Subglottic widening using a rotated H-shaped cricotracheal split for composite nasal septal cartilage grafting

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Introduction

Various open surgical techniques have been previously described for subglottic stenosis. These techniques usually involve steroid injections, endoscopic dilatations, flaps, and placement of intraluminal stents. A retrospective review was conducted on 20 patients with subglottic stenosis who underwent surgical widening using composite nasal septal grafts utilizing a rotated H-shaped cricotracheal split and temporary tracheotomy without stenting. Tracheotomy was performed for patient safety. All patients maintained patent airways with wide subglottic area throughout the follow-up period. All of them were extubated or decannulated 28–33 days after surgery by removing the tracheostomy tubes. All patients started antireflux treatment on the first postoperative day and steroid inhalation 2 weeks after surgery, which was maintained for 3 months. No patients underwent further procedures. All 20 patients were decannulated and were doing well at the time of writing. To conclude, composite nasal septal cartilage grafts with a rotated H-shaped cricotracheal split for subglottic stenosis in selected cases is a viable and effective option.

Context

The most common sequel after reconstructive procedures may be restenosis of different degrees. Recurrent narrowing may be due to healing by marked fibrosis, which is a result of postoperative infection, perichondritis in the graft or recipient site, with resorption of the augmenting cartilage graft. Intraluminal stenting predisposes to infection, subperichondrial abscesses, and devitalization of the cartilage graft by friction and infection. Inadequate graft size, thickness, or method of fixation may be other factors for failure.

Aim

The aim of the study was to present the indications, surgical technique, and results of composite nasal septal cartilage grafts using a rotated H-shaped cricotracheal split for patients with subglottic stenosis.

Patients and methods

This is a retrospective review. A series of 20 patients who underwent composite nasal septal cartilage grafts without stenting from 2009 to 2014 were reviewed. They suffered from subglottic and upper tracheal stenosis: 13 patients had subglottic stenosis due to rhinolaryngeoscleroma (seven male and six female patients), five patients had postintubation upper tracheomalacia and stenosis (one male and four female patients), and two male children had congenital subglottic stenosis. Postoperative data included mortality and morbidity rate, success of decannulation, need for repeat tracheotomy or Montgomery T-tube placement, and number of additional airway procedures.

Results

The operative time ranged from 1.5 to 3.25 h with a mean of 2.2 h. Blood loss ranged from 85 to 290 cm^3, with a mean of 150 cm^3. Hospitalization was 3 days in all patients with discharge on the third postoperative day, except for two children with congenital subglottic stenosis who stayed for 1 week. There were no major complications. Wound infection in two patients around the tracheotomy tube was evident 10 days after surgery, which was well controlled by parentral antibiotic and local antiseptic measures. Chest infection was recorded in five patients as mild to moderate tracheobronchitis, which resolved 1 week after surgery, except for the case of a 53-year-old female patient who progressed to bronchopneumonia after discharge, which resolved after 10 days.Return to normal life activity or work was possible in all patients after 2–3 weeks; however, 14 patients preferred home stay until tube removal. Weaning started 4 weeks after surgery and was successful within 1 week in all patients except for the two children, whose tubes were removed after 2 weeks of gradual weaning. Five patients experienced mild

shortness of breath shortly after extubation, which increased with effort. They received steroid inhalation two to three times a day for 2 weeks with improvement in symptoms. During the follow-up period all patients sustained normal breathing, except for seven scleroma patients who after 4–7 months complained of mild dyspnea, which increased slightly with effort and prevailed thereafter. Follow-up flexible laryngoscopy detected mild mucosal edema and little granulation tissue around the grafted area at the time of extubation. These granulations were more evident and encroached slightly on the airway in the five patients who suffered from mild dyspnea shortly after extubation and regressed markedly after 2 weeks of steroid inhalation. There was rapid mucosal healing of nasal septal mucosa and laryngeal mucosa, which was nearly complete at 6 weeks after surgery, with a markedly wide subglottic area.Later on, endoscopic examination detected mild lumen narrowing in seven scleroma patients who complained of mild dyspnea 4–7 months after surgery. These patients showed no more narrowing on endoscopic examination through their subsequent months of follow-up. No other new symptoms developed in the follow-up period. No patient needed further surgical intervention.

