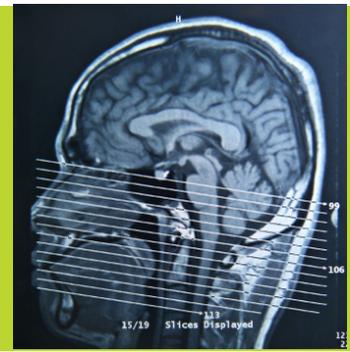


Concussion Guidelines for PHYSICIANS



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1. What is a concussion?

The 2017 Concussion in Sport Group (CISG) uses the following definition of a sports related concussion.

“Sport related concussion is a traumatic brain injury induced by biomechanical forces.”

According to the CISG, a Sports Related Concussion (McCrory et al., 2017):

1. may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
2. typically results in the rapid onset of short-lived neurological impairments that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.
3. reflects a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

2. Do you have to lose consciousness to have a concussion?

Perhaps the most important misunderstanding made when trying to define a concussion is that people

mistakenly believe concussion must involve a loss of consciousness (LOC). LOC is not required to make a diagnosis of concussion. In fact, most concussions occur without LOC. LOC is just one symptom of concussion, and, in fact, recent research has suggested that a brief (less than one minute) LOC is not necessarily as significant an indicator of concussion severity as once thought. It is important to realize that many people will report a loss of consciousness because they cannot recall events before, during or after their concussion. Unless this is witnessed as a true loss of consciousness, it may be that the person is experiencing amnesia, which is an important post-concussive symptom.

It is also important to note that concussion is not simply caused by a direct blow to the head. Blows to the face and to the jaw (which result in a force being transmitted to the brain) are also common causes of concussion. Even a significant blow elsewhere on the body (for example a hard tackle in football or rugby; being body checked in hockey) can cause concussive symptoms through a rapid movement of the soft brain inside the hard case of the skull.

In some head injuries, there may be structural injuries to the brain, such as intracranial bleeds which, if suspected, are critical to rule out early in the management of head injury. However, by definition, concussion does not result in any structural injury. Concussion, which is typically caused by a sports injury or fall, is instead a functional injury to the brain cells. Research protocols might show changes using advanced MRI techniques but these research protocols are not “routine” or “conventional” and

thus do not have any clinical role at this juncture. Given the lack of structural injury, routine structural neuroimaging studies (CT, structural MRI) by definition are negative in concussion.

3. Who gets a concussion?

The majority of concussions that a family physician will see are sport or activity related. Sports that involve contact or collision (hockey, soccer, football, rugby) are among the most common sports where concussion is seen. Other sports, such as basketball, also often involve contact and are therefore a higher concussion risk than non-contact activities.

However, since a concussion occurs due to the brain accelerating and decelerating within the cranial cavity, a concussion can occur in virtually any activity, including non-sporting activity (such as in motor vehicle crashes, injuries at work and falls at home or elsewhere, particularly in the elderly) where a blow to the head, face or jaw, or other force to the head occurs. You should ask about potential concussion when you have a patient who notes a history of a whiplash injury, or an injury around the neck and shoulder area. For example, someone who fell directly on the shoulder may report mainly shoulder pain at the time, but may also have post concussive symptoms that are important to deal with.

4. What are the signs and symptoms?

Concussions can include one of more of the following symptoms:

- **Physical symptoms:** headache, dizziness, nausea, feeling unsteady, feeling “dinged” or “stunned” or “dazed”, feeling like their “bell was rung”, seeing stars or other visual disturbances, ringing in the ears, double vision, simply “not feeling right”.
- **Cognitive symptoms** include: confusion, amnesia, disorientation, poor concentration, and memory disturbance.
- **Balance Impairment** (e.g. unsteady gait)
- **Behaviour/Emotional symptoms:** feeling of depression, moodiness, irritability

- **Sleep/Wake disturbance** (e.g. drowsiness, insomnia)

It is important to note that not all concussions will include all of these features. If any one of the aforementioned symptoms (or other similar symptoms) is present, concussion should be suspected. Keep in mind that symptoms and signs may be more pronounced later or within a short time after the injury.

