Oropharyngeal Stenosis

A Complication of Multilevel, Single-Stage Upper Airway Surgery in Children

Jeremy D. Prager, MD; Brandon S. Hopkins, MD; Evan J. Propst, MD; Sally R. Shott, MD; Robin T. Cotton, MD

Objectives: To describe oropharyngeal stenosis (OPS), a potential complication of multilevel, single-stage upper airway surgery involving lingual tonsillectomy in children, and to discuss the manner in which OPS may be managed successfully.

Design: Case series with an average follow-up of 12 months.


Patients: Medical charts were reviewed for 104 patients who underwent lingual tonsillectomy over a 30-month period from January 1, 2007, to June 30, 2009.

Intervention: Multilevel, single-stage upper airway surgery, including lingual tonsillectomy.

Main Outcome Measure: Development of OPS noted during office or intraoperative examination.

Results: Forty-nine of 104 patients underwent multilevel, single-stage upper airway procedures that included lingual tonsillectomy. Four of these 49 patients developed OPS, for a complication rate of 8.2%. Three patients required pharyngoplasty (scar release, debulking of fibrotic tissue, and reorientation of the scar) and triamcinolone injections in the operating room. A fourth patient underwent simple scar release in the operating room. No patient who underwent lingual tonsillectomy alone or in combination with an additional procedure at the same level of the upper airway developed OPS.

Conclusions: Oropharyngeal stenosis is a potential complication of multilevel, single-stage upper airway surgery involving lingual tonsillectomy in children. Although there is pressure to perform multilevel procedures that address each site of upper airway obstruction in 1 sitting, this case series suggests the need for a more conservative, staged approach if lingual tonsillectomy is planned.


Oropharyngeal stenosis (OPS) is a narrowing of the upper aerodigestive tract in the region of the soft palate, lateral pharyngeal walls, and tongue base. The narrowing may appear as a cicatricial scar that is visible in the oropharynx and caused by adhesion of the anterior pillars and inferior tonsillar fossae to the tongue base, which accordingly narrows the oropharyngeal aperture. Symptoms of dyspnea on exertion, dysphagia, poor weight gain, sleep-disordered breathing, and obstructive sleep apnea (OSA) may result from OPS. Some patients with OPS may be asymptomatic.

In the past, OPS has been described as a rare complication of tonsillectomy with or without adenoidectomy (T±A). Deep dissection of the lower tonsillar pole and removal of adjacent lingual tonsil tissue may cause OPS. Excessive cautery and postoperative bleeding have been associated with nasopharyngeal stenosis and OPS. Other potential pathogenetic causes include oropharyngeal infection, most notably syphilis, although other infectious causes have been identified.

With increased awareness of persistent airway obstruction despite previous T±A, other upper airway structures are being surgically addressed with increasing frequency. These surgical solutions include methods of nasal airway improvement, soft palate reduction, lingual tonsillectomy, and procedures to reduce the tongue base. Many new techniques and devices have been used in these procedures. Multilevel procedures are those that address structures in several upper airway regions: the nasal airway, nasopharynx, soft palate, palatine tonsils, and their pillars, lingual tonsils, and tongue base. According to this definition, adenotonsillectomy is a multilevel, single-stage procedure. The trend has been to treat multilevel upper airway obstruction with multilevel procedures performed simulta-
word-secured location. Institutional review board approval was viewed as a separate population. The treatment of patients with lingual tonsillectomy, were noted and closely re-
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gual tonsillectomy, medical records were reviewed for those pa-
dergone multilevel, single-stage procedures that included lin-
After the discovery of several patients with OPS who had un-
ment of OPS.

A total of 104 individuals underwent 105 separate lingual 
tonsillectomy procedures during the specified period (1 pa-
tient underwent lingual tonsillectomy alone and again as part of a multilevel, single-stage procedure at a later date).
The most common indication was upper airway obstruc-
tion, followed by recurrent pharyngitis. Fifty-six patients 
underwent single-level, single-stage surgery: lingual ton-
sillectomy alone or lingual tonsillectomy in combination 
with other procedures at the same level of the upper air-
way (radiofrequency ablation of the tongue base or poste-
rrior midline glossectomy). Of these 56 patients, 35 under-
went follow-up examinations, none of which revealed OPS.

