



Supraglottoplasty outcomes in relation to age and comorbid conditions

Stephen R. Hoff^a, James W. Schroeder Jr.^{b,c,*}, Jeff C. Rastatter^{b,c}, Lauren D. Holinger^{b,c}

^a Department of Otolaryngology - Head and Neck Surgery, University of Illinois Medical Center at Chicago, Chicago, IL United States

^b Division of Pediatric Otolaryngology, Children's Memorial Hospital, Chicago, IL United States

^c Department of Otolaryngology, Northwestern University Feinberg School of Medicine, Chicago, IL United States

ARTICLE INFO

Article history:

Received 26 September 2009

Received in revised form 18 November 2009

Accepted 20 November 2009

Available online 21 December 2009

Presented at American Society of Pediatric Otolaryngologists' Annual meeting—Seattle, Washington, USA, May 2009

Keywords:

Laryngomalacia
Aryepiglottoplasty
Supraglottoplasty
Stridor

ABSTRACT

Objective: To determine if age and comorbid conditions effect outcomes in children undergoing supraglottoplasty for severe laryngomalacia.

Design: Retrospective study.

Setting: Urban tertiary-care children's hospital.

Patients: Children undergoing supraglottoplasty for severe laryngomalacia between February 2004 and July 2008. 56 patients were identified.

Outcome measures: Persistence of upper airway obstruction, revision surgery (supraglottoplasty), and additional surgery (tracheostomy).

Results: 33/56 (58.9%) patients had no comorbid conditions and 23/56 (41.1%) patients had comorbid conditions. In noncomorbid patients, 36.4% of those less than 2 months of age at the time of surgery required revision supraglottoplasty, compared to 5.3% of patients between 2 and 10 months ($p < 0.05$). Compared to the 2–10-month age group, there was a significantly higher percentage of patients with comorbid conditions in the >10-month group (32.1% vs. 79%, $p < 0.01$). Patients with comorbid conditions were diagnosed at a significantly later age than those without (6 mo vs. 2 mo, respectively), and had significantly higher rates of revision supraglottoplasty (47.8% vs. 18.2%) and tracheostomy (39.1% vs. 0.0%). 70% of children with neurological conditions required revision surgery, with 60% requiring tracheostomy. The revision surgery and tracheostomy rates were significantly higher compared to the noncomorbid group ($p < 0.01$ and $p < 0.0001$). Children with cardiac conditions had a higher rate of tracheostomy than noncomorbid children (30% vs. 0%, $p < 0.01$). 16.7% of children with genetic conditions required supraglottoplasty, and none required tracheostomy.

Conclusions: In noncomorbid patients, those undergoing supraglottoplasty less than 2 months of age had a significantly higher rate of revision supraglottoplasty. Patients with neurologic and cardiac comorbidities require tracheostomy at a significantly higher rate than noncomorbid patients.

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1. Introduction

Laryngomalacia is the most common cause of stridor in the newborn. It typically presents between 2 and 6 weeks of age, worsens until approximately 6–9 months of age, and then resolves without the need for surgical intervention [1,2]. In 10–15% of patients, laryngomalacia is severe enough to cause upper airway obstruction, acute life threatening events (ALTE), or poor weight gain and/or failure to thrive [3].

Supraglottoplasty has supplanted tracheotomy as the primary surgical intervention in patients with severe laryngomalacia

causing severe upper airway obstruction. This procedure has a high success rate (38–100%) and a low complication rate [4,5]. Supraglottoplasty is typically performed between 2 and 10 months of age, and most patients have resolution of upper airway obstruction after the first surgical intervention. It is common for stridor to persist [3,6]. In approximately 4–50% of patients, upper airway obstruction or feeding difficulties persist, and a revision supraglottoplasty is necessary [5–7].

Persistent upper airway obstruction after supraglottoplasty requiring a tracheostomy occurs in 1.7–8.8% of all patients [3–7]. Patients with medical comorbidities have been shown to have worse outcomes after supraglottoplasty. Those with neurologic conditions have the highest failure rate [5,8]. Patients with severe laryngomalacia are more likely to have other medical comorbidities, including genetic syndromes and congenital cardiac anomalies [4].

This study aims to determine whether the patient's age at surgery has an effect on surgical outcomes of supraglottoplasty. It

* Corresponding author at: Division of Pediatric Otolaryngology, Children's Memorial Hospital, 2300 Children's Plaza, Box 25, Chicago, IL 60614, United States. Tel.: +1 773 880 6606; fax: +1 773 880 4110.

E-mail address: jschroeder@childrensmemorial.org (J.W. Schroeder Jr.).

also aims to determine the relation of medical comorbidities to the success rate of primary supraglottoplasty, and identify which comorbidities contributed to failure. Our hypotheses are that patients with severe laryngomalacia requiring supraglottoplasty at less than 2 months of age are more likely to require revision surgery, and that medical comorbidity is associated with a higher revision supraglottoplasty rate.

2. Methods

Retrospective study of patients who underwent supraglottoplasty for severe laryngomalacia between February 2004 and June 2008 at The Children's Memorial Hospital in Chicago, Illinois by the senior authors LH and JWS. Institutional Review Board approval was obtained prior to study. All patients were diagnosed with severe laryngomalacia causing upper airway obstruction, and/or failure to thrive that required surgical intervention. The diagnosis of laryngomalacia was made based on clinical presentation and confirmed by awake flexible fiberoptic laryngoscopy. Supraglottoplasty was performed either with laryngeal microinstruments, CO₂ laser technique, or microdebrider.

