Objective: To determine the prevalence of synchronous airway lesions and esophagitis in children younger than 18 months undergoing adenoidectomy for adenoid hypertrophy and upper airway obstruction.

Design: Retrospective review spanning 4.5 years.

Setting: Tertiary care children’s hospital.

Patients: All children younger than 18 months who underwent adenoidectomy for upper airway obstruction by 2 pediatric otolaryngologists. Exclusion criteria: craniofacial dysmorphism and congenital syndromes.

Interventions: Simultaneous interventions during adenoidectomy included flexible nasopharyngolaryngoscopy (n=32), direct laryngoscopy (n=31), rigid tracheobronchoscopy (n=30), and esophagoscopy with biopsy (n=32).

Main Outcome Measures: Prevalence of synchronous airway lesions and histologic esophagitis.

Results: Thirty-five children younger than 18 months underwent adenoidectomy for airway obstruction (2 also had simultaneous tonsillectomy). Synchronous airway lesions were found in 19 (59%) of 32 patients who underwent airway endoscopy, including laryngeal edema (n=9), laryngomalacia (n=8), tracheal vascular compression (n=4), subglottic stenosis (n=4), midmembranous vocal fold lesions (n=3), bronchial stenosis (n=1), and true vocal fold immobility (n=1). Among 32 patients who underwent esophageal biopsy, histologic evidence of gastroesophageal reflux disease was found in 10 patients (31%), and eosinophilic esophagitis was found in 4 patients (13%). Overall prevalence of any synchronous finding (airway and/or esophagus) was 27 (77%) of 35.

Conclusions: Synchronous airway lesions and esophagitis (both gastroesophageal reflux disease and eosinophilic esophagitis) were prevalent among children younger than 18 months undergoing adenoidectomy for adenoid hypertrophy and upper airway obstruction. The presence of these findings argues for consideration of endoscopy during adenoidectomy for very young children.
Thirty-five patients met the inclusion criteria for the study. Average age at the time of adenoidectomy was 13 months (age range, 5-17 months). There were 20 boys and 15 girls. All cases of adenoidectomy were performed for symptoms of chronic nasal airway obstruction and mouth breathing. The noisy breathing was described by caregivers as snoring in 22 cases. A clear history of stridor was documented in only 3 cases. Other commonly reported symptoms that appeared to potentially be related to airway obstruction included dysphagia with gagging, choking, and/or apnea during feeds (n=5), cyanotic episodes (n=3), neck retractions (n=2), chronic cough (n=2), and failure to thrive (n=2). Apnea was most frequently diagnosed when a caregiver reported a history of witnessed apneic events (n=23) and in some cases by home monitoring (n=3) or formal polysomnography (n=3). Since many of the symptoms could have been due to a variety of abnormalities besides simply adenoid hypertrophy, operative endoscopy was performed as part of the diagnostic approach along with addressing the enlarged adenoids.

Adenoid hypertrophy was diagnosed preoperatively with either office flexible fiberoptic nasopharyngoscopy (n=8) or a lateral neck plain radiograph (n=12) and was also noted on a computed tomography scan in 2 patients. In 2 cases with marked tonsillar hypertrophy for which tonsillectomy was performed, hypertrophy of the adenoids was assumed preoperatively. In another 13 cases, adenoid hypertrophy was suspected preoperatively based on clinical signs and symptoms and was documented during flexible nasopharyngoscopy at the time of the surgical procedure.

Simultaneous interventions during adenoidectomy included flexible nasopharyngolaryngoscopy (n=32), direct laryngoscopy (n=31), rigid tracheobronchoscopy (n=30), and esophagoscopy with biopsy (n=32). Two patients also had tonsillectomy at the same time as adenoidectomy. The Table lists the synchronous airway and esophageal findings that were encountered. Among those 32 patients who underwent airway endoscopy, the average number of synchronous airway lesions per subject was 0.9 (range, 0-3 lesions).

Of 27 patients who underwent both airway endoscopy and esophageal biopsy, only 4 (15%) had the combination of a synchronous airway lesion and histologic evidence of esophagitis. Of 24 bronchoalveolar lavage results, all were negative for any significant number of lipid-laden macrophages. No cases of epiglottis or tongue base collapse were noted.

Overall prevalence of any synchronous finding (airway and/or esophagus) was 27 (77%) of 35.

For purposes of the study, patients were divided into 2 groups based on age. Group A represented those patients younger than 12 months (n=8; age range, 5-11 months), whereas group B included those patients aged between 12 and 17 months (n=20). In group A, there were 10 boys and 5 girls. In group B, there were 10 boys and 10 girls. The prevalence and types of synchronous airway abnormalities and esophagitis are demonstrated in the Table. In general, the younger patients (group A) appeared to have a greater number of synchronous findings; however, only laryngomalacia was significantly more common in this group.

