ORIGINAL ARTICLE

Characteristics of a Mild Head Injury Subgroup With Extreme, Persisting Distress on the Rivermead Postconcussion Symptoms Questionnaire

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ABSTRACT. Kirsch NL, de Leon MB, Maio RF, Millis SR, Tan-Schriner CU, Frederiksen S. Characteristics of a mild head injury subgroup with extreme, persisting distress on the Rivermead Postconcussion Symptoms Questionnaire. Arch Phys Med Rehabil 2010;91:35-42.

Objective: To examine baseline variables and identify characteristics of participants with extremely high reports of symptoms (ie, outliers) 12 months after mild head injury (MHI).

Design: A prospective cohort study of MHI with and without loss of consciousness (LOC) and/or posttraumatic amnesia (PTA) recruited from and interviewed at the emergency department (ED), with a follow-up telephone interview at 12 months.

Setting: Level II community hospital ED.

Participants: Participants (n=58) with MHI and LOC less than or equal to 30 minutes and/or PTA less than 24 hours and participants (n=173) with MHI but no PTA/LOC. Inclusion criteria: age greater than or equal to 18 years, less than or equal to 24 hours after injury, Glasgow Coma Scale score greater than or equal to 13, and discharge from the ED. Fourteen (6%) participants had extremely high scores on the Rivermead Postconcussion Symptoms Questionnaire (RPQ).

Main Outcome Measures: RPQ and questions on health services use and litigation.

Results: Characterizing the outlier cases are prior head injury, preinjury disability, history of substance use, unemployment, and elevated somatic symptoms at the ED. At 12 months, outliers had higher use of health services and litigation.

Conclusions: The existence of a subgroup with a distinctive pattern of baseline characteristics in combination with elevated somatic symptoms at the time of presentation to the ED suggests that further taxonomic distinctions may be warranted for the MHI population, each requiring appropriately targeted interventions for addressing symptomatic complaints.

Key Words: Brain injuries; Rehabilitation.

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ESTIMATES OF THE RATE of persisting symptoms after MHI range from 6%[1] to 24% to 40%.[2-4] These include (1) alterations in cognitive ability[5-7]; (2) changes in mood, personality, and behavior[6,8-10]; (3) limitations of everyday functioning,[11] such as disrupted work status[3,6,12,13]; and (4) limited participation in social activities.[9,14-16]

The persistence of these symptoms after MHI has remained a perplexing phenomenon,[17,18] because recovery patterns often appear inconsistent with the degree of known neurologic impairment or accident characteristics. For example, several studies have demonstrated a dose effect for MHI, such that increasing injury severity is associated with increasing symptom severity.[19-21] However, others have been unable to demonstrate such an effect,[5,22,23] or counterintuitively, report that patients having milder head injury also have worse outcomes.[22,24-30]

As a result of these observations, it has become increasingly important to examine the clinical characteristics of various MHI subgroups, including those with and without neurologic changes. The purpose of this study is to examine preinjury (ie, baseline) and injury characteristics of a subgroup of outliers with highly elevated postconcussion complaints 1 year after MHI and to determine which of these characteristics differentiate the outlier subgroup from other MHI patients. In order to place this subgroup into perspective, we first briefly describe other proposed taxonomic subclassifications of the MHI population for whom persisting symptomatic complaints have been attributed to various causes. Factors associated with persisting symptoms after MHI include identifiable neuropathology, psychologic response to the injury or traumatic event, motivation, and specifically pertinent to this study, baseline characteristics.

Neurologic changes after MHI, in particular white fiber changes that are detectable with diffusion tensor imaging,[31,32] and their resolution over time have been reported.[33,34] However, to the limits of our review, and as recently noted,[35,36] no prospective studies have as yet been published that demonstrate

List of Abbreviations

ED	emergency department
GLM	General Linear Model
LOC	loss of consciousness
MHI	mild head injury
MTBI	mild traumatic brain injury
PTA	posttraumatic amnesia
RPQ	Rivermead Postconcussion Symptoms Questionnaire

an association between changing symptom patterns and white fiber status.

Alternative nonphysiologic explanations for persisting symptoms have also been proposed. Depression,[19,37,38] posttraumatic stress disorder,[19,39] limited social support,[39] difficulties with social integration,[15] expectations of poor outcomes,[40-42] and misattribution of preinjury symptoms to a recent trauma[43-45] all may individually contribute to protracted recovery. Decreased motivation associated with injury-related compensation has also often been identified as predictive of delayed recovery.[9,17,46-48] Conversely, the role of motivation can be inferred from studies of sports-related MHI. In this cohort, the estimated recovery period is shorter, with symptoms returning to baseline within 7 to 14 days,[49-51] in contrast with non–sports-related MHI, with estimated recovery often extending over 3 to 12 months.[1,4,17,52,53]

Last, baseline functioning has been reported to be related to poor outcomes after MHI. Preinjury physical health,[54,55] psychologic health,[27,56,57] and social functioning[14,56] have been identified as predictors of persisting symptoms more so than, or instead of, head injury characteristics.

