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Anterolateral thigh butterfly free flap for reconstruction of laryngopharyngeal defect: surgical considerations

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Short Communication

Dr E Ozer takes responsibility for the integrity of the content of the paper

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Abstract

Background. Reconstruction of a pharyngoesophageal defect remains a challenging problem, especially with involvement of the neck skin. This study aimed to demonstrate the surgical technique of utilising a butterfly modification of the anterolateral thigh flap.
Results. Reconstruction of the pharyngoesophageal defect was accomplished using the butterfly modification of the anterolateral thigh free flap. The flap was tubed on the leg while still being attached to the pedicle, to minimise the ischaemia time.
Conclusion. Butterfly anterolateral thigh free flap allows for multi-layer closure of the neopharynx and can be utilised for reconstruction of pharyngoesophageal and neck skin defects.

Introduction

The anterolateral thigh flap has been well-described for use in reconstructing laryngopharyngeal defects. This flap provides the reconstructive surgeon with the versatility to maximise aesthetic and functional outcomes with a single flap.[1–3] The anterolateral thigh free flap possesses many advantages in head and neck reconstruction, including extended flap size and pedicle length, minimal donor size morbidity, and shorter operative time with simultaneous two-team co-operation.[4–12] It also avoids the need for a double free flap for larger and more complicated defects.

Utilisation of this versatile flap has been well-published throughout the literature. This paper primarily aims to describe the surgical technique of the butterfly modification of the anterolateral thigh flap, presented alongside a video demonstration that provides a visual understanding of this flap's unique utility.

Surgical technique

A 55-year-old patient presented with laryngeal squamous cell carcinoma that required a laryngopharyngectomy. The resection and reconstruction team worked simultaneously during the procedure. After careful consideration of the various reconstructive options, the anterolateral thigh free flap with the butterfly modification technique was ultimately selected given the patient's poor results on the pre-operative Allen test (used to assess the status of blood supply within the hand), which thus eliminated the radial forearm free flap as a viable surgical option. The anterolateral thigh free flap harvest has been previously described.[2,3,7–9,11,12]

The rectangular central portion of a previously planned elliptical anterolateral thigh free flap was designed for tubing purposes for the pharyngeal defect (Figure 1 and Figure 2a). A thin area was de-epithelialised (Figure 2b). Modified Connell sutures were then used to re-approximate the medial de-epithelialised edges (Figure 3), thus forming the tube for the neopharynx. The anterolateral thigh free flap was then disconnected and brought up to the head and neck once the ablative portion of the case was completed. The neopharynx tubed anterolateral thigh free flap was then attached to the base of tongue and cervical oesophagus (Figure 4). A second layer of closure was then completed with the modified Connell sutures by re-approximating the lateral de-epithelialised edges (Figures 5 and 6).

After finishing the inset, the microvascular anastomosis was completed. The pedicle was positioned carefully to prevent kinking. The rest of the flap wings on either side were de-epithelialised given that there was no neck resurfacing required. A small monitoring skin paddle was incorporated into the neck incision. Bilateral closed suction neck drains were placed. Finally, the leg donor site was closed primarily using local advancement of the soft tissue flaps, to achieve tension-free closure.

A short video, available on *The Journal of Laryngology & Otology* website, demonstrates the technique used for the creation of the neopharynx (Appendix 1).

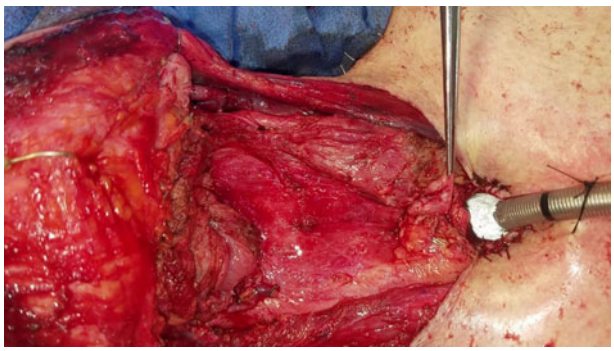

Fig. 1. Pharyngolaryngectomy defect following tumour excision.

