

## Original Article

# Tracheoesophageal puncture site closure with sternocleidomastoid musculocutaneous transposition flap

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## ABSTRACT

**Introduction:** Tracheoesophageal voice prosthesis is highly effective in providing speech after total laryngectomy. Although it is a safe method, in certain cases dilatation or leakage occurs around the prosthesis that needs closure of tracheoesophageal fistula. Both non-surgical and surgical methods for closure have been described. Surgical methods are used when non-surgical methods fail. We present the use of the sternocleidomastoid musculocutaneous (SCMMC) transposition flap for the closure of tracheoesophageal fistula. **Materials and Methods:** An incision is made at the mucocutaneous junction circumferentially around the tracheostoma. Tracheoesophageal space is dissected down to and beyond the fistula. The tracheoesophageal tract is divided. The oesophageal mucosa is closed with simple sutures. Then SCMMC transposition flap is raised and transposed to cover sutured oesophagus and the defect between the oesophagus and the trachea. **Results:** This study was done prospectively over a period of 1 year from June 2012 to May 2013. This technique was used in patients with pliable neck skin. In nine patients, this procedure was done (inferior based flap in nine cases) and it was successful in eight patients. In one case, there was dehiscence at the leading edge of flap with oesophageal dehiscence, which required a second procedure. In two cases, there was marginal necrosis of flap, which healed without any intervention. Nine patients in this series were post-radiation. **Conclusion:** This method of closure is simple and effective for patients with pliable neck skin, who require permanent closure of the tracheoesophageal fistula.

## KEY WORDS

Sternocleidomastoid musculocutaneous flap; tracheoesophageal puncture (TEP) closure, flap for Tracheoesophageal puncture site

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## INTRODUCTION

Tracheoesophageal puncture (TEP) with the insertion of voice prosthesis represents a useful and safe method for voice restoration after total laryngectomy. This has become the most reliable and accepted modality of speech rehabilitation. Most patients do well with TEP, but a leakage of saliva or ingested food around the prosthesis does occur with the reported rate ranging from 7% to 42% of the cases.<sup>[1]</sup> This is often due to a fistula that is too large to accommodate a valve without leakage. In addition, when the prosthesis is too long for the tract, it enlarges the fistula. Also situations occur in which a stenosis occurs below the puncture site, which allows pooling of secretions in the area and leakage around a properly fitted prosthesis. Numerous measures have been advocated to tackle this problem, with none of them giving a satisfactory outcome. Downsizing the insertion of the prosthesis with larger inner flanges, augmentation or narrowing of the party wall between the trachea and the oesophagus are among few of the suggested methods. When these conservative measures fail or when the fistula is too large, its surgical closure may become necessary. The objectives of surgery are dissection and disconnection of fistula, closure of oesophagus after dissecting the party wall between the trachea and the oesophagus, tracheostoma relocation at previous TEP site, tracheostomal stenosis correction, interposition of muscle and skin flap, these form a main stages of the surgical obturation of the fistula. We present a technique wherein a sternocleidomastoid

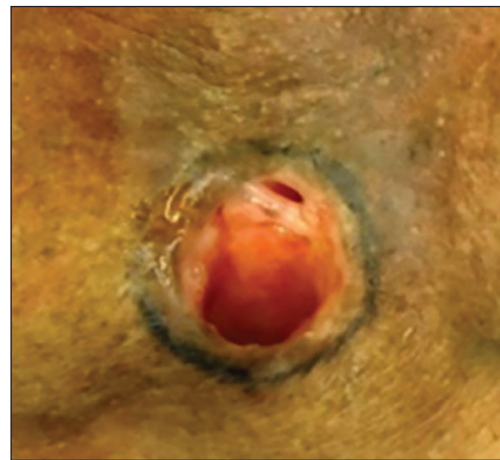
musculocutaneous (SCMMC) transposition flap is used as a pedicle flap to interpose between the party walls after layered closure of oesophagus and relocation of trachea at the TEP site. This reliable and simple technique provides good vascular tissue for closure.

## MATERIALS AND METHODS

The technique was used in nine patients, the patient details are mentioned in Table 1.