5. What exactly causes the symptoms?

The pathology behind concussion and its resultant symptoms is still at the infancy stages of being understood. Injury to the neurons will result in ionic shifts resulting in a metabolic crisis. This interferes with cell-to-cell communication in the brain. However, there is no simple “test” which will give all the answers about diagnosis and resolution of the problem. This is obviously a significant limiting factor in our assessment and management. Therefore, it is critical to be aware of the multiple post concussive signs and symptoms, and of appropriate management, which will be described further below.

6. How do I make a diagnosis? What about grading systems?

If any of the above symptoms or signs is noted in a setting of potential head injury (and don't forget that head injury can occur in association with neck, shoulder and upper body injuries), a concussion should be suspected and the diagnosis of concussion should be considered.

The [ACE](#) (Acute Concussion Evaluation), [SCAT5](#) (Sports Concussion Assessment Tool 5) and the [Child SCAT5](#) are the currently the typical types of tools in concussion diagnosis and assessment and are designed for use by physicians and licensed healthcare professionals. While the SCAT5 and the Child SCAT5 are tailored to evaluating concussions within the sports setting, the ACE is typically used within an ED setting.

The Child SCAT5 is a standardized tool for evaluating concussions in children between 5-12 years of age,

while SCAT5 is used to evaluate athletes 13yrs or older. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion.

Furthermore, there maybe a number of “modifying factors” which may influence the investigation and management of concussion, and may predict the potential for more prolonged symptoms. These predictors of include:

- demographic factors (girls and adolescents),
- past history factors (past personal history migraine or prior concussion duration >1 week),
- physical exam (tandem stance balance difficulty),
- early signs (answering more slowly) and symptoms (headache, noise sensitivity and fatigue)

In patients with high number of risk factors for prolonged symptoms, the athlete might be best managed in a multi-disciplinary manner coordinated by a physician with specific expertise in concussion management. (See *Additional Resources* for ONF standards for post-concussion care)

7. I'm at the rink or the field and I suspect someone has sustained a concussion. How do I deal with this?

Coaches, parents and players all play an important role in helping to identify when a concussion might have occurred using the Concussion Recognition Tool 5 (CRT5) is useful in evaluating concussions. According to the 2017 Concussions in Sports Group, in all suspected cases of concussion, the individual should be removed from the playing field and assessed by a physician or licensed healthcare provider. Furthermore, the group emphasizes that while a sideline evaluation of cognitive function is an essential component in the assessment of this injury, it is a rapid screening for a suspected Sports Related Concussion, rather than the definitive diagnosis of head injury. (McCroly et al., 2017)

Regardless, the [SCAT5](#) and [Child SCAT5](#) tools can be used by physicians and qualified healthcare providers

in a performing a Brief neuropsychological (NP) assessment that tests for attention and memory.

As with any injury, it is critical to assess airway, breathing and circulation first. If the player is unconscious, it is critical to understand that a spine injury could also have occurred and the athlete must be dealt with accordingly, using full spine precautions and management techniques, and rapid transport to hospital by ambulance. If the player is conscious, but clearly confused and unable to provide a reasonable history (such as noting neck pain, feeling an extremity, etc.), then it is better to err on the side of caution and also treat this as a potential spine injury. More typically, the player will exhibit symptoms and signs as discussed in question 3 above. *It is critical to understand that the symptoms may not seem that significant initially, but may continue to evolve and become more severe with time.* Thus, any player that you suspect to have had a concussion should be removed from the game or practice and not allowed to return. No medication should be given, and the signs and symptoms should be monitored for increasing severity.

Signs of a structural brain injury could include: increasingly severe headaches, decreasing level of consciousness, increasing tiredness and confusion, any lateralizing weakness, seizure temporally remote from the injury, or persistent vomiting. Anyone with these symptoms needs immediate emergency assessment. If you, as a physician, are dealing with a concussion at the rink or the field, it is important to do only what you feel comfortable within your level of expertise. If you have extensive experience dealing with concussion, the player may not need further medical assessment. If not, the player should be referred for further assessment, whether in the emergency department acutely, or to another physician with more concussion expertise as soon as possible. All concussed individuals should be seen by a physician.

