Effect of Glenoid Bone Loss and Shoulder Position on Axillary Nerve Position During Latarjet Surgery

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INTRODUCTION: Bone loss is a significant risk factor for recurrent anterior glenohumeral instability and failure of soft tissue Bankart procedures. Latarjet is increasingly being utilized, but complication rates for the procedure are high, with significant rates of nerve injury. While musculocutaneous nerve injuries are more common, axillary nerve injuries are more likely to be permanent. Axillary nerve anatomy is complex and likely altered by both the presence of glenoid bone loss as well as the performance of the non-anatomic Latarjet procedure. Understanding the dynamic anatomy of the nerve is crucial to preventing injury. To our knowledge, no studies have evaluated the effect of glenoid bone loss and shoulder position on axillary nerve anatomy. The purpose of our study was to quantify the effects of changes in shoulder position and degree of glenoid bone loss on the anatomy of the axillary nerve. The purpose of our study was to quantify the effects of changes in shoulder position and degree of glenoid bone loss on the anatomy of the axillary nerve. Our hypothesis was that both shoulder position and glenoid bone loss significantly affects axillary nerve position relative to the glenoid.

METHODS:

10 fresh frozen cadavers (mean: 59.3±10.8 years, range 36-74) were used with a custom shoulder testing system. After skin and outer soft tissues were removed, the axillary nerve was dissected from its origin off the posterior cord of the brachial plexus. Six suture markers were placed approximately 1cm apart medial to lateral along the axillary nerve and digitized with a Microscribe 3DLX. Three conditions were observed: (1)intact, latarjet with (2)15% glenoid bone loss and (3)30% glenoid bone loss. For each condition, the minimum distance of the nerve from the 6 o'clock position of the glenoid was measured and calculated as the Axillary nerve – Glenoid minimum (AN-glenoid min) distance. Bone loss of 15% and 30% was made using the measured maximum AP diameter of the glenoid. Measurements were obtained at 0°, 30°, and 60° of glenohumeral abduction and 0°, 45°, 90° of humeral external rotation. A linear mixed effects repeated measures ANOVA model with Tukey's honest significance post hoc tests were performed to compare the relative axillary nerve positions between the three conditions. A P value of $< .05$ was set to indicate significance.

RESULTS:

Effect of Shoulder Position on Axillary Nerve-Glenoid Distance after Latarjet

The mean AN-glenoid min distance with the arm in a neutral position of 0° abduction and 0° ER was 15.5±1.2mm. Abduction of the arm resulted in a trend towards decrease in AN-glenoid min distance [15.5±1.2mm (0° abduction) vs. 14.9±1.3mm (30° abduction) vs. 13.6±1.1mm (60° abduction)]; however, this did not reach statistical significance [**p-value = 0.09]** (Figure 1). External rotation of the abducted shoulder resulted in a mean increase in AN-glenoid min distance at both 30° [14.9±1.3mm (0° ER) vs 17.3±1.5mm (90° ER); : **p-value < 0.045**] and 60° [13.6±1.1mm (0° ER) vs. 17.7±1.6mm (90° ER),: **p-value = 0.006**] of glenohumeral abduction (Figure 2). However, external rotation of the shoulder at 0° glenohumeral abduction resulted in no significant increase in AN-glenoid min distance [15.5±1.2mm (0° ER) vs 16.1±1.4mm (45° ER): **p-value = 0.21**].

Effect of Glenoid Bone Loss and Latarjet on Axillary Nerve-Glenoid Distance:

Glenoid bone loss had no significant effect on AN-glenoid min distance at 0° abduction [AN-glenoid min: 15.5±1.2mm (native) vs. 15.2±1.2mm (15%) vs.14.4±1.3mm (30%); **p-value > 0.059**] (Figure 3). However, Glenoid bone loss of 30% resulted in a significantly decreased AN-glenoid min distance compared to native glenoid at 30° [-1.9mm; **p-value = 0.015**] (Figure 4) and 60° [-3.8mm; **p-value = 0.007**] of glenohumeral abduction and 90° ER. External rotation of the shoulder at 60° glenohumeral abduction increased AN-glenoid min distance in both the native [13.6±1.1mm (0° ER) vs. 17.7±1.6mm (90° ER); **p-value = 0.006**] and 15% bone loss [12.4 ± 1.2mm (0° ER) vs 15.8±1.7mm (90° ER); **p-value = 0.001**] groups, however; there was no significant difference was seen in the 30% bone loss group [12.6±1.1mm (0° ER) vs 13.9±1.6mm (90° ER); **p-value = 0.499**]

DISCUSSION AND CONCLUSION:

Larger amounts of glenoid bone loss may place the axillary nerve at a greater risk of injury during the Latarjet procedure. Minimizing shoulder abduction during the procedure may be prudent, especially in this higher risk group.

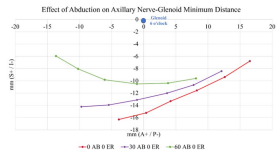

Figure 1: Effect of Abduction on Axillary Nerve-Glenoid Minimum Distance

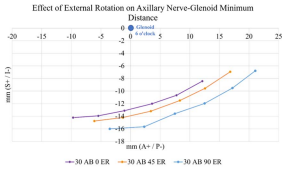

Figure 2: Effect of ER on Axillary Nerve-Glenoid Minimum Distance

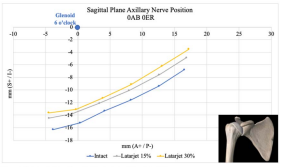

Figure 3: Relative Axillary Nerve Position in Sagittal Plane 0AB 0ER

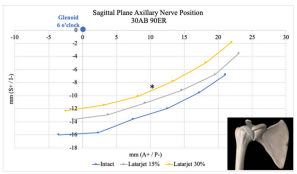

Figure 4: Relative Axillary Nerve Position in Sagittal Plane 30AB 90ER.

*: Latarjet 30% minimum distance from glenoid 6 o'clock was significantly decreased compared to intact. $P = .015$