Forty-nine patients underwent multilevel, single-stage surgical procedures that included lingual tonsil-
llectomy. No patients underwent more than 1 multilevel 
procedure. Twenty-four of the patients (49%) were fe-
male, and 25 were male. No patients were noted to have 
OPS at their first examination in the operating room or 
clinic. The average age at the time of procedure was 10 years (age range, 1-21 years; SD, 5 years 2 months). The 
average duration of follow-up was approximately 12 
months (range, 0-32 months; SD, 10 months). Twelve 
patients (24%) did not receive follow-up. The distribu-
tion of procedures, broken down by multilevel, single-
stage surgery vs single level, single-stage surgery and pres-
ence or absence of OPS, is presented in Table 1.

Four patients who underwent multilevel, single-stage surgery involving lingual tonsillectomy developed OPS, 
for a complication rate of 8.2%. This compares with the 
0% incidence of OPS in the population of patients who 
underwent lingual tonsillectomy either alone or in com-
bination with procedures at the same level of the upper 
airway (0 of 56 patients). The clinical courses of these 4 
patients are presented in Table 2 in order of their pre-
sentation. The average age of these patients at the time of 
their multilevel, single-stage procedure was 4.5 years (age 
range, 3 years 4 months to 5 years 8 months). Each pa-

tient required intervention in the operating room. Fol-
low-up for these patients averaged 1 year 5 months (range, 
11-24 months).

Each of the 4 patients with OPS experienced clinical 
setbacks as a result of his or her OPS. Patient 1 was di-
agnosed as having OSA by polysomnography after his OPS 
was noted and required continuous positive airway pres-
sure for several months while the OPS was being treated. 
He has since been weaned from this support. Patient 2 
had worsening of his OSA on polysomnography because 
of OPS and required oxygen supplementation, which was 
eventually discontinued during treatment of his OPS. He 
is not currently being treated with continuous positive 
airway pressure and has yet to undergo another poly-
somnography. Patient 3, a girl, underwent an examina-
tion under anesthesia and unanticipated intraoperative 
scar division. Patient 4 experienced delayed decannula-
tion (6 months) as she underwent multiple additional pro-
cedures to improve her OPS. Patient 5, whose course is 
representative, is described herein in greater detail.

Patient 2 was a nearly 3½-year-old boy with a history 
of trisomy 21. He was diagnosed as having OSA by polysomnography after his OPS 
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Methods

After the discovery of several patients with OPS who had un-
dergone multilevel, single-stage procedures that included li-
gual tonsillectomy, medical records were reviewed for those pa-
tients who had undergone lingual tonsillectomy from January 
1, 2007, to June 30, 2009, at Cincinnati Children’s Hospital Medi-
cal Center, Cincinnati, Ohio. The review included operative re-
ports and clinical notes from before, during, and after this pe-
riod. Patients who underwent multilevel, single-stage procedures, 
including lingual tonsillectomy, were noted and closely re-
viewed as a separate population. The treatment of patients with 
OPS was examined. Data were collected in a deidentified, 
password-secured location. Institutional review board approval was 
obtained for this retrospective case series.

Results

Abbreviations: Ad, adenoidectomy; LT, lingual tonsillectomy.
aOne patient underwent LT alone and again as part of a multilevel, 
single-stage procedure at a later date.

eously in a single-stage fashion.4,5 This trend has been 
extended to the pediatric population.