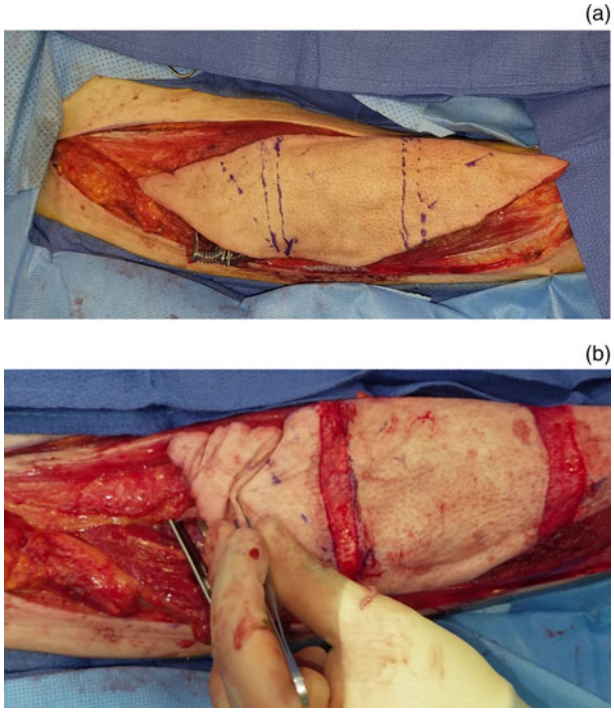

Fig. 2. Anterolateral thigh free flap: (a) outlining the area to be de-epithelialised and (b) following de-epithelialisation.

Discussion

Reconstruction of pharyngoesophageal defects, especially in patients with large resulting skin defects, continues to be a challenge following aggressive tumour resection. Immediate post-reconstructive considerations include preventing fistulae communicating to deep neck spaces, resulting in bleeding from the great vessels in the neck. Functional considerations include ensuring that the flap lumen is wide enough to prevent stenosis. Donor site morbidity also needs to be considered.

Typical options include a radial forearm free flap, a jejunum flap or an anterolateral thigh flap. Compared to the rectus abdominis and radial forearm free flap, the anterolateral thigh free flap has several advantages for large soft tissue reconstruction, making it a viable alternative.[2,3] The anterolateral thigh free flap is amenable for a two-team harvest, primary donor site closure is readily achieved without skin grafting, and wound complications are limited.

When considering the body habitus of more obese patients, the thickness of the flap means it may additionally be used for the reconstruction of intra-oral defects.[7–9] Removal of the excess adipose tissue and deep fascia may aid in reducing flap bulk as needed; however, excessive thinning should be avoided to prevent flap necrosis.

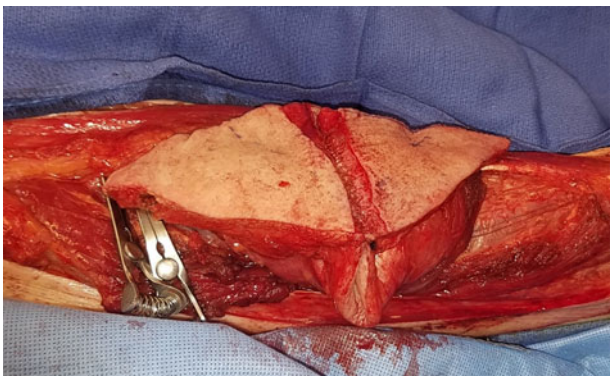

Fig. 3. Formation of the tube design while the anterolateral thigh free flap remains attached.

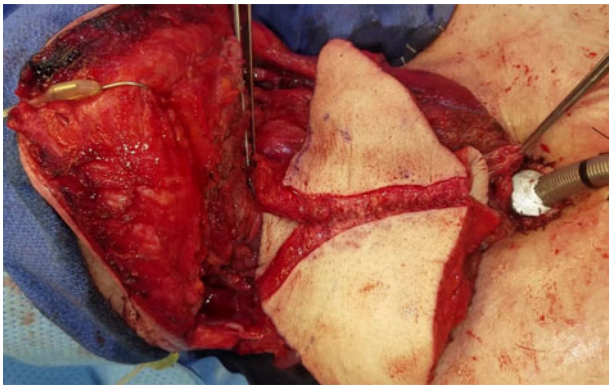

Fig. 4. Tubed anterolateral thigh flap inset.

A variety of surgical techniques that utilise the anterolateral thigh free flap have been described for the reconstruction of complicated head and neck defects simultaneously involving the pharynx and external skin. Durmus *et al.* have previously described the butterfly anterolateral thigh flap for the reconstruction of laryngopharyngeal defects along with external skin resurfacing.[1]

Yu reported the use of a single anterolateral thigh free flap, which was split into two separate skin islands.[12] One skin island flap was used for the reconstruction of an inner pharyngeal or oesophageal defect, while the other was incorporated in the reconstruction of the external skin and tracheal defects; however, this technique required the availability of at least two cutaneous perforators.[11]

Bianchi *et al.* described the use of an anterolateral musculocutaneous free flap for hypopharyngeal reconstruction.[4] The flap was tubed for pharyngeal reconstruction with a thin layer of muscle for peripheral support. One of the primary advantages of this technique includes a decrease in the operative time to 30–40 minutes, compared with the 2–3 hours required for perforator-based flap harvest.

Genden and Jacobson used an elliptical flap design, folding it to form a conical design for the pharyngeal reconstruction.[5] A portion of the flap was then exteriorised for monitoring purposes.

