

Assessment and Management of Concussion/ Head Injury¹

by
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Introduction

This paper addresses the current assessment and management of concussion/head injuries within the sporting arena. This topic has engendered a varied amount of discussion over the years with different sporting codes utilising different criteria for the identification of a concussed sports person. This discussion has also included the concussed sports person's required time away from all sports training and active participation within their chosen sport.

Concussion/Head Injury

Terminology. The term concussion/head injury has been defined as being "a clinical syndrome characterised by immediate and transient post-traumatic impairment of neural function, such as alteration of consciousness, disturbance of vision, equilibrium, etc. due to brainstem involvement".¹ More recently it has been described as a "syndrome that may or may not include loss of consciousness".²

There has been no universally accepted definition of concussion /head injury, but a popular definition used has been "trauma induced alteration in mental status that may or may not be accompanied by a loss of consciousness".³ The essential elements to the definition of concussion is that it can be "both immediate in onset and transient" in nature in the presentation by the athlete.⁴

Guidelines: From as far back as 1980, there are various guidelines published, based on the presenting symptomology, which attempt to assist in the identification of the severity of a concussion/head injury. These guidelines have seen standards set for grades of concussion, but the definition of what constitutes a specific grade is as varied as the definition for concussion is.

The early detection and long term documentation of the athlete with concussion is necessary for the management and monitoring of the history of the concussion. However, "attempts to characterise and classify the spectrum of concussions by stratifying the signs and symptoms as indicators of relative severity have been difficult. Yet the need to accurately diagnose the severity of these injuries is obvious, especially at the time of the injury when the triage decision is critical to the patient's future."⁵

The guidelines for grades of concussion have been published, along with the return-to-play guidelines. with their incumbent strengths and weaknesses.² The general trend in recent times has seen the guidelines becoming more conservative. These changes are based on anecdote, personal experience and extrapolation of data from limited studies.^{2,6}

The most commonly referred to classification of grades of concussion has been the guidelines of Cantu.^{2,7-9} More recently, Specialist Medical Associations have produced their own guidelines. In 1991, the Colorado Medical Society produced their guidelines following the death of a football player from an on-field injury. In 1997, the Quality Standards Subcommittee, American Academy of Neurology (AAN) amended the Colorado guidelines and the criteria for a Grade 1 concussion (Table 1).⁹

The various guidelines are useful for the assessment of the severity of the insult to the brain but can lead to differing assessments as to the severity of the concussion. One case study identified that the concussed athlete can be classified as Cantu - Grade 2; Colorado Medical Society - Grade 3; Torg - Grade 4; AAN-grade 2. ²

Guideline	Grade 1	Grade 2	Grade 3
Cantu	No loss of consciousness Post-traumatic amnesia last less than 30 min	Loss of consciousness lasts less than 5 min OR Post-traumatic amnesia lasts longer than 30 min	Loss of consciousness lasts longer than 5 min OR Post-traumatic amnesia lasts longer than 24h
Colorado	Confusion without amnesia No loss of consciousness	Confusion with amnesia No loss of consciousness	Loss of consciousness (of any duration)
Practice Parameter (AAN)	Transient confusion No loss of consciousness Concussion symptom or mental status change resolves in less than 5 min	Transient confusion No loss of consciousness Concussion symptoms or mental status change lasts longer than 15 min	Loss of consciousness (brief or prolonged)