In many cases, you may be asked to discuss concussion assessment and management with parents, coaches, and trainers. The previously mentioned principles apply. When a concussed athlete is being assessed by a non-physician, it is important

that the athlete be assessed by a physician as soon as possible after the injury.

Here are some of the critical considerations of a sideline assessment.

- The player should be evaluated by a physician or other licensed healthcare provider onsite using standard emergency management principles and particular attention should be given to excluding a spine injury.
- The appropriate disposition of the player must be determined by the treating healthcare provider in a timely manner. If no healthcare provider is available the player should be safely removed from practice or play and urgent referral to a physician arranged.
- Once the first aid issues are addressed, an assessment of the concussive injury should be made using the [ACE](#), [SCAT5](#) or [Child SCAT5](#) or other sideline assessment tools.
- The player should not be left alone following the injury and serial monitoring for deterioration is essential over the initial few hours following injury.
- A player with diagnosed concussion should not be allowed to return to play on the day of injury.

8. A concussed athlete comes into my office for assessment. How do I do this?

An individual clinical assessment must include:

- A medical assessment including a comprehensive history and detailed neurological examination including a thorough assessment of mental status, cognitive functioning, behavioural changes, sleep wake disturbance, ocular and vestibular function and gait and balance.
- A determination of the clinical status of the patient including whether there has been improvement or deterioration since the time of injury. This may involve seeking additional information from

parents, coaches, teammates and eyewitness to the injury.

- A determination of the need for emergent neuroimaging in order to exclude a more severe brain injury (e.g. structural abnormality)

A thorough history, and physical examination are the key to diagnosis and management. It is most helpful if the concussed athlete comes to the office with a friend, parent, etc. who can often provide some of the history that may be difficult for the concussed person to remember. Start by asking about the injury: What happened? Was there a loss of consciousness, and if so for how long? (Remember, a more prolonged loss of consciousness is significant). Is there any amnesia for the event? What are the symptoms? What is the clinical course of the symptoms (improving, worsening)?

It is also extremely important to ask about a past history of concussions, and to get specific details regarding these. It has been found that there may be an increased risk of sustaining subsequent concussive injuries after a first concussion. Thus, the athlete with multiple concussions may be at significantly more risk. The athlete who is becoming concussed more and more easily, and frequently, with more severe and longer lasting symptoms, is of significant concern. When asking about previous concussions it is important to not just ask about documented concussions, but about any episodes where the person had any post concussive symptoms. Many will not make the connection between the symptoms and the fact that they may have been concussed. For example “having your bell rung” or “seeing stars” are often not perceived as a concussion by many, but are in fact consistent with post concussive symptoms even if only transient.

Following the history, an appropriate physical examination should be performed. This should look at the head, the neck (it is very common in the setting of a blow to the head or the face that neck pain can result, and can contribute to symptoms such as headaches), eyes, ear, nose and throat. A full neurologic assessment is important to rule out structural injury or other neurologic causes of symptoms.

Balance and coordination testing is helpful. The [SCAT5](#) and [Child SCAT5](#) tools can be used by physicians and qualified healthcare providers in performing a Brief neuropsychological (NP) assessment that tests for cognitive screening, memory function, balance assessment and cervical spine assessment.

In addition to physical tests, cognitive tests can be done to establish whether or not a patient has a concussion. When the standard mini mental status exam is not adequate to confirm the presence of a concussion, tests of orientation, memory and concentration should be performed.

(See *Additional Resources* for the ONF Guidelines on diagnosing and managing concussion, 2014)

Computerized Neurological Testing

CNT (computerized neuropsychological testing) has a role in select cases, when used by a qualified practitioner. However, CNT does not replace the expertise and experience of the clinician in the assessment and management of SRC in children, and has no validated role in prevention strategies. Baseline testing of youth athletes using any tool (including CNT) is not required to provide post-injury care of those who sustain a suspected or diagnosed concussion. Therefore, routine use of CNT is not recommended in youth athletes regardless of sport or level of play. Finally, given that baseline testing results evolve as children age, this further limits the use of CNT for diagnosis and management of concussion in children.

