

Post-concussion states: How do we improve our patients' outcomes? An Australian perspective

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Abstract

There is limited data surrounding incidence and prevalence of concussion and the resulting post-concussion states. This creates difficulty when investigating ways to optimise patient management. It is proposed that a registry of patients presenting with symptoms and signs after a concussion, as part of a large scale TBI registry across Australia, would provide a starting point for future research with a view to improving the outcomes of patients experiencing symptoms and signs after concussion.

Keywords

Concussion, post-concussion states, traumatic brain injury, registry

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Introduction

There is limited data surrounding incidence and prevalence of concussion and the resulting post-concussion states. Acute post-concussion state is often simply termed 'concussion', and this term is used interchangeably with mild traumatic brain injury (mTBI), despite being a more specific way of describing characteristic symptoms and signs that may be experienced after mTBI.¹ Complexities surrounding terminology have created a risk of under-reporting of 'concussion', which has contributed to a lack of accurate statistics on disease burden and evidence regarding outcomes. This creates difficulty when investigating ways to optimise patient management.

The epidemiological problem

It is reported that mTBI accounts for 70–85% of traumatic brain injury (TBI) in Australia and worldwide.^{2,3} The most recent data reported by the Australian Institute of Health and Welfare (AIHW)⁴ based on Principal Diagnosis indicates that there were 14,190 coded episodes of TBI in Australia in the year 2004–2005, of which 9,669 were coded as concussion. In addition to being out of date, this data does not capture diagnoses coded in secondary diagnosis fields, and

therefore does not reflect the true number of hospitalisations for concussion in Australia, or the number of concussions that present and are diagnosed outside of the hospital setting (such as in General Practice). Recent studies have reported the overall incidence of TBI as 99/100,000 persons per year in New South Wales,⁵ and 97.8 per 100,000 population in North Queensland,⁶ but a study of incidence rates for TBI in New Zealand identified 790 cases per 100,000 person-years.³ Based on this work by Feigin *et al*, one can estimate there are approximately 200,000 cases of TBI per year in Australia. Given that approximately 85% of TBI cases are 'concussion', it can be

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estimated that there are 170,000 cases of 'concussion' per year in Australia.

The annual incidence of emergency department visits for TBI that did not result in hospitalisation or death, and as such are likely to be mild in nature, in the United States (US) has been reported as 787/100,000,⁷ and an Ontario-based study estimated the annual incidence of 'concussion' (as defined by ICD-9-CM) as 1153/100,000.⁸ The global incidence of mTBI has been estimated between 40 and 55 million,⁹ but missing and non-uniform standards of data acquisition and reporting of concussion and the post-concussion states makes it difficult to compare data between countries. Furthermore, adult outpatient presentations of head trauma in general remain poorly understood,¹⁰ and there is widespread consensus that 'concussion' is underdiagnosed.¹¹

The bias of sport-related data

'Concussion' has been defined as a TBI induced by biomechanical forces¹²; this can result either from a direct blow to the head or from an impulsive force to the body which is transmitted to the head. Such concussion forces are not just experienced in sport, and the possibility of post-concussion symptoms should be considered in patients presenting after falls, motor vehicle or cycling accidents, and traumatic assault such as those subjected to intimate partner violence.^{3,13-16} Despite acute post-concussion states only being reportedly associated with sport in approximately 20% of adults,^{17,18} available epidemiological data is predominantly related to sport and recreational activities. Much of this data comes from high school and college athletes¹⁹⁻²¹ and professional and community sports people,^{22,23} and there is under-reporting outside organised sport and in non-sport related activities. There is also limited data available relating to people with symptoms after a concussion who are seen, and managed, outside the emergency department setting.¹⁹

The patient and the clinician

Patients who experience a concussion face several hurdles: will the initial assessor, either in a community or healthcare setting, recognise they have sustained a concussion and consider the risk of acute post-concussion symptoms? If considered, is the patient referred for, and do they attend, medical assessment for diagnostic clarification? And, how are acute post-concussion symptoms identified by the medical practitioner?

