



UPDATE: EVALUATION AND MANAGEMENT OF CONCUSSION IN SPORTS

This is a summary of the American Academy of Neurology (AAN) guideline update regarding evaluation and management of athletes with suspected or diagnosed concussion in sports.

Please refer to the full 2013 update at www.aan.com for more information, including definitions of the classification of evidence, classification of recommendations, and clinical contextual profiles.

FOR ATHLETES WHAT FACTORS INCREASE OR DECREASE CONCUSSION RISK?

Clinical Context: Preparticipation Counseling

Our review indicates that there are a number of significant risk factors for experiencing a concussion or a recurrent concussion in a sports-related setting. It is accepted that individuals should be informed of activities that place them at increased risk for adverse health consequences.

Level B	School-based professionals should be educated by experienced licensed health care professionals (LHCPs) designated by their organization/institution to understand the risks of experiencing a concussion so that they may provide accurate information to parents and athletes.
	To foster informed decision making, LHCPs should inform athletes (and where appropriate, the athletes' families) of evidence concerning the concussion risk factors as listed below. Accurate information regarding concussion risks also should be disseminated to school systems and sports authorities.

Preparticipation counseling recommendations by subcategory

Type of sport

Among commonly played team sports with data available for systematic review, there is strong evidence that concussion risk is greatest in football, rugby, hockey, and soccer.

Gender

Clear differences in concussion risk between male and female athletes have not been demonstrated for many sports; however, in soccer and basketball there is strong evidence that concussion risk appears to be greater for female athletes.

Prior concussion

There is strong evidence indicating that a history of concussion/mild traumatic brain injury (mTBI) is a significant risk factor for additional concussions. There is moderate evidence indicating that a recurrent concussion is more likely to occur within 10 days after a prior concussion.

Equipment

There is moderate evidence indicating that use of a helmet (when well fitted, with approved design) effectively reduces, but does not eliminate, risk of concussion and more-serious head trauma in hockey and rugby; similar effectiveness is inferred for football. There is no evidence to support greater efficacy of one particular type of football helmet, nor is there evidence to demonstrate efficacy of soft head protectors in sports such as soccer or basketball. There is no compelling evidence that mouth guards protect athletes from concussion.

Age or competition level

There is insufficient evidence to make any recommendation as to whether age or competition level affects the athlete's overall concussion risk.

Position

Data are insufficient to support any recommendation as to whether position increases concussion risk in most major team sports.

FOR ATHLETES SUSPECTED OF HAVING CONCUSSION, WHAT DIAGNOSTIC TOOLS ARE USEFUL IN IDENTIFYING THOSE WITH CONCUSSION AND THOSE AT INCREASED RISK FOR SEVERE OR PROLONGED EARLY IMPAIRMENTS, NEUROLOGIC CATASTROPHE, OR LATE NEUROBEHAVIORAL IMPAIRMENT?

Clinical Context: Use of Checklists and Screening Tools for Suspected Concussion

The diagnosis of a sport-related concussion (SRC) is a clinical diagnosis based on salient features from the history and examination. Although different tests are used to evaluate an athlete with suspected concussion initially, no single test score can be the basis of a concussion diagnosis. There is moderate evidence that standardized symptom checklists (Post-Concussion Symptom Scale/Graded Symptom Checklist [GSC]) and the Standardized Assessment of

Concussion (SAC) when administered early after a suspected concussion have moderate to high sensitivity and specificity in identifying sports concussions relative to those of the reference standard of a clinician-diagnosed concussion. There is low-moderate evidence that the Balance Error Scoring System (BESS) has low to moderate sensitivity and moderate to high specificity in identifying sports concussions. Generally, physicians with expertise in concussion are not present when the concussion is sustained, and the initial assessment of an injured athlete is done by a team's athletic trainer, a school nurse, or, in amateur sports in the absence of other personnel, the coach. These tools can be implemented by nonphysicians who are often present on the sidelines. Proper use of these tests/tools requires training. Postinjury scores on these concussion assessment tools may be compared with age-matched normal values or with an individual's preinjury baseline. Physicians are formally trained to do neurologic and general medical assessments and to recognize signs and symptoms of concussion and of more-severe traumatic brain injury (TBI).

