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SHORT COMMUNICATION

Fascia lata graft closure of an enlarged tracheoesophageal puncture (TEP) after laryngectomy/laryngopharyngectomy

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Abstract
Enlargement of tracheoesophageal puncture (TEP) is seen in 1–29% of laryngectomee/laryngopharyngectomee using tracheoesophageal voice. It predisposes patient for recurrent aspiration pneumonia. Surgical closure of TEP is required in 30–67% of patients not responding to conservative measures. Surgical closure of an enlarged TEP using a flap may be time consuming, complex, and logistically challenging to organize. A novel technique of Fascia lata graft closure of an enlarged TEP is presented here. This technique can be useful in carefully selected patients with an enlarged TEP.

Keywords Tracheoesophageal puncture · TEP · Tracheaoesophageal fistula · Fascia lata · Laryngectomy · Laryngopharyngectomy

Introduction

Tracheoesophageal puncture (TEP) and voice prosthesis (VP) is the gold-standard of speech and voice rehabilitation in alaryngeal patients; however, it is not free from complications [1, 2]. Enlargement of TEP is one of the commonest complications seen in 1–29% these patients [3]. It is defined as leakage around the VP unresponsive to standard prosthetic management including changing the VP, downsizing the length of VP, or placing VP with large flanges [1]. It predisposes the patient to aspiration of saliva, liquids and food material, increasing the risk of aspiration pneumonia [4].

Management of an enlarged TEP is challenging and various conservative and surgical methods have been described. 30–67% of patients require surgical closure of TEP after failed primary conservative treatments [3].

Common surgical methods currently used for closing of an enlarged TEP include local or distant/free flaps. Rotated interposed sternocleidomastoid (SCM) flap [4], triple layer closure with interposed SCM using an extended semilunar incision [5], SCM musculocutaneous transposition flap [6], triple layer closure using de- epithelialised tunneled deltopectoral flap [7], triple layer closure using interposed dermal graft [8], double layer closure with everted suture closure of tracheal mucosa [9], deltopectoral perforator flap [10] and radial forearm free flap (RFFF) [11] are well described in the literature.

The authors present their experience of fascia lata (FL) autograft closure of an enlarged TEP. To the best of our knowledge this technique has not been described in the literature to date.

Material and methods

Preparing the fistula site

The margins of TEP are freshened, TEP tract is excised (Fig. 1a, b) and the size and type of final defect to be reconstructed is measured (Fig. 1c). If both the esophageal and tracheal mucosal surfaces cannot be closed (tension-free) with local tissue advancement then it is not suitable for repair by this technique. The sizes of fistula in our series were 5 mm and 12 mm, respectively.

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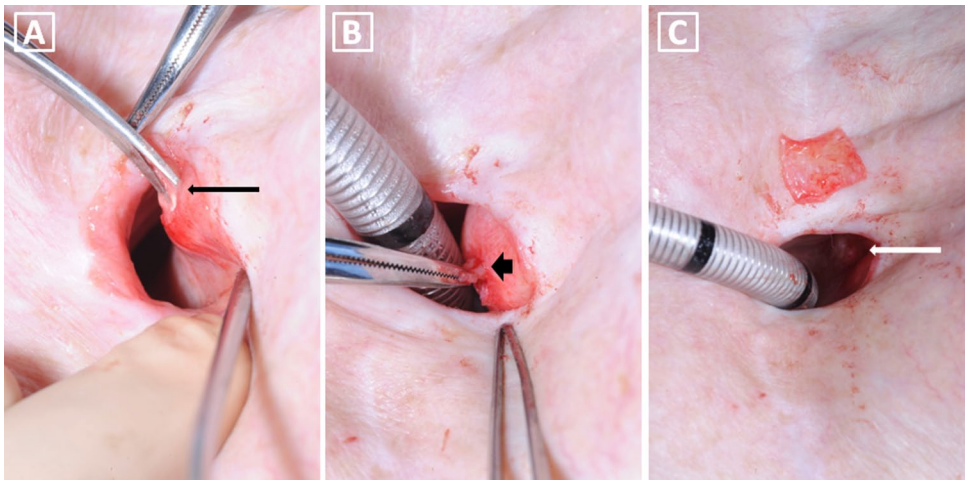

Fig. 1 Mobilizing the flaps by sharp scissor dissection (**a**), freshening of mucosa (**b**), and final defect to be reconstructed after freshening of the TEF along with harvested fascia lata in inset (**c**)

Harvesting fascia lata

Fascia lata is a tough deep/investing fascia which wraps the musculature of the thigh [12, 13]. It condenses laterally to form iliotibial band (ITB) which attaches distally to the lateral femoral condyle and serves as an attachment site for muscles responsible for abduction and medial rotation of thigh [12, 14].