Table 1: Diagnostic Grading Scales for Sports-Related Concussion

1. Every athlete with a concussion should be evaluated by a physician.
2. Loss of consciousness precludes a return to play that day.
3. Persistence of (longer than 15 minutes) or delayed onset of any symptoms such as headache, dizziness, malaise, slowness to respond mentally or physically at rest, or with provocation (supine with legs elevated) or with exercise precludes a return to play that day.
4. Any deterioration in physical or mental status after the initial trauma, such as increasing headache, dizziness, or nausea, warrants immediate transport to an emergency facility where neurologic or neurosurgical consultation and neuroimaging are available.
5. When prolonged symptoms (greater than 15 minutes) are experienced after a concussion, great care must be exercised in returning an asymptomatic athlete to practice or competition. Without at least 5 to 7 days of rest, neuro function may not yet be normal. Further research is needed to demonstrate the association, or lack of association, between symptoms, neurocognitive function, and injury susceptibility. Until this age-specific information is available, such decisions must be approached with great concern. Repeated examinations of the athlete are needed during a gradual increase in physical exertion to determine if these stresses trigger symptoms. If symptoms recur, the athlete is not ready to return to play. Current neuroscience knowledge in humans does not give a safe, firm timetable for return to play after concussion in most circumstances. Therefore, each athlete with prolonged symptoms (more than 15 minutes) must be evaluated individually. Repeated and thorough evaluations, preferably by the same clinician, are most helpful in determining readiness to play.
6. Newer tools, such as balance testing, cannot be recommended for clinical decision-making after a concussion at this time. However, their use for further data collection is encouraged. The balance test may prove to be a useful tool for identifying impairment associated with concussion.
7. We recommend further study of the SAC48-50 as part of the initial evaluation of an athlete with a concussion to gain experience with its use. Furthermore, wide-scale examination of this instrument is needed at all levels of competition and in different athletic groups. While recognizing its clinical potential, we believe it is premature to recommend its generalized use as the sole determinant of clinical decisions after the concussion. We do recommend continued wide-scale clinical testing of this instrument.
8. We recognize the need for continued clinical and basic science research of sports-induced concussions. The clinical use of neuropsychologic assessments in the study of athletes has been limited by a current

lack of research studies that have specifically investigated the use of these assessments in sports. We recommend the establishment of cooperative studies across athletic organizations at the junior, high school, college and professional levels that would promote the longitudinal study of large groups of athletes.

9. We specifically promote the establishment of databases on all athletes with concussions. If similar neuropsychologic instruments are used at all levels, longitudinal analysis of test results for specific athletes will be possible as the athlete progresses from one level to the next. This type of information would be particularly useful to athletes, their families, and physicians to assess the risk of future injury and further difficulties.

Table 2: Recommendations of the AOSSM Concussion Workshop Group 1999

These differing levels of severity can lead to different treatment regimes depending upon the model utilised within the assessment of the concussion. For the athlete within a chosen sport, a standardized protocol is essential to enable standardization of care.

Within the guidelines published,^{2,7,10-13} the criteria for a Grade one concussion is similar for the first part in that all agree that there has been no loss of consciousness. The differences begin, however, with one guideline identifying grade one as being without post-traumatic amnesia II while others note post-traumatic amnesia clearing from one 2 through to thirty minutes.⁷

Research undertaken in 1996 identified that not everyone knew of the different guidelines for concussion. Of all the American Medical Society for Sports Medicine members surveyed, 90% were familiar with the Cantu guidelines, whereas only 59% were familiar with the Colorado guidelines.¹²

Following a review in 1997 by several specialist Medical Societies on the concussion guidelines, the American Orthopaedic Society for Sports Medicine (AOSSM), the American Academy of Pediatrics. The American Osteopathic Academy of Sports Medicine, the National Academy of Neuropsychology. The International Neuropsychological Society, and the American Academy of Orthopaedic Surgeons reached a consensus on the treatment and management of concussions in sport in October 1999 (Media Release AOSSM website). This consensus has led to the release of set of recommendations for the care of people with a concussion/ head injury. This has enabled team physicians, coaches, athlete trainers and other health professionals working with athletes to have defined parameters to work within (Table 2).⁵

Initial Assessment of Concussion: Within all the guidelines published, the Glasgow Coma Scale (GCS) is the standardized initial assessment tool for the concussed athlete. The Virginia Neurological Institute utilizes this within their concussion guidelines and classify varying grades of concussion depending upon the GCS scale⁸. Wojtys *et al.* identified that a GCS score of 11 or higher has an excellent prognosis, whereas a GCS score of seven or less is very serious.⁵

Other Assessment Tools: There are several neuro-physiological assessment tools available for the ongoing assessment of concussion/head injury. These have been selected and applied to brain-injured non-athletes. The tests found to be useful for the sports-related head injury have been used at professional sporting levels and "have shown to have predictive use" for effects of concussion monitoring.⁵ One such test is the Digit Symbol Substitution Test. The test needs to be administered in athlete's pre-season to enable a baseline to be established. The test will only identify the progression of recovery and is neither an objective measure for recovery nor a diagnostic test for concussion.¹⁴