Conclusion
Composite nasal septal cartilage grafting with a rotated H-shaped cricotracheal split is a viable and successful option for selected cases of laryngotracheal stenosis. The use of a stent with its associated morbidities is avoided with this technique. No additional endoscopic or open procedures were needed in any of the cases; successful decannulation in less than 1 month could be achieved.

Keywords:
composite nasal septal cartilage grafts, laryngotracheal stenosis, rotated H-shaped cricotracheal split, subglottic stenosis

Introduction

Adult subglottic and proximal tracheal stenoses are some of the most crippling complications of many pathologies such as scleroma, endotracheal intubation, or other laryngotracheal trauma. Subglottic stenoses are a part of the broader category of laryngotracheal stenosis that comprises any lesion from the supraglottic larynx to the trachea. Patients with laryngotracheal or tracheal stenosis may present with stridor, shortness of breath, or exercise intolerance and may be tracheotomy dependent. The surgeon must have several choices of procedures available to correctly treat the variety of lesions that may occur [1].

Rethi [2] initially proposed anterior and posterior division of a stenosed laryngeal or tracheal airway, or both, followed by dilation in the 1920s. Subglottic enlargement using a cartilage–mucosa autograft was used in an experimental study in 1975 [3], followed by repair of laryngeal stenosis with nasal septal grafts in 1976 [4]. Shortly thereafter, a composite nasal septal cartilage graft was used in reconstruction in 1989 [5].

For many decades management of laryngotracheal stenosis depended primarily on prevention of its occurrence by adopting many prophylactic measures, especially in neonates, infants, and children [6].

Since 1980, the principles of Rethi have been extensively applied. Many modern reconstructive surgeons have adhered to the concepts of anterior, and occasionally posterior, division of the stenosed airway and augmentation of the divided airway with autologous 'wedge' grafts.

The surgical techniques for modern-day single-stage laryngotracheal reconstruction in the adult have been previously described [7]. After augmentation of the airway, most surgeons use an intraluminal stent in conjunction with a tracheotomy. The stent is secured externally and removed 4–6 weeks later in the operating room. The patient is often admitted to the hospital for decannulation when the airway is deemed stable and secure.

In the early 1990s, single-stage laryngotracheal reconstruction without stenting was described for pediatric patients and then for adults [8], with reported success rates of greater than 80%.

Most procedures entail anterior division of the cricoid cartilage with insertion of a free septal or auricular cartilage graft [9] or an anterior costal cartilage graft. Laryngotracheal reconstruction without stenting involves the temporary use of an endotracheal tube as the only 'stent' [10]. When anterior grafting is used, the tube is removed within 3–7 days. If anterior and

posterior grafting is used, the tube is left in place for 12–15 days before extubation [11]. The advent of high-level pediatric ICUs has facilitated the diligent care needed during the intubation and early extubation phases of reconstruction.

Tracheal resection and reconstruction was the standard treatment for postintubation stenosis in many institutional studies. However, when the stenosis extends proximally to the subglottic larynx surgical treatment is particularly difficult. Specific surgical techniques have to be used to preserve the recurrent laryngeal nerves [12].

In another study, a graft consisting of cartilage and mucosa was harvested from the nasal septum and was fixed with sutures to a titanium semi-ring, augmenting the anterior tracheal wall, with high success [13].

In 2010, one patient was treated with an anterior cricoid split maintained with septal cartilage wrapped in a partially de-epithelialized radial forearm free flap, with a follow-up of 6 months. The patient has been fully decannulated and has not experienced airway collapse or any other complications [14].

Balloon laryngoplasty has been a highly effective, low-risk alternative or adjunct to traditional reconstructive procedures in children with subglottic or laryngeal stenosis [15].

Endoscopic posterior cricoid split and costal cartilage graft placement in the management of pediatric bilateral vocal fold immobility, posterior glottic stenosis, and subglottic stenosis was reviewed in a multi-institutional study with encouraging results [16].

