Failures and Complications of Supraglottoplasty in Children

Françoise Denoyelle, MD, PhD; Michel Mondain, MD, PhD; Nicolas Gresillon, MD; Gilles Roger, MD; Franck Chaudré, MD; Erea Noël Garabédian, MD

Objectives: To study the failures and complications of bilateral supraglottoplasty in children with severe laryngomalacia and to compare children with isolated laryngomalacia (IL) with those who have additional congenital anomalies (ACAs).

Design: Retrospective medical record review.

Setting: Two tertiary referral centers.

Subjects: A total of 136 consecutive patients, aged 3 days to 60 months (median age, 3 months) who underwent laser or instrumental bilateral supraglottoplasty. Isolated laryngomalacia occurred in 102 children, aged 3 days to 19 months; ACAs were found in 34 children, aged 3 weeks to 60 months.

Outcome Measures: Persistence of dyspnea, sleep apnea, and/or failure to thrive; need for further treatment; minor complications (defined as granuloma, edema, or small web); or major complication (supraglottic stenosis).

Results: Failures or partial improvement were observed in 12 (8.8%) of 136 cases, all having ACAs. The overall rate of complications was 7.4% (10/136). There were no significant differences between the IL and ACA groups concerning the rate of recurrence needing revision surgery (3/102, 2.9% vs 3/34, 9%), the rate of minor complications (4/102, 3.9% vs 1/34, 3%), or the rate of supraglottic stenosis (4/102, 3.9% vs 1/34, 3%). Supraglottic stenosis was managed by revision surgery in 4 cases and/or noninvasive ventilatory assistance in 2 cases. The long-term outcome appeared to be better when reintervention could be avoided or was kept to a minimum.

Conclusion: Failure of supraglottoplasty was only observed in cases of laryngomalacia with ACAs. The complication rate was similar whether or not ACAs were present.

The procedure were extubated at the end of the procedure and for 24 hours. All the patients who required intubation during the first 2 years of this study, patients were observed for 24 hours tubated until the complete reversal of anesthesia. During the aryepiglottic folds and the lateral epiglottis in some cases. Cosä, identified by the “suction test,” was then removed along the aryepiglottic folds was first divided. The redundant mucosa of or laryngeal microinstrumentation (119 cases). The mucosa of ther carbon dioxide laser (superpulse mode, 3-5 W) (17 cases) pension, and the supraglottoplasty was performed using ei-

tion was necessary. The laryngoscope was placed under sus-

posterior supraglottic region without an endotracheal tube. In some cases, preglottic jet ventilation or endotracheal intuba-

tion was required. The laryngoscope was placed under sus-

Anesthesia to the nostril. The diagnosis was confirmed after com-

sultation using a flexible laryngoscope after applying local an-

nosis, and pharyngolaryngomalacia) and encephalopa-

Symptoms of severe laryngomalacia (ie, chronic dyspnea and/or

failure to thrive) was necessary after surgery) but had no benefit on feeding problems (ie, nasogastric feeding was still required)

We considered a “recurrence” to be the reappearance of symptoms of severe laryngomalacia (ie, chronic dyspnea and/or failure to thrive with growth retardation and/or obstructive sleep apnea) 4 weeks or more after surgery in children initially free of these symptoms after postsurgical healing of the mucosa. Cases classified as a “failure” had no improvement of the initial symp-

toms and required further therapy (tracheotomy, noninvasive ventilation, oxygen therapy, or nasogastric feeding).

The 136 patients included were aged 3 days to 60 months (median, 3 months) at the time of surgery. No associated disease—isolated laryngomalacia (IL)—was found in 102 children, aged 3 days to 19 months. Associated congenital anomalies (ACAs) were found in 34 children, aged 3 to 60 months. These were mainly Pierre Robin or “Robinlike” syndromes (retroglossia, glossop-

tosis, and pharyngolaryngomalacia) and encephalopa-

thies (Table 1).