Level B	Inexperienced LHCPs should be instructed in the proper administration of standardized validated sideline assessment tools. This instruction should emphasize that these tools are only an adjunct to the evaluation of the athlete with suspected concussion and cannot be used alone to diagnose concussion. These providers should be instructed by experienced individuals (LHCPs) who themselves are licensed, knowledgeable about sports concussion, and practicing within the scope of their training and experience, designated by their organization/institution in the proper administration of the standardized validated sideline assessment tools.
	In individuals with suspected concussion, these tools should be utilized by sideline LHCPs and the results made available to clinical LHCPs who will be evaluating the injured athlete.
	Team personnel (e.g., coaching, athletic training staff, sideline LHCPs) should immediately remove from play any athlete suspected of having sustained a concussion, in order to minimize the risk of further injury.
	Team personnel should not permit the athlete to return to play until the athlete has been assessed by an experienced LHCP with training both in the diagnosis and management of concussion and in the recognition of more-severe TBI.
Level C	LHCPs caring for athletes might utilize individual baseline scores on concussion assessment tools, especially in younger athletes, those with prior concussions, or those with preexisting learning disabilities/ADHD, as doing so fosters better interpretation of postinjury scores.

Clinical Context: Neuroimaging for Suspected Concussion

No specific imaging parameters currently exist for suspected SRC, but there is strong evidence to support guidelines for selected use of acute CT scanning in pediatric and adult patients presenting to emergency departments with mTBI. In general, CT imaging guidelines for mTBI were developed to detect clinically significant structural injuries and not concussion.

Level C	CT imaging should not be used to diagnose SRC but might be obtained to rule out more serious TBI such as an intracranial hemorrhage in athletes with a suspected concussion who have loss of consciousness, posttraumatic amnesia, persistently altered mental status (Glasgow Coma Scale <15), focal neurologic deficit, evidence of skull fracture on examination, or signs of clinical deterioration.
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FOR ATHLETES WITH CONCUSSION, WHAT CLINICAL FACTORS ARE USEFUL IN IDENTIFYING THOSE AT INCREASED RISK FOR SEVERE OR PROLONGED EARLY POSTCONCUSSION IMPAIRMENTS, NEUROLOGIC CATASTROPHE, RECURRENT CONCUSSIONS, OR LATE NEUROBEHAVIORAL IMPAIRMENT?

Clinical Context: Return to Play (RTP)—Risk of Recurrent Concussion

There is moderate to strong evidence that ongoing symptoms are associated with ongoing cognitive dysfunction and slowed reaction time after sports concussions. Given that postinjury cognitive slowing and delayed reaction time can have a negative effect on an athlete's ability to play safely and effectively, it is likely that these symptoms place an athlete at greater risk for a recurrence of concussion. There is weak evidence from human studies to support the conclusion that ongoing concussion signs and symptoms are risk factors for more-severe acute concussion, postconcussion syndrome, or chronic neurobehavioral impairment. Medications may frequently mask or mitigate postinjury symptoms (e.g., analgesic use for headache).

Level B	In order to diminish the risk of recurrent injury, individuals supervising athletes should prohibit an athlete with concussion from returning to play/practice (contact-risk activity) until an LHCP has judged that the concussion has resolved.
	In order to diminish the risk of recurrent injury, individuals supervising athletes should prohibit an athlete with concussion from returning to play/practice (contact-risk activity) until the athlete is asymptomatic off medication.

Clinical Context: RTP—Age Effects

Comparative studies have shown moderate evidence that early postconcussive symptoms and cognitive impairments are longer lasting in younger athletes relative to older athletes. In these studies it is not possible to isolate the effects of age from possible effects of level of play, and there are no comparative studies looking at postconcussive impairments below the high school level. It is accepted that minors in particular should be protected from significant potential risks resulting from elective participation in contact sports. It is also recognized that most ancillary concussion assessment tools (e.g., GSC, SAC, BESS) currently in use either have not been validated or are incompletely validated in children of preteen age or younger.

Level B	Individuals supervising athletes of high school age or younger with diagnosed concussion should manage them more conservatively regarding RTP than they manage older athletes.
	Individuals using concussion assessment tools for the evaluation of athletes of preteen age or younger should ensure that these tools demonstrate appropriate psychometric properties of reliability and validity.

Clinical Context: RTP—Concussion Resolution

There is no single diagnostic test to determine resolution of concussion. Thus, we conclude that concussion resolution is also predominantly a clinical determination made on the basis of a comprehensive neurologic history, neurologic examination, and cognitive assessment. There is moderate evidence that tests such as symptom checklists, neurocognitive testing, and balance testing are helpful in monitoring recovery from concussion.