It was found that the most common sequel after reconstructive procedures may be restenosis of different degrees [17]. Recurrent narrowing may be due to marked fibrosis, which is a result of postoperative infection, perichondritis in the graft or recipient site, with resorption of the augmenting cartilage graft. Intraluminal stenting predisposes to infection, subperichondrial abscesses, and devitalization of the cartilage graft by friction and infection. Inadequate graft size, thickness, or method of fixation may be other factors of failure [18].

We have treated 20 patients with subglottic and high tracheal stenosis using composite nasal septal graft and rotated H-shaped cricotracheal split without stenting and have been able to decannulate all patients within 3–4 weeks. The success or failure of these procedures,

which is judged by the ability to decannulate the patient, appears to be related to the extent of the initial injury. We discuss the technique of composite nasal septal graft and the method of fixation in the recipient area (rotated H-shaped cricotracheal split). We conclude that composite nasal septal cartilage grafts using a new method of fixation (rotated H-shaped cricotracheal split) for subglottic stenosis in selected cases are a viable option for reconstruction.

Patients and methods

A series of 20 patients who underwent composite nasal septal cartilage grafts without stenting at the Hearing and Speech Institute, Embaba, Giza from 2009 to 2014 were reviewed. The age and sex of each patient were identified, along with the etiology and location of stenosis. The study protocol was approved by the institutional ethical review committee. Informed consent was obtained from all patients.

The 20 patients of the study suffered from subglottic and upper tracheal stenosis, with 13 patients having subglottic stenosis due to rhinolaryngeoscleroma (seven male and six female patients), five having postintubation upper tracheomalacia and stenosis (one male and four female patients), and two male children having congenital subglottic stenosis (Table 1). Postoperative data included mortality and morbidity rate, success of decannulation, need for repeat tracheotomy or Montgomery T-tube placement, and number of additional airway procedures.
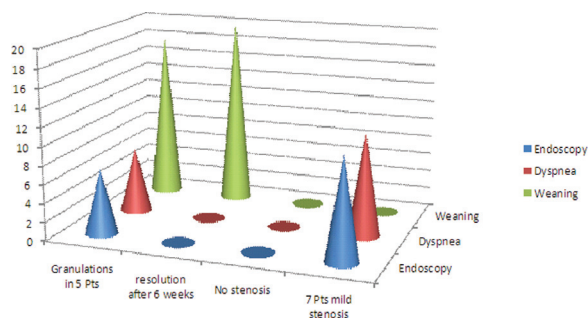
Surgical technique

After appropriate selection of patients, general anesthesia is induced through the tracheotomy. If a tracheotomy is not present, an oral endotracheal tube is introduced and advanced to, but not beyond, the level of the stenosis. The lungs are ventilated through the narrowed airway until the anterior midline vertical incision is completed. The anterior airway is surgically exposed and the trachea is opened at the third and fourth tracheal rings with the lungs ventilated again through tracheotomy. A composite nasal septal cartilage graft with an intact mucosal side is harvested about 2×3 cm (Fig. 1), leaving a light nasal pack.

Table 1 Etiology and sex distribution

Etiology of subglottic stenosis	Male	Female	Total
Scleroma	7	6	13
Postintubation	1	4	5
	2	–	2
Congenital subglottic stenosis	10		
	10	20	

Figure 1

Composite nasal septal graft.

Figure 2

Rotated H-shaped cricotracheal split and septal graft positioning.

The recipient site is prepared, with anterior split of the cricoid and first one to two tracheal rings (H-shaped split). Under an operating microscope, the stenotic fibrotic segment is dissected from the cartilaginous lumen. As regards the technique of fixation, the septal cartilage is positioned as the base of a triangle or hemisphere and its other two borders become the splayed-apart split laryngotracheal wall. This position of the graft mandates additional cuts (the first in the cricothyroid membrane bilaterally; the second between the last splitted tracheal ring and its next bilaterally) to be H-shaped (Fig. 2). Thus, through these incisions, the cricotracheal wall can be kept away like an open book: keeping the nasal mucosal side into the airway lumen, respecting its mucociliary direction from distal to proximal, and removing half a centimeter of mucosa from each side of the graft, where it is fixed with 2-3 (3-0) vicryl stitches to the edge of the cricotracheal wall, carefully placing it so as not to enter the airway. In this way we obtain a roomy subglottic space, nearly triangular or hemispherical in cross-section, which resists circumferential stenosis. The septal mucosa has a key role in protecting the cartilage, acting as an island from which the cells migrate and spread to line the rest of laryngeal lumen. Again tracheotomy is mandatory for safety, which can be removed after 2–4 weeks in a gradual weaning process after ensuring good healing on weekly flexible endoscopy, and exclusion of airway compromise due to edema, granulations, or graft displacement.