### Surgical Procedure

The procedure is performed under general anaesthesia. The patient is prepared and draped in the usual manner [Figures 1 and 2]. The area that surrounds the tracheostoma is infiltrated with epinephrine



**Figure 1:** Tracheoesophageal fistula and marking at the mucocutaneous junction around tracheostoma

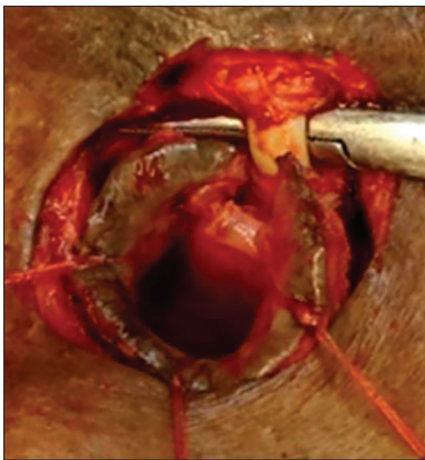
**Table 1: Details of patients**

| Patient no | Age (years)/ Sex | Procedure                               | H/o irradiation | Flap and side | Complications             | Intervention            | Result         |
|------------|------------------|---|-----------------|---------------|---------------------------|-------------------------|----------------|
| 1          | 46/M             | TL+Primary closure of pharyngeal mucosa | No              | SCMMT (left)  | No                        | —                       | Successful     |
| 2          | 60/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (left)  | Marginal necrosis of flap | Conservative management | Successful     |
| 3          | 38/F             | TL+Primary closure of pharyngeal mucosa | no              | SCMMT (left)  | Marginal necrosis of flap | Conservative management | Successful     |
| 4          | 63/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (left)  | No                        | —                       | Successful     |
| 5          | 52/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (right) | No                        | —                       | Successful     |
| 6          | 39/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (left)  | No                        | —                       | Successful     |
| 7          | 53/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (left)  | No                        | —                       | Successful     |
| 8          | 70/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (right) | Dehiscence                | PMMF                    | Not Successful |
| 9          | 51/M             | TL+Primary closure of pharyngeal mucosa | yes             | SCMMT (right) | No                        | —                       | Successful     |

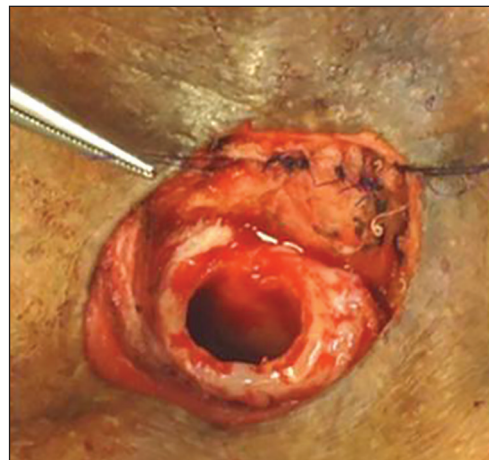
PMMF: Pectoralis major muscle flap, TL: Total laryngectomy, SCMMCT: Sternocleidomastoid musculocutaneous transposition

1:100,000. An incision is made in the mucocutaneous junction circumferentially around tracheostoma. The trachea is separated all around and the posterior wall of the trachea is separated from the oesophagus down to and beyond the tracheoesophageal fistula. The tracheoesophageal tract is divided, the mucosa of the oesophagus is closed with simple interrupted sutures using 4-0 absorbable PDS sutures is prepared from the polyester, poly (p-dioxanone). (Ethicon company) [Figure 3]. Subsequently, the trachea, distal to fistula, is excised and mobilised all around, and maturation of the new tracheostoma is done which takes care of the stomal stenosis. Depending on the condition of the skin over sternocleidomastoid muscle, right or left side flap is selected (flap selected from side with good skin condition). The flap is marked with planning in reverse, and it is placed completely over the muscle with the width of flap not more than 3 cm in order to close donor area primarily and to fit the flap exactly into

the defect between the trachea and the oesophagus [Figure 4]. Base of the flap is made at the scar of previous neck incision. The skin and subcutaneous tissues are incised; the incision is deepened to the underlying sternocleidomastoid muscle. The flap is raised including sternocleidomastoid muscle in the flap as musculocutaneous flap preventing injury to the internal jugular vein (IJV) and carotid vessels [Figure 5]. The flap is transposed to cover the sutured oesophageal defect and to interpose between the trachea and the oesophagus. Upper edge of flap is sutured to upper skin margin and lower edge is sutured to posterior upper margin of the trachea [Figure 6]. It is easier to start the closure from the lower margin, proceeding laterally and then superiorly. The flap harvest site is closed primarily. Nasogastric tube feeding is advised until the wound has healed completely. Postoperatively dye study is done after 10 days to look for integrity of the oesophageal closure.



