

Injuries in Cricket

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Context: Cricket is a popular global sport that requires a combination of physical fitness, skill, and strategy. Although a noncontact sport, overuse and impact injuries are common since players engage in a wide range of physical activities, including running, throwing, batting, bowling, catching, and diving. Significant or match time-loss injuries are defined as those that either prevent a player from being fully available for selection in a major match, or during a major match, cause a player to be unable to bat, bowl, or keep wicket when required by either the rules or the team's captain. This review describes the various region-wise injuries sustained in cricket along with their epidemiology, biomechanics, treatment, and prevention.

Evidence Acquisition: Data were collected from peer-reviewed articles (obtained via PubMed search) published through November 2016 that involved the medical, biomechanical, and epidemiological aspects of cricket injuries.

Study Design: Clinical review.

Level of Evidence: Level 4.

Results: Cricket was one of the first sports to publish recommended methods for injury surveillance in 2005 from England, South Africa, Australia, the West Indies, and India. While the incidence of injuries is about the same, the prevalence of injuries has increased due to game format changes, increasing number of matches played, and decreased rest between matches. Bowling (41.3%), fielding, and wicket keeping (28.6%) account for most injuries. Acute injuries are most common (64%-76%), followed by acute-on-chronic (16%-22.8%) and chronic ones (8%-22%). The most common modern-day cricket injury is hamstring strain, and the most severe is lumbar stress fracture in young fast bowlers.

Conclusion: With improved understanding of the scientific and medical aspects of cricket, along with advances in surgical and nonsurgical treatment techniques, the time to return to play has shortened considerably. While the prevalence of cricket injuries has increased, their severity has decreased over the past decades.

Keywords: cricket; bowling; injuries; biomechanics; overuse injuries; lumbar stress fracture

Cricket is a global sport traditionally popular in the commonwealth nations but now being played in 105 member countries of the International Cricket Council. Cricket is the world's second-most popular spectator sport after football and has captivated people of every age, sex, background, and ability for more than 400 years. A bat-and-ball game with complex rules, cricket involves physical fitness, skill, and strategy.

Cricket is played on a rectangular pitch centered on an oval field with 11 players on a team. Each side comprises batsmen, bowlers, fielders, and a wicketkeeper. After a run-up, bowlers have to deliver a hard ball toward the stumps 22 yards (20 m) away using a round-arm extended elbow action (see Figure A1 in Appendix

1, available in the online version of this article), with the ball usually bouncing before being hit by the batsman. The batsman uses a variety of strokes to hit the ball with a special wooden bat and score runs (see Figure A2 in Appendix 1, available online). Fielders, including the wicketkeeper behind the stumps, prevent runs from being scored and attempt to get the batsman out.

There are 3 formats of cricket at the professional level based on the duration of the game: T20, 1-day, and test matches. T20 are intense, short-duration matches involving 20 overs (of 6 balls each) bowled by each team. One-day matches have each team bowling 50 overs each, whereas test matches last 5 days and have each team batting twice, with approximately 90 overs being bowled in a day.

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Although cricket is a noncontact sport, overuse and impact injuries are common since players engage in a wide range of physical activities, including running, throwing, batting, bowling, catching, jumping, and diving. Moreover, projectile injuries occur despite protection, since the 5.5-ounce hard ball is bowled at the batsman at speeds of up to 160 km/h and can bounce off the pitch in an erratic fashion or swing through the air. The definition of a *significant* or *match time-loss* cricket injury is one that either prevents a player from being fully available for selection in a major match, or during a major match, causes a player to be unable to bat, bowl, or keep wicket when required by either the rules or the team's captain.³⁶ These injuries have been further differentiated based on the mode of onset: sudden-onset noncontact injuries (eg, anterior cruciate ligament [ACL] tear during knee twisting while fielding, ankle sprain during bowling run-up, rectus tear during sudden evasive action during batting), impact/traumatic injury (eg, mallet finger during catching, fractured rib due to player collision during fielding), gradual onset associated with bowling/running/throwing/batting practice/weight-training (eg, gradual onset low back pain in fast bowlers secondary to lumbar pars stress fracture), insidious (gradual and no identifiable mode of onset) (eg, anterior knee pain secondary to patella-femoral chondral degeneration in bowlers, posterosuperior shoulder pain during overhead throwing secondary to superior labral anteroposterior [SLAP] lesions), and medical illnesses (eg, flu, gastroenteritis). These types of injuries have been included in the definition of cricket injuries since 2016 as these had the potential to affect cricket training or playing.³⁷

