

# Coracoid and Coracoacromial Arch Morphology as Contributors to Shoulder Pain in Menopause

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## Summary

The rotator interval (RI), an anatomic space confined by soft tissues and the coracoid, plays a potential role in shoulder pain in menopause. Narrowing of this space may irritate tissues due to its bony parameters. This study examined the impact of coracoid and coracoacromial arch shape on shoulder pain in menopause in 26 females (12 pre-menopausal, 14 menopausal; mean age  $47.4 \pm 16.0$  years). Results showed a significant effect of menopause status on just one measure of coracoacromial arch shape, the coracoacromial base angle, where base angle was greater pre-menopause. These findings suggest coracoacromial arch morphology likely plays a limited role in the development of shoulder pain in menopause.

## Introduction

Musculoskeletal pain in menopause is common and likely driven by declining estrogen, which increases the risk of inflammation and often leads to heightened pain sensitivity [1]. Adhesive capsulitis (AC) is a common condition in menopause, caused by inflammation and fibrosis of the glenohumeral joint capsule and characterized by shoulder pain and restricted shoulder motion [2,3]. An AC diagnosis requires the presence of pain in addition to restricted motion, as restricted motion alone is not sufficient for a diagnosis [1]. The RI, an anatomic space confined by the glenohumeral ligaments, subscapularis, supraspinatus, glenohumeral joint capsule, and coracoid plays a role in the pathophysiology of AC [4]. Inflammation of any soft tissue borders will reduce the RI, restricting the healthy translation of other soft tissues within the space and ultimately causing pain [4]. Individual morphology likely plays a role in the impact of inflammation on the RI, as slight inflammation may cause pain and restricted motion in one individual but not in another, depending on morphological variability in the tissue confines of the RI. Despite its role as a permanent boundary for the RI, variability in coracoid shape has yet to be considered as a contributor to shoulder pain in menopause. The purpose of this study was to determine the role of three-dimensional coracoacromial arch shape in shoulder pain in menopause.

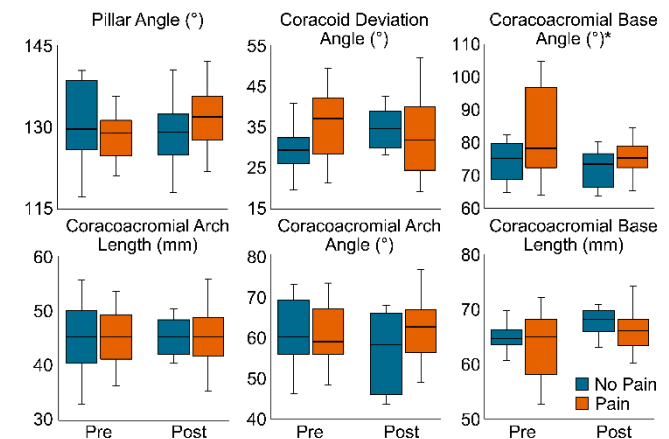
## Methods

Twenty-six females (12 pre-menopause and 14 post-menopause) (mean (SD) age:  $47.4 \pm 16.0$  years) underwent bilateral magnetic resonance imaging of the upper extremities using a two-point Dixon sequence (TE<sub>1</sub>: 1.34ms, TE<sub>2</sub>: 2.57ms, TR: 4.21ms, flip angle: 9°, field of view: 380mm, 1.2mm isotropic voxel size). Scapulae were segmented from water-only images. Seven planes and ten landmarks were used to quantify coracoid (deviation, pillar angle) and coracoacromial (arch length, base length, arch angle, base angle) arch shape. Participants reported shoulder pain for each arm as a binary value (no pain/pain). Separate general linear models for each metric explored the impact of menopause status, pain, and

their interaction. A critical alpha was set at 0.05 and marginal significance was set at 0.10.

## Results and Discussion

A significant main effect of menopause status on coracoacromial base angle was revealed, with pre-menopausal women exhibiting greater base angle on average than menopausal women ( $p = 0.049$ , **Figure 1**), indicating a more superiorly positioned coracoid relative to the glenoid. Shoulder pain had a marginal effect on coracoacromial base angle. Those who reported pain had a greater coracoacromial base angle compared to those who did not ( $p = 0.054$ ). A greater coracoacromial base angle would decrease the size of the RI if the soft tissue borders are held constant, which may result in compression of tissues causing pain. We failed to detect a significant effect of menopause, pain, or their interaction on any other metric (**Figure 1**).



**Figure 1:** The impact of menopause status and pain on the included morphological metrics. Bars represent median  $\pm$  IQR. Main effect of menopause status is denoted by \*.

## Conclusions

Shoulder pain is prevalent in menopause. Our results suggest that coracoid and coracoacromial arch shape likely play only a limited role in the etiology of pain. While a difference was observed in coracoacromial base angle as it relates to menopause status, more investigation is needed to understand its functional or clinical significance. Ongoing work from our group will account for the soft tissue borders of the RI in addition to acromial shape and resolve the role of RI border morphology on shoulder motion.

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## References

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