

## High-grade pronator teres tear in a cricket batsman

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We present a case of a torn pronator teres muscle of the right forearm that occurred following prolonged batting during recreational cricket. Previous reports of cricket injuries to batsmen describe phalanx fractures due to direct ball impact. However, we could find no prior reports of pronator teres or other upper-extremity muscle injury. Our patient demonstrated a high-grade tear to the pronator teres muscle and no injury to the collateral ligaments. In this case, repetitive use of the pronator and flexor muscles with quick acceleratory movements stressed this muscle group and resulted in injury.

### Case report

A 36-year-old man complained of right medial elbow pain that began following prolonged batting in a game of cricket. Initial symptoms included elbow aching, tenderness, and pain. Despite rest, symptoms continued for a month, causing the patient to visit a sports medicine physician. On exam, he exhibited tenderness to palpation over the medial collateral ligament, and some swelling was noted at the medial elbow. Range of motion for the shoulder, elbow, and wrist was normal in all planes. He also exhibited slight laxity in the right elbow with valgus stress at 30 degrees, and pain with valgus stress at 0 degrees. His physician considered medial epicondylitis, but felt the patient's findings were most likely due to a medial collateral ligament injury.

MRI of the right elbow (without contrast) showed intact radial and ulnar collateral ligaments. Minimal nonspecific bone-marrow edema was noted in the proximal radius, but there was no evidence of fracture. Minimal feathery edema was noted within the adjacent flexors and felt to represent mild strain. The biceps brachii, brachialis, triceps, and the common extensor-supinator muscles and their tendons appeared normal. Coronal T2-weighted (T2W) fat-saturated

images showed a high-grade tear of the right pronator teres muscle (Fig. 1). Radiographs of the elbow were not obtained.



Figure 1. Coronal T2W fat-saturated image of the right elbow shows an irregular zone of high signal intensity (arrows) interrupting the pronator teres (pt) muscle, consistent with a high-grade muscle tear.

Followup exam by an orthopedic hand surgeon demonstrated pain with wrist flexion and ulnar deviation. The surgeon felt that there was no effective surgical repair for a

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pronator teres tear and recommended continued use of over-the-counter pain medications and avoidance of activities that provoked the pain. The expected outcome is healing of the muscle tear, with formation of scar tissue.

### Discussion

To our knowledge, there have been no prior published reports of pronator teres muscle injury of any type. However, the MR findings in our patient are similar to those seen in other acute traumatic musculotendinous injuries (1), with an irregular zone of high-signal intensity interrupting the pronator teres muscle.

Musculotendinous injury may occur due to either direct contusion or as the result of indirect trauma from excessive tension (1). Such injuries usually occur as the result of a single traumatic event, unlike the case of our patient, who was injured following prolonged batting. Also unlike our patient's case, most indirect musculotendinous injuries occur near the myotendinous junction---the weakest part of the musculotendinous unit (1). Musculotendinous injuries are graded according to the extent of the injury (Table).

Grade	Extent	MR findings
I	Stretch injury	Interstitial edema and hemorrhage at injury site, extending into the adjacent muscle fascicles, often with a feathery appearance on MR images
II	Partial tear	Partial tear without retraction; hematoma and perifascial fluid collections frequently noted about myotendinous junction
III	Complete tear	Complete rupture of the myotendinous unit, often with retraction

These injuries are usually not visible on radiographs, may be inapparent on CT, and are best visualized with sonography or MR.

Based on studies from Commonwealth countries where cricket is most frequently played, the most common injuries seen in high-level cricket occur in young players (up to age 24) while bowling (2). These include lower-limb injuries (hamstring strains and groin injuries) as well as back injuries due to the repetitive twisting and extension motion while bowling (3, 4). Players at recreational levels experience injuries evenly distributed among all positions: bowling, batting, and fielding. These injuries are primarily to the upper and lower limbs and are predominantly fractures. The incidence of cricket injuries is relatively low compared to that

of contact sports, but the risk of injury increases as level of play increases (5).

