

# **Course 7**

## **Concussion and head injuries**

## **Learning objectives of the course**

Upon completion of this course, the student will be able to:

- Recognise the signs and symptoms of a concussion on the field.
- Apply the “If in doubt, sit them out” rule and implement immediate removal of the athlete.
- Know the main lines of international protocols (SCAT, Pocket SCAT).
- Implement a gradual and safe return to play (6-step RTP protocol).
- Identify high-risk sports and prevention measures.

## **Introduction: concussion, an often underestimated emergency**

Concussion is a mild traumatic brain injury (mTBI) of traumatic origin that transiently alters neurological function. Long considered “benign”, it is now recognised as a potentially serious condition, especially when mismanaged or when return to play is too early.

In contact sports (rugby, American football, hockey, boxing, football/soccer, handball, etc.), concussion is common. The coach plays a key role in detection and in preventing early return, which is responsible for feared complications (second impact syndrome, cognitive sequelae).

**“If in doubt, sit them out” – International consensus rule on concussion.**

### **1. Definition and simplified pathophysiology**

#### **1.1 Definition (Berlin 2017 consensus, updated 2022)**

Concussion is a transient neurological disorder induced by a biomechanical mechanism (direct or indirect blow to the head, neck or body transmitted to the head), causing an immediate and reversible alteration of brain function, with no structural abnormality visible on standard imaging (CT, MRI).

#### **1.2 What happens in the brain**

- A sudden movement (acceleration/deceleration, rotation) causes stretching of axons and neuronal membranes.
- Massive release of neurotransmitters (glutamate), calcium influx, mitochondrial dysfunction.
- Disturbances in energy metabolism (increased glucose demand, decreased blood flow).

These disturbances last from a few days to several weeks.

### 1.3 Severity and recovery

Most concussions (80-90%) recover within 7 to 14 days in adults.

*The major risk is early return: if a second impact occurs before complete healing, the risk of second impact syndrome (malignant brain oedema, possible death) is real.*

Repeated concussions increase the risk of cognitive sequelae, depression, and chronic traumatic encephalopathy (CTE).

## 2. Recognising the signs of concussion

Signs can be observed by the coach (visible signs) or reported by the athlete (symptoms). All may appear immediately or within minutes/hours.

### 2.1 Observable signs (by the coach or referee)

Sign	Example
<b>Sudden loss of consciousness (even brief)</b>	Athlete collapses, even for 1-2 seconds
<b>Confusional state</b>	Disoriented, no longer knows the score, the opponent
<b>Balance disturbances</b>	Staggering, falling, unsteady gait
<b>Retrograde (before impact) or anterograde (after) amnesia</b>	“What happened?”
<b>Slow responses, blank stare</b>	Does not react to simple questions
<b>Focal neurological signs (rare)</b>	Arm paralysis, head deviation

### 2.2 Symptoms reported by the athlete

Headache (most frequent)

- Nausea, vomiting
- Dizziness, vertigo
- Blurred vision, sensitivity to light (photophobia)
- Sensitivity to noise (phonophobia)
- Feeling of “mental fog”
- Unusual fatigue
- Sleep disturbances (insomnia, hypersomnia)
- Irritability, sadness, anxiety

### 2.3 Absolute warning signs (medical emergency – evacuate)

- Prolonged loss of consciousness (> 1 min)
- Seizures
- Repeated vomiting
- Limb weakness, facial asymmetry
- Progressive neurological deterioration (agitation, drowsiness)
- Wound or deformity of the skull, clear fluid or blood draining from ear/nose
- In these cases: call emergency services immediately, assume spinal immobilisation.

### 3. On-field management (international protocols)

#### 3.1 Golden rule: “If in doubt, sit them out”

Any athlete who has sustained a blow to the head and presents even a single sign (even transient) of concussion must be removed immediately from the session or match. No return on the same day, even if symptoms disappear.

#### 3.2 Field tools: SCAT 5 / SCAT 6 and Pocket SCAT

- SCAT (Sport Concussion Assessment Tool): complete tool for medical use (physician, physiotherapist).
- Pocket SCAT: simplified version for coaches, referees, first aiders.

#### Key elements for a coach:

Step	What to do?
1. Observation	Is there loss of consciousness, imbalance, confusion?
2. Immediate questions	“Where are we?”, “What period is it?”, “What happened?”
3. Simple test (Maddocks)	Sport-specific questions (e.g., “What is the score?”, “Who is the opponent?”). An error is suggestive.
4. Balance test (BESS)	Feet together, eyes closed, 20 sec: sign of instability.