9. Do I need to order any imaging?

As noted previously, concussion is a functional injury not a structural injury, and thus, imaging studies will not be useful. If there is any suspicion of a structural injury, such as a bleed (for example increasingly severe headaches), then imaging with a CT, or MRI in select circumstances, may be indicated. A CT may be warranted if there is suspicion for an intracranial injury using clinical prediction rules (e.g., PECARN, CATCH, Canadian Head CT rules).

For the approach to suspected intracranial head injury, refer the CPS algorithm (figure 1) within the CPS Position Statement for children presenting with head

trauma. (CPS, 2016) The Canadian Head CT Rule may be applied for adults. (Steill et al., 2001) See *Additional Resources* for details.

If there is any concern about associated injuries, such as facial fractures, injuries to the neck, etc., then appropriate imaging should be ordered. Alternative imaging technologies (e.g., fMRI, DTI, etc.) are still at early stage of development in concussion and not recommended other than in a research setting.

10. How can I manage this player? What sort of treatment options do I have? How do I know when to allow them back to sport?

As was previously discussed, *when a player shows any signs or symptoms of concussion, they should not be allowed to return to play in the current game or practice.* They should not be left alone; regular monitoring for deterioration is essential given that symptoms can progress. *It is clear that excessive physical and cognitive (mental) activity increases post concussive symptom severity and prolongs their course. Thus, the most important initial management feature for concussion is rest, from both physical and cognitive exertion. Major restrictions on physical and cognitive activity should not last more than 24-48 hours.* In someone with severe symptoms, there should still be gradual introduction of physical and cognitive activities. Most are able to proceed with very light daily activities (excluding weight training, sport participation, and other major exertion activities). If their symptoms are worsened, they should reduce their level of activity. It is very important to make this clear to the player, friends and family, as too rapid return to major activity levels early on can often be a significant cause for prolonged symptoms.

The Concussions in Sports Groups notes that normal recovery of concussions symptoms following an SRC may take between 10–14 days in adults and approximately 4 weeks in children. If symptoms persist beyond this expected timeframe, the group recommends detailed multimodal clinical assessments as outlined within the *Consensus Statement on Concussion in Sport, Oct 2016.* (McCrory et al., 2017).

Critical points of advice for a concussed patient's recovery

Initial period of rest (both physical and cognitive) generally no more than 24-48 hours of rest; followed by a gradual return to activity (mental and physical) as tolerated by the individual is recommended.

It is always unsafe to return to activities that may result in a new concussion (e.g., new fall, new collision) while patient is symptomatic. Patients must be medically cleared before contact or higher risk activities are permitted. While patients may increase activities as tolerated, too rapid a progression while still symptomatic may prolong the post-concussive course.

While rest is still the recommended treatment during the acute phase (24-48 hours immediately following the injury), there is still minimal evidence to inform what is the ideal degree and length of rest prescribed. Further, a strict rest protocol post-injury in adolescents may worsen outcomes and contribute to increased symptom reporting. (Schneider et al, 2017) The most current recommendation around rest follows that a brief period (24-48 hours) of cognitive and physical rest is appropriate for most patients. Following this, patients should be encouraged to gradually increase activity. The exact amount and duration of rest are not yet well defined and require further investigation. (Reference: <http://dx.doi.org/10.1136/bjsports-2016-097475>)

Clinicians should work carefully with the student/athlete to create a well-paced return to learn, return to play and return to life treatment plan that includes reassurance, positive expectations of recovery, reasonable and gradual re-introduction to activity and consideration of other physical and psychosocial factors that may affect outcome.