Follow-up data were available for all 20 surviving patients. Follow-up ranged from 2 to 5 years, with a mean of 3.2 years. A total of 20 patients underwent composite nasal septal grafting without stenting. The 20 patients of the study suffered from subglottic and upper tracheal stenosis, with 13 patients having subglottic stenosis due to rhinolaryngoscleroma (seven male and six female patients), five patients having postintubation upper tracheomalacia and stenosis (one male and four female patients), and
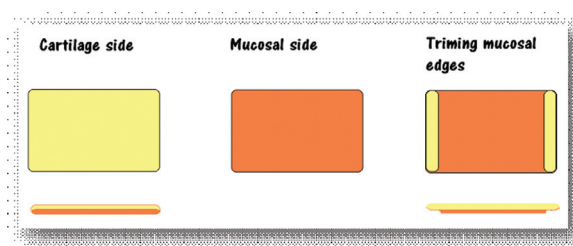
two male children having congenital subglottic stenosis. Patient ages ranged from 6 to 53 years (mean age, 38 years). The etiology of the stenosis is shown in Table 1, with the predominant cause being scleroma. The location of the stenosis is shown in Table 2, with the subglottis involved in all cases.

A tracheotomy was present in eight of the 20 cases, and the other 12 patients had been tracheostomized as the first step in the procedure. All patients were kept under close observation for the first 3 postoperative days in the inpatient rooms, with recording of pulse, temperature, blood pressure, and oxygen saturation. Atraumatic suction was performed through the tube every 2 h for the first 12 h, and then in decreasing frequency according to the patient's condition. Parentral antibiotics, analgesia, and proton pump inhibitors were administered for the first week. All patients were discharged on the third postoperative day, except for the two male children, who were discharged after 1 week. Weekly follow-up visits were conducted in the outpatient clinic, observing any chest or wound infection, and assessing the healing process endoscopically in the graft area with detection of edema, granulations, or fibrosis. After 3–4 weeks, the weaning process started and was completed after 1 week. Monthly follow-up visits were conducted for 6 months and then every 3 months for 2–3 years, recording any difficulty in breathing as a symptom and flexible endoscopic recording of any airway narrowing as a sign. These recordings were tabulated and statistical values are shown.

Results

The operative time ranged from 1.5 to 3.25 h with a mean of 2.2 h. Blood loss ranged from 85 to 290 cm^3, with a mean of 150 cm^3. Hospitalization was 3 days in all patients with discharge on the third postoperative day, except in the case of two children with congenital subglottic stenosis, who stayed for 1 week. As regards complications, there were no major complications in the form of injury to important adjacent structures or

massive hemorrhage. Other complications in the form of wound infection in two patients around the tracheotomy tube was evident 10 days after surgery, which was well controlled by parentral antibiotic and local antiseptic measures. Chest infection was recorded in five patients as mild to moderate tracheobronchitis, which resolved 1 week after surgery, except in the case of a 53-year-old female patient who progressed to bronchopneumonia after discharge, which resolved after 10 days (Table 2).

Return to normal life activity or work was possible in all patients after 2–3 weeks; however, 14 patients preferred home stay until tube removal (Table 2).

As regards the final outcome, weaning started 4 weeks after surgery and was successful within 1 week in all patients, except in the case of the two pediatric patients in whom the tubes were removed after 2 weeks of gradual weaning. Successful weaning was established when patients could breath freely independently of the tube without sense of dyspnea or shortness of breath. Five patients experienced mild shortness of breath shortly after extubation, which increased with effort. They received steroid inhalation two to three times a day for 2 weeks, with improvement in symptoms. During the follow-up period all patients sustained normal breathing, except for seven scleroma patients who after 4–7 months complained of mild dyspnea, which increased slightly with effort and prevailed thereafter (Table 3).

