Synchronous Airway Lesions and Esophagitis in Young Patients Undergoing Adenoidectomy

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**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.

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Adenoid hypertrophy is one of the most common causes of pediatric nasal obstruction. It can lead to pediatric respiratory distress and is an important cause of obstructive sleep apnea (OSA) in infants and children. Effects of pediatric OSA can include failure to thrive, pulmonary hypertension, cor pulmonale, and neurocognitive problems that can adversely affect future school performance.

The contribution of adenoid hypertrophy to pediatric upper airway obstruction is even more significant in the presence of other structural factors that compromise the upper airways. The prevalence of synchronous airway lesions in infants with adenoid hypertrophy has been only rarely reported. In children with OSA, dynamic synchronous airway lesions such as laryngomalacia have been found in 44% and seem to decrease in prevalence once children reach age 1 year, and gastroesophageal reflux disease (GERD) has been found in 88% of infants younger than 1 year with adenoid hypertrophy.

Adenoidectomy has been shown to be safe and effective at relieving upper airway obstruction in young infants. Failure of nonobese, otherwise healthy children to improve after adenotonsillar surgery for OSA may be due to persistent dynamic synchronous airway lesions. Thus, in children younger than 1 year, it has been recommended that a careful endoscopic evaluation of the upper airway should be performed to help guide surgical therapy and help in postoperative planning and expectations.
All patients younger than 18 months (<540 days) undergoing adenoidectomy at Children's Hospital of Pittsburgh by the authors (D.L.M. and R.F.Y.) from January 1, 2001, to July 1, 2003, were identified using a computerized medical record search of Current Procedure Terminology codes 42830 and 42835. Adenoidectomy was performed with the patient under general anesthesia with a combination of suction electrocautery at 30 to 35 W and forceps debridement of residual adenoid tissue. Operative reports, including any simultaneous endoscopic procedures and associated findings, were reviewed. This study was approved by the University of Pittsburgh institutional review board and was designated as "exempt" under section 45 Code of Federal Regulations 46.101b(4).

The primary reason for endoscopic evaluation at the time of adenoidectomy was to search for any potential synchronous aerodigestive abnormalities that could theoretically be contributing to airway obstruction in addition to adenoid hypertrophy in these very young patients.

To be included in the study, patients needed to have been diagnosed with adenoid hypertrophy with associated clinical symptoms of upper airway obstruction, including snoring, mouth breathing, and restless sleep. Since the goal of the study was to determine the prevalence of synchronous airway lesions among otherwise healthy infants with adenoid hypertrophy, children with known congenital syndromes, craniofacial anomalies, or severe neurodevelopmental delay were excluded.

Endoscopic images were viewed on a Sony HR Trinitron color video monitor (Sony Corp, Tokyo, Japan) using a Storz camera adaptor and a xenon light source (Karl Storz, Culver City, Calif.). Flexible fiberoptic nasolaryngoscopy was performed using a 4-mm Storz flexible laryngoscope (Karl Storz) to assess dynamic true vocal fold mobility. Storz rigid pediatric bronchoscopes and esophagoscopes cannulated with a 0° Hopkins rod telescope (Karl Storz) were used to perform laryngobronchoscopy and esophagoscopy. Laryngeal edema was considered present if the operative report described edema of the arytenoid, interarytenoid, and/or membranous true vocal fold mucosa. Subglottic stenosis was sized using the Cotton-Myer grading scale.4

Vascular compression of the trachea was diagnosed when pulsatile compression of the trachea resulting in an estimated 50% or more narrowing of the tracheal lumen was witnessed endoscopically. Two posterior wall mucosal biopsy specimens were obtained from the endoscopically estimated distal third of the esophagus using optical biopsy forceps (Karl Storz Inc, Tuttlingen, Germany). Occasionally, flexible (in lieu of rigid) esophagoscopy with blinded grasp biopsy through the scope (Olympus, Tokyo, Japan) was performed by gastroenterology staff members.

Esophageal specimens underwent routine processing with vascular sectioning and staining with hematoxylin-eosin. The pathology department in our hospital makes the diagnosis of histologic esophagitis suspicious for GERD if at least 2 of the following 3 features are present: (1) basal cell hyperplasia, (2) elevated papillary height, and (3) inflammatory epithelial inflammation with eosinophils, neutrophils, or lymphocytes.5 For purposes of the present study, an esophageal biopsy specimen with 2 or 3 of the features described herein was considered positive. Eosinophilic esophagitis was diagnosed when there were more than 20 eosinophils present per high-powered field.6

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=15; 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 recurrence of upper airway obstruction following adenoidectomy. A greater number of patients younger than 12 months (8/14; 57%) experienced recurrent or persistent symptoms of upper airway obstruction than older patients (4/19; 21%), although this difference was not statistically 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 remained asymptomatic (mean, 4 months; range, 2 weeks–12 months). Among the 12 patients who developed recurrent upper airway obstruction after adenoidectomy, subsequent interventions included tonsillectomy alone (n = 3), tonsillectomy and revision adenoidectomy (n = 5), antibiotic therapy for tonsillitis (n = 2), revision adenoidectomy alone (n = 1), and repeated upper aerodigestive tract endoscopy with esophageal biopsy showing persistence of reflux esophagitis (n = 1). All experienced symptomatic improvement 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 upper airway obstruction, esophagitis (GERD and/or eosinophilic esophagitis) was present in 7 (70%) of 10 assessed with esophagoscopy, and synchronous airway lesions were present in 7 (58%) of 12 assessed with airway endoscopy. Among those patients who had complete resolution of symptoms postoperatively with no known recurrence, esophagitis was found in 6 (50%) of 12 assessed with esophagoscopy, and synchronous airway 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 obstruction after adenoidectomy and those who did not.

In the present study, upper aerodigestive tract endoscopy 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 studies 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 adenoidectomy despite these other findings, with adenoid regrowth and tonsillar hypertrophy more likely to be a cause of recurrent symptoms than reflux or synchronous laryngotracheal 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, laryngomalacia was found in 44%, and children younger than 1 year had a greater amount of dynamic abnormalities (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 synchronous finding, especially in children younger than 1 year. The lack of postadenoidectomy symptoms associated with most dynamic synchronous airway lesions (eg, laryngomalacia) may be owing to a decrease in upper airway resistance after adenoidectomy, thus leading to improvement in the accompanying dynamic disorder.2

A similar debate exists with regard to the evaluation of infants with laryngomalacia. Synchronous airway lesions may be present in up to 19% of infants with laryngomalacia, but only 3.9% of patients with laryngomalacia...
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 reflex 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 immuno deficiency.

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.