Other things to keep in mind:

- no alcohol
- no prescription or non-prescription drugs without medical supervision. Specifically, no sleeping tablets

- Do not drive until medically cleared
- Do not participate in contact sport activities or activities with high risk for falling until medically cleared

Warning signs to watch for

Concussed patient must be advised that problems could arise over the first 24 – 48 hours. The athlete should not be left alone and must go to a hospital at once if they:

- Have a headache that continues to worsen
- Are very drowsy or can't be awakened
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on their feet; have slurred speech

11. When should I provide clearance to return to play if I am asked to do so?

A typical graduated return to play or activity protocol is as follows:

1. **Symptom limited activity.** Physical and mental rest during the first 24-48 hours of the injury. Physical Rest means no training, playing, exercise, weights. Cognitive Rest means, avoiding television viewing, extensive reading, computer-based activities, etc. Any activity that increases symptoms must be avoided. Beware of excessive exertion with activities of daily living that can exacerbate symptoms. Avoid daytime sleep as it would throw off the circadian rhythm.

Proceed to step two only when symptoms are declining and do not worsen with activity.

2. **Light aerobic exercise** such as walking or stationary cycling. Monitor for symptoms and signs. No resistance training or weight lifting.
3. **Non-contact activities** – Sports training (eg. skating in hockey). No contact or risk of contact.
4. **Drills without body contact.** May add light resistance training at step 3 or 4 and then progress to heavy weights. The time needed to progress from non- contact to contact exercise will vary with the severity of the concussion and player. Medical clearance must be obtained before proceeding to the next step.
5. **Drills with body contact.**
6. **Game play.**

* Please note that each level is a step, not a day. It may take more than one day to proceed between each step. However, each step should take a minimum of one day, i.e. a full 24 hour period. The key to this approach is that the athlete should only continue to the next level if symptoms are not exacerbated by activity at the current level.

If any post concussive symptoms worsen with activity and then try to progress again after a day or so of rest, and only proceed to the next stage when tolerated. It is critical to note that the athlete may not be able to progress from one step to another on a daily basis. So, when asked “How long will I be out?” by the athlete, parent or coach, it is clear that it is impossible to give a specific answer. Sport-specific post- concussion rehab programs have been developed by concussion experts, but follow the guidelines given above.

“Return-to-Physical Activity” may occur in parallel to “Return-to-Learn” protocol if tolerated by the patient. These [Return to Learn](#) and [Return to Play](#) tools by Parachute detail the steps in recovery process for a concussed student athlete. The protocol can also be applied to adult athletes wherein, cognitive activities that do not exacerbate symptoms are first introduced within the graduated protocol, followed by introduction to physical activity.

To summarize this important management information, remember that the athlete should rest for the first 24-48hour post injury, and then progress to a step-wise return to play protocol as tolerated. An athlete

should not return to contact or high-risk activities until cleared to do so by a physician.

Once you are certain that the athlete is completely symptom-free, and has proceeded through all steps of the graduated return to play protocol, then you may indicate that the player is fit to return to full competition.

REMEMBER: A player should never return to activities that worsen symptoms. They should definitely not return to sports on the same day even if they show no signs of a concussion.

12. What about somebody who has had multiple concussions? When should I be telling them it is not a good idea to return to contact or collision sports?

It has certainly been observed that once one has had one concussion, there is an increased risk of subsequent concussive injuries. However, there are multiple factors that come into play, including possibly genetics. If you have an athlete who has had numerous concussions especially within a short period of time such as a few weeks or months, it is prudent to be very cautious, and to seek further opinion from a physician with expertise in dealing with concussion.

Three concerning scenarios are when:

1. the athlete who has had numerous concussions, with each concussion seemingly more easily obtained, and with symptoms which are more severe and longer lasting;
2. any athlete who has residual neurocognitive problems after other symptoms have all resolved (e.g. memory or concentration impairment); and
3. protracted, prolonged symptoms. These are people potentially at risk for significant long-term problems and would best be advised to give up any contact or collision activities, which put them at risk. However, it would be best to involve the advice of a concussion expert in this regard where possible.

13. Are children managed differently?

The [Child SCAT5](#) is a standardized tool for evaluating injured children for concussion and can be used in children aged from 5 to 12 years. The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The Child SCAT5 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. A child may have a concussion even if their Child SCAT5 assessment is “normal”

The concept of “cognitive exertion” is very important in children; this refers to school, home computer use, video games, etc. These may exacerbate post-concussion symptoms. Thus, it is necessary to rest from these activities as well, until symptoms decline, then gradually re-introduce them as tolerated by the child.

