



# Obstructive Sleep Apnea in Children

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E. Grier de Lauréal, MD

Pediatric Otolaryngology

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- No Disclosures

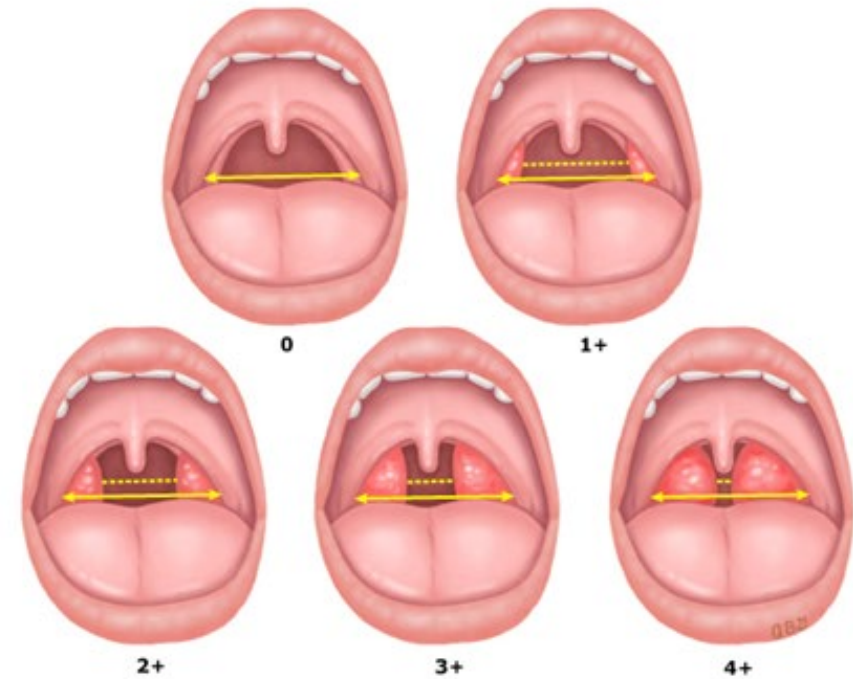
# Pediatric OSA

- 1 to 5 percent of children affected
- Most commonly between 2 and 6 years old
- Snoring in up to almost 20% of young children

# Risk Factors

- Adenotonsillar hypertrophy
- Obesity
  - Particularly in adolescents
- Other neurologic, skeletal or medical causes
  - Cerebral palsy, down syndrome, cranio-facial anomalies, Prader-Willi, etc

## Standardized grading of tonsil size



Tonsil size is most often described on a scale from 0 to 4+:

- 0 – Tonsils are entirely within the tonsillar pillar or previously removed by surgery.
- 1+ – Tonsils occupy less than 25% of the lateral dimension of the oropharynx, as measured between the anterior tonsillar pillars (solid yellow arrow).
- 2+ – Tonsils occupy 26 to 50% of the lateral dimension of the oropharynx.
- 3+ – Tonsils occupy 51 to 75% of the lateral dimension of the oropharynx.
- 4+ – Tonsils occupy more than 75% of the lateral dimension of the oropharynx.

Drawing based on text description in: Brodsky L. Modern assessment of tonsils and adenoids. *Pediatr Clin North Am* 1989; 36:1551.

# What to ask?



- Nocturnal symptoms

- Snoring 3 or more nights a week (insufficient alone!)
- Mouth breathing, pauses in breathing, coughing or choking in sleep, restless sleep
- Enuresis
- Sleep walking or sleep terrors
- Teeth grinding



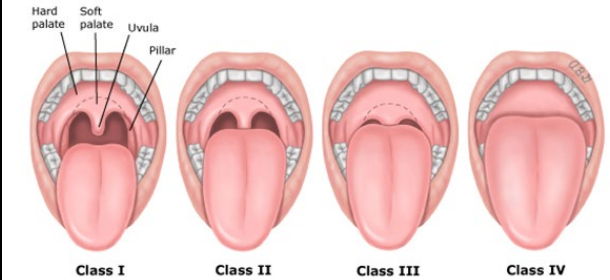
- Daytime symptoms

- Sleepiness less common in kids
  - Age inappropriate naps, falling asleep in school, bus etc
- Behavioral problems
  - Hyperactivity, aggression, impulsivity
- Mouth breathing
- Morning headaches