Although various techniques for free flap monitoring have been described (e.g. pulse oximetry, internal and external Dopplers, colour duplex sonography, thermotropy), the use of cutaneous monitoring paddles allows for reliable, straightforward and easily accessible observation of flap viability.

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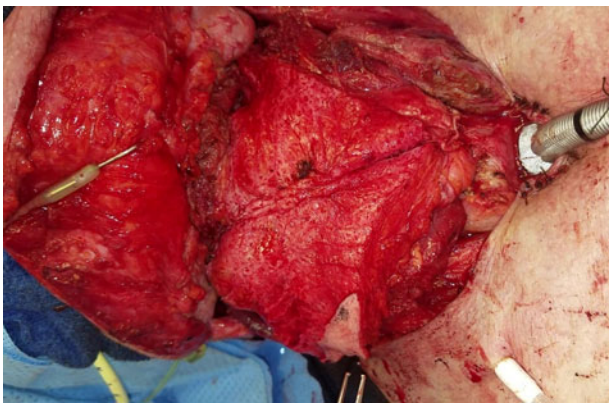

Fig. 5. Second layer of closure of the tube with de-epithelialised bilateral triangular flap wings; a small skin paddle is preserved for external monitoring (the bilateral triangular flap wings may be preserved for external skin coverage if necessary).

Fig. 6. Final closure with the incorporation of the external monitoring skin paddle.

In a review of pharyngoesophageal reconstruction with an anterolateral thigh free flap, Revenaugh *et al.* found that the incorporation of a suprastomal cutaneous monitoring paddle allowed for reliable clinical observation of flap health, without increasing complications such as speech or swallowing dysfunction.[13] Similar results have been reported with radial forearm free flap use, although the amount of forearm skin available and inset geometry restricted the cutaneous portion available for reconstruction; these factors appear to be less limiting with anterolateral thigh free flap harvest given the larger amount of tissue available.[14–16]

Murray *et al.* utilised a salivary bypass tube both as a template for flap tubing and as intraluminal support for the neopharynx.[10] Use of the salivary bypass tube together with surrounding fascia protected healing anastomoses and minimised fistula formation. In order to assess the impact of salivary bypass tubes on fistula and stricture formation, Punthakee *et al.* carried out a retrospective cohort study of 103 patients who underwent hypopharyngeal free flap reconstruction.[17] These authors demonstrated a significant decrease ($p = 0.048$) in the fistula rate in patients who received salivary bypass tubes (7.4 per cent) versus those who did not (22.4 per cent); however, no difference was shown in multivariate analysis, likely owing to the large number of patients required to detect a change in outcomes.[17] Despite the small sample size of these studies, salivary bypass tube use appears to play a role in reducing fistula and stricture formation, and its use should be considered in flap reconstruction for hypopharyngeal defects.

In the butterfly technique, one large skin paddle is employed for both inner pharyngeal and outer skin reconstruction, thus eliminating the need for a second flap. One key advantage is that this technique may be applied regardless of the type or number of anterolateral thigh free flap skin perforators. The butterfly technique also allows for multi-layer, watertight closure of the neopharynx, thereby reducing the risk of an anastomotic leak.

Intraluminal salivary bypass tube support also aids in reducing the incidence of wound dehiscence and fistula formation considerably (33 per cent), as reported by Durmus *et al.*, compared to the published series of fistula formation for which the rate is as high as 65 per cent.[1,10] However, this technique has certain limitations.

As the width of the anterolateral thigh free flap dictates the length of the neopharynx, laryngopharyngeal defects measuring more than 10 cm in length should be excluded for reconstruction with this technique. Additionally, while the exteriorised skin paddle is used as a surrogate to assess the viability of the entirety of the flap, this skin paddle tends to be one of the more vulnerable components, which may complicate clinical decision-making in the setting of flap harm or suspected compromise. Lastly, use of this technique is also limited in significantly larger cutaneous head and neck defects for which exteriorised skin paddles are insufficient to reconstruct the resulting wound following ablation.

Conclusion

The butterfly modification of the anterolateral thigh free flap is an effective method of reconstruction for pharyngoesophageal defects. It ensures a wide lumen to maintain post-operative swallowing function, and double-layer closure to minimise fistula formation; it also fills the neck soft tissue defect, thereby protecting the great vessels. A similar technique is also well-suited to address the combined pharyngeal and cutaneous defects resulting from the resection of peri-stomal recurrence. The authors demonstrate that this technique is efficient, reliable and altogether avoids the necessity for a second flap harvest during reconstruction.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0022215121004394

Competing interests. None declared

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Appendix 1. Supplementary video material

A short video demonstrating the technique used for the creation of the neopharynx is available online at *The Journal of Laryngology & Otology* website, at ??

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