Partial Cricotracheal Resection and Extended Cricotracheal Resection for Pediatric Laryngotracheal Stenosis

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KEYWORDS

• Pediatric • Laryngotracheal stenosis • Subglottic stenosis • Cricotracheal resection
• Laryngotracheal reconstruction • Stents • Infants • Children

KEY POINTS

- Train yourself adequately in laryngotracheal surgery and upper airway endoscopy before addressing the challenging surgery of pediatric laryngotracheal stenosis (LTS).
- Remember that inappropriate initial management of LTS can lead to permanent intractable sequelae and that the patients' best chance lies in the first operation.
- Perform a thorough preoperative assessment of the patients' medical condition and of the stenosis to choose the best surgical option and timing.
- Master all types of surgical techniques starting from appropriate use of the carbon-dioxide laser for minor intrinsic stenoses to laryngotracheal reconstruction with cartilage expansion, partial cricotracheal resection, and extended-cricotracheal resection for the more severe grades of LTS.

INTRODUCTION

Pediatric airway surgery encompasses a wide array of endoscopic and open procedures developed over the last decades to treat a variety of pathologic conditions of the larynx and trachea in infants and children. These conditions include congenital anomalies (laryngomalacia, bilateral vocal fold paralysis, subglottic stenosis, vocal fold webbing, laryngeal atresia, saccular cysts, laryngoceles, laryngotracheoesophageal clefts)[1,2] and acquired conditions resulting from prolonged intubation,[3] external and internal trauma, and rare neoplasias.

It is beyond the scope of this short essay to describe all of the endoscopic and surgical interventions that are needed to address such a variety of different pathologies. This article focuses instead on the yield of partial cricotracheal resection (PCTR) and extended-PCTR (E-PCTR) used for the management of congenital and acquired laryngotracheal stenosis (LTS) in infants and children.

Acquired LTS in the pediatric age group differs significantly from adult LTS for the following reasons:

1. Subglottic stenosis (SGS) is more often associated with glottic involvement, mainly

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posterior glottic stenosis (PGS), vocal fold synechia, or transglottic stenosis (28 of 141 = 33% of the cases in the authors' series of patients). This situation usually requires an interarytenoid expansion with a posterior costal cartilage graft (PCCG) combined with a subglottic resection, the so-called E-PCTR. But in many cases, PGS is not combined with SGS or only with a minor degree of SGS, so laryngotracheal reconstruction (LTR) with PCCG is usually sufficient to restore an adequate airway.[4]

2. The size of the subglottis is much smaller in infants and children than in adults. This smaller size implies a more challenging postextubation period in the pediatric intensive care unit (PICU) after single-stage PCTR and a perfect mucosal approximation at the anastomotic site during the surgery to avoid granulation tissue formation and restenosis.[5]
3. Finally, pulmonary and neurologic sequelae from prematurity or congenital (cardiac, esophageal or maxillofacial) anomalies often add to the therapeutic challenge.

PREOPERATIVE WORKUP

A thorough endoscopic evaluation usually provides all of the information needed for careful planning of the surgery.[6]

If precise description and measurements of the LTS are obtained from the endoscopy, then radiographs add little to the preoperative workup, because laryngeal cartilages show poorly on computed tomography (CT)-scan images in infants and children. However, 3-dimensional CT-scan or MRI reconstructions are useful for assessing intrathoracic airway narrowing secondary to congenital cardiovascular anomalies or rare tumors.[7]

Endoscopic Assessment

- Transnasal bronchofiberscopy under spontaneous respiration is performed to assess vocal fold (VF) mobility and all potential sites of extralaryngeal obstruction (naso-oropharynx, tracheostoma, distal trachea, and bronchi).[8]
- Rigid direct laryngotracheoscopy with a bare 0° telescope is used to precisely assess the location, extent, and size of the SGS; the exact location of the tracheostoma with respect to the stenosis; and the number of residual normal tracheal rings situated below the tracheostoma.
- Suspended microlaryngoscopy is implemented in case of VF immobility to differentiate neurogenic VF paralysis from PGS, potentially with cicatricial cricoarytenoid joint fixation.
- In the pediatric community, the Meyer-Cotton airway grading system is routinely used as a predictor of success or failure after LTR used for the cure of SGS.[9] But more recently, implementation of glottic involvement and patients' comorbidities to the degree of SGS has shown to be the best predictors of outcome following PCTR and E-PCTR because the diseased airway segment is fully resected during the surgery[10] (**Table 1**).
- Finally, a bacteriologic aspirate of the trachea is systematically taken to look for resistant bacteria that require proper treatment before the surgery. Failure to do so may ruin the final result of PCTR, E-PCTR, or LTR.

Patients' General Condition

- A full medical history of the cause of the SGS, including the cause for long-term intubation, should be obtained.[11]

Table 1
Modified Myer-Cotton airway grading system

Myer-Cotton Grade		Isolated SGS (a)	Isolated SGS + Comorbidities (b)	SGS + Glottic Involvement (c)	SGS + Glottic Involvement + Comorbidities (d)
I	0%–50%	SGS Ia	SGS Ib	SGS Ic	SGS Id
II	51%–70%	SGS IIa	SGS IIb	SGS IIc	SGS IId
III	71%–99%	SGS IIIa	SGS IIIb	SGS IIIc	SGS IIId
IV	No lumen	SGS IVa	SGS IVb	SGS IVc	SGS IVd

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