

A Novel Technique for Laryngotracheal Reconstruction for Idiopathic Subglottic Stenosis

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Idiopathic subglottic stenosis is the most challenging condition in the field of upper airway reconstruction. We describe a successful novel technique for enlarging the airway space at the site of the

laryngotracheal anastomosis in very high-level reconstructions.

(Ann Thorac Surg 2016;102:e469–71)

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Technique

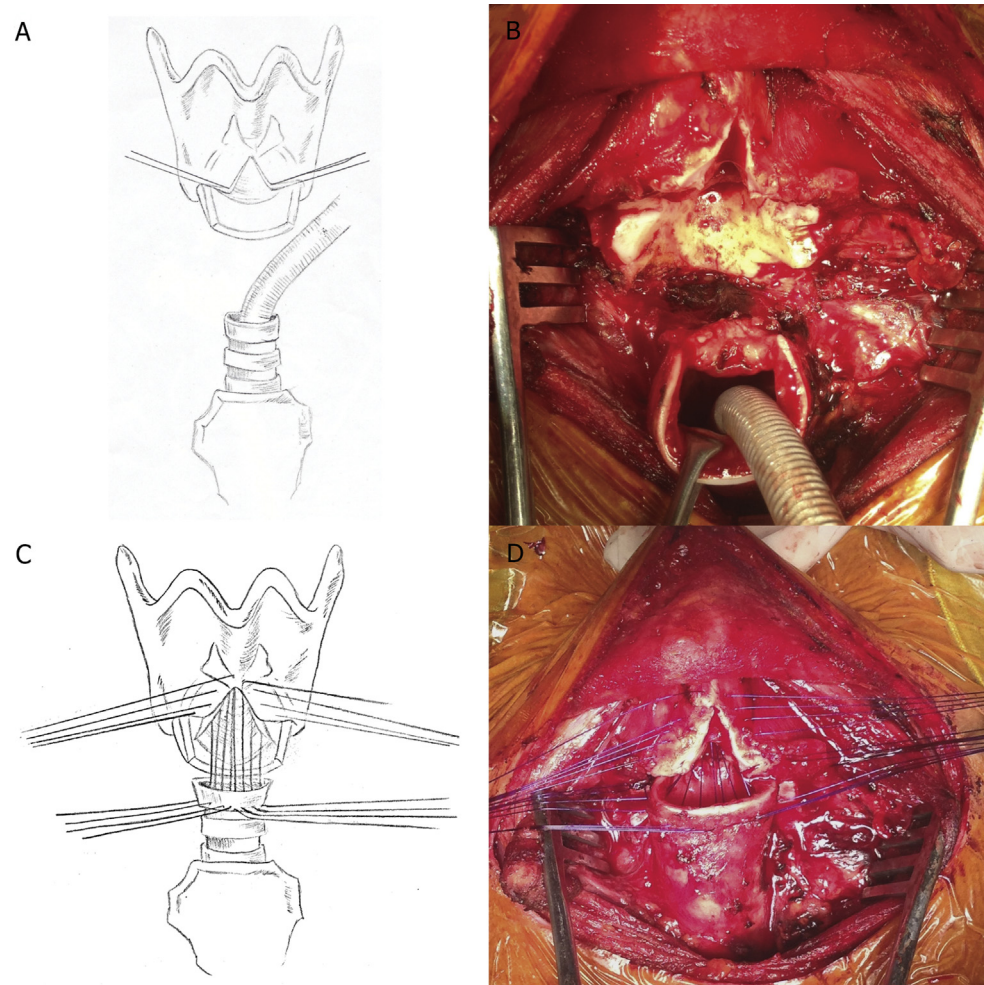
Between March and November 2015, 3 patients (2 women and 1 man, a professional soccer player) with idiopathic subglottic stenosis underwent laryngotracheal resection and reconstruction at our institution. One of them had been previously treated with laser ablation at another institution. One patient had a history of previous thyroiditis and gastroesophageal reflux, both treated pharmacologically. In each patient, flexible fibero bronchoscopy performed in our division showed severe stenosis with involvement of the glottis up to the vocal cords. Stenosis grade was from 70% to 90% of the airway lumen. A preoperative laryngotracheal examination was performed to evaluate the mobility and trophicity of the vocal cords, severity and extent of the stricture, grade of inflammation, and presence of edema or malacia. To complete the preoperative study, computed tomography of the neck and chest was performed, with a volume rendering reconstruction along with assessment of both the axial and sagittal slices to better define the location and extent of the narrowing of the airway and to enable a more precise evaluation of the tracheal wall status and of the extraluminal structures and tissue. Tight adhesions and abundant scar tissue were dissected to expose the cervical trachea, which was mobilized and prepared up to

