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ORIGINAL ARTICLE

Vascularized dermal autograft for the treatment of irreparable rotator cuff tears

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Background: Irreparable rotator cuff tears (IRCTs) are a challenging problem with diverse treatment modalities. We propose a technique for the treatment of IRCTs in which a vascularized dermal autograft is transferred to the posterosuperior region of the rotator cuff using the supraclavicular artery (SCA) island flap.

Materials and methods: Dissection of 11 fresh cadavers (19 shoulders) was performed, and the SCA island flap was harvested in all specimens. A full-thickness posterosuperior rotator cuff defect was created, and the flap was tunneled under the acromion and secured into position over the defect using multiple suture anchors. Simulated flap perfusion was then assessed, and flap measurements were recorded.

Results: There were 4 male and 7 female cadavers (19 shoulders). Flap perfusion was assessed in 10 shoulders. On average, the flap thickness was 4.7 mm (range, 3.5-7.1 mm); width, 32.6 mm (range, 25.5-38.0 mm); and length, 169.2 mm (range, 132.0-235.0 mm). The average distance from the flap tip to the Neviaser portal was 76.2 mm (range, 48.0-99.6 mm), and that from the flap tip to the anterolateral acromial edge was 54.1 mm (range, 29.5-75.1 mm). The pedicle-to-footprint distance was 113.7 mm (range, 88.5-147.0 mm). The average flap length exceeded the pedicle-to-footprint distance by 55.5 mm (range, 43.5-88.0 mm), indicating adequate excursion of the flap. All flaps demonstrated adequate simulated perfusion after fixation.

Conclusion: The SCA island flap may be an option for a vascularized dermal autograft for IRCTs, as shown in this cadaveric study. This illustrates a possible technique with vascular viability.

Level of evidence: Anatomy Study; Cadaver Dissection

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Keywords: Irreparable rotator cuff tear; supraclavicular artery; dermal autograft; rotator cuff repair; shoulder surgery; vascularized pedicle flap

This study received approval from the University of Southern California Fresh Tissue Dissection Laboratory Steering and Ethics Committee and was exempt from requiring institutional review board approval (basic science cadaveric study).

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Significant strides have been made in the treatment of irreparable rotator cuff tears (IRCTs) over the past several years. There are a wide range of treatment options for these controversial tears but also indistinct indications. Treatments include simple rotator cuff débridement, partial cuff repair, biceps tenotomy or tenodesis, tendon transfer, and even arthroplasty.⁴ Superior capsule reconstruction (SCR) has become popularized for the treatment of early rotator cuff tear arthropathy, intended to delay the need for a reverse total shoulder arthroplasty. Mihata et al¹⁵⁻¹⁸ were the first authors to describe the SCR technique biomechanically, and there have been multiple subsequent biomechanical and clinical articles validating its use for IRCTs.

Acellular dermal matrix (ADM) allograft tissue is approved by the US Food and Drug Administration as an augmentation for rotator cuff repairs and has been used off-label as a patch for bridging gaps greater than 1 cm.^{3,5,9} More recently, the use of ADM has expanded to SCR. In this technique, ADM is used to reconstruct the superior glenohumeral capsule, using multiple anchors in the glenoid and laterally over the footprint at the greater tuberosity. Because of concerns of donor-site morbidity when using fascia lata autograft, ADM has gained popularity for its ease of use and implementation. Unfortunately, there have been no long-term or comparative studies evaluating failure and functional outcomes using ADM. Several concerns about SCR have been raised, including failure of allograft healing and graft attrition owing to poor vascularity. There is no current evidence regarding healing rates and use of ADM in SCR. However, according to the clinical study of Mihata et al,¹⁵ there was a 17% failure rate even with the use of fascia lata autograft. We propose a new technique in which it is possible to use a vascularized dermal autograft to provide vascularity to the posterosuperior region of the rotator cuff in cases of IRCTs.

