

What a headache! Reviewing mild traumatic brain injury management in a new trauma service

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ABSTRACT

AIM: Mild traumatic brain injury (mild TBI) is a common, poorly managed condition with an underestimated impact and inadequate follow-up. This study aimed to assess local practice in terms of assessment and follow-up.

METHODS: A retrospective review of all patients presenting to Christchurch Hospital between 1 August 2019 and 30 September 2019 with ICD-10 coded diagnosis of head trauma was conducted. Patients younger than 16 or older than 80 years who had a concurrent medical illness or who did not meet diagnostic criteria for mild TBI were excluded. This was to minimise diagnostic uncertainty where patients may have had mild TBI like symptoms due to alternate pathology. Primary outcomes included documentation of post-traumatic amnesia (PTA) with the Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS), provision of mild TBI information, the proportion referred for follow-up and the proportion followed up at the mild TBI clinic. Demographic data included age, sex, ethnicity, mechanism of injury, admission service and rate of admission.

RESULTS: A total of 525 patients were identified, with 239 patients included. Median age was 29 years (IQR 22–50) and 65.3% (n=156) were male. The most common mechanisms of injury were falls (25.5%, n=61) and assault (25.5%, n=61). The most-commonly recorded diagnosis was head injury (41.4%, n=99), followed by concussion (34.3%, n=82). A-WPTAS was documented for 4.2% of patients (n=10). The provision of written mild TBI advice to patients was documented in 61.5% of cases (n=147). On discharge, no follow-up was documented for 63.6% of patients (n=152). In those with documented follow-up, 23.4% (n=56) was with a general practitioner (GP) and 5.4% (n=13) were referred to mild TBI clinic. Review of Accident Corporation Commission (ACC) records identified claims for 80.3% (n=192) of the cohort. Of these, 11.5% (n=22) received a payment for mild TBI services and 2.1% (n=4) had their service provided by Christchurch Hospital.

CONCLUSION: The results suggest that current management of mild TBI at Christchurch Hospital needs improvement. Accurate diagnostic coding allows patients to access ACC-funded clinics. The utilisation rates of these clinics confirm that the frequency of specialist follow-up is low, which is in keeping with the international literature. Furthermore, given the strongly predictive nature of post-traumatic amnesia for outcomes, the low rate of A-WPTAS assessment is concerning. These results suggest that a mild TBI protocol is needed to standardise assessment, management and follow-up.

Mild traumatic brain injury (mild TBI) represents a significant burden of morbidity and health expense. An estimated 36,000 traumatic brain injuries (TBIs) occur in New Zealand each year, with a large proportion of these being mild.¹ Indeed, the incidence of mild TBI in New Zealand has been reported as high as 749

per 100,000 people per year.² Rates of TBI in Australia have been reported as high as 107 per 100,000 people per year.³ Morbidity can include ongoing headaches, dizziness, nausea, as well as cognitive, mood and sleep disturbance, all of which can significantly impact on quality of life.^{4,5} Furthermore, the incidence of mild TBI is also likely under-

estimated due to underdiagnosis, which precludes follow-up and may result in worse long-term outcomes. These concerns are corroborated with the high proportion of missed diagnoses in the emergency department (ED) and the low rate of follow-up seen in two recent large cohort studies.⁴⁻⁶

TBIs also incur significant costs for the health system. In a 2014 population-based study of TBI patients, an incidence-based cost of illness model estimated the total lifetime cost per person with mild TBI in New Zealand as NZD \$6,878 (95% CI: 5573–8251).⁷ While on a case-by-case basis this is lower than for moderate/severe TBI, the high prevalence of mild TBI meant the total cost of mild TBI treatment was three times higher than for the moderate/severe group.⁷ This is in keeping with data showing between 20–47.9% of individuals suffering from mild TBI will have ongoing symptoms at one year follow-ups.^{8,9}

The harm caused by mild TBI is recognised in the TBI strategy and action plan of the Accident Corporation Commission (ACC),¹ an organisation providing compulsory insurance cover for personal injury for all New Zealand citizens. Current recommendations for the management of mild TBI include accurate diagnosis, assessment of post-traumatic amnesia (PTA), information provision and consideration of follow-up.^{1,5,10-12} In view of these factors, this study aims to assess current practice at Christchurch Hospital and consider avenues for improvement.

Methods

Population

A retrospective review of all patients presenting to Christchurch Hospital ED between 1 August 2019 and 30 September 2019 with International Classification of Disease Tenth Revision (ICD-10) coded diagnosis of head trauma was conducted.¹³ As an audit, this study was outside the scope of Health Disability Ethics Committee review, though local registration was performed. Where patients were admitted, clinical coding was performed by dedicated clinical coders. Alternately, when discharged directly from ED, clinical coding was performed by departmental staff. Christchurch Hospital is a 620-bed hospital serving

a population of approximately 630,000 people of the broader Canterbury region. The emergency department had 100,000 presentations in 2019. Patients younger than 16 or older than 80 years who had a concurrent medical illness or who did not meet diagnostic criteria for mild TBI were excluded.

