

REVIEW

Fractures of the Coronoid Process of the Ulna

David Ring, MD

From the Hand and Upper Extremity Service, Department of Orthopaedic Surgery, Massachusetts General Hospital, Boston, MA.

The coronoid process is critical to elbow stability and is vulnerable during injury. Traumatic elbow injuries are relatively uncommon, so it is important for surgeons to be mindful of the importance of specialized treatment of the coronoid for optimal elbow function. Optimal coronoid fracture fixation is determined by fracture morphology, which can usually be predicted based on the overall pattern of injury. There is evidence that improved understanding of coronoid fractures and their management is improving the results of treatment. (*J Hand Surg* 2006;31A:1679–1689. Copyright © 2006 by the American Society for Surgery of the Hand.)

Key words: Coronoid fractures, traumatic elbow instability, elbow dislocation, internal fixation.

The coronoid process of the ulna has been recognized as the keystone of the elbow—a critical element for stable, effective elbow function.¹ Fracture of the coronoid is associated with the most challenging traumatic elbow instabilities.^{2–4} There is evidence that an improved understanding of the coronoid process and improved management of coronoid fractures is leading to better recovery from elbow injury.^{5–7} This article reviews current concepts in the management of coronoid fractures.

Anatomy

The trochlear notch of the proximal ulna consists of the coronoid process and the olecranon process. Each process has a distinct articular facet with an intervening nonarticular transverse groove.^{8,9} The trochlear notch is divided in the sagittal plane by a ridge that interdigitates with a corresponding groove in the trochlea (*Fig. 1*).¹⁰

The nearly 180° (semicircular) capture of the trochlear notch is tilted somewhat posteriorly to help prevent anterior subluxation of the trochlea. A line between the tip of the coronoid process and the tip of the olecranon process lies at approximately a 30° angle to a line through the ulnar diaphysis.¹¹

The coronoid process and the radial head together form an anterior buttress, preventing posterior subluxation or dislocation of the elbow. The radial head extends medially, overlying a portion of the ulnar

metaphysis (*Fig. 2*). The coronoid process is medially translated with respect to the ulnar metaphysis, and the most medial portion of the coronoid protrudes from the medial surface of the ulnar metaphysis. The coronoid process therefore extends both anteriorly and medially from the ulnar metaphysis, making it relatively thin and susceptible to injury in these areas (*Fig. 2*).

The anterior elbow capsule attaches a few millimeters distal to the very tip of the coronoid process,¹² but even the smallest of coronoid fractures usually includes the capsular insertion.¹³ The insertions of the anterior band of the medial collateral ligament and the lateral collateral ligament complex are at the base of the coronoid.¹² When the coronoid is fractured at the base, the ligaments are often preserved, because failure occurs through bone rather than ligament.^{3,7} In contrast, smaller fractures may be more likely to be associated with ligament injury.

Biomechanics

Several biomechanic studies have addressed the role of the coronoid process in elbow stability in response to either axial, varus, or posterolateral rotatory loads. Substantial loss of the coronoid process was necessary to destabilize the elbow under loading mechanisms less representative of daily activity and with a setup less representative of typical injury patterns. Closkey and colleagues¹⁴ did not encounter posterior

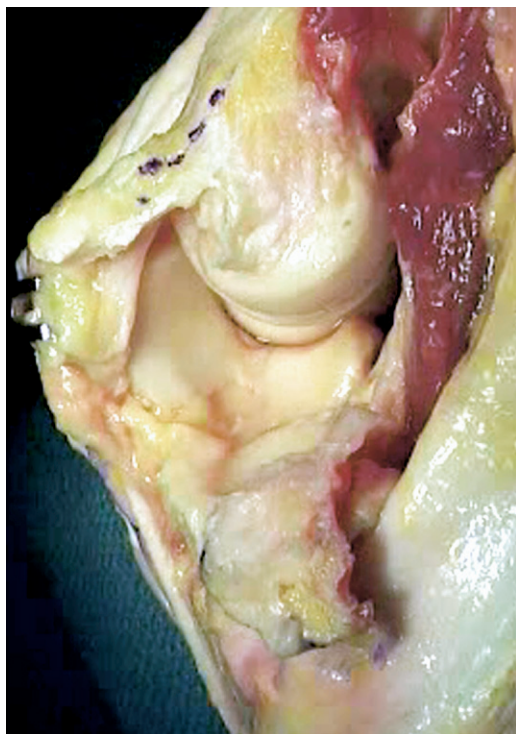


Figure 1. The cadaver dissection shows the nonarticular transverse groove separating the coronoid and olecranon articular facets of the trochlear notch of the ulna.