EPIDEMIOLOGY

Cricket was one of the first international sports to publish recommended methods for injury surveillance in 2005.³⁶ Subsequently, format and rule modifications necessitated changes to injury surveillance, and in 2016, an international consensus statement on injury surveillance in cricket was introduced.³⁷ Scientific data on injury surveillance in cricket have been reported from England, South Africa, Australia, the West Indies, and India.^{15,23,27,32,42,43,46} While the incidence of injuries is more or less the same, the prevalence of injuries has been steadily increasing because of the increasing number of matches played and the decreasing amount of rest periods between matches.³⁰ The most common cricket injury reported is hamstring strain, and most severe is lumbar stress fracture in young fast bowlers, which is usually season ending.^{30,34}

Bowling (41.3%), fielding, and wicket keeping (28.6%) account for most injuries.⁴³ Acute injuries are most common (64%-76%), with the rest being acute-on-chronic (16%-22.8%) and chronic (8%-22%).^{27,43} Younger players (<24 years old) sustain more overuse and bowling injuries than older players.⁴³ Lower limb injuries form nearly 49.8% of injuries, followed by back injuries (22.8%), upper limb injuries (23.3%), and neck injuries (4.1%). Hamstring and quadriceps strains formed the majority of lower limb injuries sustained primarily during bowling and fielding.

Injuries to fingers primarily during batting and fielding predominate upper limb injuries (35.4%), and shoulder injuries (21.7%) occurred during throwing and bowling.⁴³ Players in the West Indies sustained 40% of injuries during test matches, 32% during 1-day matches, and 28% outside of match play.²⁷

CRANIOFACIAL INJURIES

From 1870 to 2015, a total of 36 catastrophic head injuries were reported in professional international cricket: 5 (14%) were fatal and 9 (22%) were career-ending. Six injuries (16.5%) involved major ocular injury that warranted surgical intervention. Batsmen (31 injuries, 86%) were the most vulnerable, followed by wicketkeepers (3 injuries, 8%) and fielders (2 injuries, 5.5%).⁴⁴

Cricket-related maxillofacial injuries account for 6% to 7.1% of the total sports-related maxillofacial injuries. Midface fractures (70%) were most common, with the zygoma (31.9%) being most commonly fractured; 38% of patients required hospitalization.^{24,43}

Cricket causes 5.4% to 9% of all sporting eye injuries. In cricket, a rising ball has been incriminated in serious injuries of the eye whereby the dominant side is most involved in the hook shot. All 5 players from a single study who sustained eye injuries had a permanent visual defect, while 1 player sustained globe rupture.²² A wicketkeeper, on the other hand, is more likely to incur an eye injury when a spin ball dislodges the bails. Hence, sports-specific eye gear is recommended for batsmen and wicketkeepers.^{22,44}

The use of protective helmets during batting started in 1978, and helmets have been reported to decrease the frequency of head/neck and facial injuries from 62% to 4% over a 2-year period. The recent fatal accident of Australian cricketer Phillip Hughes highlighted the deficiencies in existing helmet designs and reignited the debate on rule modifications with regard to bouncer and beamer fast deliveries. Moreover, the incidence of concussion in cricket is not known, and existing helmets are designed to prevent catastrophic head injury but not concussion.⁴⁴ Additionally, most recent midface injuries and nasal fractures have occurred despite the player wearing a helmet, with the ball entering through the grill. Hence, cricket helmet protection is a controversial issue, and constant updates to safety standards are paramount. It is also important to educate and protect recreational players, since injuries in this group are not reported and underestimated.