the thyroid cartilage proximally and beyond the stenotic segment distally. The distal margin of the stenosis was about 1 to 1.5 cm from the glottis, and the upper limit involved not only the cricoid ring but also a distal portion of the thyroid cartilage, with actual involvement of the vocal cords. Therefore, a variation of the standard technique that we have previously reported [1, 2] was used. After resection of the anterior portion of the cricoid ring and cricothyroid membrane, the thyroid cartilage was incised longitudinally on the midline for an extent of about 2 cm (partial laryngofissure), and the margins were retracted laterally to increase the airway space (Figs 1A, 1B). The apex of the incision reached the anterior end of the vocal cords. The posterior plate of the cricoid was preserved as in the standard technique, and the mucosa and the proliferative scar tissue were nibbled away. The trachea was divided below the stenosis on healthy mucosa. A running suture of 4-0 absorbable monofilament material was used for the posterior membranous wall of the anastomosis. Interrupted 3-0 sutures were placed at 2-mm intervals in an outside-to-inside fashion on the anterior part of the anastomosis (Fig 1C). The nasotracheal tube was advanced into the distal trachea, and the sutures were tied. The downward traction determined by the knots placed at the apex of the incision and the lateral retraction of the margins of the incised thyroid cartilage increased the airway space, providing optimal caliber of the subglottic space, thus reducing the discrepancy between the anteroposterior and laterolateral axes of the proximal trachea, avoiding a potential ovoid anastomosis (Fig 1D). The lower trachea was directly anastomosed to the retracted ends of the thyroid cartilage; the elastic properties of cartilage tissue allowed compensation for tissue discrepancies (Fig 2). An armored nasotracheal tube was left in place uncuffed in the awakened patients for 24 hours, with the tip distal to the anastomosis to protect it and to allow safe

Accepted for publication March 30, 2016.

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Fig 1. (A) The subglottic defect has been resected including the anterior portion of the cricoid ring and the cricothyroid membrane; the thyroid cartilage is incised longitudinally on the midline for an extend of about 2 cm (partial laryngofissure) and the margins retracted laterally with stay sutures to increase the airway space. The apex of the incision reaches the anterior end of the vocal cords. The trachea has been divided below the stenosis and intubated for ventilation. (B) Intraoperative view of the resection. (C) Interrupted sutures have been placed in an outside-to-inside fashion, but untied, between the margins of the incised thyroid cartilage and the lower trachea. (D) Intraoperative view of the reconstruction.



tracheobronchial cleansing. The tube was removed on the first postoperative day, after bronchoscopic review of the anastomosis and vocal cords. Neither postoperative stenting nor protection tracheostomy was required. The remaining postoperative course was uneventful, and the patients were discharged on postoperative day 6 or 7. Clinical follow-up for anatomic and functional control was performed by flexible bronchoscopy at discharge, 1 and 3 months after operation, and then every 3 months for the first year, documenting complete patency of the airway lumen with a caliber of 100% (Fig 3). No late adverse events occurred. The definitive results appear excellent for all the patients, who have a normal quality of life; 1 patient with minor difficulty with the voice for the first 2 months after operation was treated successfully with steroid and aerosol therapy. The professional soccer player is back to his practice.

Comment

Laryngotracheal resection and reconstruction by end-to-end anastomosis for benign subglottic stenosis is the best definitive curative option, allowing a definitive and

stable high success rate. However, idiopathic stenosis is a rare condition of unknown cause; it is potentially progressive, is often associated with severe inflammation of the vocal cords or the subglottic space, and carries a high risk of recurrence because of incomplete resection of all the tissue involved. The optimal management and appropriateness of surgical resection is therefore controversial: some authors believe that surgical repair is not indicated [3], and others reported a 91% to 97% rate of good to excellent long-term results, with no mortality [4-6]. Notwithstanding, also in demanding cases of idiopathic stenosis like those reported above with actual involvement of the glottis, our variation of the standard technique allows enlargement of the diameter of the narrowest portion of the airway, assuring wide airway caliber and providing effective definitive cure for these patients.

