



An analysis of referees and referrals to a specialist concussion clinic in New Zealand

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Abstract

Aim. This study reviews the characteristics of referrals to a specialist concussion clinic (Burwood Hospital Concussion Clinic, Christchurch, New Zealand) in its first two years of operation.

Method. Information regarding referral source, demographic and clinical features, time since mild traumatic brain injury (MTBI), assessment and treatment provided, service follow-up, and outcome at discharge were collected from a file search of all referrals received in the two years ending in October 2004.

Results. Cases reflected the clinical and demographic diversity expected of those incurring an MTBI. Age and referral source were associated with failing to keep initial appointments. Assessments typically resulted in ongoing treatment from the service, although many were 'one-off' assessments. One-in-five cases resulted in ongoing treatment for more than 7 months. Gender, cause of MTBI, and time delay between injury and assessment were significantly associated with receiving long-term follow-up. Most cases had a good clinical outcome at discharge.

Conclusions. While the Concussion Clinic services the intended clinical population, referrals for assault-related MTBIs were greater than expected, and men may be under-referred. The disproportional number of non-attending patients referred from Christchurch Hospital Emergency Department along with the unanticipated proportion of cases receiving long-term follow-up, suggest a need for review of the referral response systems and the scope of service provision.

Mild traumatic brain injury (MTBI) is a common injury with diverse patterns of physical, cognitive, and psychosocial disability; MTBI accounts for 70–90% of traumatic brain injuries presenting to hospitals and outpatient clinics.^{1–3} While recovery from MTBI is mostly uneventful, it has been consistently demonstrated that a minority of MTBI patients experience long-term symptoms and disability.^{4–6} The reasons are not fully understood and may relate to multiple physiological and psychological factors, with compensation and litigation issues consistently highlighted as being associated with poorer outcomes.^{1,7–9}

Whether early intervention makes any difference to outcome has been debatable, with only equivocal empirical support evident for early intervention models of rehabilitation.⁴ Nevertheless, early limited educational intervention, reassurance, and support regarding symptom management; and guidance regarding resumption of pre-injury roles; is beneficial.^{4,5,8–11}

The Burwood Hospital Concussion Clinic is a new service initiated on a background of uncertainty regarding the benefits of early and time-limited rehabilitation in the

MTBI group. Accordingly, we aimed to more closely examine the characteristics of cases referred, their subsequent management, and their crude outcomes.

As patient non-attendance results in significant costs in terms of administrative and clinical time,¹²⁻¹⁴ frequency and characteristics of non attendance to initial appointments were reviewed to identify any variables that may improve management of non-attendance issues. Likewise, the Clinic is aware that some cases have required longer follow-up than planned for in the service specifications, which emphasise short-term intervention.

Accordingly, this study also sought to investigate the demographic and clinical characteristics of cases remaining on the caseload longer than 7 months after initial assessment.

Methods

Patients—Responding to the high incidence and prevalence rates of MTBI (and the related costs of rehabilitation in New Zealand), Accident Compensation Corporation (ACC) recently invited tenders for services for provision of time-limited assessment and interdisciplinary intervention for MTBI.

The Burwood Concussion Clinic obtained ACC funding and ‘went live’ in November 2001. Referrals are accepted directly from the local hospital emergency department, primary health care providers (e.g., General Practitioners), ACC Case Managers, and other approved sources such as neurological services.

Following an initial triage, patients are generally accepted into the Clinic if they are aged 16 years or over and have suffered from a MTBI within the last 6 to 12 months. Acceptance decisions are based on diagnostic indicators that include period of loss of consciousness for less than 30 minutes; Glasgow Coma Scale (15) score of ≥ 13 , and 15 within 6 hours of injury; post-traumatic amnesia for less than 24 hours; and no past history of severe traumatic brain injury (TBI).^{3,16-18}

Despite being the practice of some services, patients are not necessarily excluded from the Clinic when there is evidence of intracranial complications.^{11,19} Consistent with studies reporting on MTBI symptoms,^{3,11,20} Table 1 outlines common presenting symptoms of MTBI in our patient group.

