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UPPER & LOWER TRAPEZIUS FLAPS FOR HEAD & NECK RECONSTRUCTION

Patrik Pipkorn, Ryan Jackson, Jason Rich

Trapezius flaps are a useful reconstructive option for the head and neck. Because of the popularity of microvascular surgery, as well as surgeons' unfamiliarity with back flaps and the need for lateral or prone surgical positioning, trapezius flaps have however decreased in popularity. But, in a setting without microvascular expertise and with other reconstructive options exhausted, these are robust and reliable flaps with low morbidity.

There are ***three types of trapezius flaps*** *i.e.* ***upper, lower and lateral trapezius island flaps***. The lateral trapezius island flap has a very variable blood supply and is very seldom used and is not covered in this chapter.

Upper trapezius flap

The upper trapezius flap is based on the paraspinous perforators and branches of the occipital artery and is a good option for carotid cover for skin loss after radical neck dissection.

Benefits

- Robust and reliable blood supply
- Can be raised following prior radical neck dissection
- Can provide up to 10cm width skin and muscle
- Can provide skin cover to the midline

Caveats

- Limited arc of rotation
- Often requires skin graft to cover donor site
- Impaired shoulder function (unless XIn already sacrificed)
- Requires slightly rotated surgical position or a Mayfield headrest for surgical exposure

Lower trapezius island flap

The lower trapezius island flap is based on branches of the transverse cervical artery and provides excellent reconstruction of posterior occipital and scalp defects.

Benefits

- "The pectoralis flap of the back"
- Reliable blood supply
- Provides skin cover up to parietal scalp
- Easy to raise once familiar with back anatomy
- Up to 9cm of skin width with primary closure
- Low donor site morbidity
- Excellent arc of rotation

Caveats

- Requires lateral or prone surgical position
- Wound prone to seroma
- Questionable vascularity after neck dissection if transverse cervical vessels have been sacrificed

Surgical anatomy

As with any surgical procedure a sound understanding of the anatomy and good judgement are essential.

Muscle anatomy *(Figure 1)*

The trapezius muscle is the most superficial of the muscles of the upper back and posterior neck. It is a thin trapezoid-shaped muscle with three anatomic and functional components. The upper portion arises from the superior nuchal line and the external occipital protuberance, and it inserts into the lateral third of the clavicle, defining the posterior triangle of the neck. This part of the muscle helps to elevate the scapula and the shoulder. The lower two thirds of the

muscle originate from the seven cervical and six upper thoracic spinal processes and inserts into the acromion and spine of the scapula. These fibers help to retract the scapula. The lower part of the muscle overlies the latissimus dorsi muscle. Deep to the trapezius muscle are the thin rhomboid minor and major muscles that originate from C7-T1 and T2-T5 respectively. Superior to the rhomboid muscles is the levator scapulae muscle that arises from the posterior tubercle of the transverse processes of C1-C4 and inserts into the superior and medial borders of the scapula. These muscles retract and elevate the scapula. Superolaterally the trapezius covers the supraspinatus muscle.

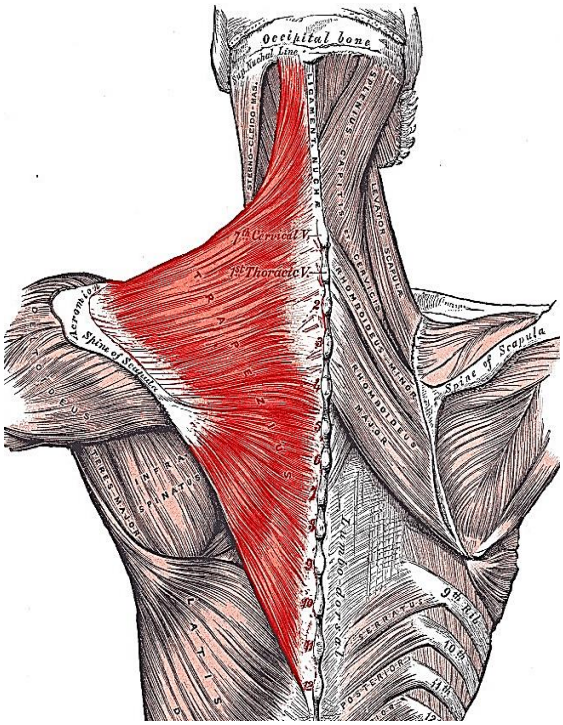

Figure 1: Trapezius, latissimus dorsi, levator scapulae, and rhomboid muscles

***Vasculature** (Figure 2)*

The trapezius muscle has a ***variable blood supply*** that has been debated over the years. When harvesting ***upper trapezius flaps these variations have no relevance***. However, ***with the lower island flap these variations are important***, but only ***if additional pedicle length is required.***

