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Articular shear injuries of the capitellum in adolescents

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Background: Fractures of the capitellum are rare and are commonly classified into 4 types. Type II variants involve a shear injury with a mostly articular cartilage component and little subchondral bone. Symptoms upon presentation after these injuries are variable, and the diagnosis can be difficult to make in the immature skeleton.

Methods: We retrospectively reviewed 3 cases of type II capitellar fractures in adolescent athletes who presented for evaluation with the senior author.

Results: All patients were initially treated conservatively, without identification or treatment of the capitellar shear component of their injury. Unfortunately, radiocapitellar arthrosis rapidly developed in all 3 and required surgical intervention at our institution. At an average postoperative follow-up of 49 months from the index procedure, patients ultimately had positive outcomes despite advanced degenerative changes on imaging. One patient required 2 subsequent operations for mechanical symptoms and pain.

Discussion: The 3 reported cases represent adolescent, athletic patients with missed shear injuries to the capitellum. These patients exhibited low Disabilities of Arm, Shoulder and Hand scores and high Mayo Elbow Performance Scores at final follow-up, but each patient demonstrated advanced degenerative changes on imaging, and 1 patient required 2 subsequent operations for mechanical symptoms and pain. A high index of suspicion is necessary to identify this injury pattern, and proper plain radiographic imaging with a low threshold for advanced imaging is necessary. Although the overall long-term prognosis is unknown for these patients, early recognition likely would have changed the initial conservative management decision in each and, theoretically, might have altered the outcome for these patients.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Capitellum; capitellar; fracture; type 2; Kocher-Lorenz; adolescent; athlete; elbow

Fractures of the capitellum are commonly classified into four types[10]: type I, a shear injury with a significant amount of subchondral and cancellous bone from the lateral condyle; type II, a shear type of injury with a mostly articular cartilage component and very little subchondral bone; type III, a fragment of capitellum with comminution; and type IV, with extension into the trochlea. In children and adolescents,

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fractures of the capitellum are rare and usually occur at the time of capitellar ossification at around age 12.[1,5,6] Symptoms at presentation after these injuries are variable, and the diagnosis can be difficult to make in the immature skeleton.

We report 3 adolescent athletes with type II capitellar fractures. All patients were initially treated conservatively, without identification or treatment of the capitellar shear component of their injury. Unfortunately, radiocapitellar arthrosis rapidly developed in all 3 and required surgical intervention at our institution. At an average postoperative follow-up of 49 months from the index procedure, patients ultimately had positive outcomes despite advanced degenerative changes on imaging. One patient required 2 subsequent operations for mechanical symptoms and pain. This report highlights the need for recognition of this injury pattern in the skeletally immature patient with prompt intervention once identified.

Case reports

Patient 1

A 12-year-old skeletally immature male baseball/basketball player presented 4 months after suffering a right radial head fracture from falling off his scooter onto his outstretched arm. This injury was evaluated first by a physician at another institution who did not recognize the capitellar shear injury and treated the fracture conservatively in a cast and subsequently with range of motion exercises.

The patient presented to our institution 4 months later with motion loss despite aggressive physical therapy and the use of a dynamic splint at night. He reported persistent pain emanating from the radiocapitellar region of the lateral elbow that was worse with forearm rotation. His motion at presentation was 15° to 125°. He lacked 20° supination and 10° of pronation compared with his contralateral side and had marked crepitation on forearm rotation. Grip strength measured 63% of the uninjured side.

Plain radiographic images from the initial time of injury revealed an obvious radial head fracture. In addition, there was a subtle crescent shaped density lateral to the humerus on the frontal projection in the region of the capitellum (Fig. 1). Plain radiographs at presentation 4 months after the injury demonstrated significant incongruity involving the radiocapitellar joint (Fig. 2). A computed tomography (CT) scan demonstrated an impaction injury to the radial head and neck, a curvilinear fragment associated with a large defect in the radial aspect of the capitellum, and a loose body in the volar aspect of the distal humerus in the region of the coronoid recess likely having originated off the surface of the capitellum. Advanced arthritic changes between the radial head and the capitellum were evident (Fig. 3).

Owing to the bipolar nature of the radiocapitellar disease, the patient's persistent pain and limitations in range of motion, and after conservative measures implemented at the other institution had failed, the patient underwent a radial head resection combined with a capsular release to recover elbow mobility. At this time, the ulnar nerve was formally transposed. Intraoperatively, the patient was noted to have grossly advanced radiocapitellar arthrosis (Fig. S1) and incongruity with loss of rotation on the basis of the joint deformity, in addition to a capsular contracture.

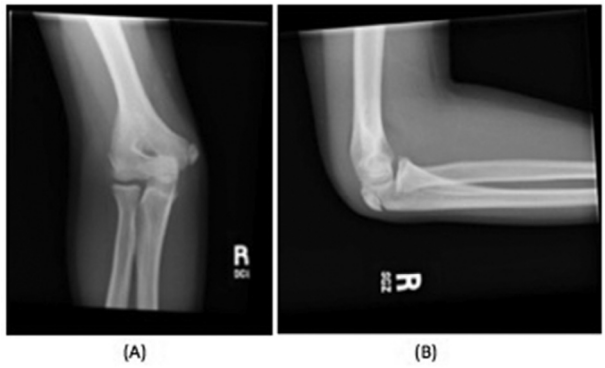

Figure 1 **(A)** Anteroposterior and **(B)** lateral plain radiographic views of the right elbow of patient 1 at the time of injury demonstrate a radial head fracture and a small shear fracture off of the capitellum.

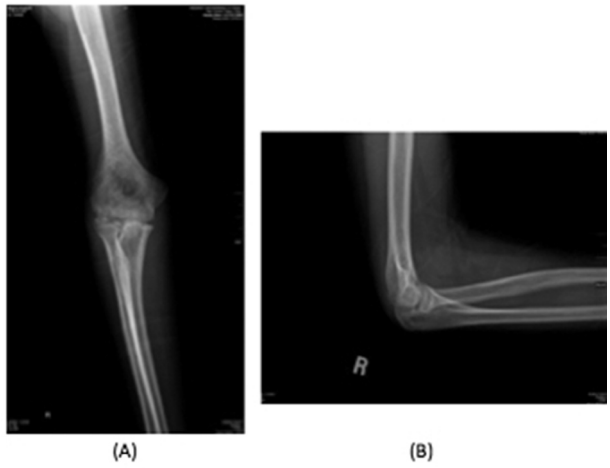

Figure 2 **(A)** Anteroposterior and **(B)** lateral plain radiographic films of the right elbow of patient 1 at 4 months after injury demonstrate degeneration and incongruity of the radiocapitellar joint.

Postoperatively, the patient began an elbow release protocol consisting of immediate continuous passive motion (CPM), weighted stretching, dynamic bracing, and formal therapy. At 3.5 months postoperatively, the patient was able to attain a 0° to 135° motion arc and was cleared to resume baseball-batting activities and begin upper extremity strengthening.

At his 1-year follow-up visit, the patient was asymptomatic and without focal complaints, with motion arc measuring 15° to 130° and 70° of supination and pronation. At the final follow-up at 37 months, elbow motion measured 0° to 130°, with supination to 75° vs. 80° on the contralateral side and pronation to 50° vs. 60° on the contralateral side. He had no