Table 1. Common presenting symptoms of mild traumatic brain injury (MTBI)

- Fatigue
- Headache
- Nausea
- Vestibular disturbances
- Subjective cognitive impairment
- Irritability
- Visual disturbances
- Tinnitus
- Neck pain
- Sleeping problems
- Noise and light intolerance
- Low mood
- Anxiety

During the course of assessment and rehabilitation, patients may be seen by a range of rehabilitation disciplines depending on their assessed needs. The clinic aims to complete assessments and initiate rehabilitation (where indicated) within 3 to 6 weeks post-injury. Intervention any earlier following injury is not considered useful given that the literature has consistently indicated that a high proportion of MTBI cases demonstrate spontaneous recovery during the first few weeks.^{1,7,8}

Data collection—All files (n=357) generated by the Concussion Clinic in the 2-year period ending in October 2004 were manually reviewed to gather data on source of referral; age and gender of case;

cause of MTBI; time delay between MTBI and first clinic contact; type and number of assessments and treatments conducted by the clinic; time period of clinic follow-up; and estimated outcome of the MTBI at point of discharge.

Long-term cases were categorised as patients requiring follow-up for longer than 7 months. This category was chosen as it represented the top quartile of the four follow-up time categories. Outcome was categorised as “good” if the MTBI symptoms had resolved and the patient was deemed to have returned to premorbid functioning; a “fair” outcome was defined as remaining symptomatic but having resumed pre-injury roles such as employment; while “poor” outcome was defined as persisting post-concussion symptoms and failure to resume pre-injury roles at time of discharge from the clinic.

A further outcome category (“undetermined”) was defined as those referred on to other agencies (e.g. psychiatric services) for significant clinical problems interfering with rehabilitation (e.g. depression). Of those referrals that never resulted in an initial assessment, the reasons for this were categorised as either patient or referrer cancelling the referral, or ‘did not arrive’ (DNA).

Ethical clearance and approval from the relevant organisations was obtained prior to undertaking the audit.

Statistical analysis—The association between continuous and categorical variables was analysed using correlation, ANOVA, independent sample t-tests and Chi-squared respectively. Logistic regression (‘Enter’) was performed on statistically significant univariate variables to estimate the independent contribution to risk of DNA and risk of being a long-term case. An alpha level of 0.05 was used on all tests.

Results

Tables 2, 3, and 4 summarise the demographic and clinical features of cases referred to the Concussion Clinic. The mean age of people referred was 33.8 years (SD=13.8), with a slightly higher frequency (57%) of males.

MTBI cause was significantly associated with gender ($\chi^2=20.5$, $df=7$, $p=0.005$) and age ($F [7-342]=6.2$, $p=0.000$). In particular, females were significantly under-represented in those presenting with assault-related MTBIs, whereas those presenting with fall-related MTBIs were significantly older ($M=41.9$; $SD=15.2$ years) than all other categories apart from those with work-related, medically-related, and other miscellaneous causes.

Excluding those patients whose referral was cancelled ($n=27$), 10% of booked-in cases did not attend (DNA) the initial assessment appointment. Age ($t [45.6]=3.4$, $p=0.002$) and source of referral ($\chi^2=15.6$, $df=5$, $p=0.008$) were significantly associated with DNA. In particular, those not turning up were significantly younger ($M=28.4$ years, $SD=8.7$) than those who did ($M=34.5$, $SD=14.1$).

The Emergency Department at Christchurch Hospital was the referring service with the largest percentage (19.5%) of DNAs, which was at least twice the rate of any other service (see Table 4). Logistic regression (‘Enter’) determined that both age and referral source remained significant independent contributors to risk of DNA.