Follow-up clinical outcome, based on subjective parental reporting from office notes, was available for 33
patients. Overall, 12 (36%) of 33 patients experienced re-
currence of upper airway obstruction following adenoid-
ectomy. A greater number of patients younger than 12
months (8/14; 57%) experienced recurrent or persist-
tent symptoms of upper airway obstruction than older pa-
tients (4/19; 21%), although this difference was not sta-
tistically significant (P = .07). The patients with recurrent
symptoms had a longer duration of follow-up (mean, 12
months; range, 5-30 months) than patients who re-
maind asymptomatic (mean, 4 months; range, 2 weeks–12
months). Among the 12 patients who developed recur-
rent upper airway obstruction after adenoidectomy, sub-
sequent interventions included tonsillectomy alone (n = 3),
tonsillectomy and revision adenoidectomy (n = 5), antibi-
otic therapy for tonsillitis (n = 2), revision adenoidectomy
alone (n = 1), and repeated upper aerodigestive tract en-
doscopy with esophageal biopsy showing persistence of re-
flux esophagitis (n = 1). All experienced symptomatic im-
provement after treatment.

Two patients (one with laryngomalacia and the other
with vocal nodules and eosinophilic esophagitis) still had
mild postoperative stridor, which persisted for up to 2
months after adenoidectomy.

Among those patients with recurrent or persistent up-
per airway obstruction, esophagitis (GERD and/or eo-
sinophilic esophagitis) was present in 7 (70%) of 10 as-
sessed with esophagoscopy, and synchronous airway
lesions were present in 7 (58%) of 12 assessed with air-
way endoscopy. Among those patients who had com-
plete resolution of symptoms postoperatively with no
known recurrence, esophagitis was found in 6 (50%) of
12 assessed with esophagoscopy, and synchronous air-
way lesions were present in 11 (65%) of 17 assessed with
airway endoscopy. Thus, esophagitis and synchronous airway
lesions were present in similar amounts in both those
patients who developed recurrent upper airway ob-
struction after adenoidectomy and those who did not.

**COMMENT**

In the present study, upper aerodigestive tract endos-
copy was routinely performed in otherwise seemingly
healthy infants who were undergoing adenoidectomy for
upper airway obstruction to search for GERD and to avoid
missing any potentially significant synchronous airway
lesions. Based on their young age, it was believed that
these children represented a special population at higher
risk for these types of findings, and several recent stud-
ies have recommended endoscopy in this setting as well.1,3

Synchronous airway lesions were quite common in our
patients (55%), as was esophagitis (44%). However, most
patients’ symptoms completely resolved after adenoid-
ectomy despite these other findings, with adenoid re-
growth and tonsillar hypertrophy more likely to be a cause
of recurrent symptoms than reflux or synchronous la-
ryngotracheal lesions. It has been shown that the younger
a child is when adenoidectomy is performed, the more
likely an eventual tonsillectomy will also be performed,
with 28.7% of children younger than 2 years at the time
of adenoidectomy having a tonsillectomy within 5 years.7

In a study by Goldberg et al,2 endoscopic evaluation
was considered to be a valuable tool in determining the
cause of OSA in special populations, including those
younger than 1 year or with neuromuscular disorders or
craniofacial dysmorphism. In this study of 39 children
with OSA who underwent flexible airway endoscopy, la-
ryngomalacia was found in 44%, and children younger
than 1 year had a greater amount of dynamic abnormali-
ties (such as laryngomalacia) and a smaller amount of
“fixed” abnormalities (such as tonsillar hypertrophy) than
older children. Although the results of the present study
would suggest that many synchronous airway lesions are
not clinically significant, we still favor the use of rigid
endoscopy to rule out the occasional serious synchro-
nous finding, especially in children younger than 1 year.
The lack of postadenoidectomy symptoms associated with
most dynamic synchronous airway lesions (eg, laryn-
gomalacia) may be owing to a decrease in upper airway
resistance after adenoidectomy, thus leading to improve-
ment in the accompanying dynamic disorder.2

A similar debate exists with regard to the evaluation of
infants with laryngomalacia. Synchronous airway le-
sions may be present in up to 19% of infants with laryn-
gomalacia, but only 3.9% of patients with laryngoma-

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**Table. Synchronous Airway Lesions and Esophagitis in Young Patients Undergoing Adenoidectomy**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Patients (n = 32)</th>
<th>&lt;12 (n = 14)</th>
<th>12-17 (n = 18)</th>
<th>P Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous airway lesions</td>
<td>19 (59)</td>
<td>10 (71)</td>
<td>9 (50)</td>
<td>.29</td>
</tr>
<tr>
<td>Laryngomalacia</td>
<td>8 (25)</td>
<td>7 (50)</td>
<td>1 (6)</td>
<td>.01</td>
</tr>
<tr>
<td>Laryngeal edema</td>
<td>9 (28)</td>
<td>5 (36)</td>
<td>4 (22)</td>
<td>.45</td>
</tr>
<tr>
<td>Vocal nodules</td>
<td>3 (9)</td>
<td>0</td>
<td>3 (17)</td>
<td>.24</td>
</tr>
<tr>
<td>Subglottic stenosis (grade 1 or 2)</td>
<td>4 (13)</td>
<td>3 (21)</td>
<td>1 (6)</td>
<td>.30</td>
</tr>
<tr>
<td>Tracheal vascular compression</td>
<td>4 (13)</td>
<td>2 (14)</td>
<td>2 (11)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>GER</td>
<td>10 (31)</td>
<td>6 (43)</td>
<td>4 (22)</td>
<td>.27</td>
</tr>
<tr>
<td>EE</td>
<td>4 (13)</td>
<td>0</td>
<td>4 (22)</td>
<td>.11</td>
</tr>
<tr>
<td>Any esophagitis</td>
<td>14 (44)</td>
<td>6 (43)</td>
<td>8 (44)</td>
<td>&gt;.99</td>
</tr>
</tbody>
</table>

