPFRONT-study received questionnaires at 2 weeks (T1), 3 months (T2), and 6 months (T3) after injury comprising items on complaints, mood, and outcome. For the current study, the following questionnaires were used.

Outpatient follow-up (OFU) (T1–3). At each time interval, patients were asked whether they visited one or several medical specialists (e.g., neurologist, surgeon). Patients were divided into groups based on OFU with neurologists within 6 months after injury. Patients reporting OFU at any moment were classified to the OFU group (with OFU). Patients who completed all three measurements and reported no OFU were classified as no outpatient follow-up (nOFU). In all cases, OFU was initiated by the patients, who were referred to the outpatient clinic by a general practitioner.

Head Injury Symptom Checklist (HISC) (T1–3). The assessment of post-concussive complaints was conducted by means of a checklist,^{4,14} comprising 21 common post-concussive complaints, which were scored on pre-injury and current levels. Dichotomized scores were calculated: 0=no increase and 1=any increase compared with pre-injury status.

Hospital Anxiety and Depression Scale (HADS) (T1). Feelings of anxiety and depression were measured using the HADS.¹⁵ Both anxiety and depression are scored by means of seven questions on a four point Likert scale. The cutoff value is set at 7 (range 0–28), above which patients are considered clinically depressed or anxious.

Impact of Event Scale (IES) (T1). To assess symptoms of post-traumatic stress, patients completed the IES, which is a 15 item questionnaire with scores ranging from 0 to 5.^{16,17} A cutoff value of 19 (range 0–75) is used to dichotomize patients into groups with and without serious symptoms of post-traumatic stress disorder.¹⁸

Return to Work (RTW) (T3). Return to work was defined as “returning to previous vocational or educational activities.” A return to work scale was applied for assessing partial or complete resumption, which was scored in three categories: 0=pre-injury work or study completely resumed, 1=pre-injury work or study partially resumed (i.e. work on a lower level or part time), 2=previous work or

study not resumed. For analyses, we dichotomized scores into complete versus incomplete and no resumption.

Glasgow Outcome Scale - Extended (GOS-E) (T3). The GOS defines outcome after TBI on an eight point scale, ranging from death (score=1) to complete recovery (score=8). Scores were dichotomized into complete recovery (score 8) and incomplete recovery (scores ≤7).^{19,20}

Statistical analyses

Data were analyzed with SPSS 22.0 (IBM SPSS Statistics, SPSS Inc, Chicago, IL). Patients and injury characteristics were compared using parametric (Student *t* test) and nonparametric (χ^2 , Mann–Whitney *U*) testing. Prediction of group membership (OFU vs. nOFU) was made with univariate and multivariate binary logistic regression analyses.

Results

All mTBI patients arriving at the ED were screened for participation. In total, 25% was excluded based on various criteria: 5% alcohol/drug addiction, 10% psychiatric history, 5% inability to