# Evaluation

- History as before
  - snoring, pauses in breathing, enuresis, etc
- Exam
  - Growth – obese? Or poor growth?
  - Head and Face
    - Craniofacial anomalies (ie retrognathia, midface hypoplasia), mouth breathing, turbinate hypertrophy
  - Mouth
    - High arched palate, macroglossia, tonsil size

## The modified Mallampati classification for difficult laryngoscopy and intubation



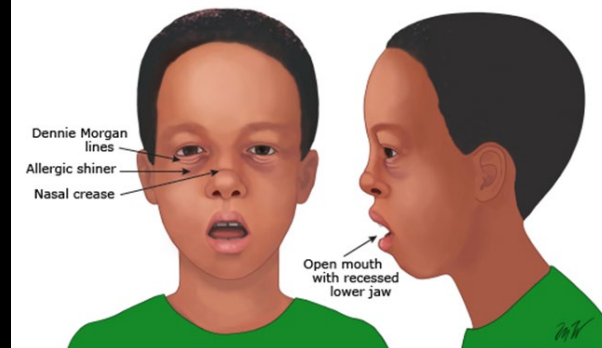
The modified Mallampati classification<sup>[1]</sup> is a simple scoring system that relates the amount of mouth opening to the size of the tongue and provides an estimate of space available for oral intubation by direct laryngoscopy. According to the Mallampati scale, class I is present when the soft palate, uvula, and pillars are visible; class II when the soft palate and the uvula are visible; class III when only the soft palate and base of the uvula are visible; and class IV when only the hard palate is visible.

Reference:

1. Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. *Anaesthesia* 1987; 42:487.

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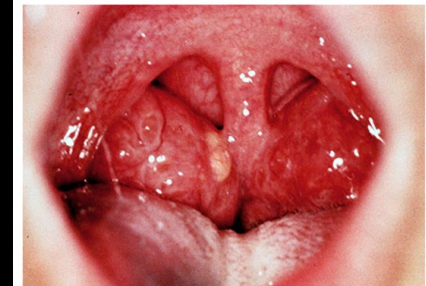
## Child with allergies



Children with allergic rhinitis may display "allergic shiners" and "adenoid facies," resulting from longstanding mouth-breathing. The features of adenoid facies include a long, narrow face; narrow, upturned nose; short upper lip; exposed upper incisors; recessed lower jaw; and forward head posture.

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## Large tonsils



Large tonsils often accompany obstructive sleep apnea in children. This photograph shows tonsils that would be graded as 4+ and could easily cause airway obstruction during sleep.

Courtesy of Dr. Ron Mitchell.

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# Evaluation

- Gold standard: in lab polysomnography (PSG)
- Only diagnostic tool to definitively identify obstructive events and classify severity of OSA
- Lots of variation in clinical practice regarding use of PSG
  - Ease of obtaining/availability factor
  - Generally recommend for high risk patients
  - When exam and symptoms do not correlate
- Video/audio recordings from parents

# PSG – what are we looking for

- AHI
  - Obstructive vs central
  - 1-5 mild, 5-10 moderate, >10 severe
- Sleep efficiency
- REM
- O2 nadir
- CO2

## Sleep Architecture

The total recording time of the polysomnogram was 452.8 minutes. The total sleep time was 367.5 minutes. The patient spent 0.8% of total sleep time in Stage N1, 62.2% in Stage N2, 30.1% in Stages N3, and 6.9% in REM. Sleep latency was 25.9 minutes. REM latency was 280.5 minutes. Sleep Efficiency was 81.2%. Wake after sleep onset was 59.5 minutes.

## Respiratory Events

The polysomnogram revealed a presence of 6 obstructive, 27 central, and 1 mixed apneas resulting in a Total Apnea index of 5.6 events per hour. There were 91 hypopneas resulting in a Total Hypopnea index of 14.9 events per hour. The combined Apnea/Hypopnea index was 20.4 events per hour. There were a total of 0 RERA events resulting in a Respiratory Disturbance Index (RDI) of 20.4 events per hour.