**Figure 2:** Incision made at mucocutaneous junction; trachea is dissected circumferentially to separate it from the oesophagus



**Figure 3:** Trachea and oesophagus are separated, mucosa of the oesophagus is closed with inverted interrupted sutures using 4-0 absorbable PDS suture



**Figure 4:** Marking of SCMMC flap on the left side, the flap is over SCM muscle



**Figure 5:** SCMMC flap is raised



## RESULTS

This procedure was successful [Figures 7 and 8] in eight patients. In one case, there was dehiscence at the leading edge of flap with oesophageal dehiscence. This patient presented later with recurrent fistula for which pectoralis muscle flap was used to seal the fistula, which healed without any complication. In two cases, there was marginal necrosis of flap which healed without any



**Figure 6:** Flap is transposed to cover sutured oesophageal site and inset completed



**Figure 7:** Tracheoesophageal fistula: preoperative



**Figure 8:** Tracheoesophageal fistula: Late post-operative following SCMMC flap

intervention. The donor site healed well without any complications in all patients.

## DISCUSSION

Total laryngectomy is the treatment of choice in advanced laryngeal cancer not amenable to organ preservation protocols. The method of tracheoesophageal speech where the pulmonic air is channelled into the pharyngoesophageal segment was first introduced by Singer and Blom;<sup>[2]</sup> however, it is not without its share of problems.<sup>[3]</sup> The most common problem with TEP is the leakage of saliva or food with an enlarging fistula. In approximately 10% of the patients, extravasation of saliva and food does occur from the puncture site.<sup>[4]</sup> Many factors have been attributed to this leakage. Pistoning and dilation of the tract by the prosthesis, poor wound healing because of radiation, and hypothyroidism leading to necrosis of the wound edges and widening of the stoma are some of the factors. Conservative measures are usually effective in the management of the fistula. Spontaneous closure generally occurs within 2 weeks after removing the voice prosthesis.<sup>[5-7]</sup> If the fistula does not close spontaneously, attempts have been described to induce closure by repeated cauterisation with silver nitrate or electrocautery.<sup>[7]</sup> Another strategy used is the Blom–Singer indwelling low-pressure shunt valve, which provides an enlarged and thin oesophageal flange. This can be substituted in other valves by the use of silicon wafers introduced between the tracheal wall and the outer flange. Increasing the tracheoesophageal wall thickness by means of injectable substances has been suggested by many authors, with different materials used with variable success rates. The first product used for this purpose was Gax collagen<sup>[8]</sup> and other agents used include autologous fat<sup>[9]</sup> Bioplastique (Bioplasty),<sup>[10]</sup> and granulocyte-macrophage colony-stimulating factor.<sup>[11]</sup> A small number of patients in whom conservative measures fail may require surgical intervention for the permanent closure of the fistula. Surgical closure of tracheoesophageal fistula has been well described in literature. The earliest method was reported by Singer *et al.*<sup>[12]</sup> who advocated the use of interposed rotated muscle flaps during the closure of the fistula. The use of muscle could however cause compression of the oesophagus and narrowing of the stoma. Three-layer closure of the fistula with interposition dermal graft has also been reported in literature.<sup>[13]</sup> Hosal and Myers<sup>[14]</sup> described a technique in which the fistula was identified between the trachea and the oesophagus and was divided. The mucosa of the oesophagus was closed

with inverted sutures, and the tracheal mucosa was closed with everted sutures.<sup>[14]</sup> Judd and Bridger<sup>[15]</sup> reported the use of sternocleidomastoid muscle as an interposition flap in a three-layer technique. Although similar in technique to the initial description of Singer *et al.*,<sup>[12]</sup> the authors used an extended semilunar incision that would improve the vascularity of the interposed muscle. The deltopectoral flap used as de-epithelialised flap tunnelled subcutaneously and inset between the trachea and the oesophagus<sup>[16]</sup> and deltopectoral flap used as perforator flap to close TEP site have also been described.<sup>[17]</sup> As other option radial forearm free flap with vascular anastomosis was used to close the fistula.<sup>[18]</sup> The use of the sternocleidomastoid muscle flap has been described once in literature before the authors had used a SCMMC flap and an inset between the trachea and the oesophagus.<sup>[15]</sup>

In our technique, there is dissection between the trachea and the oesophagus to identify the fistula tract. There is separate closure of the oesophagus and excision of trachea distal to fistula with fresh maturation of tracheostoma and interposition of muscle between the oesophagus and the trachea, which reduces the risk of recurrence. Cutaneous part of flap provided skin coverage for raw area between the trachea and the skin left after dissecting between the oesophagus and the trachea.

## CONCLUSION

This method of closure is simple and effective for those patients with pliable neck skin who require permanent closure of the tracheoesophageal fistula.

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## Conflicts of interest

There are no conflicts of interest.

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