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The Supraclavicular Artery Island Flap: A Practical Approach for Reconstruction of Extensive Cervicofacial Defects Following Giant Cavernous Hemangioma Resection

ABSTRACT

Objective: To demonstrate the utility of the supraclavicular artery island flap (SCAIF) as a viable alternative to free tissue transfer for reconstruction of large cervicofacial defects.

Methods:

Design: Case Report
Setting: Tertiary National University Hospital
Patient: One

Results: A 43-year-old woman with a giant cavernous hemangioma measuring 21.43 x 9.91 x 20.75cm underwent tumor resection and immediate reconstruction using SCAIF. Following preoperative embolization and complete tumor excision, an 11 x 15cm cervicofacial defect was successfully reconstructed using SCAIF. The patient experienced post-operative complications including multiple wound dehiscences and hypertrophic scar formation but achieved significant functional and aesthetic improvement. At three months follow up, the patient reported cessation of bleeding episodes, improved feeding capacity, and enhanced quality of life despite persistent tracheostomy dependence. Plans for secondary surgery include scar revision, commissuroplasty, and intralesional steroid injections.

Conclusion: The supraclavicular artery island flap presents a practical, cost-effective alternative to free tissue transfer for extensive cervicofacial reconstruction, particularly in resource-limited environments or in patients where free tissue transfer is contraindicated. Advantages include good color match, wide arc of rotation, and ease of harvest. Despite potential complications, it offers excellent functional and aesthetic outcomes with acceptable donor site morbidity.

Keywords: *cavernous hemangioma; supraclavicular artery island flap; locoregional flap; cervicofacial defect*

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Philipp J Otolaryngol Head Neck Surg 2025 Sep; 40 (Suppl.): 45-49

Reconstruction of extensive cervicofacial defects remains one of the most challenging aspects of head and neck surgery. The complex anatomy of this region demands reconstruction techniques that not only restore structural integrity but also preserve critical functions including respiration, deglutition, and articulation while maintaining facial aesthetics. While free tissue transfer has become the gold standard for complex head and neck reconstruction in developed countries, several factors may limit its application including patient comorbidities, institutional capabilities, surgeon expertise, and economic considerations.

The supraclavicular artery island flap (SCAIF) has emerged as a reliable pedicled flap option for cervicofacial reconstruction. Originally described for post-burn cervical contracture release, its applications have expanded to include oropharyngeal, skull base, and cervicofacial defects.[1] It is comparable to the radial forearm free flap in terms of thickness and pliability but has the advantage of a better color match.[2] We present a case demonstrating successful reconstruction of an extensive cervicofacial defect following resection of a giant cavernous hemangioma using SCAIF, highlighting its utility as a practical alternative to free tissue transfer in appropriate clinical scenarios.

CASE REPORT

A 43-year-old woman presented with a 20-year history of a progressively enlarging left facial mass that initially began as a violaceous patch at the left submandibular region. Over the preceding two years, she experienced recurrent bleeding episodes and functional impairment including difficulty chewing and speaking due to lower lip involvement. Physical examination revealed a massive, violaceous-brown, multilobular, pendulous mass extending from the left pre-auricular region to the malar area, involving the lower lip, and crossing the midline to the right submandibular region. *(Figure 1A)* The mass extended inferiorly to the submental and submandibular region, cervical level III, and posteriorly to the left post-auricular area. *(Figure 1B)* Wedge biopsy confirmed the diagnosis of cavernous hemangioma. Computed tomography demonstrated a contrast-enhancing facial mass measuring 21.43 x 9.91 x 20.75cm extending into the superficial lobe of the left parotid. *(Figures 2A, B)* Magnetic resonance imaging revealed intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images, consistent with vascular malformation. *(Figures 3A, B)* Given the extensive vascularity and size of the lesion, preoperative superselective embolization of bilateral facial and right internal maxillary arteries was performed using polyvinyl alcohol (PVA) and gelfoam. Surgery was scheduled 72 hours post-embolization to minimize collateral circulation development. Complete excision of the mass was achieved, resulting in an 11 x 15 cm cervicofacial defect involving the left preauricular and malar regions, lower lip vermillion, submental and submandibular areas.

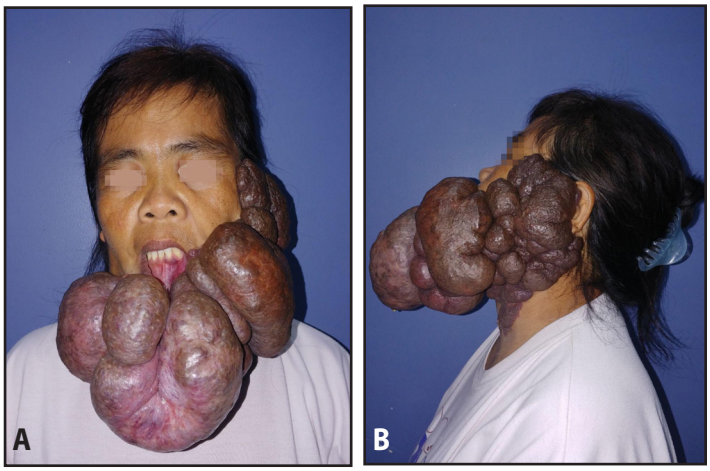

Figure 1. Preoperative photos showing: **A.** Anterior view of a massive cavernous hemangioma spanning the left pre auricular area crossing midline towards the right submandibular area; and **B.** Left lateral view showing posterior extent to the left post auricular area, and inferior extent to level III of the neck. Photos published with permission.