Abbreviations: EE, eosinophilic esophagitis; GER, gastroesophageal reflux.
*Unless otherwise indicated, data are reported as number (percentage) of patients. All patients were younger than 18 months.
†Fisher exact test.
cia have synchronous airway lesions that are serious enough to warrant surgery. Thus, some authors have discouraged routine rigid endoscopy in these patients, whereas others have recommended routine rigid endoscopy to avoid missing the uncommon case of a rare, life-threatening synchronous lesion.

Gastroesophageal reflux disease, common in infants to begin with, seems to be quite prevalent in children undergoing adenoidectomy for airway obstruction. In a retrospective study of 95 children undergoing adenoidectomy for adenoid hypertrophy and chronic nasopharyngitis, GERD (assessed by a variety of tests) was present in 42% overall, and in 88% of patients 1 year or younger compared with only 7% of a control group undergoing placement of tympanostomy tubes only. In another study of 24 infants younger than 1 year undergoing adenoidectomy for OSA, GERD was diagnosed preoperatively in 87.5% of patients using 24-hour midesophageal pH-metry. Carr et al noted that only 50% of children who underwent adenoidectomy experienced complete resolution of symptoms, leading the researchers to suspect that GERD and laryngopharyngeal reflux were contributing factors. They recommended laryngeal endoscopy in all young patients undergoing adenoidectomy to assess for signs of laryngitis. On the other hand, Shatz noted that most of the infants who underwent adenoidectomy in his study were taking medication for reflux preoperatively, and none seemed to require reflux medication postoperatively, leading him to suspect that treatment of upper airway obstruction led to the resolution of reflux. It has been suggested that the negative inspiratory effort associated with airway obstruction in infants can lead to significant negative intrathoracic pressure and positive intraabdominal pressure, which can exert a significant potentiating effect on reflux.

Although most infants younger than 18 months who undergo adenoidectomy for upper airway obstruction experience relief of symptoms postoperatively, synchronous airway lesions and GERD are common in this population and could potentially be contributing factors to upper airway obstruction. The decision to perform endoscopy in patients younger than 18 months undergoing adenoidectomy continues to be a subject of debate. Concern regarding the potential to miss an occasional case of a serious synchronous abnormality has led us to perform endoscopy in most of our infants in this category, even in the absence of any craniofacial dysmorphism, neuromuscular delay, or congenital syndrome.

When synchronous airway lesions or esophageal inflammatory changes are found in young children with upper airway obstruction and adenoid hypertrophy, the adenoids should still be addressed in most instances, especially if they still appear to be the most obvious source of the symptoms. The decision to perform surgical or medical interventions for synchronous airway lesions would depend on the degree of obstruction perceived endoscopically, or on the degree of esophagitis perceived histologically, combined with an assessment of any ongoing airway symptoms that may persist even after the child has healed from adenoidectomy. For example, persistent failure to thrive and apparent life-threatening events following adenoidectomy in an infant with endoscopically severe laryngomalacia may lead to consideration of a supraglottoplasty procedure. Persistent nasal congestion and airway obstruction in an infant undergoing antireflux medical therapy who has healed from adenoidectomy and for whom histologic esophagitis was the only other synchronous finding should trigger consideration of studies such as esophageal and pharyngeal pH probe testing, gastric scintigraphy, and possibly a gastric fundoplication. Consideration can also be given to the potential role of environmental allergies and immunodeficiency.

Each case must be considered individually, and a multidisciplinary approach is encouraged. One must also be prepared to wait out the transient worsening of upper airway obstruction from edema and postanesthetic emergence after adenoidectomy before being able to critically reassess the contribution of any synchronous airway lesions to ongoing respiratory symptoms.

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Correspondence: Robert F. Yellon, MD, Division of Pediatric Otolaryngology, Children’s Hospital of Pittsburgh, 3705 Fifth Ave, Pittsburgh, PA 15213 (robert.yellon@chp.edu).

Author Contributions: Dr Yellon 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: Mandell. Acquisition of data: Mandell and Yellon. Analysis and interpretation of data: Mandell and Yellon. Drafting of the manuscript: Mandell. Critical revision of the manuscript for important intellectual content: Yellon. Statistical analysis: Mandell. Study supervision: Yellon.

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REFERENCES


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