Table of Contents

Introduction ......................................................... 3
Awareness ............................................................. 3
Concussion diagnosis background ................................ 4
Clear and immediate diagnosis of concussion .................. 4
  When should a team doctor/physio run out for an on-field assessment? .......................... 5
  What should an on-field assessment include? ........................................ 5
  Role of the umpire and players on the field ........................................... 6
  Role of a video review ............................................................................. 6
Suspected diagnosis of concussion ................................... 7
Concussion not suspected – risk of delayed onset concussion .......................... 8
Concussion Diagnosed ..................................................... 8
  Immediate management of concussion ................................................. 9
  Rehabilitation ....................................................................................... 9
  The return to play decision .................................................................. 10
  Management of a difficult concussion case ........................................... 10
  Role of formal neurophysiological assessment ........................................ 11
Baseline testing ............................................................ 11
Community level competition ........................................... 11
Concussion in children ..................................................... 12
References ................................................................................. 12
Head trauma assessment flowchart .................................... 13
Introduction

While concussion is not a common injury in cricket and the incidence of repetitive head trauma even less so, nevertheless, due to the potential health risks associated with head trauma, management guidelines are required. The ICC’s Concussion Management Guidelines follow the guidance provided by the 2016 Berlin Concussion Consensus (http://bjsm.bmj.com/content/47/5/250), which is the current best practice benchmark.

Concussion is defined as a ‘traumatic brain injury induced by biomechanical forces’(1). It typically results in a rapid onset of neurological impairment that resolves spontaneously, although in some cases, clinical features may evolve over time. A concussion does not cause any structural damage to the brain, but acute clinical signs and symptoms largely reflect functional disturbance. Nevertheless, concussion is a potentially serious injury that may have both short (increased musculoskeletal and brain injury risk) and long-term (CTE, dementia and mental health issues) health risks. Concussion therefore requires a conservative management approach.

These guidelines cover head injuries and concussion during both games and training.

Awareness

All players, support staff and officials should be aware of the potential health risks of concussion and the ICC Concussion Guidelines, aimed at protecting players from these potential risks.

Furthermore, all participants in the sport need to be aware that any player who has a concussion diagnosed or concussion strongly suspected during a match, must be removed from that match and only return to competition when cleared by a medical practitioner experienced in the management of concussion. In one day or Twenty20 matches, this means the player cannot return to play in that game unless, the concussion diagnosis is reversed by a medical practitioner. In a multi-day match, this means that the player must be medically
cleared before he/she can return to the game.

The ICC, Member Federations, National teams and their health care personnel are all responsible for raising the awareness of the risks related to head trauma and the need for a more conservative approach to the management of concussion.

Concussion diagnosis background

The diagnosis of concussion is based on symptoms and/or signs of acute neurological dysfunction, altered mental state or cognitive impairment. The symptoms and signs may come on rapidly, evolve over time, sometimes have a delayed onset (up to 48 hours) and usually resolve relatively quickly. The condition can present in different ways depending on what aspect of the brain’s function has been disturbed. The condition can be difficult to interpret clinically as many of the symptoms and signs are largely non-specific.

After head trauma and a potential SCAT5 assessment soon after that injury, a final diagnosis cannot be made because of the frequent incidence of delayed symptoms of concussion. A final diagnosis can only be made after delayed onset concussion has been excluded at about 48 hours post-injury.

Clear and immediate diagnosis of concussion

Cricket at the elite level generally has good medical support at matches. If during the course of a match, a player receives a significant knock to the head or neck and is unable to immediately resume play, a concussion should be suspected and the most senior member of the team’s health care personnel, ideally a doctor, should immediately attend to the player.

From a practical perspective, a player with new (post-trauma) neurological symptoms or signs or any evidence of a disturbed mental state or cognitive function following a significant head knock, is considered to have concussion until an alternative diagnosis is confirmed.
If any of the following signs are observed then the diagnosis of concussion is clear:
- confirmed loss of consciousness,
- suspected loss of consciousness (prolonged immobility > 5 seconds)
- seizure, convulsion or tonic posturing (stiffening of any limb)
- ataxia, loss of motor control, inability to stand or staggering
- dazed or blank stare
- player in a confused state, disoriented or with memory impairment

In such circumstances, the player should be immediately removed from the match with the diagnosis of concussion already made. A SCAT5, referred to later in these Guidelines, can be deferred to after the day’s play.