Especially when the vocal cords are involved, other laryngoplasty techniques, even without complete resection of the diseased segment, have been proposed, especially by otorhinolaryngologists, to enlarge the narrow subglottic space by the insertion of an autologous tissue graft (bone or cartilage) between the divided

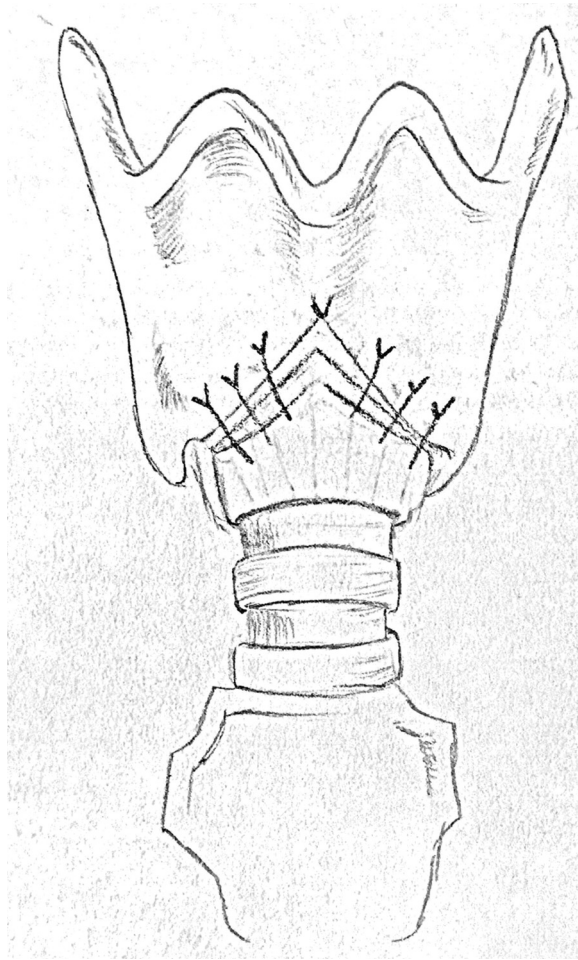


Fig 2. The knots have been tied and the laryngotracheal anastomosis has been completed. Downward traction of the sutures placed at the apex of the laryngofissure and the elastic properties of cartilage tissue allow compensation for tissues discrepancies.

cartilaginous portions of the anterior and posterior wall of the cricoid ring, but they have shown lower success rates in the long term, with prolonged need for postoperative stenting [7].

Laryngofissure may also improve access to the posterior mucosa in the immediate subglottic region. Ordinarily, a complete anterior laryngofissure, or an incision of the lower two thirds of the thyroid cartilage, is performed to expose the vocal cords and the upper subglottic region, and when a mucosal posterior defect is created, it can be resurfaced by use of a pedicled flap of membranous trachea fashioned from the distal tracheal margins, or in conjunction with an otolaryngologist, a supraglottic mucosal flap may be advanced between the vocal cords. The laryngofissure is then closed anteriorly. However, we think that this procedure should be performed only when the standard technique of cricotracheal resection and

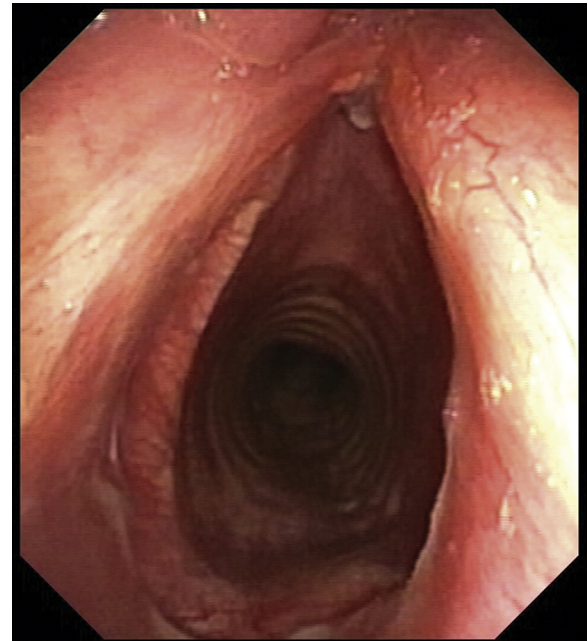


Fig 3. Endoscopic view of the anastomosis after 1 month.

reconstruction does not allow a permanent adequate caliber of the airway.

The partial laryngofissure we have described proved sufficient to obtain an optimal caliber and a permanent enlargement of the subglottic space by the placement of only 1 anastomotic suture, thus reducing the time of operation and simplifying the procedure.

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