Mean oxygen saturation was 95.1%. The lowest oxygen saturation during sleep was 87.0%. Time spent  $\leq 88\%$  oxygen saturation was 2.3 minutes (0.5%). End Tidal  $\text{CO}_2$  during sleep ranged from 20.2 to 49.8 mmHg. End Tidal  $\text{CO}_2$  was greater than 50 mmHg for 0 minutes and greater than 55 mmHg for 0 minutes. Transcutaneous  $\text{CO}_2$  during sleep ranged from 33.0 to 41.8 mmHg. Transcutaneous  $\text{CO}_2$  was greater than 50 mmHg for 0 minutes and greater than 55 mmHg for 0 minutes.

## Limb Activity

There were 0 limb movements recorded. Of this total, 0 were classified as PLMs. Of the PLMs, 0 were associated with arousals. The Limb Movement index was 0 per hour while the PLM index was 0 per hour and PLM with arousals index was 0 per hour.

## Cardiac Summary

The average pulse rate was 87.8 bpm. The minimum pulse rate was 18.0 bpm while the maximum pulse rate was 155.0 bpm.

## Other notable findings:

Patient was breastfeed intermittently throughout the study.

## Diagnosis:

1. This study demonstrates Severe OSA (G47.33). The overall AHI was 20.4, the central apnea index was found to be 4.5 and the obstructive AHI was 15.9. The observed central apneas were primarily physiologic, occurring during sleep/wake transitions, post-arousal, or during phasic REM sleep. Therefore, no further evaluation is needed.
2. Sleep related hypoxemia (G47.36): O2 nadir was 87%. The oxygen desaturation index (ODI) is 34.9. The patient spent 6.2 minutes of sleep time with an oxygen saturation below 90 %. Oxygen desaturations were secondary to respiratory events, brief, with self recovery.
3. No significant hypercapnia was noted.
4. Suboptimal sleep architecture for age with arousals/awakenings likely related to OSA, technical interventions and study related disruptions (first night effect).

Conditions that warrant preoperative polysomnogram prior to adenotonsillectomy

| Condition/disease                          | Comments                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Age <2 years                               | The risk for perioperative respiratory complications is increased compared with older children. The clinical examination may not accurately predict the presence of OSA.                                                                                                                                                               |
| Obesity (BMI ≥95 <sup>th</sup> percentile) | Risk for OSA generally increases with the severity of obesity.                                                                                                                                                                                                                                                                         |
| Down syndrome                              | Evaluate for hypothyroidism prior to surgery. In addition, there is an increased risk for atlantoaxial instability for children with Down syndrome.<br><br>These patients are likely to require adjuvant surgical procedures or therapy to manage residual sleep apnea after adenotonsillectomy, due to multiple sites of obstruction. |
| Craniofacial anomalies                     | Severity and sites of airway obstruction vary depending on the anomaly.<br><br>These patients are likely to require adjuvant procedures or therapy to manage sleep apnea, due to multiple sites of obstruction.                                                                                                                        |
| Neuromuscular disorders                    | These children also may have significant hypoventilation, in addition to obstructive symptoms.                                                                                                                                                                                                                                         |
| Mucopolysaccharidosis                      | Pulmonary and cardiac dysfunction may also be present.                                                                                                                                                                                                                                                                                 |
| Sickle cell disease                        | These children have increased adenoid and tonsil size compared with normal volunteers. They are also at increased risk for complications in the immediate perioperative period, including acute chest syndrome.                                                                                                                        |

Children with these conditions are at risk for OSA and/or respiratory complications following adenotonsillectomy.

# Management

- Based on age, symptoms, co-morbidities, PSG
- Adenotonsillectomy
- Watchful waiting up to 6 months
- Positive airway pressure
- Corticosteroids or anti-inflammatory therapy

# What if I do nothing?

- Untreated severe OSA 
  - HTN
  - Altered cardiac morphology (ie R and L ventricular hypertrophy)
  - Pulmonary HTN (limited data in children)
  - Poor growth
    - Excess energy breathing during sleep
    - GH may be decreased
  - ADHD or disruptive behavior