Regular endoscopic assessment by flexible laryngoscopy detected mild mucosal edema and little granulation tissue around the grafted area at the time of extubation. These granulations were more evident and encroached slightly on the airway in the five patients who suffered mild dyspnea shortly after extubation and regressed markedly after 2 weeks of steroid inhalation. Endoscopy showed rapid mucosal healing of the nasal septal mucosa and laryngeal mucosa, which was nearly complete at 6 weeks after surgery with markedly wide subglottic areas (Table 3).
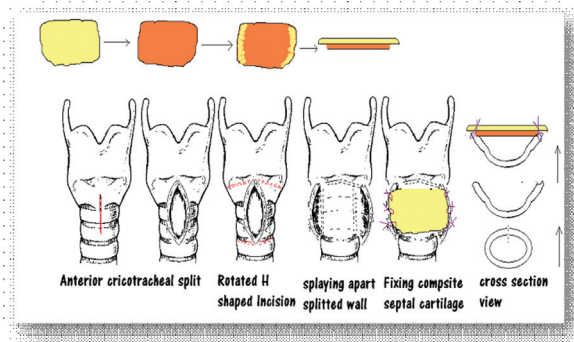
Later on, endoscopic examination detected mild lumen narrowing in seven scleroma patients who complained of mild dyspnea 4–7 months after surgery. These patients showed no more narrowing on endoscopic examination through the subsequent months of follow-up (Fig. 3). No other new symptoms developed in the follow-up period. No patient needed further surgical intervention.

There was no death in the immediate and late postoperative period or throughout the follow-up (Table 4).

Discussion

It was found that the most common sequel after reconstructive procedures may be restenosis of different degrees. Recurrent narrowing may be due

Table 2 Results and perioperative data

Operative data and outcome	Range	Mean
Operative time (h)	1.5–3.25	2.2
Blood loss (cm^3)	85–250	150
Age (years)	6–53	38
Follow-up (years)	2–5	3.2
Tracheostomy	Eight preoperative	12 intraoperative
Postoperative hospitalization	3 days in 18 adult patients	1 week in two children
Return to normal life activity	In all patient after 2–3 weeks	
Complications	Major (injury to important structures, massive hemorrhage)	–
	Wound infection	Two patients
	Chest infection	Five patients mild to moderate tracheobronchitis
		One patient bronchopneumonia

Table 3 Results (final outcome)

Final outcome	Number	Start	Complete
Weaning and decannulation	18 adult patients	After fourth week	After sixth week
	Two children	After fourth week	After sixth weeks
Dyspnea	Early	Mild	Five patients at time of extubation resolved after 2 week of steroid inhalation
		Moderate	–
		Severe	–
	Late	Mild	Seven scleroma patients after 4–7 months remained stationary
		Moderate	–
		Severe	–

Figure 3

Final outcome. Weaning started after 4 weeks of surgery and was successful within 1 week in all patients except the two child patients where the tubes removed after two weeks of gradual weaning. Five patient experienced mild shortness of breath shortly after extubation, they received steroid inhalation two to three times per day for 2 weeks with improvement of symptoms. Seven scleroma patients after 4–7 months, complained mild dyspnea which increases slightly with effort and maintained this sense thereafter. Endoscopic assessment detected mild mucosal edema and little granulation tissue around the grafted area at the time of extubation. These granulations were more evident and encroaching slightly on the airway in the five patients who suffered mild dyspnea shortly after extubation and regressed markedly after 2 weeks of steroid inhalation. Endoscopy has shown rapid mucosal healing of nasal septal mucosa and laryngeal mucosa which was nearly complete at 6 weeks after surgery with markedly wide subglottic area. Later on, endoscopic examination detected mild lumen narrowing in seven scleroma patients who complained mild dyspnea 4–7 months after surgery. These patients showed no more narrowing by endoscopic examination through their next months of follow-up.