Forty-five percent of the 300 patients were seen for a one-off assessment appointment; almost all (99%) of these assessments were conducted by a specialist medical practitioner in neuropsychiatry or rehabilitation medicine. However, more typically (56%), the assessments also involved other health practitioners (number of assessing practitioners $M=2.1$, $SD=1.1$), with neuropsychology being the most likely second discipline involved (43%), followed by occupational therapy (34%) and physiotherapy (25%).

Table 2. Demographic characteristics for cause of MTBI [mean (SD) unless otherwise stated]

| Cause of MTBI | Assault | Motor vehicle accident | Recreation or Sport | Fall | Road traffic accident | Worksite injury | Secondary to medical conditions | Other (e.g. head vs object) | Total cases |
|-------------------------------------|-------------|------------------------|---------------------|-------------|-----------------------|-----------------|---------------------------------|-----------------------------|-------------|
| Total referrals (N=357) | 72 | 70 | 67 | 57 | 25 | 20 | 10 | 29 | |
| Age (years) | 31.1 (11.7) | 31.9 (13.5) | 28.4 (10.7) | 41.9 (15.2) | 33.9 (12.3) | 37.1 (13.7) | 34.3 (16.9) | 38.8 (14.7) | 33.8 (13.8) |
| Age range | 16–70 | 16–69 | 16–55 | 16–73 | 16–55 | 18–59 | 17–67 | 16–72 | 16–72 |
| Gender (% male) | 73.6 | 62.8 | 50.7 | 49.1 | 48.0 | 80.0 | 30.0 | 48.3 | 57 |
| Assessment time post-injury (weeks) | 10.3 (14.5) | 12.0 (19.0) | 11.3 (11.7) | 11.6 (16.7) | 7.1 (5.3) | 9.7 (9.7) | 13.5 (16.1) | 17.2 (28.5) | 11.4 (16.3) |
| Failed to show for assessment (%) | 6.9 | 10 | 8.9 | 3.5 | 12 | 5 | 10 | 10.3 | 10 |

MTBI=mild traumatic brain injury.

Table 3. Assessment and treatment utilisation for cause of MTBI injury [mean (SD) unless otherwise stated]

| Cause of MTBI | Assault | Motor vehicle accident | Recreation or Sport | Fall | Road traffic accident | Worksite injury | Secondary to medical conditions | Other (e.g., head vs object) | Total cases |
|--|-------------|------------------------|---------------------|------------|-----------------------|-----------------|---------------------------------|------------------------------|-------------|
| Total assessment cases (N=300) | 61 | 62 | 55 | 51 | 21 | 19 | 7 | 24 | |
| One-off assessments only (%) | 39.3 | 48.4 | 34.5 | 38.0 | 28.6 | 26.3 | 25 | 58.3 | 45 |
| Number of different assessments offered | 2.8 (1.2) | 2.8 (1.0) | 2.7 (1.1) | 2.2 (1.1) | 2.9 (1.50) | 2.6 (1.4) | 2.2 (1.2) | 3.7 (.50) | 2.1 (1.1) |
| Total treatment cases (N=164) | 36 | 31 | 24 | 30 | 13 | 14 | 7 | 9 | |
| Number of different treatments provided | 1.4 (0.77) | 1.7 (1.2) | 1.4 (.71) | 1.4 (.67) | 1.5 (.66) | 1.4 (.50) | 1.3 (.49) | 1.9 (.93) | 1.4 (0.82) |
| Follow-up period for those offered ongoing treatment (weeks) | 20.4 (14.9) | 22.2 (13.92) | 26.0 (24.5) | 14.1 (9.4) | 24.2 (22.6) | 18.5 (13.3) | 28.8 (21.8) | 41.5 (19.0) | 22.2 (17.7) |
| Outcome at discharge (% assessed as good) | 62.7 | 67.9 | 85.1 | 81.8 | 60.0 | 62.5 | 87.5 | 67.5 | 70.2 |

MTBI=mild traumatic brain injury.

