

Concussion (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement*

DEFINITION

Concussion or mild traumatic brain injury (MTBI) is a pathophysiological process affecting the brain induced by direct or indirect biomechanical forces.

Common features include:

- Rapid onset of usually short-lived neurological impairment, which typically resolves spontaneously.
- Acute clinical symptoms that usually reflect a functional disturbance rather than structural injury.
- A range of clinical symptoms that may or may not involve loss of consciousness (LOC).
- Neuroimaging studies that are typically normal.

GOAL

The goal is to assist the team physician in providing optimal medical care for the athlete with concussion.

To accomplish this goal, the team physician should have knowledge of and be involved with:

- Epidemiology
- Pathophysiology
- Game-day evaluation and treatment
- Post-game-day evaluation and treatment
- Diagnostic imaging
- Management principles
- Return-to-play
- Complications of concussion
- Prevention

**Editor's Note:* The Team Physician Consensus Statement was published in the November 2005 *Medicine & Science in Sports & Exercise*® without two final corrections. The corrected statement is published here in its entirety.

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SUMMARY

This document provides an overview of select medical issues that are important to team physicians who are responsible for athletes with concussion. It is not intended as a standard of care, and should not be interpreted as such. This document is only a guide, and as such, is of a general nature, consistent with the reasonable, objective practice of the healthcare professional. Individual treatment will turn on the specific facts and circumstances presented to the physician. Adequate insurance should be in place to help protect the physician, the athlete, and the sponsoring organization.

This statement was developed by a collaboration of six major professional associations concerned about clinical sports medicine issues; they have committed to forming an ongoing project-based alliance to bring together sports medicine organizations to best serve active people and athletes. The organizations are: American Academy of Family Physicians, American Academy of Orthopaedic Surgeons, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and the American Osteopathic Academy of Sports Medicine.

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INTRODUCTION

It is *essential* the team physician understand:

- The recognition and evaluation of the athlete with concussion.
- Management and treatment of the athlete with concussion be individualized.

- The factors involved in making return-to-play (RTP) decisions after injury should be based on clinical judgment.
- A game-day medical plan specific to concussion injuries be developed.
- The need for documentation.
- There is a paucity of well-designed studies of concussion and its natural history.

It is *desirable* the team physician:

- Coordinate a systematic approach for the treatment of the athlete with concussion.
- Identify risk factors and implement appropriate treatment.
- Understand the potential sequelae of concussive injuries.
- Understand prevention strategies.

EPIDEMIOLOGY

- Concussions occur commonly in helmeted and non-helmeted sports, and account for a significant number of time loss injuries.
- Published reports indicate concussion injuries occur at a rate of:
 - 0.14–3.66 injuries per 100 player seasons at the high school level, accounting for 3–5% of injuries in all sports
 - 0.5–3.0 injuries per 1,000 athlete exposures at the collegiate level.
- Self-report data suggests significantly higher incidence of concussion.
- Because of under recognition and/or under reporting, the incidence of concussion and its sequelae is unknown.

PATHOPHYSIOLOGY

- Metabolic changes that occur in the animal model, and thought to occur in humans include:
 - Alterations in intracellular/extracellular glutamate, potassium and calcium
 - A relative decrease in cerebral blood flow in the setting of an increased requirement for glucose (i.e., increased glycolysis). This mismatch in the metabolic supply and demand may potentially result in cell dysfunction and increase the vulnerability of the cell to a second insult.

GAME-DAY EVALUATION AND TREATMENT

It is *essential* the team physician:

- Implement the game-day medical plan specific to concussion.
- Understand the indications for cervical spine immobilization and emergency transport.

On-Field

- Evaluate the injured athlete on-the-field in a systematic fashion:

TABLE 1. Selected acute signs and symptoms suggestive of concussion.