Surface markings are the iliac crest, anterior superior iliac spine (ASIS), lateral femoral condyle and lateral margin of patella. The FL graft should be harvested anterolateral aspect of mid-thigh [12, 14].

After preparation and local anesthetic infiltration, a longitudinal incision of 3–4 cm is made in the anterolateral aspect of mid-thigh (Fig. 2a). Sharp dissection is carried out to reach FL which lies just deep to the subcutaneous tissue. FL is gently cleaned off the fat using Fryers elevator (Fig. 2b) and a graft of adequate size (more than double the size of defect) is harvested (Fig. 2d). Hemostasis is achieved and FL defect is closed by interrupted vicryl 3-0 (Fig. 2c) to avoid herniation of muscle through the defect which may otherwise cause chronic local pain. The wound is closed in two layers using absorbable sutures.

Graft placement and reconstruction

After freshening the margins and complete excision of the TEP tract, esophageal and tracheal mucosa are gently dissected from each other by sharp dissection (by scissors/knife) to mobilize tissue flaps (Fig. 1a) sufficient for primary tension-free closure. Also ensure that there is adequate space in between the surfaces for placement of the FL graft which should extend at least 5–6 mm beyond the margins of the

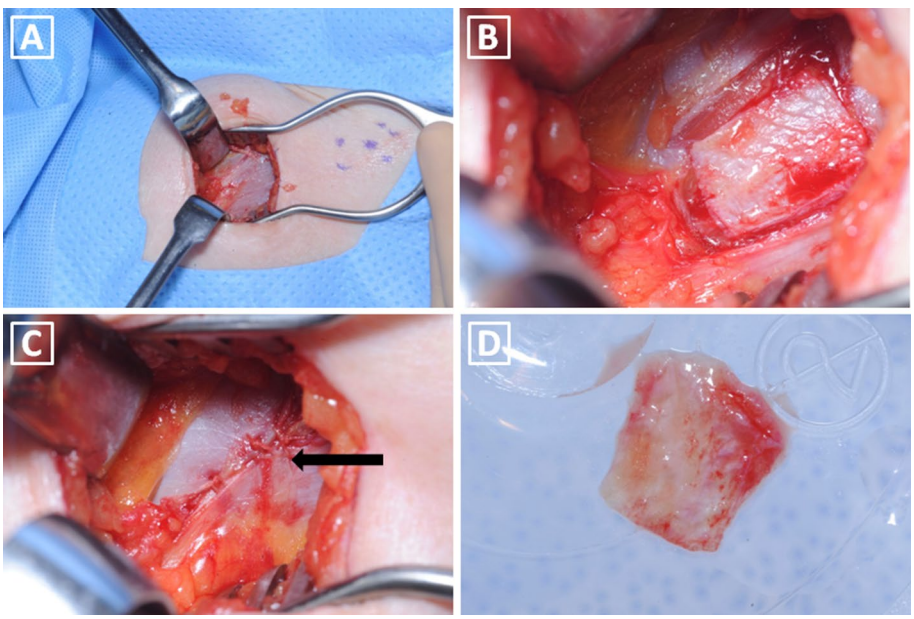

Fig. 2 Harvesting the fascia lata graft, longitudinal incision and freshened fascia lata surface (**a**), excision of fascia lata graft (**b**), closure of fascia lata defect post-harvesting (**c**) and harvested fascia lata graft (**d**)

fistula defect. It is crucial not to breach the surfaces while raising the flaps.