Mild TBI

Clinical case notes were reviewed to ascertain whether all patients met World Health Organization criteria for mild TBI,¹⁴ defined as: (1) confusion or disorientation, loss of consciousness for up to 30 minutes, any loss of memory for events immediately before or after the injury and/or transient neurologic deficit; (2) acute Glasgow Coma Score (GCS) of 13 to 15 on presentation to hospital. All those meeting the inclusion criteria, without documented GCS but no exclusion criteria were included as mild TBI.

Data extraction

Data were extracted from the patient records. These included age, gender, ethnicity, mechanism of injury, admission service, findings on neurological examination and rate of admission. National Health Index (NHI) numbers, an anonymised national health identifier, were cross referenced with ACC databases to identify those who had a claim submitted, as well as those who received follow up in a mild TBI clinic.

Outcomes

The primary outcomes included the documentation of PTA with the Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS) by the attending ED physician, documented provision of a standardised mild TBI information sheet, the proportion of patients referred for follow-up and the proportion who attended follow-up at a mild TBI clinic.¹⁵ The information sheet describes the nature of symptoms, management strategies and recommendation to seek follow-up if symptoms are not resolving.

Statistics

Categorical variables are expressed as frequencies (n) and percentages. Continuous variables are presented as median and interquartile range (IQR). Statistical analysis was conducted using IBM SPSS for Windows version 22 (IBM Corp., Armonk, N.Y., USA).

Results

Patient demographics

During the two-month data collection period, there were 5,315 trauma presentations to the emergency department, of whom 525 were identified as having ICD-10 coded head injury, broadly defined as a trauma to the head or face. There were 239 patients who met the mild TBI criteria defined above and were included in the study (Figure 1). The median age was 29 years (IQR 22–50) and 65.3% were male (n=156). Falls and assaults each accounted for 25.5% of admissions (n=61), and sporting accidents accounted for 25.5% (n=36).

Diagnosis

The most commonly recorded diagnosis by the attending ED physician was head injury (41.4%, n=99), followed by concussion (34.3%, n=82). A-WPTAS testing was documented for 4.2% (n=10). Head injury advice was documented in 61.5% of patients (n=147).

Follow-up

On discharge, no follow-up was documented for 63.6% of patients (n=152). In those with documented follow-up, 23.4% (n=56) was with a general practitioner (GP) and 5.4% (n=13) were referred to mild TBI clinic. Review of ACC records identified claims for 80.3% (n=192) of the cohort. Of these, 11.5% (n=22) received ACC-funded payment and attended a mild TBI clinic, including both community clinics and

clinics at Christchurch Hospital. Only 2.1% (n=4) attended a mild TBI clinic at Christchurch Hospital.

Discussion

Mild TBI represents a common presentation with significant morbidity. Mild TBI symptoms include headaches, fatigue, memory loss and a resultant inability to perform work and activities of daily living.^{11,12,16} The current management at our institution appears suboptimal given the low rates of definitive diagnosis, A-WPTAS testing, information provision and follow-up. The lack of definitive diagnosis and A-WPTAS testing may impede patients from accessing ACC-funded clinics, which may negatively impact outcomes.

Significant concerns have been raised in the literature regarding the underdiagnosis of mild TBI.¹⁷ The heterogeneity in diagnostic criteria for mild TBI likely contributes to this.¹⁷ Broadly, a mild TBI is considered where trauma leads to a mild temporary impairment of neurological function that improves with time. Criteria include timing of recovery, degree of GCS deficit and associated symptoms, including headache, nausea and PTA.^{11,12,16} A prospective cohort study of 197 patients presenting to a level one trauma centre by Powell et al found that in 56% of patients meeting diagnostic criteria for mild TBI did not have this diagnosis recorded by ED physicians.⁶ The heterogeneity of terminology and diagnosis is reflected in this study, in which

Figure 1: Inclusion and exclusion criteria.