The overall success rate was 79% (108/136). Success was clearly achieved in a higher proportion of cases in the IL group than in the ACA group: 89.2% (91/102) vs 50% (17/34) (P=.001). Failures or partial improvement were observed in 12 (8.8%) of the 136 cases, all having ACAs (Table 2). Failures were managed in 3 cases by tracheotomy, in 1 case by noninvasive ventilatory assistance, and in 1 case by nursing, nasogastric feeding, and oxygen therapy. There were no significant differences between the IL and ACA groups in the rate of recurrence needing revision surgery (3/102, 2.9% vs 3/34, 9%; P=.18), the rate of minor complications (4/102, 3.9% vs 1/34, 3%; P>.99), and the rate of supraglottic steno-

sis (4/102, 3.9% vs 1/34, 3%; P>.99) (Table 2)

Ten (7.4%) of 136 patients experienced complications. Five patients had successful outcomes after minor complications diagnosed during the control endoscopy. Two of these had granulomas that were removed supraglottoplasty or aryepiglottic fold division or exci-

sion. In 1987, Solomons and Prescott described the first supraglottic stenosis secondary to this procedure, and interarytenoid adhesion has been reported by Katin and Tucker and Jani et al. The aim of our study, performed in 2 referral centers, was to determine the rate of failures and minor and major complications with supraglottoplasty in children and to investigate if this was correlated with the presence of associated disease.

<table>
<thead>
<tr>
<th>Table 1. Associated Congenital Anomalies</th>
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<tr>
<td>Anomaly</td>
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<tr>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Pierre Robin or “Robinlike” syndrome</td>
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<tr>
<td>Psychomotor retardation, encephalopathy</td>
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<tr>
<td>CHARGE association</td>
</tr>
<tr>
<td>Down syndrome</td>
</tr>
<tr>
<td>Miscellaneous</td>
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<tr>
<td>Total</td>
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Abbreviation: CHARGE, coloboma (of eyes), hearing defect, choanal atresia, retardation of growth, genital defects (male only), and endocardial cushion defect.
under general anesthesia at the time of the endoscopy. Two others had significant edema at day 7 associated in 1 case with a granuloma at the top of the left arytenoid; in both cases these lesions resolved in a few days after extended antibiotic treatment and the introduction of ranitidine (not systematically used before 1997). One child had a posterior fibrous web between the arytenoids divided with microscissors.

Five (3.7%) of 136 patients developed a major complication (ie, a supraglottic stenosis). In case 1, supraglottoplasty was performed with microinstruments and laser at age 8 weeks in a boy affected by an IL with chronic dyspnea and failure to thrive. Several recurrences a few days after surgery were managed by revision surgery (3 procedures between age 3 and 15 months), with resection of fibrous supraglottic webs (Figure). Persistent dyspnea on effort promoted a final surgical intervention at age 7 years for adhesions. Freeing of the adhesions led to an improvement of the dyspnea.

Patient 2 was a 6-month-old boy with type 1 von Recklinghausen disease in whom surgery was indicated because of chronic dyspnea and failure to thrive associated with obstructive sleep apnea. Surgery was performed using microinstruments. Supraglottic stenosis was apparent at the first control endoscopy, and 2 revision procedures were performed 7 weeks and 12 months after the initial surgery. This child was lost to follow-up until he was 3 years old, at which point polysomnography confirmed the presence of obstructive sleep apnea due to laryngeal obstruction with very fibrous aryepiglottic folds. This was managed first by noninvasive ventilatory assistance and then by nocturnal nasal oxygen therapy. He is currently 6 years old and still managed by oxygen therapy.

Patient 3 was a 6-week-old girl with very severe laryngomalacia and major dyspnea. After supraglottoplasty with microinstruments, 3 revision procedures were performed for early recurrences of dyspnea caused by supraglottic adhesions. She is currently 3 years old and undergoing noninvasive ventilatory assistance to manage persistent obstructive sleep apnea.

Patient 4 was a 5-week-old girl who was operated on with microinstruments for an IL complicated by obstructive sleep apnea. Fibrous webs were detected at the first control procedure, and no revision surgery was performed. Dyspnea was persistent during crying and sleeping, but there was no growth retardation. She was managed with oxygen therapy and inpatient surveillance followed by a return home and several brief admissions during the first year of life for exacerbation of dyspnea during upper airway infections. Polysomnography when she was 12 months old showed hypopnea without apnea.

Patient 5 was operated on using a laser for chronic dyspnea with failure to thrive. Rapid recurrence of the dyspnea signaled a supraglottic stenosis, which was managed by partial epiglottectomy with microinstruments with a good improvement of the symptoms and no further recurrence.