The defect is closed in three layers. The first layer of closure is the esophageal mucosal surface using PDS 5–0 simple interrupted sutures to give a watertight closure (Fig. 3a). FL graft is now placed in between the surfaces (sandwiched) and secured with interrupted PDS firstly on all four corners (Fig. 3b) and then more stitches are placed in between to allow a good closure. This is the second layer of the closure. Finally tracheal mucosal flaps are closed using PDS 5–0 simple interrupted sutures to give a watertight closure (Fig. 3c). Conservative management is followed for 5–7 days.

Results

Case 1

An 82 years old female underwent salvage total laryngectomy and bilateral level II–IV neck dissection for residual transglottic T4N1M0 squamous cell carcinoma (SCC). A secondary TEP with valve placement was performed 4 months post-laryngectomy. She developed enlargement of TEP within 6 months of valve placement and did not respond to conservative management including Radiesse injection. Subsequently FL closure of enlarged TEP was performed (Fig. 4a, b). Closure was successful 3 years post-repair.

Case 2

A 43 years old male underwent total laryngectomy and ipsilateral level II–IV neck dissection for T4N0M0 SCC of right glottic larynx followed by post-op radiotherapy (PORT). He underwent a primary TEP and valve placement. Five months later he developed an infection at the TEP site after a valve change with enlargement of TEP within 1 week to 12 mm defect. Failing conservative measures, he underwent FL closure which did not work. Patient subsequently underwent modified single vessel deltopectoral flap to close the defect. He remains symptom and recurrence free 1 year post-repair.

Discussion and conclusion

Tracheoesophageal puncture (TEP) and voice prosthesis (VP) is one of the commonest methods to restore speech after total laryngectomy/laryngopharyngectomy [1, 2]. Ever since its conceptual development in the 1970s, tracheoesophageal (TE) speech has now become the gold-standard for speech rehabilitation [2]. It relies on a controlled

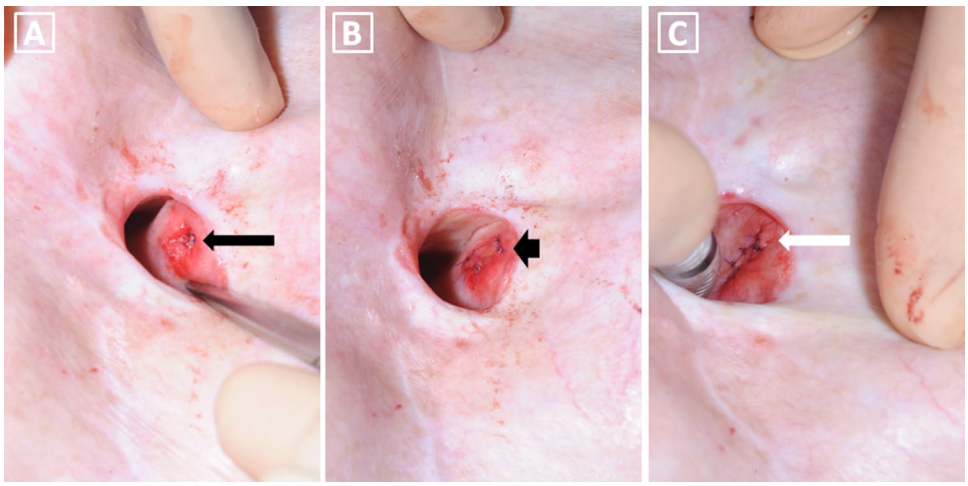

Fig. 3 Primary closure of the first layer (esophageal mucosa) (**a**), closure of the second layer after fascia lata graft placement (**b**), closure of the third layer (tracheal mucosa) (**c**)

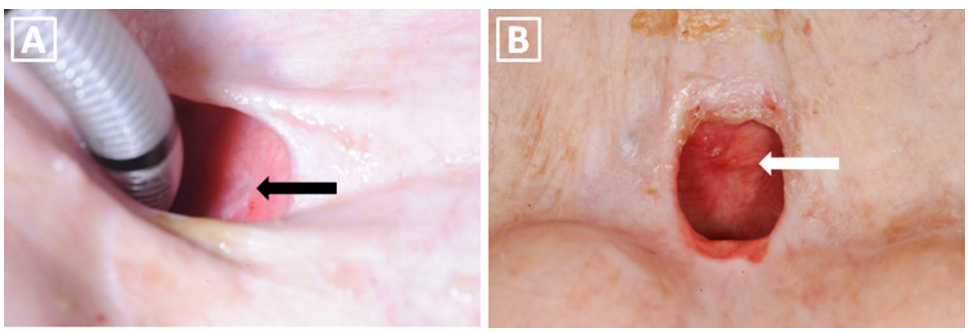

Fig. 4 Primary TEF with surrounding area of fibrosis preoperative image (**a**), 6 weeks post-reconstruction image with completely closed TEF (**b**)