## Clinical manifestations of obstructive sleep apnea in children

### Nighttime symptoms

- Snoring
- Labored breathing; paradoxical abdominal movements
- Apneas, pauses in breathing, or gasping
- Mouth breathing
- Restless or agitated sleep
- Sleeping in unusual positions (neck extended)
- Nighttime sweating, preference for minimal clothing
- Nocturnal enuresis or nocturia
- Sleepwalking, sleep terrors, or confusional arousals

### Daytime symptoms

- Mouth breathing, hyponasal speech
- Poor school functioning or other behavioral concerns (inattentiveness, difficulty learning, hyperactivity, impulsivity, irritability, rebelliousness, aggression)
- Sleepiness (eg, falls asleep at school or in the car, or excessive napping)
- Morning headache

### Potential consequences in childhood

- Attention deficit hyperactivity disorder (ADHD) or disruptive behavior disorders
- Poor growth (especially in infants and young children)
- Hypertension
- Altered cardiac morphology (right and left ventricular hypertrophy)
- Pulmonary hypertension

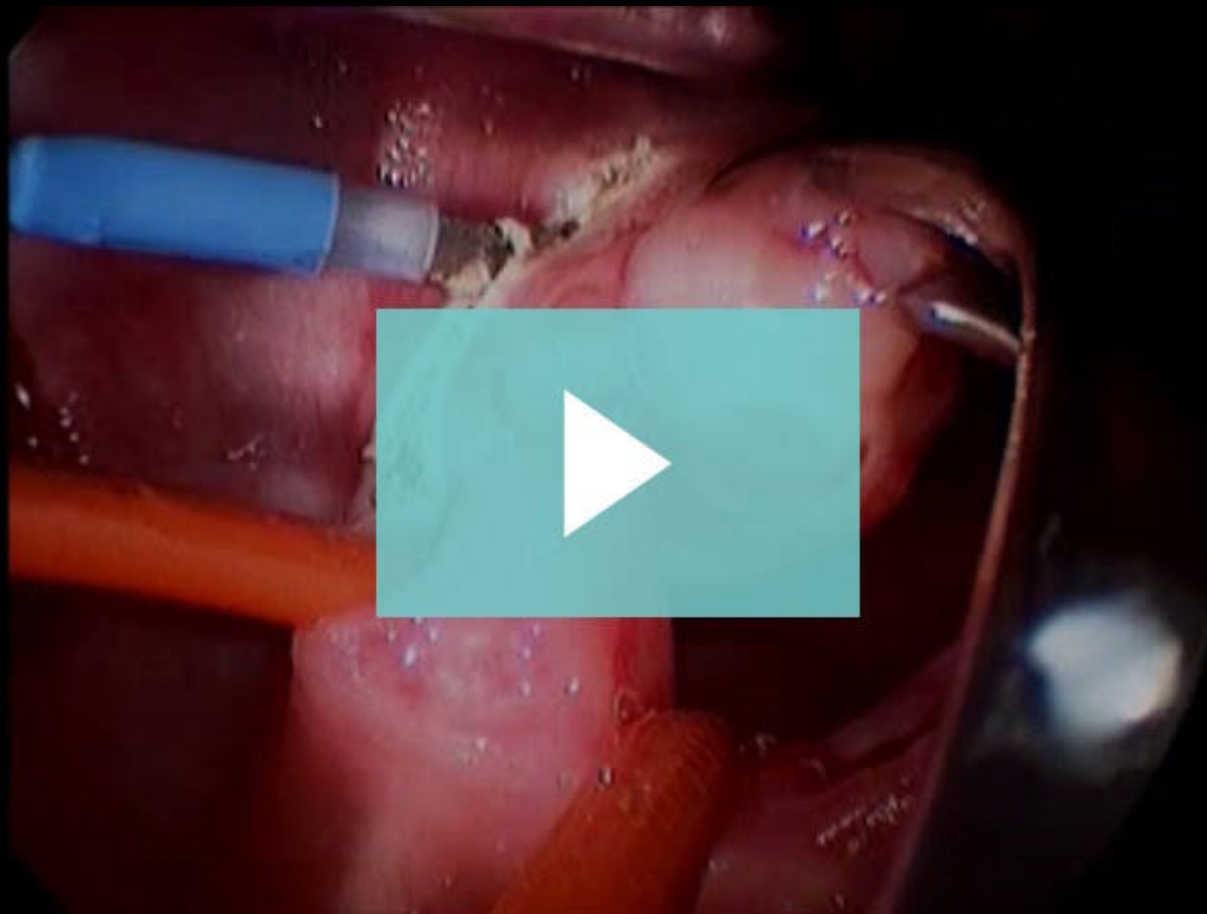
*Courtesy of Shalini Paruthi, MD.*

# Adenotonsillectomy

- Generally first line for otherwise healthy children with adenotonsillar hypertrophy
  - Severe OSA (AHI >10)
  - OSA symptoms plus recurrent tonsillitis
    - Paradise criteria: 7 infections in a year, 5 a year for two years or more or 3 a year for 3 years or more
- Even for those with documented severe OSA with no hypertrophy
- Role in mild to moderate OSA as well

# Adenotonsillectomy

- Surgical techniques
  - Cold steel
  - Bovie electrocautery\*\*\*what we use here
  - Coblator
  - Gold laser
- Recovery
  - Up to 2 weeks
- Risks
  - Bleeding 2-3% generally
  - Dehydration/need for hospitalization
  - VPI – less than 1/1000



# Adenotonsillectomy in Complicated OSA

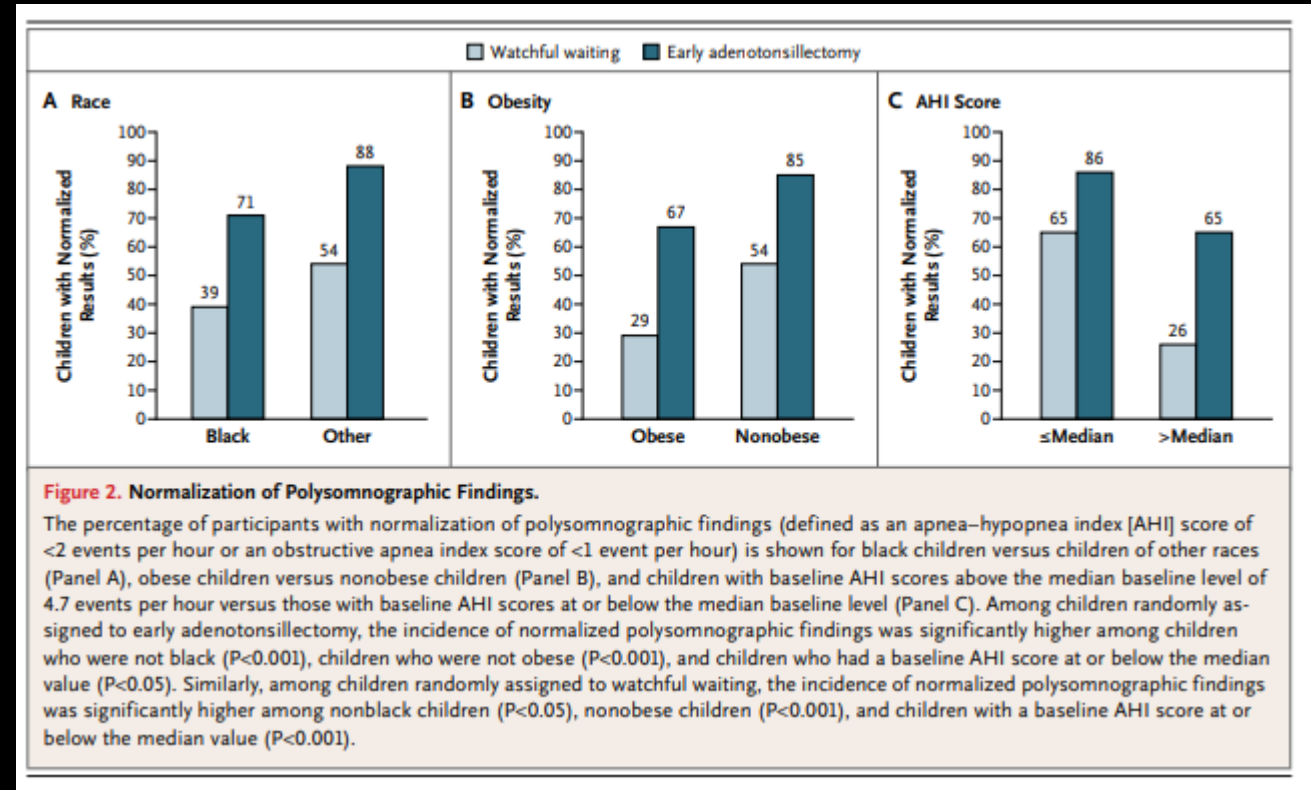
- Increased peri-operative risk
- Obesity
- Very young age (<36 months)
- Abnormal upper airway tone
- Congenital syndromes
- Craniofacial anomalies