The main blood supply to the muscle originates from branches of the ***transverse cervical artery (TCA)*** or ***dorsal scapular artery (DSA)***. The muscle has minor blood supply from ***perforating paraspinous perforators*** from posterior intercostal vessels all along its origin from C1-T6. The upper portion of the muscle has additional blood supply from branches of the ***occipital artery*** *(Figure 2)*.

The ***transverse cervical artery*** arises from the thyrocervical trunk and crosses laterally low in the neck, superficial to the prevertebral fascia and enters the trapezius from its deep surface *(Figure 2)*. Before entering the muscle, it gives off a deep branch, the ***dorsal scapular artery*** which runs deep to levator scapulae, and a ***superficial branch*** to the trapezius most commonly between the rhomboid minor and major muscles; However, occasionally this branch runs between the levator scapulae and rhomboid minor muscles.

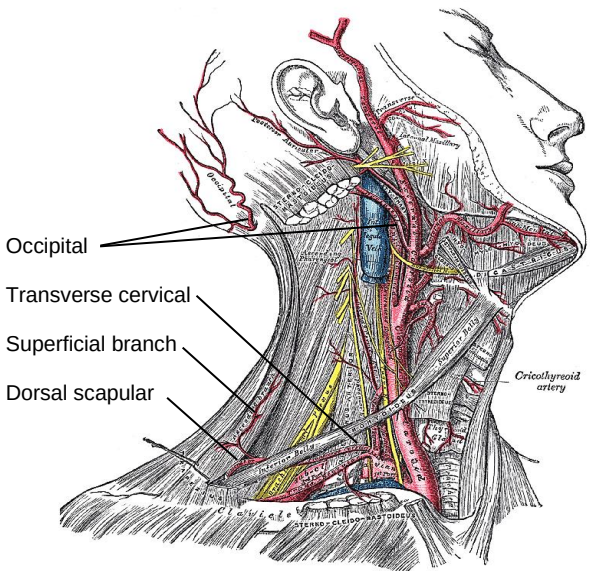

Figure 2: Occipital, transverse cervical and its dorsal scapular and superficial branches

Anatomic variations

It was long believed that the transverse cervical artery was the main blood supply to the trapezius flap after reports of distal flap necrosis when the superficial branch of the dorsal scapular artery was ligated to obtain additional length. However, cadaveric studies in the early 1990's shed further light on anatomic variations, and showed that the dorsal scapular and transverse cervical artery (superficial branch) had a reciprocal relationship. In 50% of cases the dorsal scapular artery was dominant and was a branch of transverse cervical artery. In 30% the transverse cervical artery was the main supply with the dorsal scapular artery being a branch from the transverse cervical artery. In 20 % the blood supply was equal, but had separate takeoffs from the subclavian artery. This differed slightly from earlier cadaveric studies with a higher proportion of the dorsal scapular artery having a separate takeoff directly from subclavian artery *(Figure 3)*.

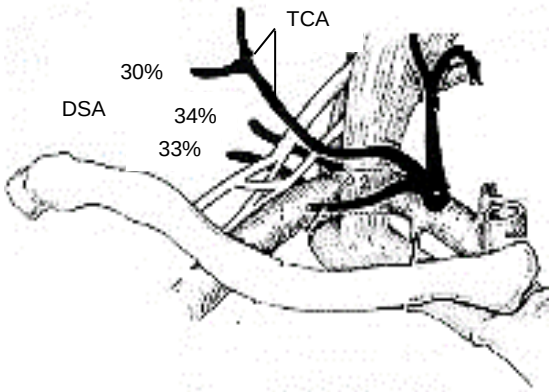

Figure 3: Origin of dorsal scapular artery (DSA)