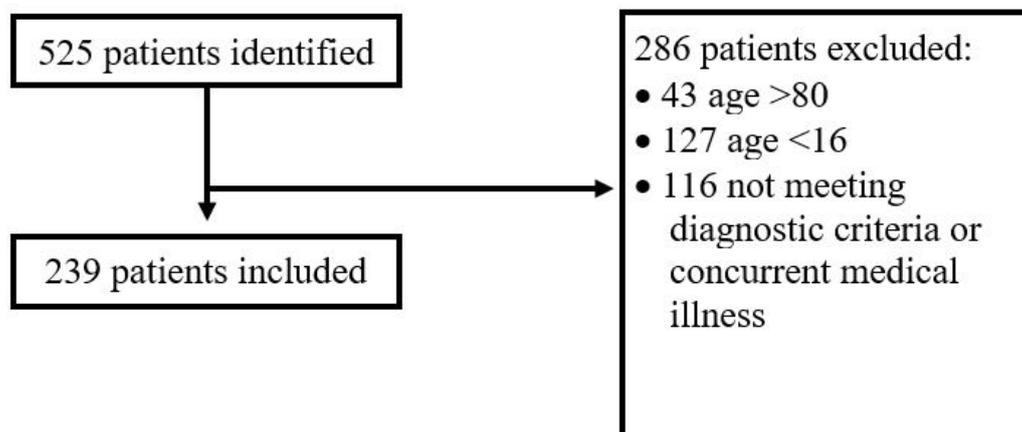


Table 1: Patient demographics.

Mild traumatic brain injury group		
Factor	Categories	n(%)
Age (Median)	29 years	IQR 22–50 years
Sex	Male Female	156 (65.3%) 83 (34.7%)
Mechanism	Fall Assault Sport Motor vehicle accident Other ¹	61 (25.5%) 61 (25.5%) 36 (15.1%) 35 (14.6%) 46 (19.2%)
Diagnosis ²	Concussion Head injury No diagnosis Traumatic Brain Injury	82 (34.3%) 99 (41.4%) 57 (23.8%) 1 (0.4%)
Neurological examination	Normal Positive findings	215 (90%) 24 (10%)
Computerised tomography head	Yes No	100 (41.8%) 139 (58.2%)
Admitted	Yes No	106 (44.4%) 133 (55.6%)
Admitted for mild traumatic brain injury	Yes No	63 (26.4%) 176 (73.6%)
Admission speciality ³	Emergency medicine Orthopaedics Neurosurgery General surgery Other specialities ⁴	79 (74.5%) 10 (9.43%) 7 (6.63%) 6 (5.66%) 4 (3.77%)
Provision of written mild head injury advice ⁵	Yes No	147 (61.5%) 92 (38.5%)
Referral for follow up ⁶	No Mild traumatic brain injury clinic General practice Specialist outpatient clinic	152 (63.6%) 13 (5.4%) 56 (23.4%) 18 (7.5%)
Attended clinic in those with documented Accident Corporation Commission claim	Yes No	22 (11.5%) 172 (89.5%)
Abbreviated Westmead Post-Traumatic Amnesia Scale	Yes No	10 (4.2%) 229 (94.1%)

¹ Mechanism of injury other than those seen above, including pedestrian, horse etc.² Defined as the diagnosis listed in the emergency department documentation.³ Speciality who were responsible for the patient as an inpatient.⁴ Including plastic surgery, intensive care, general medicine etc.⁵ Defined as documentation of advice recorded in emergency department notes.⁶ Defined as being seen in the outpatient and GP setting following discharge from hospital.⁷ Defined as symptoms including headache, fatigue, inability to focus, confusion.

no patients were diagnosed with mild TBI; rather, 41.4% of patients were diagnosed as suffering from a head injury. This is non-specific and may refer to other types of head injury, such as contusions or lacerations. The current literature reflects the underdiagnosis of mild TBI and the broader issue seen across multiple centres.^{6,17} Lack of diagnosis precludes information provision and access to follow-up. Given then that information provision may result in less symptoms at follow-up, it is possible that this is adversely contributing to outcomes.^{18–20}

Recommendations for the management of mild TBI have highlighted three key facets of care.¹⁰ These involve prospective assessment of PTA, clinical decision tool-guided use of computed tomography (CT) and provision of written and verbal advice on discharge. Prospective assessment for PTA is important as it both increases the sensitivity of diagnosis and allows for prognostication as well as determination of discharge disposition from ED. Assessment can be performed using the A-WPTAS. It is therefore concerning that A-WPTAS testing was documented for only 4.2% of patients (n=10). This is in keeping with prior studies that have shown a low rate of PTA assessment in ED (1.4–40%).^{6,10} Given that PTA assessment increases accuracy of diagnosis and provides prognostic information, the low rate seen is concerning.^{10,21} It should be noted that currently Christchurch ED does not have a formalised protocol advocating the use of the A-WPTAS in the assessment of mild TBI. Rather, assessment and management are at the attending physician's discretion, which may result in a lack of familiarity with its use. Overall, 41.8% (n=100) patients underwent CT head imaging. This approached internationally reported rates, which range between 44–79%.^{10,22} The provision of verbal and written advice may improve patient outcomes.²³ At Christchurch Hospital there is a standardised mild TBI information sheet, and provision is the responsibility of the treating clinician team. The lack of documentation around information provision in this study at 38.5% is concerning,²⁴ especially when compared to a survey of representative ED and GP practices in New Zealand for which the information provision rate following mild TBI is 45.9%

for all services and 93.4% for ED practices. However, it should be noted that the retrospective nature of this study means that the rate of head injury advice provision is likely underestimated, as it relies on accurate clinical documentation. In some cases, information may have been provided, but this was not documented. Overall, the results from this study suggest that current service provision is not meeting practice recommendations for the management of mild TBI.