### What should an on-field assessment include?

1. Ask the player if they have any symptoms such as dizziness or headache;
2. Talk to the player and see if they seem to be responding appropriately;
3. Does the player have a dazed appearance or a blank stare or does not seem their normal selves;
4. Is the player able to stand or walk normally;
5. Ask the player modified Maddocks questions relevant to cricket and
6. If available check the video of the incident for video signs of clear or suspected concussion.

If the doctor or physio notes anything of concern based on the above assessment, then the player should be taken off the field immediately for a SCAT assessment.
Fig 1. Clear and immediate diagnosis of concussion

Role of the umpire and players on the field
An umpire should call for medical assistance if a player receives a significant head knock (unable to immediately return to play) or indeed has immediate worrying signs. In addition, a less severe helmet strike/head injury should demand immediate medical attendance if a player appears:
- to have loss of consciousness
- dazed
- unable to stand or is staggering

The team doctor or the appropriate member of the team’s health care team should be called onto the field to assess the player. In such circumstances, the observations of the umpire or players on the field should be passed onto the doctor or physiotherapist.

Role of a video review
If video of the injury incident is available it should be reviewed. This can occur after the player has been attended on the field of play or may help inform management if the incident was missed.

The purpose of this review is to assist with determining whether immediate signs of concussion were present and missed in the direct observation of an incident.

If signs of a significant impact and/or suspected concussion are present following the video review, the player should be immediately removed from the field of play with the need for further examination.
Suspected diagnosis of concussion (where the diagnosis is not clear on the initial attendance)

In circumstances where there has been head or neck trauma and following attendance on the field, the diagnosis is not obvious but there are potential symptoms or signs of concussion, such as:

- the player complains of a headache or dizziness
- the player ‘seems’ not to be their normal self
- there was the ‘possibility’ of the player being unsteady on their feet

The player should be removed for further neurological assessment in the medical room. This assessment should closely follow the SCAT5 and will take at least 10 minutes.

Fig 2. Suspected diagnosis of concussion
Concussion not suspected - risk of delayed onset concussion

10-20% of concussion cases have a delayed onset. In a technical sense, concussion can only be excluded 48 hours after an incident of significant head or neck trauma.

If following an on-field assessment, concussion is not diagnosed, the player may immediately resume playing. If following an off-field assessment (the SCAT5), concussion is not diagnosed, the player may return to the match. However, because of the potential evolving nature of any brain dysfunction and delayed onset risk, the player should be observed and checked regularly (if practical, about every 4 or 5 hours), looking for developing symptoms or signs of concussion. A player must be removed from the match if concussion symptoms develop.

A formal assessment should be repeated after the match or day’s play and again about 24 to 48 hours later, utilising the SCAT5 (i.e. before start of play next day).

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Concussion diagnosed

Whether by obvious signs or symptoms or following the SCAT5, if the diagnosis of concussion is made, the player should be immediately and permanently removed from further participation in the match or training on that day.
Immediate management of concussion

At a match or training

A player diagnosed with concussion must be immediately and permanently removed from further participation in the match or training on that day. Because of this requirement, the initial focus of management is to diagnose or exclude concussion.

Serious structural head injury - emergency referral to a hospital

If a player diagnosed with concussion or suspected concussion has or develops signs of a more serious brain injury, then the player should be urgently transferred to a hospital with a neurosurgical unit. Signs of a possible serious structural brain injury include:

- deteriorating conscious state
- subsequent convulsion or seizure
- double vision
- accelerating symptoms such as headache or vomiting
- focal neurological signs or symptoms in the limbs such as weakness or altered sensation
- neck pain or tenderness
- increasing agitation, irritability or combativeness

Rehabilitation

The Berlin Consensus describes a graded return to play process leading to a formal medical clearance. Each stage of the rehabilitation should be reviewed to ensure that concussion symptoms have not returned. Generally, concussion symptoms will settle within 2-3 days and a player diagnosed with concussion is ready to return in about a week but in some individuals this time might be shorter or longer. Medical oversight, as occurs in elite teams, is essential if a player is to return to play within a week or on a subsequent day of a multi-day match.
Typical graded return to play for cricket:

- 24 hours relative rest
- light aerobic exercise
- light training
- full training
- cleared to compete

If at any of these stages symptoms return the player should drop back an exercise level.