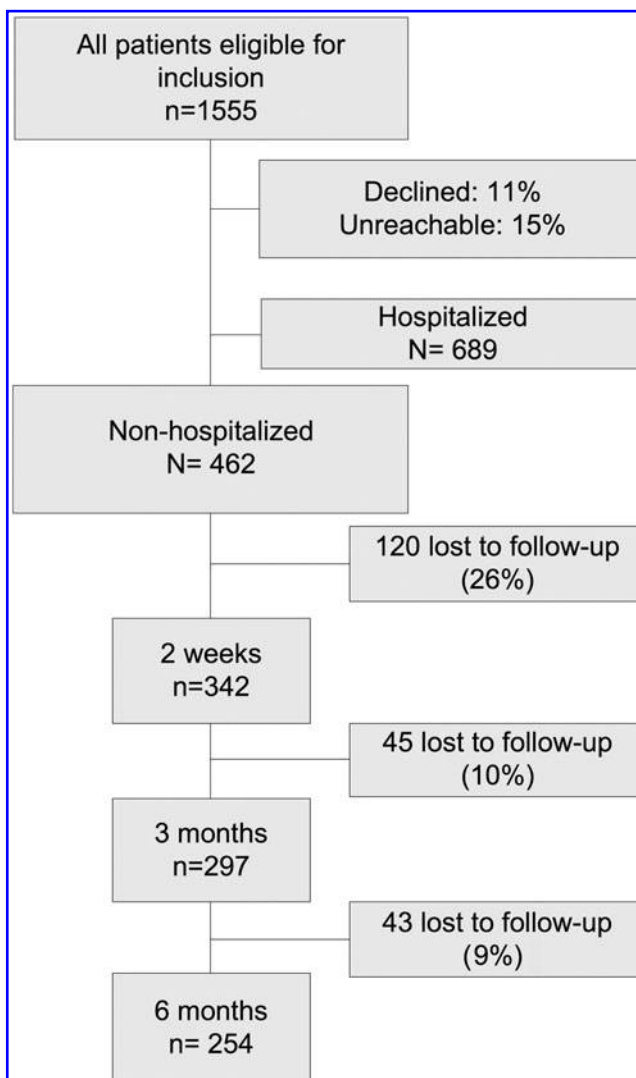


FIG. 1. Flow chart of all participants and follow-up moments.

follow up, and 5% other reasons. Of those considered eligible for inclusion ($n=1555$), 11% declined and 15% could not be contacted, leaving in total 1151 patients to be included in the UPFRONT-study, of which 40% ($n=462$) were discharged directly from the ED. Questionnaires were returned by 342 patients at 2 weeks, by 297 patients at 3 months, and by 254 patients at 6 months (55%) after injury. Figure 1 shows a flow chart of all participants and follow-up moments. Patients who returned the first questionnaire ($n=342$) were older (42.6 [17.1] vs. 34.8 [18.6], $p<0.05$) and more often female (46% vs. 33%, $p=0.017$) than those who did not complete the first questionnaire ($n=120$). Table 1 provides patient and injury characteristics for the entire non-hospitalized group ($n=462$).

In total, 291 patients provided information on outpatient follow-up with the neurologist, of which 25% returned to the outpatient clinic within 6 months after injury. None of the patient or injury

characteristics described in Table 1 differed between patients returning for follow-up (OFU, $n=73$) and patients not returning for follow-up (nOFU, $n=218$).

Outcome after 6 months was obtained for 81% of nOFU patients and 78% of OFU patients. Outpatient follow-up patients reported more complaints (6.0 [5.5] vs. 2.9 [3.8], $p<0.05$), a lower percentage of complete work resumption (67% vs. 90%, $p<0.05$), and a lower percentage of complete recovery according to GOS-E scores (49% vs. 69%, $p<0.05$) than nOFU patients. In total, 12 patients (4%) were involved in a case concerning litigation and/or compensation.

Predictors for outpatient follow-up

Patients returning for outpatient follow-up within 6 months after injury (OFU patients) were compared with patients who were not seen for follow-up (nOFU). Two weeks after injury, OFU patients were more often depressed and anxious than nOFU patients (31% vs. 11%, $p<0.001$ and 37% vs. 17%, $p<0.001$). The groups did not differ significantly on the impact of event scale (46% vs. 34% above the cutoff, $p=0.09$) and amount of post-traumatic complaints after 2 weeks (6.3 vs. 5.2, $p=0.09$). The level of complete work resumption was also comparable between groups (57% vs. 60%, $p=0.77$). Univariate and multivariate logistic regression analyses with dependent variable outpatient follow-up and independent variables age, gender, anxiety, depression, post-concussive complaints, and impact of event are summarized in Table 2.