Charts were reviewed for the following: age at first symptoms, age at diagnosis with flexible laryngoscopy, presenting symptoms (presence of stridor, apneas, cyanosis, sleep disturbance, feeding difficulties, failure to thrive), medical comorbidities, evidence of laryngopharyngeal reflux (LPR) on flexible fiberoptic laryngoscopy (FFL), age at surgery, type of surgery, presence of synchronous airway lesions, postoperative symptoms, need for nasogastric (NG) or gastric tube (G tube), need for revision supraglottoplasty, need for tracheotomy, and length of follow up.

Patients were divided into age groups according to their age at the time of surgery: less than 2 months, 2–10 months ("standard" group), and greater than 10 months. Patients with neurologic, cardiac, or syndromic/genetic comorbid conditions were identified and separated. Also included in the syndromic group were patients with Pierre-Robin/micrognathia. The data from these patients was then compared to the patients without medical comorbidities.

The primary outcome measure is the presence of postoperative upper airway obstruction, requiring revision surgery (supraglottoplasty or tracheostomy) for failure of resolution of upper airway obstruction, severe feeding difficulties, or sleep apnea symptoms. Continued stridor after supraglottoplasty is common, and was not considered a failure of surgery unless it was associated with severe upper airway obstruction.

3. Results

56 patients underwent supraglottoplasty between February 2004 and June 2008, with males representing 53.6% (30/56), and females 46.4% (26/56). Overall, CO₂ laser technique was used in 58.9% (33/56) of patients, compared to 39.3% (22/56) with laryngeal microinstruments and 1.8% (1/56) with the microdebrider. There was not a significant difference in the rates of CO₂ laser versus laryngeal microinstrument use between age groups. Also, there was not a significant difference in rate of supraglottoplasty failure when comparing CO₂ laser technique to laryngeal microinstruments ($p > 0.22$), which held true regardless of age group or with or without medical comorbidities.

4. Age

4.1. Less than 2 months at the time of surgery

There were 14 patients in this age group, 78.6% (11/14) without and 21.4% (3/14) with comorbid conditions (Fig. 1). At presentation, 42.8% (6/14) of patients had a history of cyanotic events, 21.5%

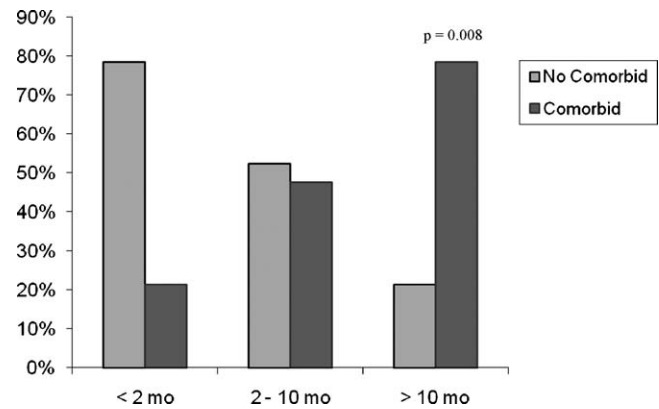


Fig. 1. Rate of comorbid condition by age group.

(3/14) required home oxygen, and 57.1% (8/14) had sleep disturbances. 50% (7/14) had poor weight gain or failure to thrive, and 14.2% (2/14) required an NG tube (Table 1). All 14 patients had evidence of LPR, with mild to moderate posterior supraglottic mucosal edema on flexible laryngoscopy. On rigid bronchoscopy, 57.1% (8/14) of patients had synchronous airway lesions, including six with subglottic stenosis (grade 1), two with tracheomalacia, and one posterior interarytenoid web. In regards to technique, 28.6% (4/14) had CO₂ laser supraglottoplasty, 57.1% (8/14) had microinstruments, and 7.1% (1/14) each had microdebrider or epiglottomy. There was no significant difference in rates of revision surgery between techniques.

Of the 11 patients without comorbid conditions, 36.4% (4/11) required revision supraglottoplasty to relieve persistent upper airway obstruction, and none required tracheostomy (Fig. 2). Compared to the 2–10-month age group, there was a significantly higher rate of supraglottoplasty in the <2-month group (5.3% vs. 36.4%, $p < 0.05$). Of the 3 patients with comorbid conditions, 33.3% (1/3) required revision supraglottoplasty and 66.7% (2/3) required tracheostomy.

4.2. 2–10 months at the time of surgery

28 patients were identified in this age group, 67.9% (19/28) without and 32.1% (9/28) with comorbid conditions (Fig. 1). 21.4% (6/28) of patients had a history of cyanotic events, 14.3% (4/28) required home oxygen, and 60.7% (17/28) had sleep disturbances. 60.7% (17/28) had poor weight gain or failure to thrive, with 32.1% (9/28) requiring an NG tube. 85.7% had clinical evidence of LPR on flexible laryngoscopy, and 64.2% (18/28) had synchronous airway lesions on rigid bronchoscopy (Table 1). 64.3% (18/28) underwent CO₂ laser supraglottoplasty, compared to 35.7% (10/28) with laryngeal microinstruments. There was no significant difference in rates of revision surgery between techniques.

Of the 19 patients without comorbid conditions, 5.3% (1/19) required revision supraglottoplasty, and none required tracheostomy (Fig. 2). 9 patients had comorbid conditions, with 22.2% (2/9) requiring revision supraglottoplasty and 22.2% (2/9) requiring tracheostomy (Table 1).

4.3. Greater than 10 months at the time of surgery

There were 14 patients in this age group, 21% (3/14) without and 79% (11/14) with comorbid conditions. Compared to the 2–10-month age group, there was a significantly higher percentage of patients with comorbid conditions in the >10-mo group ($p < 0.01$; Fig. 1). At presentation, 21.4% (3/14) of patients had a history of cyanotic events, 21.4% (3/14) required home oxygen, and 57.1% (8/14) had sleep disturbances. 35.7% (5/14) had poor weight gain or

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