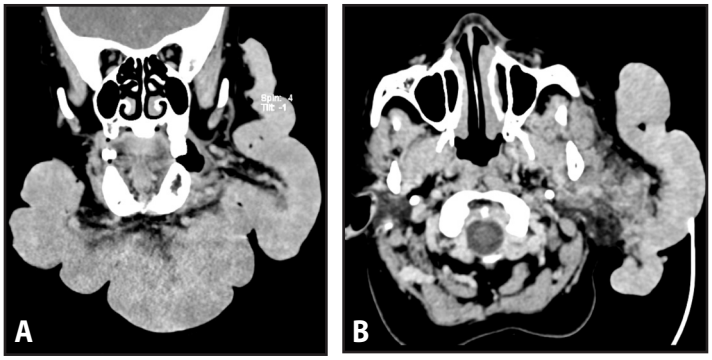

Figure 2. Contrast enhanced computed tomograph: **A.** Coronal view showing facial mass measuring 21.43 x 9.91 x 20.75cm.; and **B.** Axial view at the level of the maxillary sinuses, showing extent of the mass to the superficial lobe of the parotid

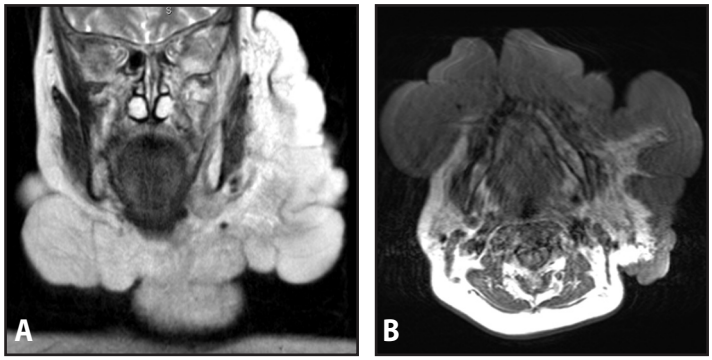

Figure 3. Magnetic resonance imaging: **A.** Coronal view at the level of the maxillary sinuses showing high signal intensity on T2 weighted images; and **B.** Axial view at the level of the mandible showing intermediate signal intensity on T1 weighted images

A left sided supraclavicular artery island flap reconstruction was performed using established anatomic landmarks for the origin of the supraclavicular artery: 2cm posterior to the dorsal edge of the

Figure 4. Surface markings for the supraclavicular artery island flap

Figure 5. The skin paddle rotated along an arc of 180 degrees

Figure 6. Post-operative antero-posterior view of the patient after closure of the flap. Photos published with permission.

sternocleidomastoid muscle, 2.5-4 cm above the clavicle, and the external jugular vein. *(Figure 4)* The flap was harvested in the sub-fascial plane from distal to proximal to preserve the perifascial anastomotic network. A 3 cm wide pedicle was identified within the fibrofatty tissues. Flap viability was confirmed by bright red bleeding from the cut edges in the absence of Doppler assessment. The skin paddle was de-epithelialized and tunneled through the band of remaining normal skin of the neck, achieving a 180-degree flap rotation. *(Figure 5)* Two-layered closure was performed using Vicryl 3-0 and nylon 4-0 sutures. Hemostatic agents and closed suction drainage were placed at both donor and recipient sites. *(Figure 6)* Total operative time was nine hours.

On postoperative day two, the patient had respiratory distress requiring reintubation, resulting in suture dehiscence at the oral commissure and lower lip. She developed hospital acquired pneumonia with ventilator dependence. On postoperative day five, a 5 x 1cm donor site dehiscence ensued, managed conservatively with silver sulfadiazine dressings. On postoperative day seven, tracheostomy was performed and dehiscence repair completed.

The patient was discharged after completing antibiotic therapy and sutures were removed after another seven days. Regular outpatient monitoring revealed successful flap integration. *(Figures 7A, B)* Despite persistent tracheostomy dependence due to underlying pulmonary pathology, the patient experienced significant quality of life improvement including complete cessation of bleeding episodes, improved feeding capacity, enhanced cosmetic appearance, and restored self-confidence and social interaction. After ensuring resolution of pulmonary disease, the patient's tracheostomy was decannulated three months postoperatively. Hypertrophic scars were also seen along the wound edges. *(Figure 8A, B)* Plans for secondary procedures including scar revision, commissuroplasty, and intralesional steroid injections are under consideration.

