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The Latarjet coracoid process transfer procedure: alterations in the neurovascular structures

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Background: The Latarjet coracoid process transfer procedure is an established, reliable treatment for glenoid deficiency associated with recurrent anterior shoulder instability, but changes in neurovascular anatomy resulting from the procedure are a concern. The purpose of our cadaveric study was to identify changes in the neurovascular anatomy after a Latarjet procedure.

Materials and methods: We obtained 4 paired, fresh-frozen cadaveric forequarters (8 shoulders) from the Maryland State Anatomy Board. In each shoulder, we preoperatively measured the distances from the mid-anterior glenoid rim to the musculocutaneous nerve, axillary nerve, and axillary artery in 2 directions (lateral to medial and superior to inferior) and with the arm in 2 positions (0° abduction/neutral rotation; 30° abduction/30° external rotation), for a total of 12 measurements. We then created a standardized bony defect in the anterior-inferior glenoid, reconstructed it with the Latarjet procedure, and repeated the same measurements. Two examiners independently took each measurement twice. Inter-rater reliability was adequate, allowing pre-Latarjet measurements to be combined, averaged, and compared with combined and averaged post-Latarjet measurements by using paired Student *t* tests (significance, $P \leq .05$).

Results: We found (1) significant differences in the location of the musculocutaneous nerve in the superior-to-inferior direction for both arm positions, (2) notably lax and consistently overlapping musculocutaneous and axillary nerves, and (3) an unchanged axillary artery location.

Conclusions: The Latarjet procedure resulted in consistent and clinically significant alterations in the anatomic relationships of the musculocutaneous and axillary nerves, which may make them vulnerable to injury during revision surgery.

Level of evidence: Basic Science Study, Anatomy, Cadaver Dissection.

Keywords: Shoulder instability; Latarjet procedure; coracoid transfer; axillary nerve; glenoid deficiency; musculocutaneous nerve

The Latarjet coracoid process transfer procedure is an established and reliable treatment option for glenoid deficiency associated with recurrent anterior shoulder instability. However, the literature identifies several challenges that are associated with Latarjet or Bristow coracoid transfer procedures. For example, Young and Rockwood[26]

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noted extensive postoperative scarring involving the musculocutaneous and axillary nerves, and Green and Norris[10] described the difficulty of performing a shoulder arthroplasty for dislocation arthropathy because of local scarring that resulted in altered anatomy. Neurovascular injuries after Bristow and Latarjet coracoid transfers have been published by several authors.[3,11,13,19,22] Burkhead[7] noted that the musculocutaneous nerve was positioned closer to the tip of the coracoid after a Bristow procedure and vulnerable to injury. The use of the Latarjet procedure is increasing, and its associated neurovascular complications and altered anatomy pose a substantial challenge to subsequent revision reconstructive surgery, making it a pertinent topic of interest and study.

The purpose of our cadaveric study was to define the changes in neurovascular anatomy after a Latarjet procedure. We hypothesized that this procedure results in clinically significant alterations of the local neurovascular structures. An understanding of the altered anatomy resulting from this procedure would equip the surgeon with critical information when planning for its primary use or for subsequent revision surgery.

Materials and methods

Four, paired, fresh-frozen adult cadaveric forequarters (8 shoulders; range of age at death, 53-90 years) were obtained from the Maryland State Anatomy Board. No specimen had undergone previous shoulder operations.

Each specimen was placed supine, and a standard deltopectoral approach was used for the Latarjet procedure. The pectoralis major was reflected medially by sharp dissection from its clavicular origin and humeral insertion. The deltoid origin was similarly reflected laterally by sharp dissection from its clavicular and acromial attachments. The coracoacromial ligament was sharply dissected off the lateral surface of the coracoid. The pectoralis minor, together with a small wafer of bone, was removed from the medial side of the coracoid.

The musculocutaneous nerve, axillary nerve, and the axillary artery were identified and tagged individually with sutures at a point where minimal dissection allowed the suture to be placed (Fig. 1). These structures were tagged only to assist in their identification when measurements were obtained.