We review our experience with multilevel, single-stage surgery 
involving lingual tonsillectomy in the pediat-

Table 1. Distribution of Procedures, Broken Down 
by Multilevel, Single-Stage Procedure vs Single-Level, 
Single-Stage Procedure and Presence or Absence 
of Oropharyngeal Stenosis (OPS) a

<table>
<thead>
<tr>
<th>Variable</th>
<th>OPS</th>
<th>Non-OPS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multilevel, single-stage procedure (49 patients)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior midline glossectomy, coblation</td>
<td>1</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Radiofrequency tongue ablation</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>LT, coblation</td>
<td>2</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>LT, electrocautery</td>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>LT, microdebrider and electrocautery</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ad, coblation</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ad, electrocautery</td>
<td>2</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Tonsillectomy</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Revision tonsillectomy, inferior palatine region</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Uvulopalatopharyngoplasty</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Soft palate reduction</td>
<td>4</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Total No. of procedures</td>
<td>121</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Single-level, single-stage procedure (56 patients) |       |         |       |
| Posterior midline glossectomy, coblation         | 0     | 9       | 9     |
| Posterior midline glossectomy, electrocautery    | 0     | 2       | 2     |
| Radiofrequency tongue ablation                   | 0     | 3       | 3     |
| LT, coblation                                   | 0     | 34      | 34    |
| LT, electrocautery                              | 0     | 20      | 20    |
| LT, microdebrider and electrocautery             | 0     | 1       | 1     |
| LT, coblation and electrocautery                 | 0     | 1       | 1     |
| Total No. of procedures                         | 70    |         |       |

The clinical courses of these 4 patients are presented in Table 2 in order of their pre-
sentation. The average age of these patients at the time of 
their multilevel, single-stage procedure was 4.5 years (age 
range, 3 years 4 months to 5 years 8 months). Each pa-

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representative, is described herein in greater detail.

Patient 2 was a nearly 3½-year-old boy with a history 
of trisomy 21. He was diagnosed as having OSA and un-
derwent an uncomplicated adenotonsillectomy, which failed 
to resolve the problem. Magnetic resonance imaging demon-
strated lingual tonsil hypertrophy. The results of his 
physical examination were consistent with lingual tonsil 
hypertrophy as well as with an elongated soft palate. He 
derwent a lingual tonsillectomy and soft palate reduction. 
The lingual tonsils were reduced with a coblation tech-
ique (ArthoCare ENT, Sunnyvale, California) at a set-

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underwent single-level, single-stage surgery: lingual ton-
Table 2. Clinical Courses of 4 Patients With Oropharyngeal Stenosis (OPS)

<table>
<thead>
<tr>
<th>Patient No./Age at Multilevel Procedure</th>
<th>Indication</th>
<th>Multilevel, Single-Stage Procedure</th>
<th>Duration Until OPS Noticed, mo</th>
<th>Surgical Repair</th>
<th>Triamcinolone, No. of Injections</th>
<th>Complication</th>
<th>Follow-up, mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/5 y 5 mo</td>
<td>UAO</td>
<td>Adenoidectomy, electrocautery</td>
<td>3</td>
<td>Left pharyngoplasty</td>
<td>3</td>
<td>CPAP</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>LTH</td>
<td>Lingual tonsilllectomy, electrocautery</td>
<td></td>
<td></td>
<td></td>
<td>Additional surgery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OSA</td>
<td>Soft palate reduction, electrocautery</td>
<td>7</td>
<td>Scar division and mucosal flaps</td>
<td>2</td>
<td>Continued OSA</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>LTH</td>
<td>Lingual tonsilllectomy, coblation</td>
<td></td>
<td></td>
<td></td>
<td>Oxygen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LTH</td>
<td>Lateral pharyngeal scar tissue, lateral pharyngeal wall</td>
<td></td>
<td></td>
<td></td>
<td>Additional surgery</td>
<td></td>
</tr>
<tr>
<td>2/3 y 5 mo</td>
<td>Chronic elongated soft palate</td>
<td>Revision lingual tonsilllectomy, lymphoid tissue reduction in palatine tonsill region and posterior pharyngeal wall, electrocautery</td>
<td>10</td>
<td>Bilateral H-V plasty, bilateral scar division</td>
<td>0</td>
<td>Intraoperative scar division</td>
<td>11</td>
</tr>
<tr>
<td>3/3 y 4 mo</td>
<td>Chronic lingual tonsillitis</td>
<td>Revision lingual tonsilllectomy, lymphoid tissue reduction in palatine tonsill region and posterior pharyngeal wall, electrocautery</td>
<td>2</td>
<td>Bilateral scar division</td>
<td>0</td>
<td>Intraoperative scar division</td>
<td>13</td>
</tr>
<tr>
<td>4/5 y 8 mo</td>
<td>UAO</td>
<td>Adenoidectomy, electrocautery</td>
<td>4</td>
<td>Bilateral H-V plasty, partial uvulectomy</td>
<td>3</td>
<td>Delayed decannulation</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>LTH</td>
<td>Lingual tonsilllectomy, coblation</td>
<td></td>
<td></td>
<td></td>
<td>Additional surgery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glossoptosis</td>
<td>Lingual tonsilllectomy, coblation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Midline posterior glossoptomy, colectomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CPAP, continuous positive airway pressure; H-V plasty, horizontal-to-vertical pharyngoplasty; LTH, lingual tonsil hypertrophy; OPS, oropharyngeal stenosis; OSA, obstructive sleep apnea; RFA, radiofrequency ablation; UAO, upper airway obstruction.