**COMMENT**

Supraglottoplasty has been an undoubted success in the management of severe laryngomalacia in the newborn.

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**Table 2. Results and Complications of Supraglottoplasty in 136 Children**

<table>
<thead>
<tr>
<th>Result</th>
<th>Isolated Laryngomalacia (n = 102)</th>
<th>Associated Congenital Anomalies (n = 34)</th>
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<tbody>
<tr>
<td>Success</td>
<td>91 (88.2)</td>
<td>17 (50)</td>
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<tr>
<td>Success after minor complications*</td>
<td>4 (3.9)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Partial improvement</td>
<td>0</td>
<td>7 (21)</td>
</tr>
<tr>
<td>Failure</td>
<td>0</td>
<td>5 (15)</td>
</tr>
<tr>
<td>Recurrence with revision surgery</td>
<td>3 (2.9)</td>
<td>3 (9)</td>
</tr>
<tr>
<td>Supraglottic stenosis</td>
<td>4 (3.9)</td>
<td>1 (3)</td>
</tr>
</tbody>
</table>

*Granuloma, edema, and small web.

However, after an initial period from 1987 to 1995, when the different teams performed classic bilateral supraglottoplasty, several studies were published reporting less invasive techniques, probably traducing the problems of supraglottic webs or stenosis encountered by many pediatric otolaryngologist teams. In the present study, 3.7% of the patients developed a supraglottic stenosis, and this rate is very similar to that reported by Reddy and Matt12 (2/57 cases or 4%). Kelly and Gray13 and Reddy and Matt12 have studied the results of the unilateral surgical procedure: 3 (17%) of 18 and 7 (17%) of 42 children, respectively, needed a contralateral procedure; but neither author observed supraglottic stenosis following unilateral surgery. Loke et al11 reported a series of 33 patients treated by simple division of the aryepiglottic folds without complications. In 1 case with associated disease, the treatment failed, and a tracheotomy was required; in 2 cases (6%) revision surgery was needed to remove the redundant mucosa.14 No supraglottic stenosis was observed.

These more conservative procedures seem to be safer, but the success rate is lower. Knowing the risk factors predictive of complications would be particularly use-

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ful in deciding which type of surgery is indicated. Authors who reported cases of supraglottic stenosis did not highlight specific risk factors. We found that the presence of ACAs is a risk factor for failure or partial failure, but the complication rate is similar to that observed in children with IL. The use of laser vs microinstruments was not statistically a risk factor for supraglottic stenosis in the present study (2/17 laser vs 3/119 microinstruments; \( P > .05 \)). The role of gastroesophageal reflux could be a factor. However, despite the systematic use of ranitidine or omeprazole during the last 4 years of our study, we observed 2 supraglottic stenoses during this period.

To date, there are no reliable predictors for the development of fibrous webs or adhesions after supraglottoplasty. However, better management of these complications could avoid more iatrogenic lesions. When analyzing our 5 case reports of major complications, we found that the long-term outcome seemed better when re-intervention could be avoided or kept to a minimum. Non-invasive ventilatory assistance in patients with laryngomalacia has been developed in Armand-Trousseau Children’s Hospital by Fauroux et al. These authors have demonstrated the benefit (on gas exchange and growth) of long-term, home, noninvasive ventilatory assistance in children with laryngomalacia complicated by obstructive sleep apnea. This technique allowed a tracheotomy to be avoided in several children.

As a result of the findings in the present study, in our practice we now (1) avoid large mucosal resections, especially if the resected areas of mucosa are facing each other on either side of the aryepiglottic fold, and (2) propose to the parents to first attempt nasogastric feeding, oxygen therapy, or noninvasive ventilatory assistance to try to avoid revision surgery in cases of postoperative stenosis when the airway obstruction is not major.

In conclusion, the presence of associated disease with laryngomalacia was a risk factor for surgical failure, but no predictive factors for the development of minor or major complications were found. The complication rate was 7.4%, and half of these complications were severe, requiring prolonged follow-up. By avoiding large mucosal resections during the initial surgery and by opting for noninvasive treatments for early stenoses and limiting surgical reintervention, surgeons might reduce the rate of severe complications.

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