In our earlier work, we reported the predictive value of preinjury health status for persisting fatigue[30] and postconcussion symptoms.[54] We specifically found that a subgroup of patients with MHI without PTA or LOC had worse outcomes than a group with nonhead injuries and a group having sustained more severe MHI—that is, with PTA or LOC. This paradoxical finding, similar to those of several studies cited,[22,24-30] led us to explore possible differences between these MHI subgroups.

It should be noted that we use the term MHI rather than MTBI based on the distinction proposed by Kay et al.[58] Additionally, we follow the recommendation of McLean and Clauw[59] to use neutral and descriptive rather than definitive classification terms because of the uncertainty of pathogenesis of symptoms after head injuries. In this study, we use the descriptive terms "with or without PTA or LOC" to describe the 2 MHI groups. These descriptive terms are part of the criteria in the case definition of MTBI as proposed by the American Congress of Rehabilitation Medicine.[60]

In contrast with our earlier work, which reported outcomes for our entire MHI sample,[30,54] for this report, we focus analyses on a subsample of outlier participants (extracted from our larger, previously reported sample) who had extremely high scores on the RPQ 12 months after injury. We hypothesize that these outlier cases represent a coherent subgroup of persons with MHI. We specifically examine baseline (ie, preinjury and injury) variables to identify distinctive characteristics of this outlier group.

METHODS

Data for this study were derived from a larger data set that prospectively investigated postconcussion symptoms and other outcomes.[30,54] The study protocol was approved by the institutional review boards of the University of Michigan Medical School, Saint Joseph Mercy Health System, and the Michigan Public Health Institute.

Participants

Procedures regarding recruitment and data collection are comprehensively presented in our earlier work.[30,54] To summarize, participants comprised an inception cohort of patients with minor head and nonhead injury evaluated and discharged directly from the ED. Inclusion criteria were age greater than or equal to 18 years, Glasgow Coma Scale score greater than or

equal to 13, not meeting the institution's criteria for activation of the adult trauma team, presentation to the ED within 24 hours of injury, and direct discharge from the ED. Exclusion criteria were transfer from another hospital and inability to speak English. Participants were classified as having had a head injury based on evidence in the medical record and patient responses to multiple questions regarding indicators of an injury to the head, altered consciousness, or accident characteristics that indicate a blow to the head. All discrepancies were resolved by attending medical staff. LOC and PTA were likewise determined through the medical record and self-report, and patients were excluded if any of the following were true: LOC greater than 30 minutes, LOC not attributable to head trauma, PTA greater than 24 hours, or patient still in state of PTA at the time of interview (Galveston Orientation and Amnesia Test score <76). When PTA length could not be determined, it was estimated to be less than 24 hours if the patient was interviewed and clear of PTA within 24 hours of the presenting injury. The rigorous procedures of determining group membership are illustrated in a previous article (fig 1).[30] From the larger cohort, we derived 2 MHI subgroups: a group with LOC less than or equal to 30 minutes and/or PTA less than or equal to 24 hours (head injury with PTA and/or LOC) and a group without any PTA or LOC (head injury only).

The sample size at the ED was 339 participants with MHI (head injury with PTA and/or LOC, n=94; head injury only, n=245). Retention rates at 12 months postinjury were 62% for the head injury with PTA and/or LOC group (n=58) and 71% for the head injury only group (n=173).

Identification of outliers. From this data set, an outlier subsample was extracted. A conservative criterion of 2.0 SDs above the RPQ study sample mean at 12 months (mean ± SD, 12.0±15.2; cut-off RPQ score=42) was established for determining outlier status. Fourteen outlier cases were thus identified from the total sample of 231 (6%), with 13 (8%) of 173 participants with head injury only and 1 (2%) of 58 participants with head injury with PTA and/or LOC.
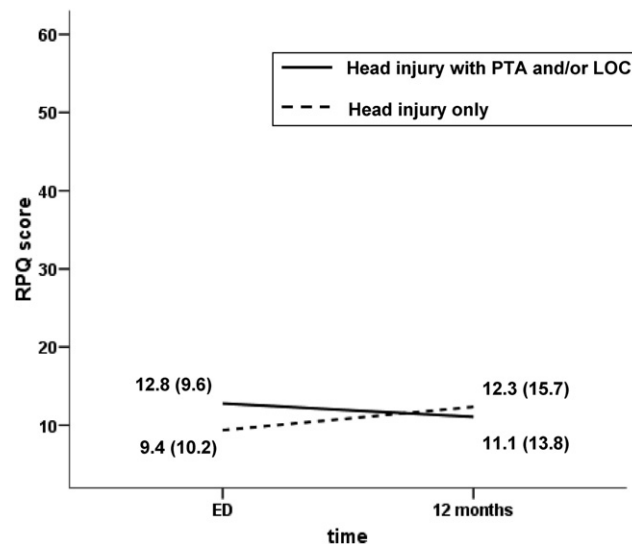

Fig 1. RPQ mean scores (SD) at ED and 12 months of the head injury with PTA and/or LOC (n=58), and head injury only groups (n=173).