Easy sideline assessment tools for the non-professional medical person, attached to a team or sporting activity, have also been developed. The Standard Assessment of Concussion on-site mental status evaluation of the athlete is one such tool for both the medical professional and the team trainer (Table 3).¹⁵ This tool allows the

non-medical professional to better determine who has had a concussion and whether they can return to play under the American Academy of Neurology guidelines. Further statistical validation is required on this assessment tool to determine its usefulness for both the professional and non-professional medical practitioner.⁵ Other sideline evaluations for concussion utilize a Mental Status Test, Neurological Assessment and a series of Exertional Provocative Tests to ensure that the athlete is able to return to their activity.¹⁶

Return to Play Guidelines: This has been described as being "one of the most vexing questions related to concussion".¹³ The return to play guidelines are as varied as the grade of concussion guidelines. Within the various guidelines published, the grade one concussion is able to return to the field within 15 minutes of the insult, provided they are free from any symptomology, IG or within 20 minutes under the Colorado Medical Society guidelines.² Cantu recommends a return to play within 30 minutes for a grade one concussion / whereas within New Zealand, the New Zealand Rugby League stipulate a three-week stand-down period for a grade one concussion.¹⁷ These arbitrary stand-down periods can be misconstrued by athletes and their management team as being the minimum time before returning to the sporting activity, irrespective of severity.

1. Orientation			2. Immediate Memory				
Month	0	1	List	Trial 1	Trial 2	Trial 3	
Date	0	1	Word 1	0	1	0	1
Day of the week	0	1	Word 2	0	1	0	1
Year	0	1	Word 3	0	1	0	1
Time (within 1hr.)	0	1	Word 4	0	1	0	1
Orientation total score	/5		Word 5	0	1	0	1
			Total				
			Immediate Memory Test Score /15				
			(Note Subject is not informed of Delayed Recall Testing of memory)				

Neurological Screening

Recollection of injury (pre or post-traumatic amnesia)
 Strength
 Sensation
 Coordination
 Loss of consciousness

3. Concentration

Digits Backwards (If correct, go to next string length. If incorrect, read trial 2. Stop after incorrect on both trials)		
Trial 1	Trial 2	Score
4 - 9 - 3	6 - 2 - 9	0 1
3 - 8 - 1 - 4	3 - 2 - 7 - 9	0 1
6 - 2 - 9 - 7 - 1	1 - 5 - 2 - 8 - 6	0 1
7 - 1 - 8 - 4 - 6 - 2	5 - 3 - 9 - 1 - 4 - 8	0 1
Months in Reverse Order (entire sequence correct for 1 point)		
Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan		0 1
Concentration Total Score		/5

Exertional Manoeuvres: (when appropriate)

5 Jumping Jacks 5 Sit-Ups
 5 Sit-ups 5 Knee Bends

4. Delayed Recall	Summary of Total Scores
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Word 1	0	1	Orientation	/	5
Word 2	0	1	Immediate Memory	/	15
Word 3	0	1	Concentration	/	5
Word 4	0	1	Delayed Recall	/	5
Word 5	0	1	Overall Total Score	/	30
Delayed Recall Total Score	/5				

Table 3: Standardized Assessment of Concussion (SAC)

It can also mislead these people into believing that medical assessment is not required after a head injury.¹¹

All the return to play guidelines stipulate that the athlete needs to be individually assessed before they can return to play, and "no two athletes are alike and no two brain injuries are identical".² A return to play too early may expose the athlete to an increased risk of the second-impact syndrome.^{2,18}

Putukian notes that each athlete needs to be treated as an individual and that the athlete should always come first, not the sport.¹⁹ Understanding the athlete and their goals and ambitions is as important as understanding the medical and musculoskeletal problem associated with concussion. The media also has a lot of influence upon the athlete's desire to return to play,¹⁹ as it can wrongly influence the athlete, and their support person's, decision to return to play. One such case was when the New Zealand Rugby League Captain and fullback, Matthew Ridge, was concussed in a Grand Final, only to return to play for New Zealand a week later.

Conclusion

Despite several attempts to clarify the classification of concussion, provide assessment and return-to-play guidelines, there is no set uniformly acceptable standard for the identification of a concussion or head injury. All the attempts to standardise a minimal criterion by International Organisations have been based upon their own empirical data and no real relevant research has been carried out.

Identification, care and management of concussion is truly an individualised process that must be undertaken by the health practitioner for their client, with the client's best interests at the forefront of all decisions.

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