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CLINICAL TECHNIQUES AND TECHNOLOGY

Surgical closure of persistent tracheoesophageal fistulas by esophageal suturing and cranial transposition of the trachea

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Implantation of a tracheoesophageal voice prosthesis is the gold standard for voice rehabilitation after a total laryngectomy. The incidence of complications generally appears to be greater in patients who have received radiotherapy.[1,2] Periprosthetic leakage, which persists despite conservative treatment, necessitates surgical treatment. This generally creates a problem that is difficult to solve, especially in the case of patients who underwent radiotherapy, as evidenced by the many surgical approaches described in the literature.

Besides local techniques, more elaborate procedures, such as the combination of local suturing with an interposition of local or distant pedicle flaps between the esophagus and trachea and closure by means of free microvascular flaps, have been published.[2-5] Cranial transposition of the trachea has been described in only one publication.[3] In the present report, our experiences with a two-layer inverting suture of the esophagus combined with a cranial transposition of the residual trachea to close refractory tracheoesophageal fistulas (TEFs) are described.

Materials and Methods

Patients

Five patients developed therapy-resistant TEFs (size maximum 1.5 × 1 cm) after laryngectomy with implantation of a Provox voice prosthesis. All received radiochemotherapy postoperatively (mean radiation dose 52.6 Gy). Fistulas were located in the cranial 3 to 4 cm of the trachea. In one patient, previous closure of TEF by the use of a local technique failed. Before the treatment was performed, informed consent was received from all patients and approved by the review board of the Friedrich-Alexander University of Erlangen-Nuremberg.

Surgical Technique

The trachea was mobilized by means of a skin incision extending from the eight-o'clock to four-o'clock position and then separated from the esophagus so that the fistula was displayed. The fistula and cranial trachea were resected, and the esophageal defect was closed by means of a two-layer inverting suture (Fig 1). The trachea caudal to the fistula was mobilized (Fig 2) and then transposed cranially and sutured tension-free to the skin of the neck.

Results

Successful closure of the fistula could be achieved in four patients (80%). The mean follow-up time was 3.5 years (range, 0.5-5 years). One patient developed a filiform recurrent tracheoesophageal fistula 10 weeks after the operation. A revision operation was performed, during which severe necrotic changes were found in the tissues concerned. This patient received booster radiotherapy because of an R1 situation in the postcricoid region at the level of the entrance of the esophagus (total radiation dose of 64 Gy). Closure of the fistula was achieved by means of a two-layer esophageal suture with interposition of a pectoralis major myofascial flap (PMF). The patient has now been free of symptoms for 2.5 years.

Discussion

More than 90 percent of TEFs after implantation of a voice prosthesis can be treated by conservative means; surgical closure is required in approximately five percent.[1] The difficulties of a surgical treatment of TEF are evidenced by the multiplicity of surgical techniques described in the literature.[2-5] For small fistulas (5-10 mm) and acceptable wound conditions, the use of local techniques is suitable and associated with success rates of 60 to 100 percent. In case of poor tissue conditions, replacement tissue, from the sternocleidomastoid muscle or the infrahyoid musculature, can be interposed between the esophagus and the posterior wall of the trachea. Reduced amount of muscle material that remains after an extensive prior operation may limit the application of this type of operation.[2-4] Defect coverage by cranial transposition of the trachea has been described only by Bessede et al.[4]

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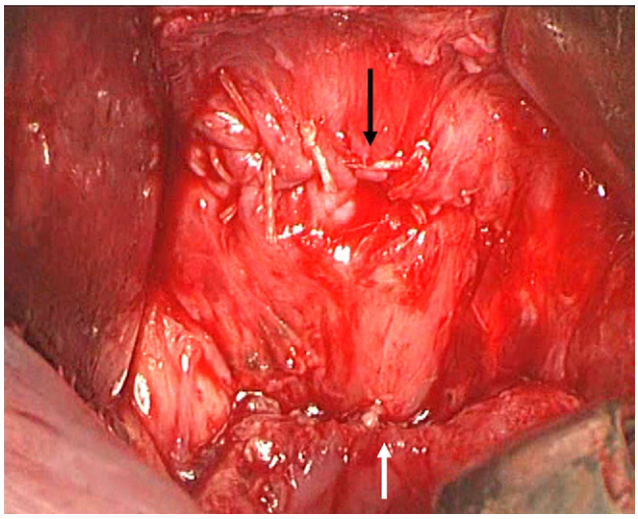