Discussion

This article focused on characteristics, outpatient follow-up, and outcome of non-hospitalized mTBI patients. Six months after injury, outcome was not as good as we had expected. Patients had, on average, four post-traumatic complaints, and 36% showed incomplete recovery as defined by the GOS-E. Within 6 months after injury, one in four of the non-hospitalized patients returned to the outpatient neurology clinic, of which one third had not completely resumed their pre-injury work or study. The patients seen at the

TABLE 1. PATIENT CHARACTERISTICS

Patient characteristics	All non-hospitalized patients (n = 462)
Age, years, mean (SD)	40.6 (18.5)
Range	16–91
Male gender	57.4
Pre-injury employment ^a	70.9
Retired	13.4
Unemployed	15.7
<i>Injury characteristics</i>	
Cause of injury	
Traffic	
Motor vehicle accident	12
Bicycle accident	28
Pedestrian accident	2
Fall/jump	39
Violence	12
Sport injury	3
Other	4
ISS score, mean (SD)	5.22 (1.8)
Alcohol usage day of injury	31.6
GCS score	
13	1
14	12
15	87
Post-traumatic amnesia	
None	19
<1 h	70
1 h – 1 day	11
Loss of consciousness	85
CT abnormalities	2.0
<i>Six month outcome</i>	
Number of complaints, mean (SD)	3.6 (4.5)
Complete work resumption ^b	86
GOS-E, complete recovery	64

Values are represented by percentages, if not specified otherwise.

^aPre-injury employment includes vocational and educational activities.

^bOnly patients with pre-injury employment.

ISS, Injury Severity Score; GCS, Glasgow Coma Scale; GOS-E, Glasgow Outcome Scale Extended.

TABLE 2. UNIVARIATE AND MULTIVARIATE LOGISTIC REGRESSION ANALYSES WITH DEPENDENT VARIABLE OUTPATIENT FOLLOW-UP

	B(SE)	SE	p value	Odds ratio (95% CI)
<i>Univariate regression</i>				
Age	0.003	0.01	NS	1.0 (1.0–1.0)
Gender	–0.517	0.22	NS	0.9 (0.5–1.5)
HADS, anxiety	1.097	0.32	0.001	3.0 (1.6–5.6)
HADS, depression	1.253	0.35	<0.001	3.5 (1.8–7.0)
HADS, anxiety and depression	1.301	0.39	0.001	3.7 (1.7–7.9)
Post-concussive complaints	0.053	0.03	NS	1.1 (1.0–1.1)
Impact of Event scale	0.012	0.01	NS	1.0 (1.0–1.0)
<i>Multivariate regression</i>				
Constant	–1.462	0.18		
HADS, anxiety	0.279	0.45	NS	1.3 (0.5–3.2)
HADS, depression	1.097	0.471	0.02	3.0 (1.2–7.5)

$R^2=0.05$ (Cox and Snell), 0.07 (Nagelkerke). Model $\chi^2(2)=12.81$, $p=0.002$.

HADS, Hospital Anxiety and Depression Scale.

outpatient clinic were more often depressed and/or anxious 2 weeks after injury than those patients not seen at the outpatient clinic, whereas no differences were found in post-traumatic complaints or pre-injury (e.g., age, gender, employment status) and injury characteristics (e.g., GCS, ISS, or PTA).

The finding that 25% of non-hospitalized patients presented themselves at the outpatient clinic within 6 months after injury is rather remarkable, given the supposed good recovery of this patient group. Predicting which patients need outpatient follow-up is not possible in the ED, because neither injury nor patient characteristics differed between OFU and nOFU patients. Two weeks after injury, both groups reported the same number of post-traumatic complaints and the same level of work resumption. However, patients seen for outpatient follow-up were more often depressed and/or anxious. Both variables showed a threefold risk for outpatient follow-up in univariate regression. The higher odds ratio for depression, and the stronger effect over anxiety in the multivariate model shows that depression is a more important predictor in this respect, which has also been established in earlier studies.^{21,22} A combination of both mood disorders showed an odds ratio of almost four, meaning that patients scoring above the cutoff for both anxiety and depression as early as 2 weeks after injury, had a four-times increased risk of returning to the outpatient clinic with delayed recovery.

