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Mild traumatic brain injury and concussion and persisting post-concussion symptoms: new guidelines to support evidence-based assessment and management in Australia and Aotearoa New Zealand

Advances in research, technology, and clinical practices are rapidly changing our understanding and treatment of mild traumatic brain injury (mTBI) and concussion, which is a form of mTBI. Emerging evidence challenges the previous dogma that these are minor injuries without long term consequences.[1,2] Frontline clinicians, however, report a lack of knowledge and confidence in managing these conditions, and community resources are limited.[3] Until recently, there was no guidance specific to the Australian and Aotearoa New Zealand context.

This is a large-scale problem, with around 240 000 people in Australia and Aotearoa New Zealand requiring medical attention for concussions each year, resulting in an estimated annual cost of AU$100 million.[4] As medical attention is sought for fewer than half of concussion experiences, these figures substantially underestimate the magnitude of the problem.[5] Concussion occurs in all age groups, with children and young adults having the highest incidence. Although sport-related concussions have recently garnered considerable media attention, concussions are more frequently caused by falls and motor vehicle accidents.[6] In addition to athletes in contact sports, repeated concussions also occur in people who experience domestic violence and assault, youth, and in incarcerated individuals.[7]

Between 25% and 48% of people with concussion have symptoms that last weeks, months or even years,[1,8,9] which are known as persisting post-concussion symptoms (PPCS). These symptoms include headaches, dizziness, visual disturbance, fatigue, sleep disturbance, sensory sensitivity, cognitive disturbance, emotional changes, and autonomic dysfunction. Untreated, they can have serious effects on a person's work, school performance, social function, and mental wellbeing.[10]

Despite evidence supporting effective interventions, 50% of people with concussion do not receive appropriate care.[3,11] Concussion management is highly variable across health professionals and community and health care settings. This reflects limited appreciation of the associated morbidity and impact on quality of life, and low levels of knowledge about best practice care.

Over the past decade, concussion management has moved from "wait and see" to proactive approaches (Box). Prompt recognition and early management strategies are vital to improving outcomes.[12,13] Sensitive clinical prediction tools decrease unnecessary brain imaging and exposure to radiation. Early education about expected symptoms following injury and their natural history decreases patient and family stress and anxiety. Strict rest after injury is detrimental, graduated physical activity starting 24–48 hours after injury shortens recovery times. Beyond this, PPCS is a complex condition that can be challenging to manage. The involvement of a multidisciplinary specialised concussion service improves long term outcomes.[14] This service usually involves a stepped collaborative approach, where care is tailored to the individual's needs and preferences, and the level of service and treatment to the patient's recovery and treatment response, stepping up to specialised services as necessary.[15,16] This service delivery model requires proactive follow-up to ensure patients receive timely and appropriate interventions.

General practitioners have a crucial role in the care of people with concussion and PPCS, including initial assessment and monitoring of recovery trajectory, assessment and treatment of physical and psychological comorbidities that impede recovery, oversight and coordination of care, and timely referral to specialised services when needed. A Western Australian study found that most general practitioners felt confident in the diagnosis and initial assessment of a concussion.[3] However, confidence in concussion management and knowledge of slow recovery and referral pathways was lower. The causes for this are likely multifactorial, including low frequency of concussion consultations (40% of general practitioners see fewer than five cases per year[3]); poor knowledge translation; confusion or conflicting information about evidence supporting essential decisions such as symptom exacerbation, and return to work, school and/or driving; and treatment options. This low confidence among clinicians leads to conflicting advice to patients, which is a common complaint in people with concussion, and undermines patient trust.[17]

Australians and New Zealanders who have experienced a concussion want improved access and greater consistency in care.[17] They often report that their concussion was trivialised and they were not given information that symptoms could persist. They found that their general practitioner did not seem to know how to help them manage PPCS. They also highlighted difficulty accessing specialised concussion services and how long distance travel decreased access to care for people in rural and remote areas.[17,18] These concerns were supported by the 2023 Australian Senate inquiry, which called for improved community access to concussion care, enhanced medical education, and expanded rehabilitation services.[19]

Key points in assessment and management of mild traumatic brain injury and concussion and persisting post-concussion symptoms

- Early recognition, removal from play, and patient education improves outcomes.
- Strict rest is not beneficial, early graduated return to activity improves recovery times.
- Age-appropriate standardised concussion symptom inventory tools are useful in concussion management, while neuroimaging should not be routinely used.
- Physical, cognitive and psychological comorbidities may impede recovery and are important therapeutic targets where post-concussion symptoms persist.
- People with persistent post-concussion symptoms require timely, stepped collaborative care involving a multidisciplinary team with expertise in concussion management.