In the early 20th century, OPS was commonly attributed to infection of the oropharynx. As cases of OPS attributable to infectious origins have declined because of antibiotic therapy, surgery has emerged as the most common cause. While OPS may result from T±A, it remains a rare complication, and many contemporary accounts of adenotonsilllectomy complications do not mention it.7,9 Multiple risk factors, including excessive cautery, bleeding, a predisposition to keloid formation, and deep dissection in the region of the inferior tonsillar poles with removal of adjacent lingual tonsil tissue, have been proposed.1,2 Most reported cases have occurred in children.1,2

A review of the literature on uvulopalatopharyngoplasty, lingual tonsilllectomy, and tongue base reduction procedures performed alone did not show evidence of OPS.4,10-18 Lin and Kolta19 noted the potential for adhesions between the epiglottis and the tongue base after coblation lingual tonsilllectomy and suggested additional caution during ablation of lingual tonsil tissue in the vallecula.

Similarly, many authors have reported no evidence of OPS after multilevel, single-stage upper airway procedures involving radiofrequency tongue base reduction.3,20-22 Although Ceylan et al10 speculate that OPS may occur after multilevel, single-stage procedures that address the palatine tonsils, base of tongue, and soft palate, their review of 47 patients treated with simultaneous radiofrequency tongue base and palate reduction noted no stenosis during 12 months of follow-up. Stuck et al21 reviewed 258 procedures that combined radiofrequency tongue base reduction and soft palate or oropharyngeal procedures. None of the patients involved developed OPS during a mean follow-up of approximately 3 months. These studies involved adult patients.
Many other authors have reported no OPS after multilevel, single-stage procedures involving techniques with more extensive mucosal incisions than radiofrequency tissue ablation.4,12,16,23-25 These studies were conducted in adults. The procedures often combined surgery of the tongue base or lingual tonsillectomy with soft palate surgery, adenoidectomy, or tonsillectomy and are therefore similar to the procedures that our series of patients underwent. We were able to find 1 patient with OPS who had undergone a multilevel, single-stage procedure other than adenotonsillectomy. Interestingly, this patient was an adult who underwent a lingual tonsillectomy combined with palatine tonsillectomy and required extensive tissue dissection and silver nitrate cauterization.1

Our patients with OPS were all young children, 5 1⁄2 years younger than our multilevel, single-stage series average. It is likely that a young age and correspondingly small upper airway elevate the risk of OPS. The procedures often combined surgery of the tongue base or lingual tonsillectomy with soft palate surgery, adenoidectomy, or tonsillectomy and are therefore similar to the procedures that our series of patients underwent. We were able to find 1 patient with OPS who had undergone a multilevel, single-stage procedure other than adenotonsillectomy. Interestingly, this patient was an adult who underwent a lingual tonsillectomy combined with palatine tonsillectomy and required extensive tissue dissection and silver nitrate cauterization.1