Level C	Clinical LHCPs might use supplemental information, such as neurocognitive testing or other tools, to assist in determining concussion resolution. This may include but is not limited to resolution of symptoms as determined by standardized checklists and return to age-matched normative values or an individual's preinjury baseline performance on validated neurocognitive testing.
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Clinical Context: RTP—Graded Physical Activity

Limited data exist to support conclusions regarding implementation of a graded physical activity program designed to assist the athlete to recover from a concussion. Preliminary evidence suggests that a return to moderate activity is possibly associated with better performance on visual memory and reaction time tests, with a trend toward lower symptom scores as compared with scores for no-activity or high-activity groups. Preliminary evidence also exists to suggest that a program of progressive physical activity may possibly be helpful for athletes with prolonged postconcussive symptomatology. There are insufficient data to support specific recommendations for implementing a graded activity program to normalize physical, cognitive, and academic functional impairments. It is accepted that levels of activity that exacerbate underlying symptoms or cognitive impairments should be avoided.

Level C	LHCPs might develop individualized graded plans for return to physical and cognitive activity, guided by a carefully monitored, clinically based approach to minimize exacerbation of early postconcussive impairments.
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FOR ATHLETES WITH CONCUSSION, WHAT INTERVENTIONS ENHANCE RECOVERY, REDUCE THE RISK OF RECURRENT CONCUSSION, OR DIMINISH LATE NEUROBEHAVIORAL IMPAIRMENT?

Clinical Context: Cognitive Restructuring

Patients with mTBI/concussion may underestimate their preinjury symptoms, including many symptoms that are known to occur in individuals without concussion, such as headache, inattention, memory lapses, and fatigue. After injury there is a tendency to ascribe any symptoms to a suspected mTBI/concussion. Patients with chronic postconcussion symptoms utilize more medical resources, namely, repeat physician visits and additional diagnostic tests. Cognitive restructuring is a form of brief psychological counseling that consists of education, reassurance, and reattribution of symptoms and often utilizes both verbal and written information. Whereas there are no specific studies using cognitive restructuring specifically in sports concussions, multiple studies using this intervention for mTBI have been conducted and have shown benefit in both adults and children by reducing symptoms and decreasing the proportion of individuals who ultimately develop chronic postconcussion syndrome.

Level C	LHCPs might provide cognitive restructuring counseling to all athletes with concussion to shorten the duration of subjective symptoms and diminish the likelihood of development of chronic postconcussion syndrome.
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Clinical Context: Retirement from Play After Multiple Concussions—Assessment

In amateur athletes, the relationship between multiple concussions and chronic neurobehavioral impairments is uncertain. In professional athletes, there is strong evidence for a relationship between multiple recurrent concussions and chronic neurobehavioral impairments. A subjective history of persistent neurobehavioral impairments can be measured more objectively with formal neurologic/cognitive assessments that include a neurologic examination and neuropsychological testing.

Level C	LHCPs might refer professional athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments for neurologic and neuropsychological assessment.
	LHCPs caring for amateur athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments might use formal neurologic/cognitive assessment to help guide retirement-from-play decisions.

Clinical Context: Retirement from Play—Counseling

Other risk factors for persistent or chronic cognitive impairment include longer duration of contact sport participation and preexisting learning disability. In professional athletes, data also support ApoE4 genotype as a risk factor for chronic cognitive impairment. The only modifiable risk factor currently identified is exposure to future concussions or contact sports.

Level B	LHCPs should counsel athletes with a history of multiple concussions and subjective persistent neurobehavioral impairment about the risk factors for developing permanent or lasting neurobehavioral or cognitive impairments.
	LHCPs caring for professional contact sport athletes who show objective evidence for chronic/persistent neurologic/cognitive deficits (such as seen on formal neuropsychological testing) should recommend retirement from the contact sport to minimize risk for and severity of chronic neurobehavioral impairments.

FOR ATHLETES WITH CONCUSSION, WHAT INTERVENTIONS ENHANCE RECOVERY, REDUCE THE RISK OF RECURRENT CONCUSSION, OR DIMINISH LONG-TERM SEQUELAE?

On the basis of the available evidence, no conclusions can be drawn regarding the effect of postconcussive activity level on the recovery from sport-related concussion or the likelihood of developing chronic postconcussion complications.

This AAN guideline is endorsed by the National Football League Players Association, the American Football Coaches Association, the Child Neurology Society, the National Academy of Neuropsychology, the National Association of Emergency Medical Service Physicians, the National Association of School Psychologists, the National Athletic Trainers Association, and the Neurocritical Care Society.

This is an educational service of the American Academy of Neurology. It is designed to provide members with evidence-based guideline recommendations to assist the decision making in patient care. It is based on an assessment of current scientific and clinical information and is not intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, and are based on the circumstances involved. Physicians are encouraged to carefully review the full AAN guidelines so they understand all recommendations associated with care of these patients.

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