Variations of how the vessels are intertwined with the brachial plexus have also been described. These variations are important to understand if additional pedicle length is required when harvesting a lower trapezius island flap. Since it is difficult to know which artery is dominant, it may be safer to not divide the distal dorsal scapular artery to preserve this additional blood supply to not jeopardize the vascular supply. To preserve the proximal dorsal scapular artery, the rhomboid minor muscle must be divided. Additionally, it is ***important to consider the status of the transverse cervical vessels as they may have been sacrificed during the neck dissection***.

Innervation

The trapezius is innervated mainly by the XIn. It enters the deep surface of the superior edge of the muscle in the lower posterior triangle of the neck after passing through the upper third of the sternocleidomastoid muscle *(Figure 4)*. It receives additional innervation from branches of C3 and C4 although the clinical importance of these fibers is unclear.

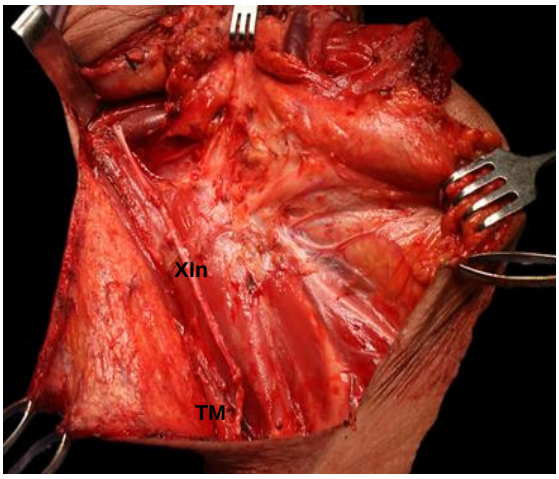

Figure 4: Accessory (XIn) fully exposed in right neck dissection, passing deep to anterior border of trapezius muscle (TM)

Upper Trapezius Flap: Surgical steps

The upper trapezius flap is based on the paraspinous perforators and branches of the occipital artery.

Informed consent

Preoperative counselling includes risk of seroma or haematoma, as well as unsightly scars. The patient needs to be informed

about shoulder dysfunction (especially if the XIn is still functioning) and the possible need for a skin graft to the donor site.

Surgical preparation and positioning *(Figure 5)*

The patient's neck and upper back are prepped and draped. Exposure needs to include the upper back, just beyond the thoracic spinal processes. This exposure is obtained by slightly tilting the patient away from the side of the flap, especially if the patient's head is supported in a Mayfield headrest. Alternatively, the patient is positioned in a lateral decubitus position, al-though this makes the oncologic resection in the neck more challenging.

Figure 5: Patient slightly tilted away from the side of the flap to expose the upper back, just beyond thoracic spinal processes

Flap design *(Figure 5)*

Before raising the flap, the surgeon needs to have a good understanding of the surgical defect.

- The superior edge of the trapezius muscle denotes the anterior edge of the flap
- Pre- or intraoperative ultrasound can be used to better define the superolateral border of the trapezius muscle to plan the incisions
- The lateral extension of the trapezius at the acromion generally marks the lateral extent of the flap
- Skin over the deltoid can be raised if additional length is needed, but any skin beyond the trapezius is supplied randomly through the dermal plexus and is not reliable
- The defect size will dictate the width of the flap, although the wider the flap the more reliable it is
- Up to about 6cm can be raised without a need for skin grafting; a simple pinch test will give guidance

Raising the flap

- Start by making the ***anterior incision*** through skin, fascia and fat to the level of the trapezius muscle *(Figure 6)*

Figure 6: Start by identifying the anterior edge of the trapezius muscle

- By making this incision anteriorly, adjustments can still be made should it turn out that the edge of the muscle is in a different position than was anticipated
- Once the anterior edge of the trapezius is identified, the remainder of the skin incision is made

- Continue with the ***posterior skin incision***
- Divide the trapezius from its attachment from the spine of the scapula
- Anteriorly the transverse cervical vessels will be encountered and need to be divided to enable rotation of the flap *(Figure 7)*