Table 4 Endoscopic assessment

Endoscopy	Early at the time of extubation	Mild mucosal edema and little granulation tissue around the grafted area in 15 patients
		Granulations more evident and encroaching slightly on the airway in the five patients
	Late 4–7 months after surgery	Mild lumen narrowing in seven scleroma patients
		No more narrowing through next months of follow-up

to marked fibrosis, which is a result of postoperative infection, perichondritis in the graft or recipient site, with resorption of the augmenting cartilage graft. Intraluminal stenting predisposes to infection, subperichondrial abscesses, and devitalization of the cartilage graft by friction and infection. Inadequate graft size, thickness, or method of fixation may be other factors of failure.

Composite nasal septal cartilage grafting utilizing a rotated H-shaped cricotracheal split for reconstruction of the impaired airway due to subglottic and high tracheal stenosis can allow for immediate airway improvement with decreased morbidity. The three main advantages of composite nasal septal cartilage

grafting are rapid mucosal healing, wide subglottic area, and avoidance of potential risks of prolonged stenting. The presence of a stent has been shown to cause airway irritation and infection, factors that are detrimental to graft healing. Prolonged stenting can cause mucosal irritation with formation of granulation tissue, tissue necrosis, and infection [19].

In our study, 20 patients underwent composite nasal septal cartilage grafts without stenting utilizing an H-shaped split. The study was conducted at the Hearing and Speech Institute, Embaba, Giza from 2009 to 2014. The age and sex of each patient were identified, along with the etiology and location of stenosis. The 20 patients in the study suffered from subglottic and upper tracheal stenosis, with 13 patients having subglottic stenosis due to rhinolaryngeoscleroma (seven male and six female patients), five patients having postintubation upper tracheomalacia and stenosis (one male and four female patients), and two male children having congenital subglottic stenosis. Postoperative data included mortality and morbidity rate, success of decannulation, need for repeat tracheotomy, and the need for additional airway procedures.

With good patient selection and preparation, surgery was conducted under general anesthesia through the tracheotomy tube or the oral endotracheal tube until tracheotomy was completed. A composite nasal septal cartilage graft with intact mucosal side was fashioned about 2×3 cms, leaving an intact septal mucosa of the other side. The recipient site was prepared, with the anterior cricoid and the first one to two tracheal rings forming an H-shaped split. Besides the anterior split there were two additional cuts (the first in the cricothyroid membrane bilaterally the second between the last splitted tracheal ring and its next bilaterally) to be H-shaped. Thus, through these incisions, the cricotracheal wall could be kept away as though an opened book: keeping the nasal mucosal side into the airway lumen respecting its mucociliary direction from distal to proximal, and removing half cm of mucosa from each side of the graft where it was fixed with 2-3 (3-0) vicryl stitches to the edge of the cricotracheal wall and carefully placed so as not to enter the airway. In this way we obtained a roomy subglottic space, nearly triangular or hemispherical in cross-section, which resisted circumferential stenosis.

The septal mucosa has a key role in protecting the cartilage, acting as an island from which the cells migrate and spread to line the rest of laryngeal lumen. Again tracheotomy is mandatory for safety, and can be removed after 2–4 weeks in a gradual

weaning process after ensuring good healing on weekly flexible endoscopy and exclusion of airway compromise due to edema, granulations, or graft displacement.

All patients were kept under close observation for the first 3 postoperative days in the inpatient rooms, recording pulse, temperature, blood pressure, and oxygen saturation. Atraumatic suction was performed through the tube every 2 h for the first 12 h, and then in decreasing frequency according to the patient's condition. Parentral antibiotics, analgesia, and proton pump inhibitors were administered for the first week. All patients were discharged on the third postoperative day, except for the two male children, who were discharged after 1 week. Weekly follow-up visits were conducted in the outpatient clinic to observe for any chest or wound infection, and to assess the healing process endoscopically in the graft area by checking for edema, granulations, or fibrosis. After 3–4 weeks, the weaning process was started and it was completed after 1 week. Monthly follow-up visits were conducted for 6 months and then every 3 months for 2–3 years, recording any difficulty in breathing as a symptom and flexible endoscopic recording of any airway narrowing as a sign. These recordings were tabulated and statistical values are shown.