Table 4. Characteristics of referrals by source

| Source of referral | General practitioners | Hospital emergency department | Accident Compensation Corporation | Hospital neurological services | Hospital occupational therapy | Other (various non-neurological services) |
|---|-----------------------|-------------------------------|-----------------------------------|--------------------------------|-------------------------------|---|
| N | 110 | 88 | 70 | 38 | 30 | 12 |
| Cause of MTBI (%) | | | | | | |
| Assault | 24.5 | 15.9 | 10.0 | 26.3 | 40.0 | 16.7 |
| Motor vehicle accident | 16.4 | 12.5 | 30.0 | 21.0 | 26.7 | 25.0 |
| Recreation or sport | 22.7 | 22.7 | 14.3 | 13.1 | 10.0 | 8.3 |
| Fall | 17.3 | 21.6 | 12.9 | 18.4 | 6.7 | 8.3 |
| Road traffic accident | 6.4 | 6.8 | 10.0 | 7.9 | 0 | 16.7 |
| Worksite injury | 7.3 | 2.2 | 7.1 | 2.6 | 13.3 | 0 |
| Secondary to medical conditions | 1.8 | 2.2 | 4.3 | 2.6 | 3.3 | 8.3 |
| Other (e.g. head vs object) | 3.6 | 15.9 | 11.4 | 7.9 | 0 | 0 |
| Assessment time post injury (weeks) Mean (SD) | 14.1 (16.2) | 5.0 (2.8) | 15.2 (23.8) | 9.7 (11.9) | 6.3 (7.0) | 16.7 (22.3) |
| Failed to show for initial assessment appointment (%) | 4.7 | 19.5 | 7.4 | 10.8 | 3.4 | 0 |

MTBI=mild traumatic brain injury.

164 patients were offered follow-up treatment over several months (M=22.2 weeks, SD=17.7). Treatment follow-up mostly (57%) involved a single health practitioner (an occupational therapist or physiotherapist in 51% and 23% of the cases respectively). Twenty-two percent of the patients offered treatment were categorised as “long-term cases” (i.e. they were followed up for more than 7 months).

Three variables were associated with the probability of being a long-term case:

- Gender was significantly associated with being long-term case ($\chi^2=9.5$, $df=1$, $p=0.002$) in that women were over-represented in this category.
- The time elapsed between the MTBI and the Concussion Clinic assessment was much longer for long-term cases (M=12.2 weeks, SD=15.8) than other cases (M=8.0 weeks, SD=6.9) ($t [82.4]=2.1$, $p=0.039$).
- Cause of injury was associated with being a long-term case ($\chi^2=14.9$, $df=7$, $p=0.040$). Inspection of the data indicated that MTBIs secondary to medical conditions and other miscellaneous causes (75% and 80% of cases in each respective group) were especially likely to become long-term cases.

Logistic regression (‘Enter’) determined that all three variables made an independent contribution to the probability of being a long-term case.

At point of discharge from the service, 70.2% of cases were classified as having a good outcome, with others classified as fair (11.8%) or poor (6.2%) outcome. A small number (11.8%) were referred on to additional health providers for further rehabilitation or treatment, and thus their outcome was undetermined. No demographic, clinical, assessment or treatment variables were associated with those cases classified as having a good outcome. The small number with a poor outcome precluded any exploration of factors associated with this.

Turning to referee characteristics (see Table 4), source of referral was significantly associated with type of MTBI ($\chi^2=67.3$, $df=42$, $p=0.008$). In particular, ACC referred significantly more MVA-related but significantly less assault-related MTBIs than expected. Source of referral was significantly associated with the elapsed time between the MTBI and being seen by the Concussion Clinic ($F [5,266]=4.3$, $p=0.001$). Post-hoc analysis indicated that those referred by Christchurch Hospital-based services (Emergency Department, Occupational Therapy, Neurological Services) were seen with more recently-incurred MTBIs than those referred by others.