Our patients with OPS were all young children, 5 1⁄2 years younger than our multilevel, single-stage series average. It is likely that a young age and correspondingly small upper airway elevate the risk of OPS. When used in these small spaces, surgical techniques can incite inflammation and injure the mucosa beyond the point at which the instrument is placed. When additional levels within a small upper aerodigestive tract are addressed, this risk is likely compounded. It is worth noting that we have not seen OPS in our routine adenotonsillectomy population, a population that includes young children with smaller upper airways. It is our practice to use electrocautery settings as high as 36 W to perform adenoidectomy. We have not experienced nasopharyngeal stenosis or OPS in this population, despite the close proximity of raw or injured mucosa in the nasopharynx and the oropharynx. It is probable, therefore, that the distance between the adenoid bed or soft palate and the lingual tonsil region (the operative sites in patients 1, 2, and 4) would be sufficient to avoid this complication, even in small children. However, the presence of OPS in our series and the apparent rarity of this complication in the adult and older children populations raises the concern that the inherently smaller upper airways of young children and the resulting closer approximation of raw or injured mucosa is a risk factor for OPS when lingual tonsillectomy is performed as part of a multilevel, single-stage procedure.

Oropharyngeal stenosis was a delayed complication in our patients, presenting 2 to 8 months after surgery and after examination results were normal. Symptoms ranged from the mild or nonexistent to the severe. Previous reports of OPS have also noted the delayed nature and varied presentation of this complication.1,2 Because of the unpredictable nature of OPS, follow-up of patients undergoing multilevel, single-stage procedures that include lingual tonsillectomy, palatine tonsillectomy, and adenoidectomy should include follow-up examinations after multilevel, single-stage procedures. We recommend that these should be performed 1, 3, 6, and 12 months after surgery. Additional follow-ups should be performed if necessary.


A1, Oropharyngeal scar with planned horizontal incision. B1, Bilateral transection of oropharyngeal scar creates enlarged airway. A-A', B-B', and C-C' indicate planned vertical closure points. C1, Completed vertical closure along planned points. D1, One-month postoperative view.
Sillectomy should also include examination of the oropharynx and tongue base, ideally with both an oral examination and nasopharyngoscopy to give a better view of the tongue base. The examination should be performed 3 to 6 months after the procedure. Caregivers should be warned of symptoms and signs that should prompt an office visit to an otolaryngologist.

Various repair techniques have been described. The most recently reported techniques use surgery and trimucosal injection, alone or in combination. McLaughlin et al concluded that trimucosal injection alone may suffice for OPS. They reserved horizontal-to-vertical pharyngoplasty for severe OPS that failed to respond to trimucosal injection alone. We have chosen to follow that lesson, combining trimucosal injection with pharyngoplasty of some form in all severe cases. Our case with more minor scar formation has been treated with scar division only. We are cautiously optimistic regarding our success to date and continue close follow-up of our patients.

In conclusion, surgery is now the most common cause of OPS, which was previously attributed to infection. Historically, tonsillectomy and, more commonly, adenotonsillectomy (a multilevel, single-stage procedure) have been associated with OPS. The frequency of this particular complication after T&A is exceedingly low. The risk appears to be similarly low in adults who undergo other types of multilevel, single-stage airway surgery. However, in young children who undergo multilevel, single-stage procedures that include lingual tonsillectomy, OPS represents a significant potential complication, as our OPS rate of 8.2% demonstrates. Furthermore, OPS is a delayed, potentially asymptomatic complication. It may be successfully managed in the operating room. The risk of this complication should be discussed with parents or guardians. Although families frequently wish to minimize the number of separate surgical procedures for their children, staging of multilevel procedures that include lingual tonsillectomy should be considered. For those patients who do undergo multilevel, single-stage procedures that include lingual tonsillectomy, appropriate follow-up is suggested.

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Author Contributions: Dr Shott had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Prager. Acquisition of data: Prager. Analysis and interpretation of data: Prager, Hopkins, Propst, Shott, and Cotton. Drafting of the manuscript: Prager, Hopkins, Propst, and Shott. Critical revision of the manuscript for important intellectual content: Prager, Hopkins, Propst, Shott, and Cotton. Statistical analysis: Prager and Propst. Administrative, technical, and material support: Hopkins. Study supervision: Shott and Cotton.

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REFERENCES