DISCUSSION

This case demonstrates the successful application of SCAIF for reconstruction of an extensive cervicofacial defect following resection of a giant cavernous hemangioma. The patient's significant functional and aesthetic improvement validates the utility of this technique as an alternative to free tissue transfer in appropriate clinical scenarios.

Cavernous hemangiomas, while histologically benign, can cause significant morbidity through mass effect, bleeding, and functional impairment.[3] Our patient's huge disfiguring facial mass caused a negative impact on her quality of life, leading to poor self-esteem, lack of self-confidence, and avoidance of social interactions. Significant functional morbidity arose when the mass bled during accidental manipulation, and there was difficulty chewing and articulating due to the extension of the mass to the lower lip. Complete surgical excision remains the gold standard for definitive treatment, though the complex vascularity necessitates careful preoperative planning

Figure 7. One month post-operative photos showing donor site dehiscence at the medial portion; **A.** Antero-posterior view; and **B.** Left lateral view. Photos published with permission.

Figure 8. Three month post-operative photos after tracheostomy decannulation. Hypertrophic scars are also seen: **A.** Antero-posterior view; and **B.** Left lateral view. Photos published with permission.

including embolization for large lesions.[4] The primary goal is to restore function and preserve the aesthetic subunits of the face.[5]

The choice of reconstruction technique for extensive cervicofacial defects must consider multiple factors including defect size and location, functional requirements, patient comorbidities, surgeon expertise, and institutional resources. While microvascular free tissue transfer offers excellent versatility and outcomes, several limitations may preclude its use such as preoperative embolization possibly compromising recipient vessel quality, limited availability of microsurgical expertise and equipment, comorbidities precluding prolonged operative procedures, and significantly higher costs associated with microvascular procedures.[5,6]

The supraclavicular artery island flap offers several compelling advantages for cervicofacial reconstruction. The thin, pliable tissue is similar to a radial forearm free flap. It offers excellent color and texture match for facial reconstruction based on reliable vascular anatomy. The wide arc of rotation can reach as far as the lateral orbital rim. The size of the flap that can be utilized varies according to the defect, with reports ranging from 4x5cm for mucosal defects to 21x11cm for post-burn contractures.[7] Harvesting is relatively straightforward, not needing microvascular expertise or equipment. Operative time compared to free tissue transfer is shorter, and immediate assessment of flap viability is possible. It offers economic advantages, such as significantly lower cost compared to free tissue transfer, reduced hospital stay and monitoring requirements, thus is suitable for resource-limited environments.

Despite its advantages, SCAIF reconstruction carries inherent risks and limitations. There may be flap-related complications, such as partial flap necrosis (4.2-14.9%), complete flap necrosis (up to 5.6%), and salivary fistula (6.4-16.7%).[8] Donor site complications include wound dehiscence (most common), scar widening and keloid formation (up to 32%), seroma and hematoma formation as well as chyle leak (rare).[9] Risk factors for complications include smoking history, multiple medical comorbidities, prior radiotherapy and flap length >22 cm. Consistent with complications found in literature, our patient developed donor site dehiscence, likely related to tension and tracheostomy interference. Plans for secondary surgery with scar revision, commissuroplasty, and intralesional steroid injection are being discussed with the patient.

Why did we not use a pectoralis major myocutaneous flap (PMMF), the historically used "workhorse" flap for extensive head and neck reconstructions? While offering reliable vascular supply and wide arc of rotation, PMMF disadvantages include excessive bulk, potential breast tissue interference, and donor site morbidity.[10] The deltopectoral flap (DP) was another viable option, but it required a second-stage procedure for pedicle division and inset revision, prolonging overall treatment timeline.[11] In our case, the SCAIF was favored for its superior aesthetic match, reduced bulk, and ability to achieve definitive coverage in a single operation.

The surgical management of large vascular tumors involves two phases: resection and reconstruction. Resection of these tumors would likely leave a large surface area that poses a unique challenge to otolaryngologists and reconstructive surgeons. For vascular tumors in particular, the utilization of preoperative embolization complicates the use of free tissue transfer, as this procedure requires normal vessels for anastomosis.[3] The supraclavicular artery island flap is a good alternative to free tissue transfer for cervicofacial defects because it is thin, pliable, and has the advantage of a better color match. It is a practical, cost-effective choice for low resource environments where free flaps cannot be performed. It is a less bulky flap relative to the workhorse PMMF,

providing better cosmetic and functional outcomes.[1] Complications may still arise from this type of flap, the most reported being keloid formation, flap dehiscence or necrosis.[9] Our patient's post-operative course had complications, owing to tracheostomy tube insertion and multiple sites of dehiscence. As a recommendation, application of skin grafts along the donor site may be necessary, because excessive linear tension could compromise healing and lead to tissue necrosis. Despite the advantages of this type of flap, the choice of reconstruction should always be individualized based on the patient's needs and fitness for surgery.

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