**Note:** These tests do not replace a medical examination. They help the decision to remove.

#### 3.3 Immediate management (algorithm)

- Complete stop of activity.
- Removal from the field (on a stretcher if loss of consciousness, balance disturbance, suspected spinal injury).
- Initial assessment (consciousness, breathing, severity signs).
- Monitoring: do not leave the athlete alone for 2-3 hours.

- Medical alert if signs of severity (see above) or major doubt.
- No return on the same day – regardless of the stakes.

### 3.4 Information to give to the athlete and their family

- Cognitive and physical rest for 24-48h.
- Avoid screens (phone, computer, television), reading, intense schoolwork.
- Signs of worsening (seizures, vomiting, drowsiness) → go to emergency department.
- Do not take alcohol, sleeping pills, or painkillers without medical advice.
- Medical consultation (primary care physician, sports physician) within 24-72h.

## 4. Gradual return to play (RTP)

Return is never decided by the coach alone, but on medical advice. The physician must confirm the disappearance of symptoms at rest and during exertion.

Standardised protocol (6 steps): minimum of one step per day, sometimes more ( $\geq 24$ h per step). If symptoms reappear → go back to the previous step.

Step	Activity	Objective
<b>1. Complete rest (24-48h)</b>	No physical activity, cognitive rest (no intense school/work)	Resolution of acute symptoms
<b>2. Light aerobic activity</b>	Walking, very light cycling, slow swimming, 50% HRmax, 10-15 min	Increase blood flow without symptoms
<b>3. Sport-specific activity</b>	Running, sport movements but no contact (e.g., dribbling, passing)	Reintroduce sport-specific gestures
<b>4. Non-contact training</b>	More intense exercises, coordination, changes of direction (no duels)	Test tolerance to intensity
<b>5. Contact training</b>	Return to light contact, then normal (under supervision)	Full reconditioning
<b>6. Return to competition</b>	Official match or competition	Medical clearance

**Minimum total duration:** 7 days (if symptoms resolved by 48h). In practice, most concussions require 10-14 days before full return.

## 5. Prevention in high-risk sports

### 5.1 Sports with high risk of concussion

Sport	Risk level
Rugby	Very high (tackles, scrums)
American football	Very high
Ice hockey	High (contacts, boards)
Boxing, MMA	Very high (direct blows to the head)
Football (soccer)	Moderate to high (aerial duels, heading)
Handball, basketball	Moderate (contacts, elbows)
Skiing, snowboarding	Moderate (high-speed falls)
Cycling (road, BMX)	Moderate (falls)

### 5.2 Prevention measures

Level	Action
Rules	Ban dangerous play (high tackling, deliberate heading). Limit heading in youth (some federations).
Equipment	Helmets (rugby? controversial, effective mainly for preventing fractures). Mouthguards (reduce transmitted force, moderate efficacy).
Education	Teach low tackling techniques, safe landing. Raise awareness among athletes and coaches about signs.
Organisation	Have a concussion officer. Written protocol. AED and emergency plan.

**Limitation of helmets:** They do not prevent concussion (moderate risk reduction). They do not give a “license to hit”.

## 6. Specifics according to populations

### 6.1 Children and adolescents (< 18 years)

- Developing brain → recovery time often longer (up to 4 weeks).
- Even stricter RTP protocol (longer step 1, mandatory medical re-clearance).
- Avoid early return at all costs → potential cognitive sequelae.

### 6.2 Athletes with a history of concussions

- Higher risk of another concussion.
- More cautious return threshold.
- After 3 concussions in one season, some recommend definitive cessation of contact sports.

### **6.3 Repeated concussions and decision to stop**

Factors: severity, short interval, persistent symptoms (>3 months).

Collegial decision (physician, coach, athlete, family); sometimes a change of sport should be advised.

#### **Key points to remember**

- ✓ Any blow to the head with neurological signs (confusion, loss of consciousness, imbalance, amnesia, headache) is a potential concussion.
- ✓ Absolute rule: “If in doubt, sit them out” – no return on the same day, no matter what.
- ✓ Tools: Pocket SCAT, Maddocks test, observation of signs.
- ✓ Return to play: gradual over at least 7 days, cleared by a physician, with 6 steps.
- ✓ Serious complication: second impact syndrome (early return → possible death).
- ✓ Prevention: education, rules, techniques, helmets (limited efficacy on concussion).
- ✓ In children: longer recovery, stricter protocol.