Given the high incidence of mTBI, it would be of great value to identify in a timely manner which patients are in need for outpatient follow-up, especially as one in three patients returning to the outpatient clinic had not resumed vocational or educational activities after 6 months. Also, in the nOFU group, 1 in 10 patients had failed to resume pre-injury activities. Both groups combined showed that a substantial portion of non-hospitalized patients who were employed before injury struggled with work or study resumption. This pattern was also demonstrated in GOS-E scores, in which almost one third of the patients who were not seen for follow-up did not reach complete recovery within 6 months after injury. This indicates that problems not only arise in vocational reintegration, but also in overall outcome and resumption of social activities. The patients who returned for outpatient follow-up within 6 months after injury were already, at 2 weeks after injury, more anxious and depressed. Apparently, problems with resumption of previous activities become clear after a certain time interval post-injury, during which the non-emotionally distressed patients seem to recover. This suggests that patients had been struggling with their problems for a while, before being seen by a neurologist, with possible loss of work productivity that could have been prevented. Currently, outpatient follow-up is recommended for all hospitalized mTBI patients,⁸ whereas for non-hospitalized patients, specialized follow-up is restricted to those with persistent complaints or problems returning to previous activities. Because the outcome figures in our study are comparable to a recent study of mTBI, which included both hospitalized and non-hospitalized patients, we suggest it would be reasonable not to make such a considerable distinction between these two groups when defining aftercare.²³

Based on the finding that outcome for non-hospitalized patients is not always as good as expected, and that emotional distress 2 weeks after injury seems to be of influence, we propose a change in clinical policy for non-hospitalized mTBI patients. We believe it could be feasible to contact all patients to assess post-traumatic complaints and feelings of depression and anxiety to identify at-risk patients for unfavorable outcome. Patients with post-traumatic complaints and an indication of emotional distress (based on the HADS questionnaire), should receive additional information on the

course of recovery after mTBI. Telephonic aftercare in the subacute phase of mTBI, and additional information on outcome and management of complaints, has been shown to be productive in symptom reduction.^{24,25} The most appropriate setting for information provision (e.g., during telephonic counseling or at the outpatient clinic) was not part of this study, and should be studied more extensively in the future. Although we realize that more extensive follow-up of mTBI patients might pose the risk of unnecessary care consumption, early signaling could, in the long term, not only reduce the indirect costs of mTBI from lost work productivity, but might also prevent long-term outpatient follow-up visits and the associated diagnostic costs (i.e., magnetic resonance imaging, neuropsychological examination).

Although this study provides valuable information concerning outcome and follow-up of non-hospitalized mTBI patients, some considerations regarding the generalizability of our results should be taken into account. The admittance rate in our study was somewhat higher than in other mTBI studies,²⁶ probably related to the inclusion of physically injured patients, which comprised 15% of our cohort. Although this makes comparison between studies challenging, mTBI is often accompanied by non-head injuries, which makes the inclusion of these patients important when discussing the entire group. However, as a result of the exclusion criteria of the UPFRONT-study, patients with alcohol and/or drug abuse, and patients with a psychiatric history requiring admission were not included, mostly because of anticipated follow-up problems.²⁷ These patients also form an important subgroup of the mTBI population, with more problems recovering from their trauma than the general population. Although we acknowledge that including these patients would form a better representation of the entire mTBI spectrum, our results provide insight into a cohort of patients of varying ages who might benefit from early recognition of unfavorable recovery. Another generalization problem is related to patient dropout in longitudinal follow-up studies, which mostly concerns those with good recovery.²⁸ In our study, patients returning the first questionnaire were older and more often female, creating a possible bias in the results. Notwithstanding these limitations, we think that we have provided valuable information that improves the understanding of the recovery trajectory of the entire spectrum of mTBI, as our study is conducted among a large sample of mTBI patients, with acceptable dropout rates. With this study, we hope to increase awareness for non-hospitalized mTBI patients and press for more research on outcome and treatment possibilities for this particular group of patients, a TBI minority that should not be forgotten.

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Author Disclosure Statement

No competing financial interests exist.

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