

# Coracoid Impingement after Reverse Shoulder Arthroplasty: A Novel Radiographic Measurement Technique with Clinical Correlation

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**INTRODUCTION:** While generally an effective procedure, a percentage of patients will have persistent pain or range of motion deficits after reverse shoulder arthroplasty (RSA). One proposed etiology of anterior shoulder pain and limited internal rotation is impingement of the humeral component on the coracoid anteriorly during adduction or internal rotation (IR). There is limited clinical data supporting this potential etiology of postoperative pain or limited IR. The primary goal of the present study was to investigate radiographic surrogates for potential coracoid impingement and their relationship to minimum 2-year postoperative pain and internal rotation after RSA.

## **METHODS:**

A retrospective review of a clinical registry of RSAs was performed to identify patients with 1) primary RSA, 2) minimum 2-year clinical follow up, 3) adequate postoperative axillary and AP radiographs. Demographic variables were collected for each patient, including age, sex, BMI, and whether surgery was performed on the dominant arm. Surgical variables were also recorded, including glenosphere diameter and metallic lateralization.

### Radiographic Evaluation

The primary radiographic measurement of interest was the subcoracoid space (SCS), defined as the space between the posterior aspect of the coracoid and the anterior glenosphere [Figure 1, red line]. Additional measurements made on the axillary radiographic included: anterior glenosphere overhang, posterior glenosphere overhang, native glenoid width, and lateralization of glenosphere relative to the coracoid tip. Given their previously established clinical relevance, the lateralization shoulder angle (LSA) and distalization shoulder angle (DSA) were also measured on AP radiographs. Measurements were made by 4 surgeons.

### Clinical Outcomes

The primary outcome of interest was the 2-year postoperative VAS score. Secondary outcomes were: 1) IR defined by spinal level (IRspine), 2) IR at 90 degrees of abduction (IR90), 3) 2 year ASES score, 4) Forward Flexion (FF), and 5) External rotation at 0 degrees of abduction (ER0).

### Statistical Analyses

A reliability analysis was performed at the beginning of the analysis. All proposed radiographic measurements had a high degree of inter-observer reliability ( $\alpha = 0.790 - 0.940$ ). Linear regression analyses were utilized to evaluate the relationship of the various radiographic measures on the clinical outcomes of interest. For each 2-year clinical outcome, the preoperative baseline of that measure was included in the regression to control for variability at presentation. For all analyses,  $p < 0.05$  was considered significant.

## **RESULTS:**

A total of 217 patients met appropriate criteria and were included in the study.

### VAS

There was a statistically significant relationship between the subcoracoid space (SCS) measurement and VAS scores:  $B = -0.497$ ,  $p = 0.047$ , indicating that for every 1 mm increase in the SCS, the 2 year VAS decreased by 0.5 points. No other demographic, surgical, or radiographic measures were significantly associated with the postoperative VAS.

### IR(spine)

There was a statistically significant relationship between the SCS and IRspine:  $B = -1.667$ ,  $p < 0.001$ , indicating that for every 1 mm increase in the SCS, there were 1.5 levels of improvement in IRspine. Glenoid metallic lateralization was also positively associated with improving IRspine; increasing BMI was negatively associated.

### IR90

There was a statistically significant relationship between the SCS and IR90:  $B = 5.844$ ,  $p = 0.034$ , indicating that for every 1 mm increase in the SCS, there was nearly 6 degrees of improvement in IR90. No other demographic, surgical, or radiographic measures were significantly associated with IR90.

### Other Clinical Outcomes

There was no association between the SCS or any other measured radiographic variable with the 2 year ASES, ER0, or FF.

**DISCUSSION AND CONCLUSION:** The subcoracoid space, measured as the space between the posterior coracoid and anterior glenosphere, has a significant association with pain and IR after RSA. Decreasing subcoracoid space was associated with increased pain and decreased IR, indicating that coracoid impingement may be an important and potentially under-recognized etiology of pain and decreased IR following RSA. Future research will be necessary to define optimal sizing and positioning of components and thresholds of the subcoracoid space to improve clinical outcomes after RSA.