Our results show that the operative time ranged from 1.5 to 3.25 h, with a mean of 2.2 h. Blood loss ranged from 85 to 290 cm^3, with a mean of 150 cm^3. Hospitalization was 3 days in all patients with discharge on the third postoperative day, except for the two children with congenital subglottic stenosis, who stayed for 1 week. There were no major complications in the form of injury to important adjacent structures or massive hemorrhage. Other complications in the form of wound infection in two patients around the tracheotomy tube was evident 10 days after surgery, which was well controlled by parentral antibiotic and local antiseptic measures. Chest infection was recorded in five patients as mild to moderate tracheobronchitis, which resolved 1 week after surgery, except in the case of a 53-year-old female patient who progressed to bronchopneumonia after discharge, which resolved after 10 days.

Return to normal life activity or work was possible in all patients after 2–3 weeks; however, 14 patients preferred home stay until tube removal. As regards the final outcome, weaning started 4 weeks after surgery and was successful within 1 week in all patients except in the case of the two children, in whom the tubes were removed after 2 weeks of gradual weaning. Successful weaning was established when patients could breath freely independently of the tube without a sense of dyspnea or shortness of breath. Five patients experienced mild shortness of breath shortly after extubation, which increased with effort. They received steroid inhalation two to three times a day for 2 weeks, with improvement in symptoms. During the follow-up period all patients sustained normal breathing, except for seven scleroma patients who after 4–7 months complained of mild dyspnea, which increased slightly with effort and prevailed thereafter.

Regular endoscopic assessment by flexible laryngoscopy detected mild mucosal edema and little granulation tissue around the grafted area at the time of extubation. These granulations were more evident and encroached slightly on the airway in the five patients who suffered mild dyspnea shortly after extubation and regressed markedly after 2 weeks of steroid inhalation. Endoscopy showed rapid mucosal healing of the nasal septal mucosa and laryngeal mucosa, which was nearly complete at 6 weeks after surgery, with a markedly wide subglottic area (Fig. 4). Later on, endoscopic examination detected mild lumen narrowing in seven scleroma patients who complained of mild dyspnea 4–7 months after surgery. These patients showed no more narrowing on endoscopic examination on their subsequent months of follow-up. No other new symptoms developed in the follow-up period. No patient needed further surgical intervention. There was no mortality in the immediate and late postoperative period or during follow-up.

Figure 4
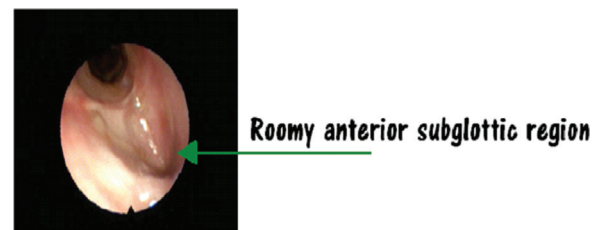
Endoscopic view showing wide roomy anterior subglottic area.

Figure 5
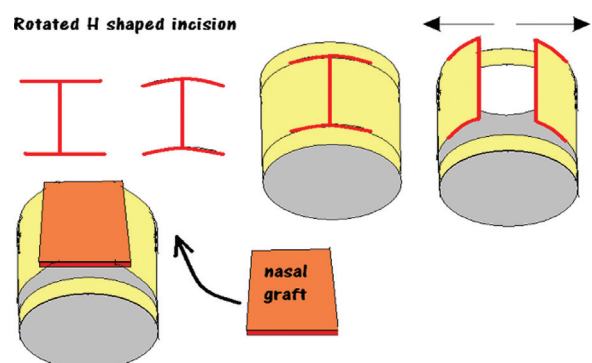
Graft positioning.

Composite nasal septal cartilage grafting with an H-shaped cricotracheal split (Fig. 5) is a viable and successful option for selected cases of laryngotracheal stenosis. The use of a stent with its associated morbidities is avoided with this technique. No additional endoscopic or open procedures were needed in any of the cases, with successful decannulation that could be readily achieved in less than 1 month.

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Conflicts of interest
There are no conflicts of interest.

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