Once a patient is identified as having symptoms and signs recognised as those related to an acute post-concussion state, identification of confounding factors and predictors of outcome must be sought with a view

to providing appropriate interventions to expedite recovery and optimise long term function. Whether this occurs is dependent not only upon the expertise of the medical practitioner, but overall understanding and knowledge of the event itself, the evolving symptoms and signs that can be identified as the post-concussion syndrome and the optimal management of such symptoms and signs. Until further information is available regarding how such presentations are being managed in our healthcare system, it is difficult to assess whether such management is optimal. A cohesive approach to gathering information on the incidence, prevalence and management of concussion and its post-concussion states is the starting point of this journey.

Once a patient is identified as having experienced a concussion resulting in a subsequent clinical syndrome, there are further difficulties in standardising management. Current predictors of outcome after TBI are not useful at an individual patient level, and until we have accurate incidence and prevalence data across all populations presenting with symptoms after concussion, there will be ongoing difficulties identifying those patients who will recover rapidly with minimal intervention, those who will require brief early intervention, and those that will require significant intervention to achieve optimal outcome. An improved understanding of symptoms and health related quality of life, and the mediating factors between each, is likely to assist in patient recovery, as well as allowing benchmarking,²⁴ and clarification of potential longer term consequences of injury.²⁵

A TBI registry

There is increasing need for an Australian clinical research registry of patients presenting with symptoms and signs after a concussion. This would allow for collection of information relating to pre- and peri-injury factors, diagnosis, clinical course, interventions and outcomes in order to further our understanding of post-concussion states. Data analysis could lead to generation of aides to clinical management, providing an evidence base to support clinical decision making, thereby improving concussion management. Improved incidence data could inform government and health services on appropriate resource allocation and planning.

The concussion registry would optimally be part of a broader registry also capturing data regarding all TBI,^{26,27} given that manifestations of injury generally occur across a spectrum of severity, rather than clearly defined states. Currently CENTER-TBI²⁸ and TRACK TBI²⁹ gather data on TBI of all severities in Europe and USA respectively. Partnership, and pooling of information with such organisations would be the ultimate aim.

Australian sporting organisations already use Injury Registers to monitor their general injury profiles and to identify methods to reduce injury risk,^{30,31} and registration of injury data can provide a clear picture of their injury mechanism, which in turn can lead to effective preventative measures and a decline in injuries.³² The Australia New Zealand Trauma Registry (ATR) has enabled Australia to establish a robust method of assessing the system of major trauma care across Australia.³³ A registry of concussion could build upon these strong foundations, capitalising on existing infrastructure to enhance efficiencies. Other registries, such as the Australian Spinal Cord Injury Register (ASCIR) which records incident cases of spinal cord injury treated in Australian Spinal Units,³⁴ enable measurements of injury incidence, study of circumstances and mechanisms of injury. This is an opt-in registry, however an opt-out process would be preferential.

A 'concussion' registry would allow collection of uniform data to evaluate outcomes for patients who sustained a concussion and suffered subsequent post-concussion symptoms in respect to establishing the natural history and prognosis, care patterns and clinical effectiveness, quality of life and management outcomes, as well as the cost effectiveness of treatment options.³⁵ Operationally the registry would require collection of data from general practice and outpatient clinics, allied health care providers such as occupational therapists, physiotherapists and psychologists, emergency departments and inpatient departments if it were to provide a complete picture of concussion incidence and management. This can be done by data linkage, which requires dedicated resources and maintenance, or it may be that national digital health record systems could be a starting point for this data collection, and enable patients to consent to such data collection.

In order to gather data from people who experience a concussion injury yet do not come in contact with health care professionals, it will be necessary to publicise the registry via sporting clubs and social media and provide an online portal for people to enter their own information. This will be data of lower quality as the diagnosis would not be confirmed by a clinician, and the data would need to be segregated from the uniform data collected via health care professionals. Nonetheless, the patient entered data would provide important information on the extent of head injury in the community and inform policy on improving clinical care for people with concussion.

Final remarks

What appears clear is that a registry of patients presenting with symptoms and signs after a concussion, as part of a large scale TBI registry across Australia,

would provide a starting point for future research. This must be in conjunction with community education to improve recognition of post-concussion states, facilitating referral for assessment, and the education of health care providers in Primary Care settings to ensure appropriate patient assessment is performed. Only then will this registry help to clarify the true incidence and prevalence of concussion and its sequelae in our community. Once this information is available nationally, the next step is access to a global registry for TBI to allow for worldwide data sharing with a view to improving the outcomes of patients experiencing symptoms after concussion.

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