Cognitive	Somatic	Affective
Confusion	Headache	Emotional lability
Posttraumatic amnesia (PTA)	Fatigue	Irritability
Retrograde amnesia (RGA)	Disequilibrium, dizziness	
Loss of consciousness (LOC)	Nausea/vomiting	
Disorientation	Visual disturbances	
Feeling "in a fog," "zoned out"	(photophobia, blurry/double vision)	
Vacant stare	Phonophobia	
Inability to focus		
Delayed verbal and motor responses		
Slurred/incoherent speech		
Excessive drowsiness		

- Assess for adequate airway, breathing, and circulation (ABC's)
- Followed by focused neurological assessment emphasizing mental status, neurological deficit, and cervical spine status
- Determine initial disposition (emergency transport vs sideline evaluation)

Sideline

- Obtain a more detailed history and perform a more detailed physical examination.
- Assess for cognitive, somatic, and affective signs and symptoms of acute concussion (see Table 1), with particular attention to retrograde amnesia (RGA), posttraumatic amnesia (PTA), and more than brief LOC (minutes, not seconds), because of their prognostic significance.
- Not leave the player unsupervised
- Perform serial neurological assessments
- Determine disposition for symptomatic and nonsymptomatic players, including postinjury follow-up (options include return-to-play, home with observation, or transport to hospital).
- Provide postevent instructions to the athlete and others (e.g., regarding alcohol, medications, physical exertion and medical follow-up).

It is *desirable* the team physician:

On-Field

- Have a plan to protect access to the injured player
- Have emergency medical personnel on-site
- Have medical supplies on-site for rescue, immobilization and transportation [See "Sideline Preparedness for the Team Physician: A Consensus Statement"; (1)]

Sideline

- Delineate the mechanism of injury.
- Perform a more detailed assessment of cognitive function (e.g., memory, calculations, attention span, concentration, speed of information processing).
- Coordinate the care and follow-up of the athlete with concussion.

- Discuss status of athlete with parents, caregivers, certified athletic trainers and coaching staff within disclosure regulations.

POST-GAME-DAY EVALUATION AND TREATMENT

It is *essential* the team physician:

- Obtain a comprehensive history of the current concussion, and any previous concussion.
- Perform a physical examination, including a detailed neurological/cognitive evaluation.
- Determine the need for further evaluation and consultation.
- Determine return-to-play status.

It is *desirable* the team physician:

- Coordinate the care and follow-up of the athlete.
- Understand the indications and limitations of neuropsychological testing.
 - Postinjury neuropsychological test data are more useful if compared to the athlete's preinjury baseline.
 - It is unclear what type and content of test data are most valuable.
 - It is only one component of the evaluation process.
- Educate the athlete and others about concussion.
- Discuss status of athlete with parents, caregivers, certified athletic trainers and coaching staff within disclosure regulations.

DIAGNOSTIC IMAGING

It is *essential* the team physician understand:

- The limited value of plain skull radiographs.
- Indications of advanced imaging, such as CT or magnetic resonance imaging (MRI), to assess associated injuries including intracranial bleed, cerebral edema, diffuse axonal injury, and/or skull fracture.
- Indications for the use of cervical imaging when cervical spine injury is suspected.

It is *desirable* the team physician:

- Review the results of the imaging studies and/or ancillary tests such as facial bone radiographs.

MANAGEMENT PRINCIPLES

It is *essential* the team physician understand:

- Brief LOC (seconds, not minutes) is associated with specific early deficits, but does not predict the severity of injury; therefore classification systems or RTP guidelines based solely on brief LOC are not accurate.
- RGA, PTA, as well as the number and duration of additional signs and symptoms, are more accurate in predicting severity and outcome. RTP guidelines which address these issues are more useful.

- Duration of symptoms is a major factor in determining severity, therefore severity of injury should not be determined until all signs and symptoms have cleared.
- The treatment of and the RTP decision for the athlete with concussion must be individualized.

It is *desirable* the team physician:

- Coordinate a team for concussion management (e.g., physicians, certified athletic trainers, neuropsychologists, emergency response personnel).
- Discuss status of athlete with parents, caregivers, certified athletic trainers and coaching staff within disclosure regulations.

RETURN-TO-PLAY (RTP) DECISION

The RTP decision should be individualized, and not based on a rigid timeline. The team physician is ultimately responsible for the RTP decision. [See "The Team Physician and Return-To-Play Issues: A Consensus Statement"; (2).]

