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Original article

Anatomical and morphological study of the subcoracoacromial canal

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A B S T R A C T

Introduction: Many clinical anatomy studies have looked into how variations in the acromion, coracoacromial ligament (CAL) and subacromial space are associated with rotator cuff injuries. However, no study up to now had defined anatomically the fibro-osseous canal that confines the supraspinatus muscle in the subcoracoacromial space. Through an anatomical study of the scapula, we defined the bone-related parameters of this canal and its anatomical variations.
Materials and methods: This study on dry bones involved 71 scapulas. With standardised photographs in two orthogonal views (superior and lateral), the surface area of the subcoracoacromial canal and the anatomical parameters making up this canal were defined and measured using image analysis software. The primary analysis evaluated the anatomical parameters of the canal as a function of three canal surface area groups; the secondary analysis looked into how variations in the canal surface area were related to the type of acromion according to the Bigliani classification.
Results: Relative to glenoid width, the group with a large canal surface area (L) had significantly less lateral overhang of the acromion than the group with a small canal surface area (S), with ratios of 0.41 ± 0.23 and 0.58 ± 0.3, respectively ($P = 0.04$). The mean length of the CAL was 46 ± 8 mm in the L group and 39 ± 9 mm in the S group ($P = 0.003$). The coracoacromial arch angle was $38^\circ \pm 11^\circ$ in the L group and $34^\circ \pm 9^\circ$ in the S group; the canal surface area was smaller in specimens with a smaller coracoacromial arch angle ($P = 0.20$).
Conclusion: Apart from acromial morphology, there could be innate anatomical features of the scapula that predispose people to extrinsic lesions to the supraspinatus tendon (lateral overhang, coracoacromial arch angle) by reducing the subcoracoacromial canal's surface area.
Level of evidence: Anatomical descriptive study.

1. Introduction

Many clinical anatomy studies have looked into how variations in acromion anatomy are associated with rotator cuff (RC) injuries, mainly for the supraspinatus tendon tears [1–4]. The most common anatomical variations associated with a risk of rupture are the hook-type acromion and a resulting subacromial space reduction. The supraspinatus tendon is confined by a fibro-osseous canal that is delimited by various structures, not only the coracoacromial ligament (CAL) and the acromion. When the scapula is viewed laterally, the acromion only makes up the posterosuperior edge of this canal. The posteroinferior edge is delimited by the scapular spine; the inferior edge is delimited by the supraglenoid tubercle. The anterior margin is made up of the base of the coracoid process below and the CAL above, with its acromial, coracoid and subglenoid attachments in the multifidus variations (Fig. 1). The supraspinatus tendon runs through a canal that can be called the 'subcoracoacromial canal'. Through an anatomical study of the scapula, we sought to analyse the various bone parameters that were likely to modify the subcoracoacromial canal's surface area and that could induce extrinsic compression of the RC, not only due to the shape of the anteroinferior rim of the acromion, but all of this canal's boundaries.

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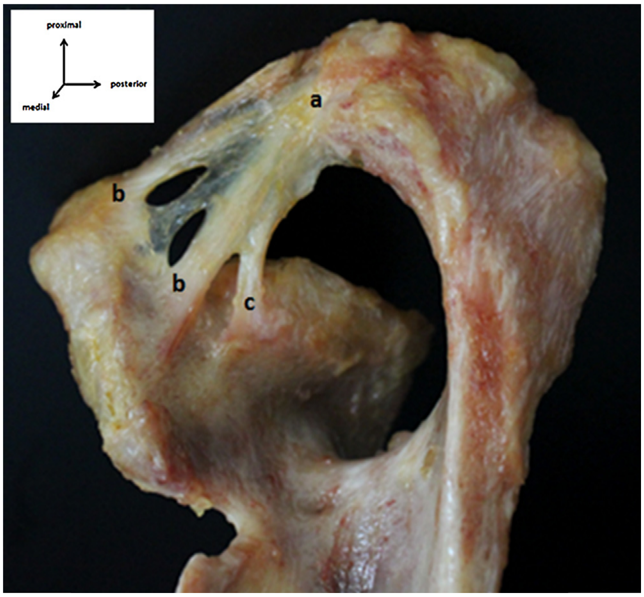

Fig. 1. Dissection showing the coracoacromial ligament in a superomedial view with its attachments: a: acromial; b: coracoid; c: supraglenoid.

2. Material and methods

This study with dry bones included 71 scapulas taken from a collection of Caucasian bones. Since all the soft tissues had been removed, we could not determine if any of the specimens had associated RC lesions. With each specimen, the scapula's height and width and the glenoid's height and width were measured with callipers by a single examiner. The average of three consecutive measurements was retained. The scapula specimens were then classified into three types according to Bigliani's classification: type I – flat acromion, type II – curved acromion and type III – hooked acromion. With each specimen, two photographs in lateral and superior orthogonal views were taken with the bones placed on a tripod. To ensure that the scapula's positioning was reproducible, the following criteria were used to ensure correct positioning. On the superior view, the inferior angle of the scapula had to be aligned with the anterior edge of the supraspinatus fossa in a plane perpendicular to the glenoid plane. On the lateral view, the scapula image had to be taken from the side in the plane perpendicular to the glenoid plane (Fig. 2).

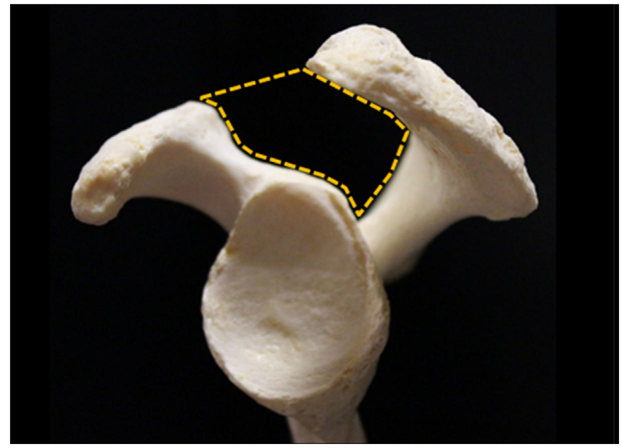

Fig. 3. Subcoracoacromial canal surface area.

2.1. Anatomical parameters of interest

The subcoracoacromial canal surface area corresponded on the lateral view to the surface area included between the superior edge of the glenoid, the anterior edge of the acromion and the scapular spine, the posterior side of the coracoid process and above, the line joining the anterosuperior edge of the acromion to the tip of the coracoid process along the course of the CAL (Fig. 3).

The coracoacromial arch angle was the angle between a line passing through the axis of the coracoid process and a line perpendicular to the glenoid surface, joining the anterior end of the acromion on a superior view (Fig. 4). On the lateral view, the lateral coracoid angle was the angle between a line passing through the axis of the base of the coracoid process and a line passing through the vertical axis of the glenoid (Fig. 4).

The posterior, lateral and anterior acromial overhangs were all measured on the superior view (Fig. 5). The posterior acromial overhang was the distance between the posterior edge of the glenoid and the anterior edge of the acromion on a line passing through the anterior and the posterior edge of the glenoid. The lateral acromial overhang has the distance between the posterior edge of the

Fig. 2. Positioning criteria for the scapula on lateral and superior views: a: inferior angle of the scapula; b: anterior overhang of the supraspinatus fossa; c: alignment of the two criteria.