# Watchful Waiting

- For those with mild-moderate OSA on PSG
- Supportive care
  - Treat allergies, asthma, nasal dryness with saline
- Sleep hygiene

# Childhood Adenotonsillectomy Trial (CHAT)

- 2013 NEJM
- Children 5-9 with AHI 1-30
- T&A as compared to watchful waiting led to:
  - Improvement in quality of life
  - Behavior
  - Subjective sleepiness
  - Sleep apnea symptoms
    - Normalized AHI 79% in T&A vs 46% in watchful waiting



# CHAT Study

**Table 2. Outcome Measures.\***

| Outcome                                       | Normative Mean | Watchful Waiting |                              | Early Adenotonsillectomy |                              | Effect Size† | P Value  |
|-----------------------------------------------|----------------|------------------|------------------------------|--------------------------|------------------------------|--------------|----------|
|                                               |                | Baseline         | Change from Baseline to 7 Mo | Baseline                 | Change from Baseline to 7 Mo |              |          |
| Primary outcome                               |                |                  |                              |                          |                              |              |          |
| NEPSY attention and executive-function score‡ | 100±15         | 101.1±14.6       | 5.1±13.4                     | 101.5±15.9               | 7.1±13.9                     | 0.15         | 0.16     |
| Secondary outcomes                            |                |                  |                              |                          |                              |              |          |
| Conners' Rating Scale score§                  | 50±10          |                  |                              |                          |                              |              |          |
| Caregiver rating                              |                | 52.6±11.7        | −0.2±9.4                     | 52.5±11.6                | −2.9±9.9                     | 0.28         | 0.01     |
| Teacher rating                                |                | 55.1±12.8        | −1.5±10.7                    | 56.4±14.4                | −4.9±12.9                    | 0.29         | 0.04     |
| BRIEF score¶                                  | 50±10          |                  |                              |                          |                              |              |          |
| Caregiver rating                              |                | 50.1±11.5        | 0.4±8.8                      | 50.1±11.2                | −3.3±8.5                     | 0.28         | <0.001   |
| Teacher rating                                |                | 56.4±11.7        | −1.0±11.2                    | 57.2±14.1                | −3.1±12.6                    | 0.18         | 0.22     |
| PSQ-SRBD score                                | 0.2±0.1        | 0.5±0.2          | −0.0±0.2                     | 0.5±0.2                  | −0.3±0.2                     | 1.50         | <0.001   |
| PedsQL score**                                | 78±16          | 76.5±15.7        | 0.9±13.3                     | 77.3±15.3                | 5.9±13.6                     | 0.37         | <0.001   |
| Apnea-hypopnea index — no. of events/hr††     | NA             |                  |                              |                          |                              |              |          |
| Median                                        |                | 4.5              | −1.6                         | 4.8                      | −3.5                         | 0.57         | <0.001‡‡ |
| Interquartile range                           |                | 2.5 to 8.9       | −3.7 to 0.5                  | 2.7 to 8.8               | −7.1 to −1.8                 |              |          |

# Positive airway pressure therapy

- Managed by Pulmonology/Sleep Medicine
- For those with minimal adenotonsillar tissue
- Strong preference for non-surgical management
- May be preferable to stabilize patients with severe OSA prior to surgery
- CPAP vs BiPAP



