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Selected anteromedial coronoid fractures can be treated nonoperatively

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Background: Surgical fixation is currently recommended for unstable anteromedial coronoid fractures, but the role of nonoperative management is not well defined. Our purpose was to report the functional and radiographic outcomes of select patients managed nonoperatively.

Methods: Between 2006 and 2012, 10 patients with anteromedial coronoid fractures underwent nonoperative treatment. Outcomes assessed included elbow range of motion (ROM), stability, strength, radiographs, and 3 functional questionnaires, including the Patient-Rated Elbow Evaluation, Disabilities of Arm, Shoulder and Hand, and Mayo Elbow Performance Index.

Results: There were 9 anteromedial subtype 2 coronoid fractures and 1 subtype 3. Mean fragment size was 5 mm, with a mean displacement of 3 mm for the subtype 2 fractures. The subtype 3 fracture was 9 mm in size with 1 mm of maximal gap displacement. At a mean follow-up of 50 months (range, 12-83 months), the average ROM of the affected elbow was 137° ± 8° of flexion, 2° ± 5° of extension, 88° ± 5° of pronation, and 86° ± 10° of supination. The mean Patient-Rated Elbow Evaluation score was 9 ± 13, Mayo Elbow Performance Index score was 94 ± 8, and the Disabilities of Arm, Shoulder and Hand score was 7 ± 9. All patients had bony union without radiographic arthrosis. There were no cases of recurrent instability or delayed surgical intervention.

Conclusions: Current indications for nonoperative management, based on the results of this study, include fractures that are small, minimally displaced, and most importantly, demonstrate no evidence of elbow subluxation. The elbow joint must be congruent and demonstrate a stable ROM to a minimum of 30° of extension. For selected anteromedial coronoid fractures, nonoperative management is an option that can lead to good clinical and radiographic outcomes.

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

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Keywords: elbow; coronoid; fracture; instability; anteromedial coronoid; varus posteromedial instability

Fractures of the coronoid process have historically been classified according to the fragment size on a lateral radiograph as type 1 (tip), 2 (up to 50% of the coronoid), or 3 (greater than 50%).[15] Improved recognition of various injury patterns has increased our understanding of coronoid fractures and has led to a newer classification by O'Driscoll et al.[10] This classification considers the anatomic location

The University of Western Ontario Research Ethics Board approved the study protocol (study number 103067).

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and morphology of the fracture, which helps to predict the injury mechanism, associated injuries, and treatment strategy. Anteromedial coronoid fractures are classified as type 2 in this system and are further divided into 3 subtypes: 1 (rim), 2 (rim and tip), or 3 (rim and sublime tubercle). These fractures are theorized to occur with a distinct injury mechanism involving an axial load with a varus posteromedial torque.[5,17] As a result, they are commonly associated with an avulsion of the lateral collateral ligament off of the lateral epicondyle and are less likely to have concomitant injuries to the radial head and medial collateral ligament.[5,6,17]

Operative intervention is typically recommended for anteromedial coronoid fractures, although the evidence stems from expert opinion or small case series.[6,17] Nonoperative treatment may be indicated for small, minimally displaced fractures with no elbow subluxation, but the available evidence is limited by short follow-up and small sample sizes.[8,18] This study evaluated the results of carefully selected patients with anteromedial coronoid fractures after a purposeful nonsurgical treatment protocol.

Materials and methods

Study design

Between 2006 and 2012, 10 patients with radiographically documented anteromedial coronoid fractures underwent nonoperative management by 1 of 3 participating surgeons (K.J.F., G.J.W.K., G.S.A.). Patients eligible for participation in the study were contacted by an independent physician (K.C.) who was not directly involved with their care. After informed consent, each patient's medical record was retrospectively reviewed for demographic information and clinical course.

Computed tomography (CT) images were used to classify the anteromedial coronoid fractures according to the system by O'Driscoll et al.[10] The anteromedial coronoid rim is classically located between the tip of the coronoid and the sublime tubercle.[10] Two-dimensional CT images were also used to measure the maximal fragment size and displacement in the coronal plane by selecting an axial cut of the coronoid (Fig. 1). CT images were obtained with 1.25-mm axial slices.