Discussion

As the Burwood Hospital Concussion Clinic is a new service, we hoped to derive information that would inform future service development and referrers. As expected, cases represented a reasonably young group of adults, although the age range was broad.

In contrast to the known greater incidence of men experiencing MTBIs,^{2,21,22} our overall sample was reasonably gender balanced, and this suggests possible under-referral of men. Closer perusal of gender mixes across injury cause reveals that females were less likely to present with assault or following worksite injuries, but more likely to present with MTBI secondary to a medical condition, such as a fall

resulting from syncope or a seizure. Rates of assault presenting to the Clinic were twice that usually cited in other countries.^{1,17,21}

More than half of our sample required the involvement of more than one type of health practitioner, with a neuropsychological screen being the most likely assessment-event accompanying any medical review. While the value of neuropsychological assessment in this population has been debatable,^{18,23} a screening assessment is completed if subjective cognitive problems persist for longer than 3 months post-injury; and in our observation, usually provides reassurance regarding absence of significant neuropsychological impairment.

In addition, a neuropsychological screen is completed for all patients involved in cognitively-demanding roles such as study, teaching, law, and medicine. Indeed, the fact that occupational therapy provides the most frequent form of treatment follow-up reiterates the perceived value of providing educational support, symptom management, and guidance regarding resumption of pre-injury roles.

Specific additional treatments are also initiated as clinically indicated, such as physiotherapy treatment for vestibular disturbances, or medication for mood disorder. Although most cases achieved full return of functioning at discharge, the high proportion requiring follow-up beyond 7 months is concerning.

Why women may be over-represented in this group is unclear, but speculations include better ability to communicate treatment needs, or even that woman may be more likely to develop prolonged post-concussion symptoms following MTBI.^{1,3,7}

It is unclear why the greater time-lag between injury and clinic contact also contributed to risk of long-term follow-up, although it is clinically known that difficult complications impacting on recovery from MTBI may take time to be declared, and this in turn contributes to later referrals.

Rates of non attendance in our sample appear modest and consistent with other reports on non-attendance to hospital outpatient clinics.^{12,14,24} Even though the numbers are small, identification of variables associated with non attendance in our sample has been helpful in terms of managing this issue.

Patients may not attend because their symptoms have improved and they do not feel they need to attend, or they have returned to work and do not wish to take time off for such an appointment. These intuitively appear particularly relevant to referrals made by the Emergency Department given that patients seen in this setting may well experience considerable improvement between discharge and the Concussion Clinic appointment. The fleeting therapeutic engagement with patients in such settings may also play a part in poor follow-through by the patient. Whatever the case, encouraging referrers in such settings to reiterate rehabilitation needs with MTBI patients is likely to be beneficial.

As with any retrospective analysis, this study is limited by the completeness of records available. Likewise, cause-and-effect relationships between variables cannot be drawn. While any bias as a result of chance variation is ameliorated by our relatively large sample size, the small numbers of cases in some of the categories still precluded further exploration. Furthermore, the Burwood Concussion Clinic is a new service and this raises the possibility of bias through an influx of 'old' or difficult cases being referred, which in turn affected the clinic's activities. For these reasons, a

repeated study is planned, and future studies should consider other issues such as the frequently highlighted risk for iatrogenic disability in this patient group,^{3,4,18} the impact of alcohol use, and previous history of MTBI.

We also intend to focus on continuing research activity in the clinic: development and/or validation of relevant outcome measures for systematically evaluating outcomes of our patients. Likewise, providing unnecessary and routine follow-up (in a patient group where spontaneous recovery rates are likely to be high) is costly, and may over medicalise the condition.

Thus, for these collective reasons, further research is required to identify MTBI patients who can most benefit from the Clinic's services. Limitations aside, this study has identified important issues for the Concussion Clinic—it may increase awareness of its functions among referrers so they become more aware of the function of the Concussion Clinic as well as the various rehabilitation needs of this population.

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