Figure 7: Anteriorly the transverse cervical vessels are encountered

- Continue with blunt dissection between the deep aspect of the trapezius and the supraspinatus musculature
- Continue the dissection medially towards the spine until the flap can be easily rotated into position *(Figure 8)*

Figure 8: Flap rotated into position

- To gain additional rotation, a back-cut can be made on the contralateral side of the spinal process
- If possible, close the defect primarily *(Figure 9)*
- Otherwise close the defect with a skin graft

Figure 9: Primary closure of door site

Lower Trapezius Island Flap: Surgical steps

The lower trapezius island flap is based on branches of the transverse cervical artery.

Informed consent

Preoperative counseling includes risk of a seroma or haematoma, as well as unsightly scars. The patient needs to be informed about a possible need for a skin graft to the donor site. There is a smaller risk of shoulder dysfunction (especially if the XIn is still functioning), because the upper portion of the muscle which elevates the shoulder is never transected, and shoulder impairment is usually limited to inability to retract the scapula. Patients should avoid lying flat on their backs after surgery to avoid compression of the pedicle.

Surgical preparation and positioning

Position the patient either prone or in a lateral decubitus position on a bean bag. Expose the upper back just beyond the thoracic spinal processes.

Flap design

Before raising the flap, the surgeon needs to have a good understanding of the surgical defect.

- The flap can be raised as a myofascial or myocutaneous flap
- Up to a 9cm wide skin paddle can be raised and still permit primary closure of the donor site; a pinch test provides guidance
- Outline the trapezius muscle on the patient's back *(Figure 10)*

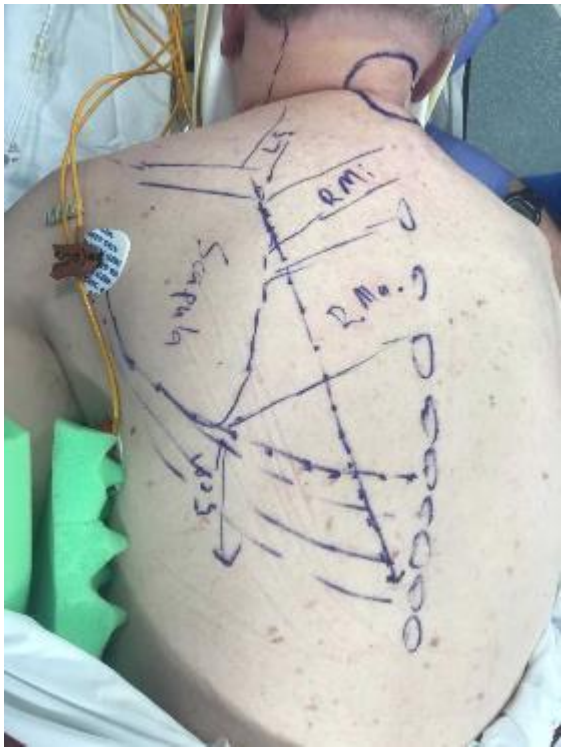

Figure 10: Outline the trapezius muscle

- The trapezius can seldom be palpated on the back, so the inferior extent of the muscle may be difficult to determine
- However, the skin paddle is generally reliable up to about 5cm below the tip of the scapula
- If uncertain, it is wise to extend the skin flap more inferiorly as the distal end can always be trimmed or discarded *(Figure 11)*

Figure 11: Outline the trapezius muscle

- Start by making the ***lateral incision*** through the skin, fascia and fat, down to the ***latissimus dorsi muscle*** *(Figure 12)*

Figure 12: Lateral incision through skin, fascia and fat, down to latissimus dorsi muscle (*)

- Bevel the cut slightly laterally to avoid jeopardizing any perforators from the trapezius to the skin
- The latissimus dorsi can be identified by its more-or-less horizontal fibers *(Figures 12, 13)*