Community therapists have an important role in the care of patients with concussion. Physiotherapists can assist in the assessment and management of headaches, dizziness, neck pain, and autonomic disturbance. Graduated exercise programs are a cornerstone of management, often created and monitored by physiotherapists or exercise physiologists. Psychologists can provide psychoeducation; management strategies for fatigue, sleep disturbance, anxiety and depression; and cognitive reframing to underpin activity management. Occupational therapists can help manage fatigue (energy conservation), return to work (environmental modifications), and cognitive difficulties (compensatory strategies). Despite many private concussion clinics providing excellent care, there are concerns about the lack of regulation in this sector. This leaves patients vulnerable to clinics that may offer quick fixes using unproven treatments or alternative therapies, often at considerable expense.[20]

Clinical practice guidelines help to improve the quality of patient care, optimise resource utilisation, and increase cost-effectiveness.[21] Although there are several clinical guidelines in concussion internationally,[22] none address all sectors of the population nor account for the varied health care settings in Australia and Aotearoa New Zealand. In order to facilitate knowledge translation, the first *Australian and Aotearoa New Zealand guideline for the management of concussion, mild TBI and PPCS* (https://anzconcussionguidelines.com/) has been developed to provide evidence-based, locally applicable, clinical practice guidelines for the care of adults and children throughout their recovery journey. The guideline also provides evidence-based and expert advice for concussion management in the context of complicating factors, including ventricular shunts, neurodevelopmental disorders and athletes with disabilities. To ensure the guideline is applicable to the Australian and Aotearoa New Zealand context, the multidisciplinary Guideline Development Group (GDG) consisted of general practitioners, specialists, allied health professionals, researchers, consumers with lived experience, and guideline development experts from across Australia and New Zealand, together with consumers from Māori and Aboriginal and Torres Strait Islander people.

The final guideline presents 119 recommendations (61 evidence-based, 58 consensus-based) and 27 practice points. It is divided into five sections that reflect the patient journey: recognition and assessment, return to activity, assessment and management of persisting symptoms, management of specific symptoms, and repeated concussion and long term effects. Each section provides an overview, rationale for management strategies, and important comorbid and premorbid considerations. The full guideline methodology details, public consultation feedback, and a summary document are available on the website www.anzconcussionguidelines.com. The guideline includes an online toolbox of clinical management algorithms, validated questionnaires and screening tools, and linkages to relevant comorbidity information and other Australian tools (eg, HeadCheck [https://www.headcheck.com.au/], PREDICT,[23] KidsConcussion [https://kidsconcussion.com.au/]); all intended to facilitate timely patient assessment and management.

In the context of varying international recommendations, the GDG gave specific consideration to available evidence concerning a minimum time away from sport and the potential long term effects of repeated concussions. Although delaying the return to play decreases the risk of repeat injury and shortens recovery time, an excessively prolonged return to play time decreases the benefits of sport participation and increases the risk of athlete non-compliance. Unfortunately, the evidence to support the exact timing of return to sport is poor. Using a modified Delphi approach, the GDG made a consensus-based recommendation that return to play be dependent on the individual being symptom free *and* a minimum time away from sport of 21 days. This reflects the GDG's concerns about the risks of repeated injury and emerging evidence that physiological recovery takes longer than symptom recovery, especially in the settings of incomplete brain recovery and in vulnerable populations. The guidance is consistent with other consensus statements, and takes an approach that reflects caution while factors that are predictive of slower recovery and risk of potential long term sequelae continue to be elucidated.[24-26]

There was also insufficient evidence to make an evidence-based recommendation on risks associated with repetitive head injuries, including chronic traumatic encephalopathy and other neurodegenerative conditions. The GDG strongly supported ongoing research in this area and acknowledged concerns around the potential long term consequences.[27] In the absence of evidence, practice points were included to ensure that patients who are concerned about potential long term effects of mTBI be taken seriously; be assessed; be treated (where appropriate) for the many, common differential diagnoses that can mimic the clinical features of chronic traumatic encephalopathy; and be referred for specialist evaluation when necessary.

The Australian and Aotearoa New Zealand concussion guideline provides high level evidence and practical

advice for clinicians providing care across the continuum of the patient journey, regardless of the cause of initial injury. There remains a substantial need for well designed clinical trials to further our understanding of concussion and its consequences, and intervention trials to improve treatment options for people with PPCS.

The successful implementation of the guideline is crucial for ensuring consistent and high quality patient care. Research into its implementation in the context of the differing Australian and Aotearoa New Zealand geographical areas will be important to ensure adequate uptake and will include evaluation of efforts to build capacity (eg, comprehensive training for general practitioners and other health care professionals, cost-effective patient monitoring approaches), integration into clinical workflows, and continuous evaluation and evolution to ensure adherence. Ongoing research will help to refine the Guideline, ensuring recommendations remain relevant in an ever-evolving health care landscape.

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