There is evidence to suggest that mild TBI has significant long-term impact on health outcomes, with up to 53% of individuals reporting persisting symptoms at one year.^{5,9,25} Although the evidence regarding the effectiveness of interventions has been mixed, post-injury follow-up may help to mitigate symptoms.¹² Given that we currently cannot accurately predict those who will go onto experience long-term morbidity, all patients presenting with mild TBI symptoms need accurate diagnosis, information provision and consideration of follow-up. In New Zealand, mild TBI clinic services are available free of charge through ACC, but access to these services requires a diagnosis and a referral. Given then that follow-up services are available, the proportion of patients accessing these is low. This likely reflects the lack of A-WPTAS testing and a formal diagnosis of mild TBI, both of which are included in the ACC referral pathway.²⁶ Earlier work by Snell et al²⁷ highlighted that many patients who access these services will need long-term follow-up, but a large proportion referred from ED will not attend. The majority of patients in the present study received their treatment entirely in the ED, but a large proportion of patients did not receive discharge education, nor were they advised to follow-up with GP services. Direct referral to mild TBI services may not always be warranted, as attested to by the high non-attendance rate seen in the study by Snell et al, which may reflect a lack of patient education. Furthermore, local departmental practice is for referrals to be made by GPs to ensure continuity of care. But the difficulty in identifying those patients at risk of long-term harm and the high proportion still having symptoms at one year means that all patients should receive clear information and be advised to seek GP review and

referral to mild TBI services if symptoms persist. Improvements in diagnosis, information provision and referral pathways are needed to remediate this.

Overall, the results of this paper suggest that a formalised management pathway is needed. This would include selection and promotion of a standard diagnostic criteria to unify departmental practice and coding, PTA assessment and provision of an information sheet. While improvement is needed in the management of mild TBI, any intervention will have to consider length of stay, staffing and cost requirements. Unfortunately, Christchurch ED is not resourced for physicians to implement the ACC TBI management pathway.¹ To facilitate improved management, a multidisciplinary approach is needed. Given their expertise with cognitive assessment, it has been suggested mild TBI assessment and A-WPTAS testing may be performed by occupational therapists (OTs). A recent survey of OTs found that they are routinely involved in the assessment and management of mild TBI.²⁸ In keeping with this, a current local quality improvement project aims to expedite mild TBI patient assessment with OT lead input, PTA scoring, discharge and follow-up, with early outpatient assessment as part of a protocolised pathway. This is currently restrained by OT availability in ED being limited at 40 hours per week (local data). Educating nursing staff to perform A-WPTAS testing has been suggested as a solution for this. However, the increased workload would necessitate interdisciplinary collaboration. Furthermore, improved assessment is likely to increase the number of patients identified as needing admission and thus a clear inpatient admission pathway is needed to facilitate patient flow. Given the nature of mild TBI, any solution needs collaboration between ED, inpatient departments and the multidisciplinary team.

There are a number of weaknesses present in the current study. Firstly, the retrospective nature of the cohort means that a significant number of cases may have been missed due to mild TBI not captured in the ICD-10 coded presentations. Secondly, as a large number of mild TBI are managed in community health centres, there is a likely a component of selection bias due to not all cases presenting to ED and those that do being potentially more severe. However, given that Christchurch Hospital represents the only ED in the catchment area, the number of missed cases is likely minimised. Furthermore, the identified rate of head injury advice and A-WPTAS assessment is dependent on clinician documentation. This may risk underestimating the true rate due to cases where documentation is incomplete. Regardless, the overall low rate of A-WPTAS testing and follow-up indicate that improvements are needed to ensure appropriate diagnosis and management of mild TBI.

Conclusion

Current evidence suggests accurate diagnosis, including PTA testing and referral for follow-up, is needed to mitigate disease effects.^{5,11,29} The results of this study indicate that diagnosis, information provision and follow-up of mild TBI at Christchurch Hospital are insufficient. The introduction of a standard management protocol and re-assessment of compliance and outcomes following implementation is needed to improve this.

Competing interests:

Nil.

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