Elbow Soft Tissue Apex as a Marker for the Anterior Humeral Line: An Anatomic Landmark for Pinning of Pediatric Supracondylar Humerus Fractures

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INTRODUCTION:

Supracondylar humerus fractures are one of the most common injuries among the pediatric population, with an annual incidence of about 180 per 100,000. The vast majority of these operative fractures are treated using percutaneous pinning. The Accreditation Council for Graduate Medical Education (ACGME) mandates that percutaneous treatment of pediatric elbow fractures is a requirement for residency training, with a minimum of five cases necessary. In comparison, national averages hover around nineteen listed cases for residents at the time of graduation. Despite the frequency of pediatric supracondylar humerus fractures, pinning of these injuries represents the second lowest case volume of orthopaedic requirements, following only foot and ankle fusions.

Given the relatively low number of cases encountered during residency, technical tips and anatomical landmarks may aid residents in quickly developing basic competence in the surgical management of these fractures. The authors propose a new anatomical landmark for pinning supracondylar humerus fractures.

For patients who have suffered an extension-type supracondylar humerus fracture and have achieved adequate reduction in the operating room, the soft tissue apex of the elbow in full flexion (approximately 130 degrees) serves as an external anatomic correlate for the anterior humeral line. Furthermore, it is the senior author's practice to place a second line one centimeter posterior to the soft tissue apex, to serve as an approximate correlate for the posterior humeral cortex. These landmarks can be used to help the trainee visualize the humeral shaft, approximate the angle necessary for pin placement, and ultimately appropriately fixate the fracture.

METHODS: A single-institution electronic medical record was reviewed for supracondylar humerus fracture fixation within the past two years. This study retrospectively analyzed images of thirty-two pediatric patients who underwent closed reduction and percutaneous pinning of supracondylar fractures. Patients were identified, and measurements were taken of both injury radiographs and intra-operative fluoroscopic images. Fluoroscopic series were reviewed for reduction laterals, while the injury films were examined for humeral measurements and fluoroscopic calibration. A line was drawn along the axis of the anterior humeral cortex through the soft tissue shadow on the reduction lateral image, and the distance from where this line intersected the skin to the apex of the soft tissue was measured.

RESULTS: Thirty-three patients were studied, comprising 17 males and 16 females, with a mean age of 6.8 years (SD ± 2.02 years). Fractures were classified using the Gartland system: 16 grade II and 17 grade III. The average humeral width on lateral x-ray was 12.83 mm (SD ± 1.81 mm), and the intramedullary diameter averaged 7.48 mm (SD ± 1.24 mm). The average difference between the soft tissue apex and the anterior humeral line measured 0.35 mm (SD ± 1.11 mm).

DISCUSSION AND CONCLUSION:

The soft tissue apex of the elbow is a reliable landmark for the anterior humeral cortex. Similarly, a mark placed one centimeter posterior to the apex provides an appropriate estimate of the posterior humeral cortex. Utilization of this landmark can help residents conceptualize the location of the humeral shaft and assist surgeons with proper placement of pins for surgical treatment of supracondylar humerus fractures.