UPPER LIMB INJURIES

A prospective study of professional cricket players in India reported that 16 upper limb injuries occurred in a study group of 95 players over 1 year (16.8%).¹⁵ Of these 16 injuries, 12 were acute, with fingers being most commonly injured during fielding, whereas 4 were repetitive stress injuries. The incidence of these injuries was 1.24 per 10,000 hours of practice, or 0.07% per 100 days of exposure. A mean 33 days of active cricket were lost due to injury, with 62.5% players losing more than 4 weeks.¹⁵

Shoulder

A study among English players found that 23% of players sustained a shoulder injury during a single season (majority affected in the throwing arm), with 63% of fielders and 35% of bowlers reporting a negative impact on their performance.³⁹ The prevalence of shoulder injuries reported is 0.8% to 1.7% in English players and 0.9% in Australian players.³³

Australian injury surveillance data from 1995 to 2001 revealed that shoulder injury prevalence among batsmen, fast bowlers, and spin bowlers was 0.3%, 0.9%, and 1.1%, respectively.³² However, in our experience, the majority of shoulder pain in cricket is secondary to tendinopathy (eg, rotator cuff, biceps) and more likely related to fielding, particularly throwing, than to bowling. Since fielding and bowling involve overhead throwing and abnormal torque across the shoulder joint, this activity is most at risk for shoulder injuries. Appendix 2 (available online) provides further details on shoulder injuries.

Elbow

Lateral epicondylitis is common in batsmen and is often caused by improper batting biomechanics or inappropriate equipment such as a heavy bat. This injury is managed in the early stages using physiotherapy and rehabilitation to recover strength imbalances of the forearm and correct biomechanical alterations in the elbow. Chronic extensor carpi radialis brevis (ECRB) tendinopathy and ECRB tears may warrant surgical correction.

The throwing mechanism adopted by both close-in fielders and fast bowlers is a whip-like motion of the arm, which places repetitive valgus strain on the elbow. In adolescent cricketers, this causes medial epicondylar apophysitis, and after confirming the radiological status of the growth plate, can be treated with rest, physical therapy, and rehabilitation. In older players, after years of fast bowling, a valgus extension overload syndrome with secondary intra-articular degeneration can develop. Arthroscopic debridement of impinging osteophytes with synovectomy and chondroplasty is often useful in extending the playing career of the bowler.

Hand

An epidemiological study demonstrated that, in Edinburgh, 22.4% of all hand injuries were due to sports, and 2.5% of these injuries were due to cricket. The fifth ray was the most commonly affected.³ The prevalence of hand and wrist injuries in cricket varies from 11% to 13%.³² Hand injuries are more common than the wrist, with the right hand being injured more often. A bruise or hematoma was the most common nonspecific injury, and distal interphalangeal joint dislocation was the most common specific injury. Only 11% of cricketers required operative intervention. The mean time lost due to injury if treated conservatively was 27 days; this grew to 50 days if the injury required operative intervention. Strapping the last 2 fingers has been advocated to prevent injuries.² Appendix 2 (available online) provides further details on hand injuries.

TRUNK INJURIES

Trunk injuries are relatively unique to cricket fast bowlers and comprise either side strains, lower rib periostitis, or posterior chest wall injuries. A side strain is an acute tear of the internal oblique muscle in pace bowlers involving the nonbowling arm side (Figure 1). The osteochondral tips of the lower ribs can sometimes also sustain avulsion fractures. This results from the bowler's nonbowling arm being pulled down from a position of maximum elevation with some lateral trunk flexion during the final delivery action.²¹ It is often a recurrent injury. When chronic, the tips of the lowest ribs can hypertrophy and impinge against the pelvis during the delivery stride (bony impingement) or the soft tissue can get pinched between the 2 structures (soft tissue impingement). The pain is consistently located in the mid-axillary line involving the lower 4 ribs, with focal tenderness at the rib attachment and pain on resisted side flexion on the affected side. Bowler's side strain is a clinical diagnosis and does not necessitate magnetic resonance imaging (MRI). MRI (STIR [short tau inversion recovery] and T2 images) can yield evidence of a tear of the internal oblique muscle, with or without associated tears of the external oblique and, less commonly, the transversalis muscle. Treatment consists of rest, taping, and a rehabilitation program aimed at pain relief, recovery of mobility and strength, and modifying bowling technique. The role of corticosteroid injections is controversial, although they have been administered with some success.²¹