tracheaoesophageal fistula (TEF) which allows one way movement of air through the fistula into the neopharynx [2]. TE speech is more intelligible and natural sounding than esophageal speech or electrolarynx), is relatively quickly attainable, has fair-to-excellent self-reported quality (in 88% patients) [6] with 95% success rates in long-term users [2]. However, it has its own complications like temporary aphonia, leakage through or around the VP, TEP enlargement, recurrent aspirations and pneumonia, VP dislodgment, failure to achieve good speech, granuloma formation, and excessive mucous discharge [2].

Reported rates of TEP enlargement vary between 1–29% with size of VP, timing of TEP, advance nodal disease, post-laryngectomy stricture, locoregional recurrence or distant metastasis correlating with enlargement of TEP [1, 3, 14]. Reported rates of enlargement of TEP/leakage around VP are 6% (range 2–13%) for patients using 16 or 16.5-French diameter prosthesis vs. 9% (range 6–21%) for 22-French or larger VP use [3]. Similarly reported rates are 4% (range 2–13%) for primary TEP vs. 11% (range 5–13%) for secondary TEP [3]. The risk of enlargement of TEP increases by 4.5-fold for patients having total laryngopharyngectomy vs. total laryngectomy alone and 6.5-fold for patients with N + vs. N0 neck [14]. Reported incidence rates of TEP enlargement are 7.3% for N0 primary cancer, 17.3% for patients undergoing TLP and 33% for patients with N + primary cancer requiring total laryngectomy [15].

Other risk factors include reflux, smoking, diabetes, thyroid dysfunctions, esophageal stricture and malnutrition [16, 17]. TEP enlargement is also noted to result in threefold increase [1] in aspiration pneumonia with 20–30% mortality [18] and chronic PEG dependence in 14% of patients.[1.]

There is no consensus regarding optimal management of an enlarged TEP, however, treatment strategies can broadly be grouped under conservative measures or surgical interventions [1]. Conservative measure include thickening of feed, temporary removal/change of VP, anterior collar placement, injection at TEP site, cautery, button placement or purse-string suture placement around the TEP site [1, 2, 17]. Additional conservative measures like nasogastric tube feeding and nutritional support, correction of anemia, correction of hypothyroidism, treating local infection, improving tissue viability and using hyoscine patches to reduce salivary secretion may be helpful in managing these patients.

Surgical techniques adapted to close an enlarged TEP mainly rely on multi-layered closure with interposition of muscle especially SCM. Deltopectoral flap can be used either as a tubed flap or a perforator flap. RFFF is a good option especially if local flap fails. Flap reconstruction of TEP is time consuming and may not be appropriate for malnourished patients with multiple comorbidities. Also using a muscle flap can lead to stomal stricture potentially requiring a second surgery in the form of stomaplasty if symptomatic. Sometimes muscle bulk can cause esophageal compression adding to morbidity.

Fascia lata autograft is used in several ENT procedures like rhinoplasty, CSF fistula repair, static facial reanimation, tympanoplasty besides craniofacial reconstruction [12, 13]. It is a strong, reliable, easily harvestable autograft which can provide large amount of graft material without any major cosmetic or functional morbidity [12, 13]. Common problems associated with FL harvesting are scar/keloid formation, hematoma, infection, and chronic pain (from herniated muscle belly) if the FL defect is not closed after harvesting the graft.

In our limited experience we had one success and one failure of this technique. The failed case had a fistula diameter of 12 mm before freshening the margins and was apparently enlarging due to ongoing local infection and post-RT changes at the time of attempting FL closure. Authors will recommend this technique for closure of TEP of less than 1 cm diameter, before considering local/distant flap reconstruction. However, careful selection of cases is required as large fistula, ongoing local infection and post-RT changes may lead to failure of closure.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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