

The Tolerance of the Anterior Humeral Line to Rotational Changes in Elbow Position

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Introduction: Supracondylar humerus fractures are commonly evaluated using the anterior humeral line (AHL) on a lateral radiograph. Rotational variations in X-ray projection can lead to significant changes in management based on where the AHL intersects the capitellum. The purpose of this study was to establish if rotational variations in elbow rotation lead to significant changes in AHL position and whether different AHL measurement techniques are more tolerant to rotation.

Methods: We utilized 10 pediatric humerus dry cadaveric specimens, and 50 pediatric patients with supracondylar humerus fractures with injury and follow-up lateral radiographs where one view was rotated while the other was considered a good quality lateral. The 10 pediatric humerus dry cadavers were rotated along the axis of the humerus in 5-degree increments ranging from -20 to +20 degrees and imaged. Two investigators measured the position of the AHL by either drawing the line using the midshaft anterior humeral surface as a guide or only the distal humeral anterior surface. The 50 pediatric patients with supracondylar humerus fractures were also measured for the position of the AHL using the midshaft or distal humeral shaft as the

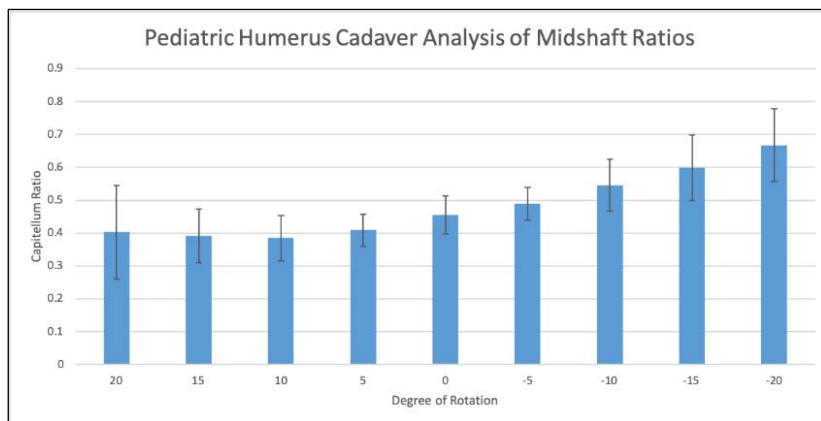


Figure 1. Proportion of capitellum posterior to anterior humeral line based on midshaft humerus as primary guide with standard deviation.

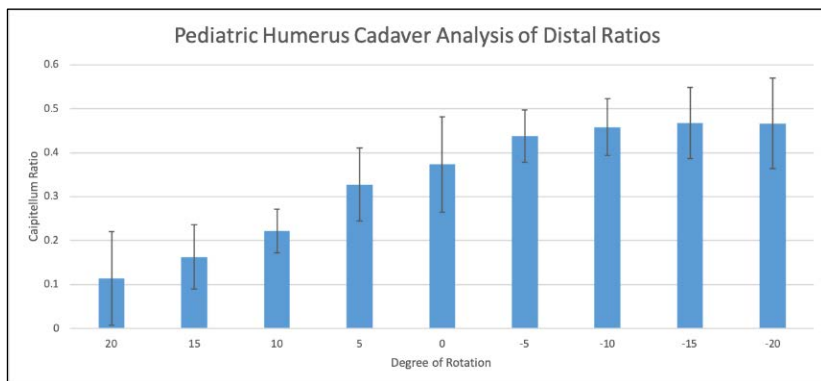


Figure 2. Proportion of capitellum posterior to anterior humeral line based on distal humerus as primary guide with standard deviation.

primary guide. The proportion of capitellum posterior to the intersection of the AHL was calculated and analyzed.

Results: In determining AHL for the pediatric humerus dry cadaveric specimens, utilizing the midshaft humerus as a guide demonstrated a more consistent AHL position through the range of rotation variations in comparison to using the distal humerus as a guide (Figures 1 and 2). In addition, the mean value at each rotational position was within the middle third of the capitellum with the midshaft measurement except at -20 degrees, compared to the distal shaft measurement where +20, +15 and +10 of rotation brought the AHL out of the middle third. In the clinical radiograph's comparison of AHL on the rotated lateral radiograph with the properly oriented lateral radiograph found excellent correlation when the midshaft humerus was utilized (ICC = 0.81), but poor correlation when the distal humerus was utilized (ICC = 0.14).

Conclusion: Our data suggests that radiographs rotated as much as 20 degrees can still provide an accurate anterior humeral line measurement, as long as the clinician uses the midshaft anterior humerus to draw the AHL. In contrast, drawing a distally based AHL provides much less tolerance to rotational position.

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