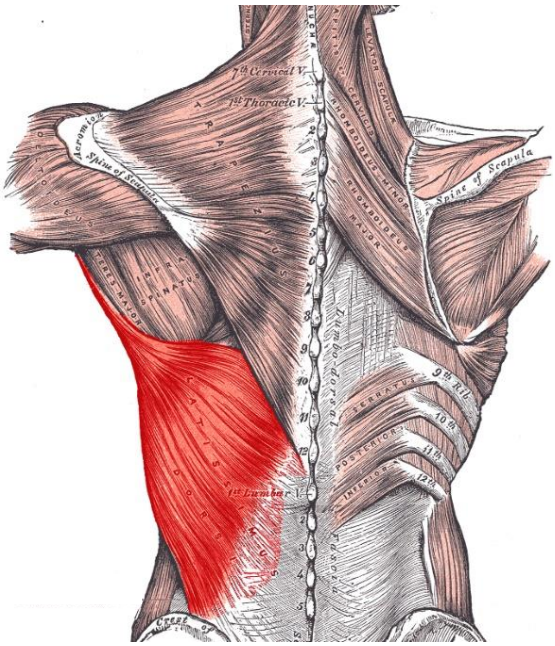

Figure 13: Latissimus dorsi muscle

- Raise the lateral flaps to expose parts of the latissimus dorsi muscle and define its anatomy
- Having dissected down to latissimus dorsi, dissect sharply on the surface of latissimus dorsi towards the spine
- By staying strictly on the latissimus dorsi muscle, the more superficial trapezius muscle is raised together with the skin flap
- The trapezius muscle is easily identified by its more vertically oriented fibers *(Figures 13, 14)*
- Follow the trapezius muscle inferiorly and identify the most inferior extension of the muscle *(Figure 15)*
- Once the inferior extension is determined, the design of the inferior skin paddle design can be finalized
- Continue with the medial skin cuts just lateral to the spine *(Figure 16)*

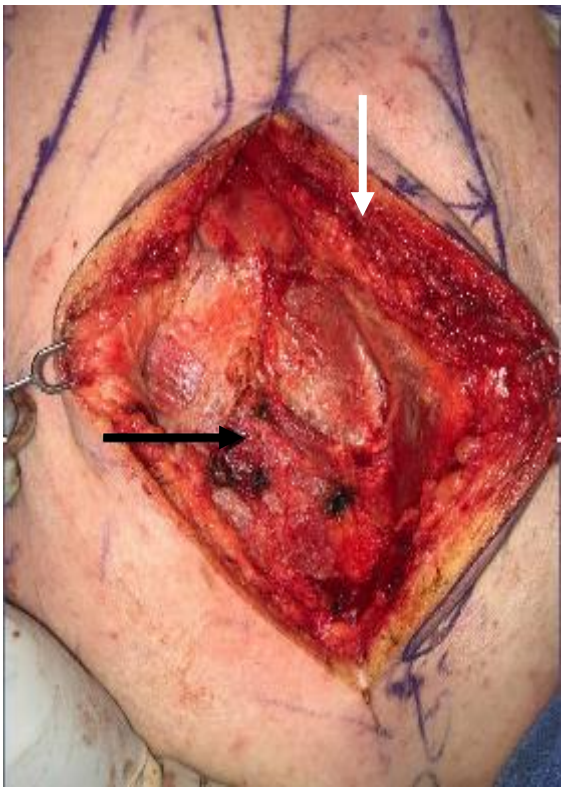

Figure 14: Latissimus dorsi (black arrow) and trapezius (white arrow)

Figure 15: Identify the most inferior extension of the trapezius muscle

Figure 16: Medial skin cuts just lateral to the spine

- The medial and lateral skin incisions are now carried in a superior direction
- The superior incision of the skin paddle can be made once the exact extent of the trapezius muscle has been defined and it has been confirmed that the skin paddle lies directly over the muscle
- Again, one can err on raising additional skin superiorly, as this can be discarded should it be redundant
- A larger skin paddle is also more reliable as more perforators are incorporated
- Continue to expose the mid- and upper trapezius *(Figure 17)*
- Making a vertical incision beyond the skin flap can greatly facilitate additional exposure
- Gentle blunt dissection on the deep surface of the trapezius will expose the thin rhomboid major muscles *(Figures 18, 19)*

Figure 17: Expose the mid- and upper trapezius

Figure 18: Gentle blunt dissection on the deep surface of the trapezius will expose the thin rhomboid major muscles