Description of treatment

We used a nonoperative treatment protocol that is similar to a previously published study.[4] In the acute setting, patients underwent closed reduction under conscious sedation, if applicable, and were subsequently immobilized in a posterior elbow splint at 90° of flexion with the forearm in neutral rotation.

All patients were subsequently assessed by 1 of 3 fellowship-trained elbow surgeons (K.J.F., G.J.K., G.S.A.) within 1 week of injury. Patients underwent a physical examination and a CT scan to characterize the anteromedial coronoid fractures. The criteria applied to identify patients suitable for nonoperative management were (1) a congruent elbow joint seen on plain radiographs and CT scans, (2) a stable arc of active elbow motion to a minimum of 30° of extension with the forearm in neutral rotation to allow early range of motion (ROM) within the first 10 to 14 days, and (3) normal findings with the hyperpronation and gravity varus stress test.

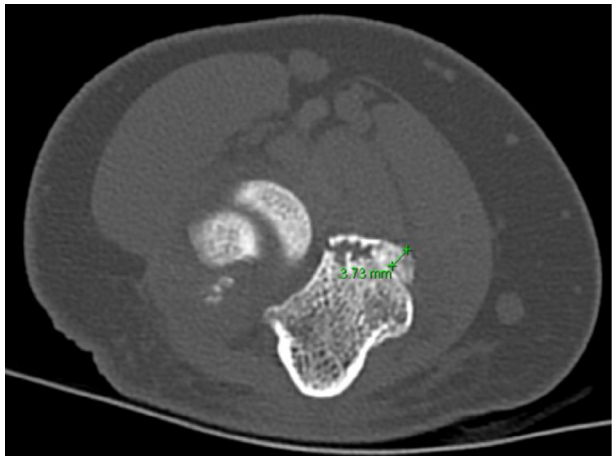

Figure 1 An axial cut of the coronoid was obtained from 2-dimensional computed tomography images to measure the maximal fragment size and displacement in the coronal plane.

Patients who met the prespecified indications for nonoperative treatment were referred to therapy for supervised ROM exercises within a stable arc in the first 10 to 14 days after injury. We are unaware of any validated clinical examination maneuvers for varus posteromedial rotatory instability (PMRI). Typically, we test for dynamic PMRI by palpating for subluxation with hyperpronation of the forearm and the elbow at 90° of flexion (hyperpronation test). In addition, we use a gravity varus stress test (Fig. 2) by placing the shoulder in 90° abduction and then asking the patient to flex and extend the elbow with the forearm in neutral rotation. A positive test is when the patient describes a sense of instability or experiences grinding or crepitation in the elbow.

Patients were seen weekly thereafter for 3 weeks for repeated clinical and radiographic examinations to monitor for fracture displacement, subluxation, or dislocation of the elbow. Active and active assisted elbow flexion/extension exercises with the forearm in neutral rotation were initiated within 2 weeks of injury. Overhead exercises with supine positioning were performed to allow early motion with the effect of gravity to maintain a congruous reduction.[12] Shoulder abduction was avoided to minimize varus stress on the injured elbows. A resting elbow splint at 90° of flexion was used for comfort in between exercises until fracture and soft tissue healing progressed, usually by approximately 6 weeks after injury. Strengthening exercises were then added. Static progressive extension splints were used as needed to manage residual flexion contractures after 6 weeks.

Description of outcome measures

Patients returned to the clinic for a study-specific evaluation by an observer (K.C.) not involved with their care. The outcome measures used in this study included 3 functional outcome scores (Patient-Rated Elbow Evaluation [PREE], Mayo Elbow Performance Index [MEPI], and Disabilities of the Arm, Shoulder, and Hand [DASH]), elbow ROM, stability, isometric strength measurements, and radiographic evaluation.

Elbow motion was recorded using a standard long-arm goniometer for flexion, extension, pronation, and supination, as reported by Armstrong et al.[2] Measurements for forearm rotation were based off of the distal forearm. Medial and lateral instability was evaluated by applying a varus and valgus stress to the elbow. Posterolateral

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