It is *essential* the team physician understand:

Same-Day RTP

- There is agreement that athletes with significant, persistent or worsening signs and symptoms (e.g., abnormal neurological examination, ongoing RGA or PTA, prolonged LOC) should not RTP.
- For other athletes with concussion, significant controversy exists for a same-day RTP decision and no conclusive evidence-based data are available. Areas of controversy include:
 - Returning an athlete with any symptoms to play.
 - Returning an athlete with fully resolved symptoms to play.
 - Certain symptoms, even if resolved, are contraindications to same-day RTP (e.g., any LOC, PTA, and RGA).
 - The duration and severity of symptoms are the determining factors of RTP.
- It is the safest course of action to hold an athlete out.

Post-Game-Day RTP

- Determine the athlete is asymptomatic at rest before resuming any exertional activity.
 - Amnesia may be permanent.
- Utilize progressive aerobic and resistance exercise challenge tests before full RTP.
- Consider factors which may affect RTP, including:
 - Severity of the current injury
 - Previous concussions (number, severity, proximity)
 - Significant injury in response to a minor blow
 - Age (developing brain may react differently to trauma than mature brain)
 - Sport
 - Learning disabilities

- Understand contraindications for return to sport (e.g., abnormal neurological examination, signs or symptoms with exertion, significant abnormalities on cognitive testing or imaging studies).
- Controversy exists for postgame RTP decisions.

It is *desirable* the team physician:

Post-Game-Day RTP

- Coordinate a team to implement progressive aerobic and resistance exercise challenge tests before full RTP.
- Recognize challenging cognitive effort may exacerbate symptoms of concussion and retard recovery.
- Discuss status of athlete with parents, caregivers, teachers, certified athletic trainers and coaching staff within disclosure regulations.
- Consider neuropsychological testing.

COMPLICATIONS OF CONCUSSION

It is *essential* the team physician:

- Understand cumulative concussions may increase risk for subsequent concussions.
- Determine when the athlete may RTP.

It is also *essential* the team physician understand other complications may occur, including:

- Convulsive motor phenomena
 - Tonic posturing or convulsive movements within seconds of the concussion
 - Dramatic, but usually benign
 - Require no management beyond on-field ABCs
 - No anticonvulsant therapy required
- Posttraumatic seizures
 - Seizure occurs days to months after concussion
 - Does require seizure management and precautions
 - Usually requires anticonvulsant therapy
- Postconcussion syndrome
 - Persistent postconcussion symptoms lasting months
 - Indicator of concussion severity
 - Precludes RTP while present
- Second impact syndrome
 - Occurs within minutes of concussion in athlete still symptomatic from prior brain injury

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- Prior brain injury can be earlier in same event
- Vascular engorgement leads to massive increase in intracranial pressure and brain herniation
- Usually with severe brain damage or death
- May occur with associated small subdural hematoma
- Except for boxing, all cases in literature in adolescents (<20 yr old)

It is *desirable* the team physician:

- Coordinate assessment and treatment of complications
- Discuss status of athlete with parents, caregivers, certified athletic trainers and coaching staff within disclosure regulations.

PREVENTION

Concussions cannot be completely prevented.

It is *essential* the team physician understand:

- Helmet use decreases the incidence of skull fracture and major head trauma, but does not prevent, and may actually increase, the incidence of concussion.
- Improper use of the head and improper fit of helmet or protective equipment may increase the risk of concussion.
- There are rules to limit concussion (e.g., spearing, head-to-head contact, leading with the head).

It is *desirable* the team physician:

- During the preparticipation evaluation, obtain a concussion history.
- Discuss the enforcement of rules to limit concussion with coaching staff and officials before practice and competition.
- Discuss with players and coaches techniques which may increase the risk of concussion.
- Support the use of mouth guards to decrease the risk of dental and facial injury, although the protection they provide to concussion risk is unclear.
- Educate athletes, parents, and coaches on the importance of reporting symptoms of concussion to limit complications.
- Educate athletes, parents, and coaches regarding the escalation of violence in sports.



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