Figure 1 Situation after resection of the fistula and cranial trachea (*white arrow* shows cranial border of the trachea). The esophagus is closed by a two-layer suture (*black arrow*).

Gehrking et al performed a V-shaped resection of the posterior wall of the trachea in the region of the fistula state that transposition of the trachea in form of a separation of its cranial end from the hypopharynx and esophagus is an important precondition for the successful closure of a TEF.[2] Provided that they are situated in the upper 3 to 4 cm of the trachea, even quite large fistulas ($\leq$ 2 cm) can be closed by cranial transposition of the trachea. Intact and less radiation-damaged tissue covers the defect. A limitation of this technique is a fistula that is situated more inferiorly, because tension-free cranial transposition of the trachea seems to be questionable.

In the case of larger fistulas ($>$ 2 cm) and/or major wound healing disturbance, as well as in the case of revision operations, fresh, nonirradiated tissue has to be brought to the site of the fistula. This step can be accomplished by the use of pedicle flaps (e.g., PMF) or free microvascular flaps (e.g., radialis flap).[2,5] In general, one disadvantage of distant flaps is the morbidity at the graft donor site. Compared with PMF, the radialis flap is very well suited to this purpose because it is thin and easy to shape. The risk of dysphagia attributable to a volume effect is slight, as is the risk of an unsatisfactory aesthetic outcome in the head and neck region. It can be bipaddled where there is a risk of narrowing of the tracheal lumen. Because the complexity and duration of this operation are considerably greater and because microvascular anastomosis is required, the patient's vascular status and fitness for anesthesia may be limiting factors.[2,5]

Our experience indicates that the surgical technique described here is a simple method of treatment that is relatively unburdensome to the patient and has a satisfactory success rate. As well as being used as a primary procedure, it can be used as a secondary procedure after local surgical techniques to close a fistula have failed.

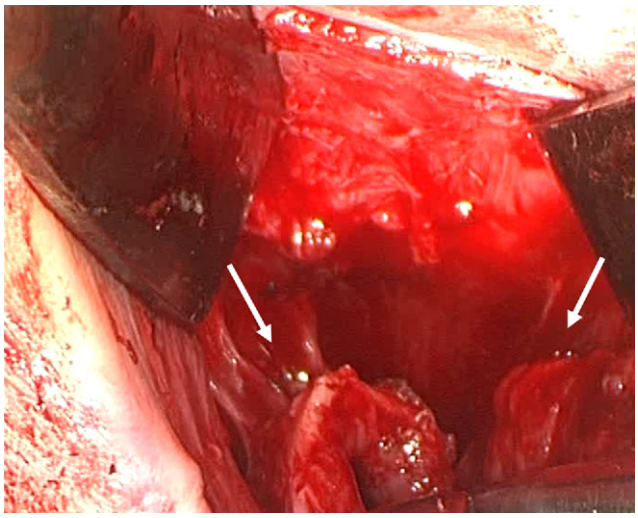

Figure 2 Mobilization of the trachea caudal to the fistula before cranial transposition and reepithelialization (*white arrows* show dorso-lateral vascular supply, which needs to be preserved).

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Michael Koch, performed operative procedures, writing, contribution to design, acquisition, analysis, interpretation, critical review, and final approval; **Johannes Zenk,** performed operative procedures, contributed to concept, critical review of article, and final approval; **Stephanie Birk,** contributed to concept and critical review of article; **Christoph Alexiou,** performed operative procedures, critical review of article, and final approval; **Heinrich Iro,** performed operative procedures, contributed to concept, critical review of article, and final approval.

Disclosures

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