“Return-to-Physical Activity” may occur in parallel to “Return-to-Learn” protocol if tolerated by the patient. Cognitive exertions including activities that require focus, concentration, memorization and multi-tasking can aggravate post-concussive symptoms. For example, students often find that going to school makes their symptoms worse, so may need to stay home until they feel better. They should then start back to school part time (e.g. half days), progressing to full time as their symptoms decline. This can often be frustrating for the student, their parents and teachers, as it is impossible to state specifically how long they will need to be at a reduced level of learning. Once back to school, the student’s workload should be managed appropriately with specific accommodations, given that an increase in cognitive exertion may aggravate their symptoms.

14. Is there anything I can do to try to prevent concussion?

Protective equipment such as helmets is often highlighted in relation to brain injury prevention. Helmets protect the brain very well against some types of brain injuries such as intracranial hemorrhages and skull fractures. However, helmets may not prevent

concussions, and there is no universally accepted “concussion-proof helmet” since concussions may occur without even direct blows to the head. A physician is in an excellent position to educate and encourage the athletes, parents, coaches/trainers about ways to recognize the injury, and to reduce the risk of concussion. Strict adherence to rules, avoiding aggression and violence such as fighting are important measures to prevent concussions. Recognition of the injury is of primary importance, since appropriate management can begin only when concussion is recognized. Nonetheless, it is important to ask about protective equipment when assessing a patient for concussion.

It is important to try to determine if the helmet is in good condition, and whether it is being worn properly. If you are unsure about this yourself, try to consult someone in your community who may be more expert in this regard (a sporting good manufacturer, hockey trainer, etc.). A helmet that is not worn properly or done up properly may not protect the head. In addition, any helmet that has sustained structural damage will also not protect the head. Helmet liners, whether made of foam, or polystyrene, will deteriorate with time, even though they may look normal. Perfumes, shampoos, and hair gels will contribute to this. There is no definite consensus, but it is often felt that hockey helmets, for example, should be replaced every year or two in someone who plays on a regular basis. Other helmets may come with replacement recommendations from the manufacturer. Helmets should be encouraged in other sports such as skiing, snowboarding, in line skating and cycling. Newer types of head-gear are now being seen in soccer.

While strong research is required to unequivocally support the role of mouth guards in preventing concussions, it is clear that mouth guards help to prevent dental injury and some jaw fractures so they should be worn for this important reason in many sports.

Discussing the concepts of fair and clean play with your patients, as well as encouraging them to improve playing style and technique (for example learning how to go into the boards appropriately in hockey) are also

very important. Advocating for enforcement of rules and rule changes to make games safer is also very important and the physician plays a significant role in this regard as a community expert. Try to be aware of educational resources available. Parachute may be able to connect you to local Chapters or community workers for this purpose.

15. What does the future hold? Is there research going on?

There are still significant gaps in our knowledge about concussion. Extensive research is going on throughout the world to try to answer some of these very important questions. While the key future research is on acute management, work is also being done in diagnostic modalities, imaging techniques, and concussion evaluation in complex cases.

It is our hope that the answers to the above questions will help to make physicians more comfortable and confident in dealing with concussion. There are certainly things that are still not known about concussion, and significant controversy in some areas. The use of grading systems, while convenient, is discouraged due to lack of scientific evidence. The key points to remember, though, are:

1. Concussion is a functional injury to the brain. You do not have to be knocked out to have sustained a concussion.
2. Concussions do not appear on standard imaging tests.
3. It is always unsafe to risk sustaining another head injury while still recovering from a current one, thus “When in doubt, sit them out”.
4. Initial concussion management begins with injury recognition and rest until the symptoms subside, after which a gradual, step-wise return to learn and return to play protocols should be followed.
5. If you are not sure, seek the help of a physician with concussion expertise where possible.
6. Prevention is critical.

Additional Resources

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www.parachutecanada.org/concussion