The supraclavicular artery (SCA) island flap is a well-established fasciocutaneous flap in the head and neck surgery literature (Fig. 1).^{1,2,11,12,20,23,25,27} This flap is based off the SCA, which is a direct cutaneous branch from the transverse cervical artery, which branches from the thyrocervical trunk and

subclavian artery (Fig. 1, A).² This flap has been shown to be a reliable and generally simple flap to elevate for coverage in head and neck oncology cases.^{1,2,11,25}

The purpose of this study was to describe a technique in the treatment of IRCTs using a vascularized fasciocutaneous autograft. This cadaveric study sought to answer the following 3 questions to assess the SCA island flap's suitability as an alternative to ADM: Does the SCA flap appropriately span the glenoid-to-tuberosity distance without tension? Does the graft remain perfused after fixation? Is the wound able to be closed primarily?

Materials and methods

The standard operating procedure of the Fresh Tissue Dissection Laboratory for obtaining and using cadavers for medical education was followed at all times. Dissection of 11 fresh cadavers (19 shoulders) was performed. The causes of death and medical histories were reviewed prior to dissection. Any specimen with gross deformity or prior surgery on the shoulder were excluded. Three shoulders were excluded from the study because of prior procedures on the shoulder. All dissections were carried out by 2 individuals who simultaneously recorded the data measurements, and all measurements were performed using digital calipers in standard fashion (Table I).

The flap was first drawn starting 2 mm anterior and crossing the medial one-third of the clavicle, and the "pinch test" was performed to determine the width of the flap posteriorly to allow later closure (Fig. 1, B).^{13,31} The pinch test is done by grasping the skin between the thumb and the index finger. This provides the width of skin and subcutaneous fat that can be removed while closing the resultant defect primarily. The lateral extent of the flap was determined by a point 2 fingerbreadths lateral to the lateral acromion, and the medial extent lay in the anterior triangle just posterior to the sternocleidomastoid (SCM) and clavicle. The flap was then elevated from lateral to medial as a full-thickness fasciocutaneous flap directly off the deltoid until the supraclavicular fossa was reached (Fig. 2, A). The skin to the flap was completely de-epithelialized using a No. 10 blade scalpel down to the dermal-epidermal junction.

Once the flap was elevated, the glenoid was prepared arthroscopically and 2 double-loaded suture anchors (Healicoil; Smith

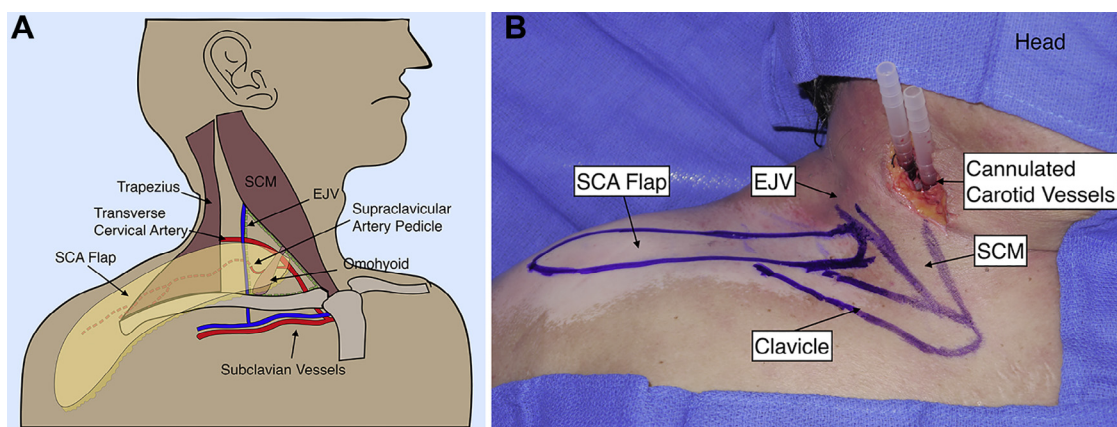


Figure 1 (A, B) Supraclavicular artery (SCA) island flap. SCM, sternocleidomastoid; EJV, external jugular vein.

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