The subscapularis muscle was identified, and a vertical incision through the superior half of the muscle and the anterior capsule was performed approximately 1 cm medial to the bicipital groove. A horizontal capsular incision 1 cm lateral to the anterior glenoid rim was created, and a plane between the inferior portion of the subscapularis and the anterior capsule was developed. The labrum was reflected from the glenoid at the bone–cartilage interface. The glenoid length was measured in the superior-to-inferior axis, its midpoint was determined and identified along the anterior glenoid rim, and a Kirschner (K) wire was drilled to mark this standardized position at the 3:00 o'clock position of the anterior glenoid (Fig. 2).

Pre-Latarjet measurements were obtained from this K wire to the 3 identified anatomic structures in 2 directions [lateral-medial (coronal plane) and superior–inferior (sagittal plane)] and with the arm in 2 positions (0° of abduction/neutral rotation and 30° of abduction/30° of external rotation). These positions simulated the usual arm positions during this surgical procedure.

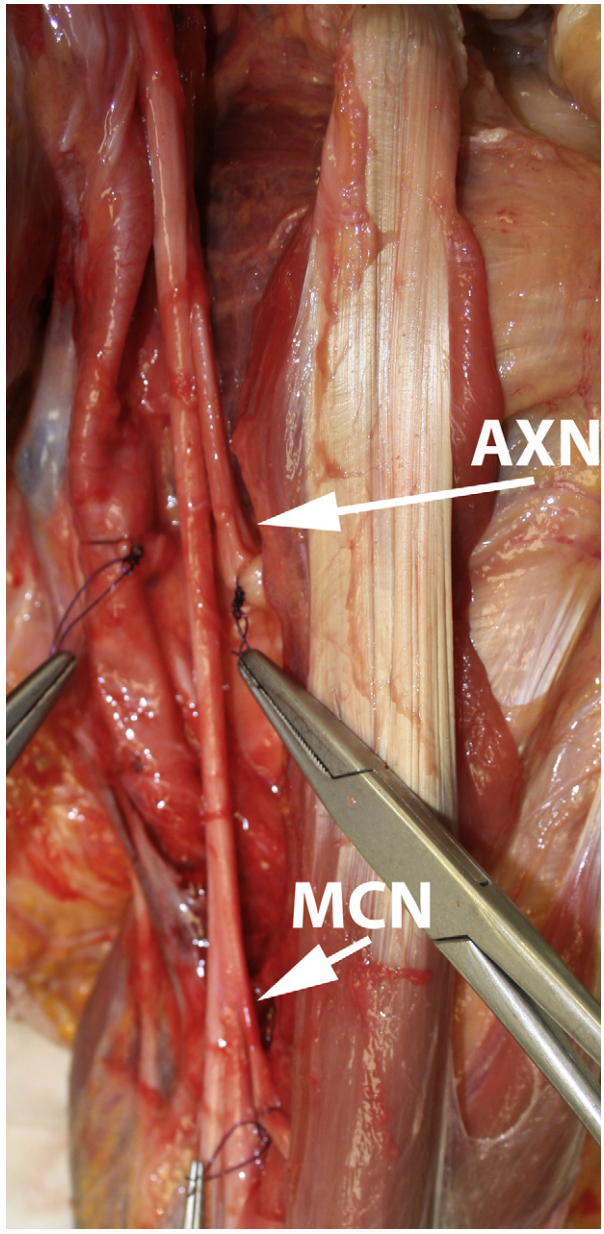

Figure 1 The musculocutaneous nerve (*MCN*), axillary nerve (*AXN*), and the axillary artery (not shown) were identified, dissected, and tagged individually with suture.

Two examiners (M.T.F., U.S.) made practice measurements to familiarize themselves with the procedure and the tools (electrocardiography calipers and a digital ruler). Then, each examiner independently measured and recorded the 12 distances twice.

The coracoid process was visualized with respect to the coracoclavicular ligaments and the conjoint tendon. A coracoid osteotomy was performed just anterior to the coracoclavicular ligaments in a medial–lateral direction to avoid injury to the neurovascular structures.

A glenoid defect was then created immediately below the reference K wire toward the inferior glenoid pole (6 o'clock position) at a 45° angle to create a reproducible and consistent