elbow displacement under longitudinal axial load in otherwise intact elbows until greater than 50% of the total coronoid height was excised. Hull and colleagues¹⁵ documented decreased resistance to varus loads with increasing loss of the coronoid process (also in the otherwise intact elbow) to less than 50% of the total height, particularly toward greater extension.

Studies evaluating rotatory instability (which is more reflective of what the elbow actually encounters with shoulder abduction) and concomitant injury to the radial head and/or lateral collateral ligament found that small coronoid fractures could also destabilize the elbow. Schneeberger and colleagues¹⁶ documented elbow dislocation under posterolateral rotatory stress in elbows with intact collateral ligaments, radial head excision, and removal of 30% to 75% of the total coronoid height. Elbow dislocation was prevented with prosthetic replacement of the radial head alone when only 30% of the coronoid was absent, but concomitant coronoid reconstruction was required to prevent dislocation when 50% to 75% of the coronoid was absent. Deutch and colleagues¹⁷ also noted subluxation of the elbow under rotatory stress: when the radial head was excised and the coronoid was fractured. In their study, either radial head replace-

ment or lateral collateral ligament reconstruction was able to prevent subluxation, with the combination of both providing the greatest stability.

Mechanisms and Injury Patterns

The mechanisms and injury patterns of traumatic elbow instability are incompletely understood. Nonetheless, some concepts seem useful for understanding these injuries and guiding management. The elbow can dislocate through either a posterolateral rotatory or a varus posteromedial instability pattern.¹⁸

The posterolateral rotatory mechanism appears to be more common. It has been proposed that the injury force is created by a fall on the extended arm, which plants and becomes fixed while the body creates a valgus and posterolateral rotatory force on the elbow. The result is that the capsuloligamentous stabilizers of the elbow tear progressively from lateral to medial, both anterior and posterior.¹⁹ The last structure injured is the anterior band of the medial collateral ligament, and the elbow can dislocate completely with this structure intact, although complete capsuloligamentous injury is the rule for complete elbow dislocations.^{20,21} The radial head and the coronoid process can fracture as the elbow dislocates. Dislocation of the elbow via a posterolateral rotatory mechanism with fractures of both the radial head and the coronoid process is commonly referred to as the terrible triad of the elbow.^{4,6,22}

It was proposed by Penrose²³ many years ago that

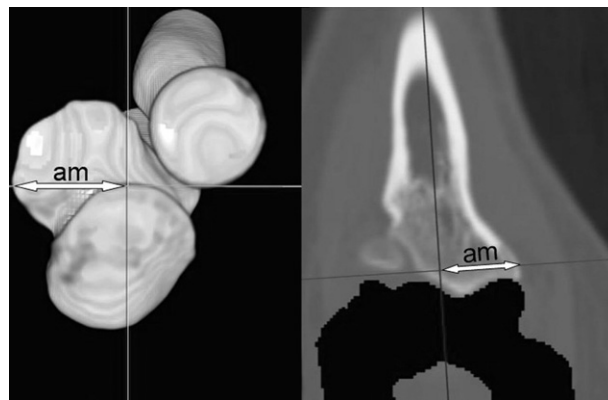


Figure 2. Together, the radial head and coronoid process of the ulna form an anterior buttress, resisting posterior dislocation of the elbow. The radial head overlies the ulnar metaphysis slightly. The coronoid process extends medially and anteriorly to the ulnar metaphysis. The relative effect is that the entire coronoid is translated medially with respect to the ulnar metaphysis. The distance "am" represents the amount of coronoid that extends medial to a line that joins a point at the tip of the olecranon process and a point bisecting the ulnar mid-diaphysis.

Download English Version:

<https://daneshyari.com/en/article/4071068>

Download Persian Version:

<https://daneshyari.com/article/4071068>

[Daneshyari.com](https://daneshyari.com)