Lower rib periostitis is an overuse injury causing thoracolumbar back pain and is often termed the "shin splints of the trunk." The offending muscles are usually the lateral trunk flexors, primarily the quadratus lumborum, and sometimes the internal oblique. The diagnosis is confirmed with increased uptake on a bone scan. It is a benign condition and is relieved with ice applications, massage, and physiotherapy.

Posterior lower chest wall injuries are also noted on the side opposite to the bowling arm. Although the exact pathology is often not identified, they behave like muscle tears of the latissimus dorsi or serratus posterior inferior and are treated with rest and rehabilitation.

LUMBAR SPINE INJURIES

Fast bowlers have a high incidence of serious and career-threatening lumbar spine injuries. These injuries can be sustained acutely during bowling or can be chronic resulting from repetitive stress of lateral flexion with rotation sustained during the delivery stride and follow-through. The most common presentations are in the form of disc degeneration and lumbar spine bony changes. The bony changes may be in the form of stress reaction, chronic stress fracture, and subtotal stress fracture and are seen on the side opposite to the bowling arm.

In a review of spinal injuries in fast bowlers, the prevalence of lumbar disc injury was 21% to 65%, with 4% to 33% of fast bowlers having severe disc degeneration.⁴ The incidence of disc

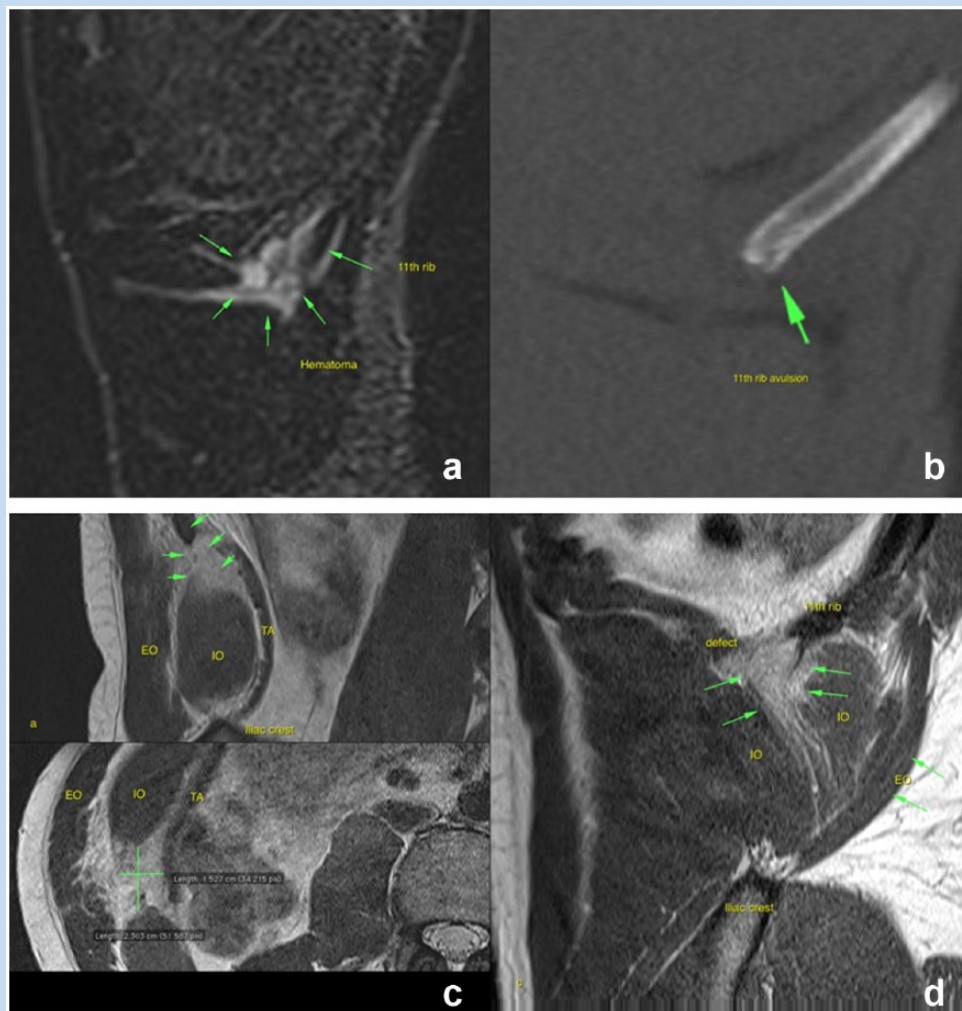


Figure 1. Acute side strain in a fast bowler after a “pull-down” injury of the nonbowling arm. Arrows delineate the tear and retraction of the internal oblique muscle. (a, c, d) Magnetic resonance imaging reveals an internal oblique muscle tear with a small hematoma. (b) The computed tomography scan reveals an associated avulsion fracture of the osteochondral tip of 11th rib. EO, external oblique; IO, internal oblique; TA, transversus abdominis.

degeneration was 15%, with the L4-L5 and L5-S1 discs being more commonly involved in 62% to 64% of bowlers affected.⁹