Among high-level players, upper-extremity injuries account for approximately less than a quarter of all injuries, with lower-limb injuries accounting for about half (2). However, among recreational players, upper-extremity injuries are much more common, roughly equaling the number of lower-limb injuries (6). In a New Zealand study, upper-extremity injuries accounted for 38% of the total injuries for the 30-39 age group (6). These upper-extremity injuries are primarily fractures to the hand/phalanges region, followed by dislocations, with soft-tissue injuries being least common.

Most extensive studies of cricket injuries broken down by position have been done at high levels of the game (2). Of the various cricket positions, batting injuries are the least commonly sustained, and account for about 17.1% of injuries to club and provincial cricketers (7). Lower-limb muscle strains incurred while batting or while running between wickets account for over half of reported batting injuries. Upper-limb injuries account for 25 to 34% of batting injuries (7). These upper-limb injuries primarily consist of fractures, dislocations, and contusions of the fingers, as a result of being struck by the ball. According to Walker et al (6), upper-extremity sprain, strain, or other soft-tissue injuries account for about 7% of injuries in all cricket positions. However, these authors do not break down these soft-tissue injuries by specific playing position.

The pronator teres and flexor muscles (Fig. 2) are used extensively in batting a cricket ball. Flexor and pronator muscle strain has been described in a number of other throwing sports (8) but appears to be very rare in cricket batsmen. Most of the overuse injuries described in cricket are associated with bowling (4).

In explaining our patient's isolated pronator injury, it may be helpful to look at other sports. The pronator and flexor muscles are used extensively in throwing sports (8). They are also used in striking sports such as baseball (9) and golf (10). Isokinetic studies of baseball batters have shown a high peak torque in the pronator muscle, whereas pitchers demonstrate a higher peak torque in their flexors. These findings suggest that these overstressed muscles could lead to medial epicondylitis or other injuries (9). Electromyographic studies of golfers show that amateur golfers have increased activity in the pronator teres muscle activity in their trail arms (right arm of a right-handed golfer) when compared to professionals (11). If similarly increased pronator activity is seen in amateur cricket batsmen such as our patient, that might help explain his increased pronator loading. Certain cricket shots, such as a cross-batted cut or pull shot (12), involve additional pronation of the trailing arm, and therefore increased pronator load. We do not know the general batting style of our patient, but speculate that a tendency toward these types of shots could have also played a role in his injury.

The usual differential diagnosis of medial elbow pain in an athlete includes medial epicondylitis, ulnar neuritis, valgus extension overload with osteophyte formation, pos-

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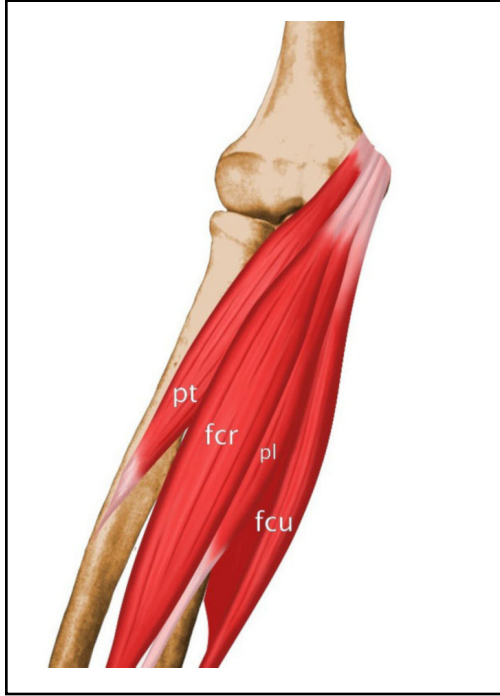


Figure 2. Anatomic diagram of muscles about the elbow, showing the pronator teres (pt), flexor carpi radialis (fcr), palmaris longus (pl) and the flexor carpi ulnaris (fcu). (Image courtesy of the University of Washington Musculo-skeletal Atlas [<http://www.rad.washington.edu/academics/academic-sections/msk/muscle-atlas>], and is used with permission).

teromedial impingement, flexor/pronator muscle strain, medial collateral ligament sprain or tear, stress fracture, and pronator teres syndrome (8, 13-15). To this list we now add isolated muscle injury of the pronator teres, as seen in our patient.

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