Radiographic Anatomy of the Proximal Ulna to Avoid Inadvertent Intra-Articular Screw Placement

Thomas Githens, DO*; Sean T. Campbell, MD; Brett Peter Salazar, BS; Malcolm DeBaun, MD; Lawrence Henry Goodnough, MD; Julius A. Bishop, MD; Michael J. Gardner, MD*
Stanford University, Palo Alto, CA, United States

Purpose: Fixation of the proximal ulna often employs placing implants adjacent to the olecranon articular margin. Screw placement is typically verified using intraoperative fluoroscopy. Surgeons often rely on lateral imaging to confirm screw safety. Anatomic nuances of the proximal ulna can be misinterpreted during fluoroscopy, potentially resulting in inadvertent intra-articular screw placement. The purpose of this study was to utilize radiopaque wire to map the proximal ulnar articular margin on lateral fluoroscopy and ensure safe extra- articular placement of implants.

Methods: Ten fresh-frozen adult elbow cadaver specimens were obtained. Radiopaque wire was applied to the articular margin of the anterior and posterior facets and the central trochlear ridge of the proximal ulna. Fluoroscopic images were obtained demonstrating the articular facet margins. Radiographic measurements were performed and used to identify relative safe screw zones.

Results: All specimens demonstrated marked extension of the ulnar and radial facets dorsal to the central trochlear ridge. The ulnar facets extended further dorsally than the corresponding radial facets. The dorsal extent of the posterior and anterior ulnar facets from the central trochlear ridge averaged 9.7 mm (range, 7.9-13 mm; standard deviation [SD], 1.5 mm) and 6.2 mm (range, 3.4-9.4 mm; SD, 1.9 mm), respectively. The average footprint of the posterior ulnar facet occupied 44% (±4.9%) of the total ulnar height from the dorsal cortex to the trochlear ridge.

Conclusion: The articular margins of the anterior and posterior facets of the proximal ulna are challenging to identify radiographically. Based on this study, a surgical "at-risk zone" exists within 9.7 mm from the radiographic margin of the central trochlear ridge. Implants placed within this zone have the potential to be intra- articular, particularly if placed about the radial or ulnar periphery. The "at-risk zone" is highlighted in red in the figure.