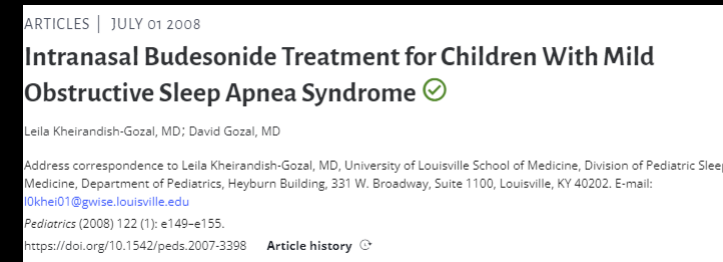
# Corticosteroids or Anti-inflammatory

- Mild or moderate OSA, nasal obstruction
- Intranasal corticosteroids +/- Leukotriene modifier
  - 2-4 weeks
  - Side effects
    - Nosebleeds
    - Nightmares, aggression, depression



# Where does this data come from?

- Randomized trial of 25 children 6 weeks of intranasal steroid reduced AHI from 11 to 6 events per hour
- Double blind crossover trial of 48 children treated with budesonide, 50% showed normalization of PSG parameters
- Systematic review concluded intranasal steroids may improve nasal obstruction but effects on PSG uncertain



# Where does this data come from?

- Cochrane review showed reduction in AHI, possibly adenotonsillar size with monteleukast
- Retrospective review of 752 children with mild OSA treated with a combination of intranasal corticosteroids and montelukast
  - > 80% experienced beneficial effects

## Antiinflammatory Therapy Outcomes for Mild OSA in Children

[Leila Kheirandish-Gozal MD](#), [Rakesh Bhattacharjee MD](#), [Hari P.R. Bandla MD, FCCP](#),  
[David Gozal MD, FCCP](#)  

Cochrane Database of Systematic Reviews | [Review - Intervention](#)

[New search](#) [Conclusions changed](#)

## Anti-inflammatory medications for obstructive sleep apnoea in children

 [Stefan Kuhle](#), [Dorle U Hoffmann](#), [Souvik Mitra](#), [Michael S Urschitz](#) [Authors' declarations of interest](#)

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# Refractory OSA

- Persistent OSA after T&A in 25% or more
- Often this may push parents towards trial of conservative treatment
- What is it?
  - AHI greater than 1 event per hour with symptoms or >5 without

## Expert Consensus Statement: Management of Pediatric Persistent Obstructive Sleep Apnea After Adenotonsillectomy

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Stacey L. Ishman, MD, MPH<sup>1</sup>, Stephen Maturo, MD<sup>2</sup>,  
Seth Schwartz, MD, MPH<sup>3</sup>, Margo McKenna, MD<sup>4</sup>, Cristina  
M. Baldassari, MD<sup>5</sup>, Mathieu Bergeron, MD<sup>6</sup>,  
Boris Chernobilsky, MD<sup>7</sup>, Zarmina Ehsan, MD<sup>8</sup>, Lisa Gagnon,  
APRN CPNP<sup>9</sup>, Yi-Chun Carol Liu, MD<sup>10</sup>, David F. Smith, MD,  
PhD<sup>11</sup>, Jeffrey Stanley, MD<sup>12</sup>, Habib Zalzal, MD<sup>13</sup>, and  
Nui Dhepyasuwan, MEd<sup>14</sup>

| Number | Statement                                                                                                                                                                                                                                                                                               | Mean | Outliers |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 2      | Children have persistent OSA if they have an AHI of greater than 1 event/hour with symptoms: or an AHI of greater than 5 events/hour without symptoms after tonsillectomy.                                                                                                                              | 7.72 | 1        |
| 3      | Shared decision making (including the likelihood of success/cure of additional interventions) assists families and children to determine their optimal surgical and nonsurgical management of persistent OSA.                                                                                           | 8.40 | 0        |
| 16     | Children have persistent OSA if they have mild to moderate OSA (obstructive AHI between 1 and 10 events/hour) with associated daytime and/or nighttime OSA symptomatology after AT.                                                                                                                     | 7.90 | 1        |
| 17     | Children with persistent OSA after AT benefit from multidisciplinary treatment with specific practitioners determined by the medical needs of the child. These providers can include primary care physicians, sleep medicine clinicians, dentists, otolaryngologists, and pulmonologists, among others. | 8.81 | 0        |
| 18     | Symptoms suggesting persistent OSA include snoring, mouth breathing, secondary enuresis, difficulty with attention, fatigue, behavioral problems, underweight/overweight, restless sleep, and hyperactivity.                                                                                            | 8.27 | 1        |