Figure 19: Exposed thin rhomboid major muscle (*)

- The lateral and medial incisions through trapezius muscle can now be made
- By dividing the trapezius close to the origin of the spinal processes and laterally towards the scapula, the flap is raised in a distal-to-proximal fashion *(Figure 20)*
- With careful dissection, the branch from the dorsal scapular artery can now be identified as it enters the muscle on its deep aspect between the rhomboid major and minor muscles *(Figure 21)*
- At this point the reach of the flap is assessed. Usually the flap easily reaches the postauricular level without needing to divide the dorsal scapular artery, which greatly enhances the robustness of the flap
- If ***additional reach*** is needed, the deep dorsal scapular vessels may need to be divided, although this is rarely needed
- An alternative to dividing the dorsal scapular for additional flap length is to divide the rhomboid minor and maintaining the dorsal scapular artery intact

Figure 20: The flap is raised in a distal-to-proximal fashion by dividing the trapezius close to the origin from the spinal processes and laterally towards the scapula

Figure 21: Branch from dorsal scapular artery entering the muscle on its deep aspect between rhomboid major and minor

- To ***increase the arc of rotation***, the trapezius muscle can be narrowed superiorly around the pedicle
- However, the safest way is to divide the muscle laterally and medially and to keep the pedicle undissected
- Once the flap has been rotated into position, two suction drains are placed in the back
- The skin is closed in layers using large absorbable sutures for the deep dermis and nylon/staples for the skin *(Figure 22)*
- Drains are removed once output is <30 ml/24 hours
- Staples are removed at least after two weeks

Figure 22: Closed donor site

Clinical examples

Case 1: Upper trapezius flap in a female with a history of parotid cancer following resection, radiation and reirradiation for recurrence.

Case 2: Upper trapezius flap in a male with a history of cutaneous squamous cell carcinoma with previous neck dissection and postoperative radiation, now with regional recurrence.

Case 3: Lower trapezius island flap in a male with a history of multiple recurrent cutaneous squamous cell carcinomas and previous radical neck dissection, radiation therapy, and re-resection with a new single nodal recurrence in posterior neck.

Case 4: Lower trapezius island flap in a female with a history of brain cancer and posterior fossa craniectomy with poor skin quality over a titanium mesh.

References

1. Netterville JL and Wood DE (1991). "The lower trapezius flap. Vascular anatomy and surgical technique." *Arch Otolaryngol Head Neck Surg* 117(1): 73-6
2. Urken, ML. Atlas of regional and free flaps for head and neck reconstruction. Raven Press. Ltd. New York. 1995

Other flaps described in *The Open Access Atlas of Otolaryngology Head & Neck Operative Surgery*

- *Pectoralis major flap*
- *Buccinator myomucosal flap*
- *Buccal fat pad flap*
- *Nasolabial flap*
- *Temporalis muscle flap*
- *Deltopectoral flap*
- *Paramedian forehead flap*
- *Cervicofacial flaps*
- *Submental artery island flap*
- *Supraclavicular flap*
- *Latissimus dorsi flap*
- *Local flaps for facial reconstruction*
- *Radial free forearm flap*
- *Free fibula flap*
- *Rectus abdominis flap*
- *Anterolateral free thigh flap*
- *Thoracodorsal artery scapular tip (TDAST) flap*
- *Principles and technique of microvascular anastomosis for free tissue transfer flaps in head and neck reconstructive surgery*

Authors

Patrik Pipkorn MD,
Assistant Professor, Head & Neck and Microvascular Reconstruction
Washington University
St Louis, MO, USA
pipkorn@wustl.edu

Ryan Jackson MD
Assistant Professor, Head & Neck and Microvascular Reconstruction
Washington University in St Louis
St Louis, MO, USA
jackson.ryan@wustl.edu

Jason T. Rich MD
Assistant Professor, Head & Neck and Microvascular Reconstruction
Washington University in St Louis
St Louis, MO, USA
richj@wustl.edu

Editor

Johan Fagan MBChB, FCS(ORL), MMed
Professor and Chairman
Division of Otolaryngology
University of Cape Town
Cape Town, South Africa
johannes.fagan@uct.ac.za

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