The prevalence of spondylolysis in the general population is 3% to 6%. The prevalence of bony changes in bowlers seen on MRI is 24% to 81%, but the prevalence of each subtype varies in each study. It appears that the chronic stress reaction is the most common subtype, and the L4 and L5 vertebrae are the most commonly involved.⁴¹ Furthermore, the nondominant side is most commonly involved in these bony abnormalities.^{18,40,41} Appendix 2 (available online) provides further details on lumbar spine injuries.

Lumbar Disc Degeneration

As many as 61% of fast bowlers have been reported to have abnormalities of the intervertebral disc seen on MRI, with 33% having severe lumbar disc degeneration. The majority of degenerative discs were found at the L4-L5 and L5-S1 levels.

However, disc degeneration is usually asymptomatic, and bowlers continue to bowl.⁴¹ Disc degeneration was earlier thought to be a causative factor of spondylolysis, but nearly 50% of patients with a pars chronic stress reaction did not have any disc degeneration. Patients with chronic bilateral fractures had disc degeneration, indicating that bilateral pars fracture could lead to disc degeneration.⁴¹

Spondylolysis

Bowlers with chronic fracture or fatigue reaction present with a slowly progressive mechanical backache. They experience pain progressively earlier in their spell until they are unable to bowl. Those with an acute fracture present with a breakdown and acute spasm in the back.³⁸ Diagnosis is confirmed on computed tomography scan. Recently, MRI has become the investigation of choice in fast bowlers with low back pain.¹⁰ It can help in early

visualization of vertebral stress changes, which can reliably predict risk of future stress fracture.

Injury Prevention

A series of educational initiatives with encouragement of fast bowlers to adopt a nonmixed technique has succeeded in decreasing the incidence of spine injuries. The single-leg balance test on an unstable surface with the eyes closed and Star Excursion Balance Test, especially while standing on the ipsilateral side of the bowling arm, can help identify bowlers who are at high risk of sustaining back and lower trunk injuries. Poor performance on these tests is predictive of injuries later in the season.