If the player is a student they may require a couple of days off school to rest. A player should not return to full training if unable to attend school or work without symptoms returning.

**The return to play decision - for a subsequent match or during a multi-day match**

A concussed player requires a formal medical clearance to return to training and play and never permitted to return on the day of the injury. Usually a player will recover in about 7 days but this can vary from individual to individual.

**Management of a difficult concussion case**

If the concussion symptoms continue for more than 3 weeks a player should be referred to a specialist who is experienced in the management of concussion. More than likely the player will be referred for a full neuropsychological assessment and may require a standard MRI to exclude structural brain damage. Other investigations will be undertaken as determined by the specialist neurological examination.

In difficult cases, the specialist, in collaboration with the team doctor, is responsible for clearing the player to return to full training and competition.
Role of formal neuropsychological assessment

Formal neuropsychological assessments are indicated in the management of difficult concussion, i.e players with persistent symptoms or signs, escalating symptoms related to separate concussion incidents and/or potential retirement decisions related to concussions.

Baseline testing

Baseline testing can be a useful adjunct to the neurological assessment and in tracking recovery. This may utilise the actual SCAT5, online systems such as Cogsport and ImPACT or pen and paper cognitive screening tools.

Baseline testing is recommended for elite teams but not community level sport. If baseline testing had been undertaken (ie. computerized cognitive testing such as CogState or ImPACT, SCAT5 or written cognitive assessment) this should ideally return to baseline before a player can return to competition. Any baseline neurophysiological testing is an adjunct to a neurological assessment and any final decision must be by a doctor.

Community level competition

At the community level, a cricket match is highly unlikely to have a medical practitioner present. Therefore, any possibility of concussion should see the player removed from play and referred to a medical practitioner for management of concussion.

The Berlin Consensus has developed a concussion recognition tool and this document will assist parents and coaches in recognising the possibility of concussion.

pocket Concussion Recognition Tool (CTR) -
http://bjsm.bmj.com/content/bjsports/47/5/267.full.pdf
Concussion in children

Managing the identification of concussion in children requires a more conservative approach. The Child SCAT5 has been developed for use by medical professionals for the assessment of children between the ages 5-12 years. For players aged 13 years or older, the SCAT5 can be used.

*Child SCAT5* -  [http://bjsm.bmj.com/content/bjsports/early/2017/04/26/bjsports-2017-097492childscat5.full.pdf](http://bjsm.bmj.com/content/bjsports/early/2017/04/26/bjsports-2017-097492childscat5.full.pdf)

Rehabilitation of children is slower and initial attention should be to remove the child from school and monitor symptoms related to schoolwork and then exercise and sport.

If symptoms persist for 3 weeks, the child should be referred to a pediatric concussion specialist.

**REFERENCES**

Head Trauma Assessment
(Following on-field assessment by a team doctor or physio)

**Clear & immediate diagnosis of concussion**
- loss of consciousness, seizure, tonic posturing, ataxia, dazed, confused, disoriented
  
  **Remove from play/training**
  
  Watch for signs of a structural head injury requiring urgent treatment

**Suspected Concussion**
- complains of symptoms consistent with concussion, player seems not their normal self or possibility of balance disturbance
  
  **Off-field assessment**
  
  **SCAT5 & Video review if available**
  
  **Concussion diagnosed**
  
  **Remove from play/training**
  
  Watch for signs of a structural head injury requiring urgent treatment

  **Concussion excluded**
  
  **Resume play/training**
  
  Checked every 4 or 5 hours for developing symptoms

**Concussion NOT suspected**
- no signs or symptoms, including a review of any video of the incident
  
  **Resume play/training**
  
  Checked every 4 or 5 hours for developing symptoms
  
  **SCAT5 at the end of play on that day and repeated at 48 hours**