How-to-do-it

Tracheal release and thymus wrapping of the tracheoplasty anastomosis through mini-sternotomy

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Abstract

Despite breakthroughs in general thoracic surgery, tracheoplasty remains a technically difficult procedure. The authors performed tracheoplasty on a 75-year-old woman diagnosed with recurrent thyroid cancer and tracheal invasion. Through an L-shaped unilateral mini-sternotomy added to a collar incision, we performed tracheal mobilization and release followed by resection of six tracheal rings. The tracheoplasty anastomosis was then wrapped with the right lobe of the thymus. Using this procedure, tracheoplasty was successfully performed with no complications related to the tracheal anastomosis. Tracheoplasty performed through mini-sternotomy, with a combination of full tracheal release and wrapping with the right lobe of the thymus, may represent a novel, effective, and less-invasive surgical procedure.

Keywords: Thymus; Wrapping; Tracheoplasty; Anastomosis; Mini-sternotomy

1. Introduction

Prior to the 1960s, surgical treatment for tracheal tumor was not generally undertaken due to postoperative complications. However, with the development of better operative techniques and postoperative management, surgery has since become the therapeutic modality of first choice for this condition, in order to maximize prognosis. When performing tracheal resection, however, the length that can be safely resected is currently the subject of some controversy [1]. Moreover, it is important to reduce tension on the anatomic site to avoid postoperative leakage, which is almost always fatal [2].

2. Technique

A 75-year-old woman underwent a partial right lobectomy for thyroid cancer (well-differentiated papillary type) in 1988 and additional resection of the residual right lobe for recurrence in 2001. Because blood-stained sputum was noted at the end of December 2002, chest and neck computed tomography was examined and showed tracheal compression by recurrent thyroid tumor. As bronchofiberscopy revealed a friable tracheal tumor, surgical en bloc resection was planned.

Under general anesthesia the patient was placed in the supine position and a cervical collar incision was made. We then performed total thyroidectomy to include the remnant thyroid gland, accompanied with resection of enlarged cervical lymph nodes. After removing almost all the thyroid tumor (that invading the residual right lobe, left lobe, and isthmus, but not that invading the trachea) and lymphadenectomy, an L-shaped unilateral right-sided mini-sternotomy was added to the collar incision. This involved creating an 8-cm midline skin incision, then dividing the sternum longitudinally from the suprasternal notch to the third intercostal space using an oscillating saw. A transverse half-sternotomy from the right border to the center of the sternal body was then made in the same intercostal space. With the addition of this right-sided mini-sternotomy, excellent exposure was achieved. After dissecting the thymus tissue, the dilated left innominate vein, superior vena cava (SVC), brachiocephalic artery, and ascending aorta were located. Tracheal mobilization and release were
accomplished with blunt dissection from the anterior sheath of the trachea through the carina to the bilateral main bronchi, just behind the ascending aorta without opening pericardium. With this procedure, the trachea was mobilized to the oral side easily and safely. Subsequently, tracheal sleeve resection was performed to include the thyroid tumor. Following division of the trachea, the oral endotracheal tube was pulled back into the proximal airway, and the distal trachea was intubated with a flexible, cuffed, armored endotracheal tube. Because the proximal tracheal stump was just beneath the tumor, an additional one-ring resection was carried out. So, six rings from the second to the seventh of total circumferential excision were carried out. Fig. 1 shows the extent of the tumor and resected area of the trachea. A frozen section of the resected specimen was intraoperatively sent to pathology and absence of invasion at the margins was confirmed. End-to-end tracheoplasty was then performed with 14 interrupted 3–0 absorbable monofilament sutures, ensuring no tension on the anastomotic site (Fig. 2A). The endotracheal tube was intermittently removed and replaced, as required, in order to place the sutures. Once the sutures in the membranous trachea had been tied, the distal airway was extubated, and the original orotracheal tube was carefully advanced across the anastomosis into the distal airway. Although no air-leakage was demonstrated on a 25 cm H₂O seal test, the anastomotic suture line was wrapped with a flap of tissue dissected from the right lobe of the thymus through the rear of brachiocephalic artery (Fig. 2B). After ensuring complete hemostasis, two thoracic tubes (J-VAC) were placed from both sides of the collar incision to the anterior mediastinum. The collar incision and mini-sternotomy incision were then closed in layers in the usual manner. Postoperative cervical flexion using fixation was not performed because tracheal mobilization and release were accomplished perfectly with no tension on the anastomotic site. The postoperative course was uneventful.

3. Discussion

The concept of direct tracheal end-to-end anastomosis has been accepted as the ideal method of tracheal repair after resection for various benign or malignant tracheal diseases [3]. However, it was long believed that no more than 2 cm could be removed for anastomosis to be consistently achieved [4]. Tension is of utmost importance in tracheal anastomosis, as this influences healing, stenosis, and suture breakdown, which is almost always fatal [2]. To minimize tension on the tracheal anastomosis perioperatively, tracheal mobilization and release with dissection
from circumferential tissues, followed by postoperative cervical flexion for around 7 days have generally been performed. With these procedures, surgeons can now safely resect long circumferential segments of the trachea and achieve primary reconstruction without the need of a prosthesis in the majority of operable patients [5].

The authors performed resection of six circumferential segments of the trachea (totaling 4.2 cm in length) followed by tracheoplasty for recurrent thyroid cancer with tracheal invasion. Tracheal tumor, especially locally invasive thyroid carcinoma, which is a good indication for this procedure, usually has an excellent prognosis after complete tracheal resection [6].

The majority of operable tracheal diseases can be resected through a cervical collar incision accompanied by median sternotomy. Median sternotomy provides optimal operative exposure in most tracheal diseases necessitating resection of a long tracheal segment [5]. On the other hand, our surgeons have been taught to utilize larger incisions for tumor resection in order to complete the resection safely and with certainty. However, in the current era of limited access surgery patients are led to expect little postoperative pain, short hospital stays, and excellent cosmetic results. Recent approaches to minimally invasive cardiac surgery [7] prompted our general thoracic surgeons to look for a surgical approach that might reduce intraoperative trauma. We therefore performed tracheal resection and tracheoplasty through a cervical collar incision accompanied by right-sided mini-sternotomy transecting the third intercostal space. By dissection from the anterior of the tracheal sheath through the bilateral main bronchi and lung hilus, mini-sternotomy provided a good view for tracheal mobilization and release. Naturally, much attention was paid to the lateral blood supply during tracheal mobilization and release and the distal segment in particular was not freed circumferentially.

Pediculated flaps of greater omentum are reported to be particularly valuable for clinical thoracic surgery because of their good blood supply, angiogeneity, plasticity, and immune properties [8]. The authors therefore wrapped the anastomosis with a pediculated flap of the right thymic lobe, with anticipation of similar usefulness and effectiveness. Whereas using an omental flap requires opening the abdomen, the right lobe of the thymus is more easily accessible to dissection within the current mini-sternotomy incision. By performing full tracheal mobilization and release accompanied by wrapping with a pediculated flap of thymus, successful tracheoplasty can be achieved through mini-sternotomy with no complications.

Tracheoplasty performed through mini-sternotomy with a combination of full tracheal release and wrapping with the right lobe of the thymus may be a novel, effective, and less-invasive surgical procedure. In particular, wrapping of the tracheoplasty anastomosis with pediculated thymus might represent an excellent substitute for omentopexy.

References