LOWER LIMB INJURIES

In a longitudinal study of the nature of injuries to South African cricketers, lower limb injuries accounted for nearly half of injuries (49.8%) and primarily included injuries to the hamstring (17.8%) and quadriceps (10.1%) muscles, patella and knee (18.5%), and ankle (10.6%). These injuries were primarily caused by bowling and fielding.⁴³

Hamstring

Hamstring strain has emerged from being one of many common injuries a decade ago to being the most common injury in the sport at the elite level. This is presumably in association with the rise of T20 cricket. These strains have a seasonal incidence of 8.7 injuries per 100 players per season, with most strains being grade 1 or 2.³⁴

Hamstring injuries are often related to the high number of overs bowled in the previous week.³¹ In addition, other modifiable factors postulated are inadequate warm-up, fatigue during play, inadequate flexibility, low back injury, and strength imbalance between hamstrings and quadriceps (hamstring strength <60% of quadriceps). Nonmodifiable factors include older age and previous injury.²⁵ Bilateral asymmetry of knee flexor strength has not been found to be a predisposing factor in hamstring injuries in cricket players unlike soccer.¹¹ Lower limb muscle strains have been found to be correlated with lumbar stress fractures. While calf strains have a strong correlation, hamstring and quadriceps strain have less strong correlation. Most hamstring and abdominal strains occur on the nonbowling side, and most quadriceps and calf strains occur on the bowling side.³⁰ Appendix 2 (available online) provides further details on hamstring injuries.

Quadriceps

Fielding, bowling, and batting regularly require sudden forceful eccentric contraction of the quadriceps during regulation of knee flexion and hip extension. Higher forces across the muscle-tendon units with eccentric contraction can lead to strain injury. Excessive passive stretching or activation of a maximally stretched muscle can also cause strain. The rectus femoris is the most frequently injured component of the quadriceps and the

strain is classically at the distal musculotendinous junction, midportion, or the proximal insertion. Appendix 2 (available online) provides further details on quadriceps injuries.

Knee

The most common knee problems in cricketers, especially fast bowlers, are related to workload and include patellar tendinopathy, chondral degeneration, and medial tibial or femoral stress fractures. The relationship of workload to injury often determines the type of injury: Tendons appreciate constant moderate loads, bone stress fracture correlates with increased medium-term workload with a history of low career workload, and joint injury correlates with high career workload.²⁹ Appendix 2 (available online) provides further details on knee injuries.

As limited-overs matches are often decided by a few runs, fielders are regularly required to dive full length to stop a ball, resulting in an increasing number of acute knee and ankle injuries (besides cervical spine “whiplash” injuries).⁴³ Players and coaches need to be aware of the increase in these injuries, and specialized training sessions focusing on the correct technique for diving and returning to a balanced position to throw the ball are necessary to keep players injury free.

Foot and Ankle

Epidemiologic studies of cricket injuries have reported that 11% of injuries affecting fast bowlers involve the foot and ankle.³² The forefoot is more prone to acute injuries during high peak sagittal moments during bowling whereas the hindfoot is more susceptible to overuse injuries and lateral ankle instability.

Posterior ankle impingement is a common problem in cricketers and comprises a variety of conditions, including flexor hallucis tendinitis, peroneal tenosynovitis, intra-articular loose bodies, ankle synovitis, and os trigonum disorders. It usually affects fast bowlers on the contralateral side of bowling arm. Pain is only experienced during bowling in the back foot due to forced dorsiflexion during front-foot landing and not during running.²⁶ Lateral ankle radiographs usually visualize the os trigonum. MRI is the investigation of choice as it shows associated soft tissue inflammation and chondral injury.²⁶ Modern low-cut boots that exaggerate ankle movement, varying ground hardness, and increased bowling workload contribute to repetitive trauma and inflammation around the os trigonum, causing posterior ankle pain and impingement. Appendix 2 (available online) provides further details on foot and ankle injuries.

CONCLUSION

Modern-day cricket requires greater physical prowess, and it is the duty of the players, coaches, medical support team, and administrators to incorporate measures to ensure that unnecessary injuries do not prevent players from fulfilling their full potential in the sport. Injury surveillance and prevention are just as important as early detection and treatment. It is encouraging to note that with improved understanding of the

scientific and medical aspects of cricket, along with advances in surgical and nonsurgical techniques, and that although the prevalence of cricket injuries has increased,³⁵ their severity has decreased over the past decades, and the time to return to play has shortened considerably.

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