Abbreviations: AHI, apnea hypopnea index; AT, adenotonsillectomy; OSA, obstructive sleep apnea.

| Number | Statement                                                                                                                                                                                                                                                          | Mean | Outliers |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 4      | PSG is useful after medical or surgical treatment of severe persistent OSA or mild or moderate persistent OSA with symptoms.                                                                                                                                       | 7.90 | 0        |
| 5      | When PSG is not readily available or when children cannot tolerate an in-laboratory PSG, alternate testing in children (eg, oximetry, home sleep testing, or cardiorespiratory study) can be used to evaluate persistent OSA.                                      | 7.72 | 1        |
| 23     | A PSG is useful after treatment <sup>a</sup> for persistent OSA to direct management for asymptomatic children with factors that increase the likelihood of persistent OSA that include Down syndrome, obesity, craniofacial syndromes, and neurologic impairment. | 7.72 | 1        |
| 25     | Waiting 3 months to obtain a PSG after surgical or medical treatment <sup>a</sup> in a child with persistent OSA allows for surgical recovery and establishment of normal sleep schedule.                                                                          | 7.90 | 0        |
| 29     | Instruments to evaluate symptom burden and QOL, such as the PSQ and OSA-18, are useful tools in assessing children at baseline and the impact of treatment and treatment modalities in children with persistent OSA.                                               | 7.90 | 0        |
| 30     | Evaluation for recurrent adenoid hypertrophy is indicated for children with nasal obstruction and persistent OSA after AT.                                                                                                                                         | 8.36 | 0        |

**Table 5. DISE Statements: Statements That Reached Consensus**

| Number | Statement                                                                                                                                        | Mean | Outliers |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 14     | Children undergoing DISE-directed surgery for persistent OSA may experience improvement in SDB symptoms and quality of life.                     | 7.81 | 0        |
| 31     | The nose is a common site of obstruction in children with persistent OSA and should be assessed.                                                 | 7.5  | 0        |
| 32     | DISE allows for identification of sites of obstruction before performing additional airway surgery for children with persistent OSA.             | 8.63 | 0        |
| 33     | Children undergoing DISE-directed surgery for persistent OSA may experience improvement in the apnea-hypopnea index and oxygen saturation nadir. | 7.72 | 0        |

Abbreviations: DISE, drug-induced sleep endoscopy; OSA, obstructive sleep apnea; SDB, sleep disordered breathing.

**Table 3. Management of Children With Obesity: Statements That Reached Consensus**

| Number | Statement                                                                                                                                                                   | Mean | Outliers |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 19     | Weight loss is part of a multipronged approach to treat overweight and obese children with persistent OSA.                                                                  | 8.18 | 1        |
| 20     | Weight loss in children with obesity and persistent OSA improves their OSA.                                                                                                 | 7.36 | 1        |
| 21     | Nutritional counseling is a necessary part of the multidisciplinary care for children with obesity and persistent OSA.                                                      | 7.72 | 1        |
| 22     | Children with obesity and persistent OSA benefit from treatment by weight-loss professionals, including but not limited to nutrition, endocrinology, and bariatric surgery. | 7.54 | 1        |

**Table 4. Medical Management: Statements That Reached Consensus**

| Number | Statement                                                                                                                                | Mean | Outliers |
|--------|------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 7      | In children with persistent OSA and surgically modifiable sites of obstruction, surgery or a trial of CPAP are both reasonable options.  | 8.72 | 0        |
| 8      | AutoPAP is a useful therapy in select children with persistent OSA who are awaiting CPAP titration study or further surgical management. | 8.27 | 0        |
| 10     | Intranasal steroids are a safe and effective treatment for children with mild or moderate persistent OSA and nasal obstruction.          | 7.90 | 1        |
| 11     | Montelukast is an effective treatment for children with mild or moderate persistent OSA and symptoms of SDB.                             | 7.63 | 1        |
| 13     | CPAP is a reasonable treatment option for children with obesity and persistent OSA.                                                      | 8.45 | 0        |
| 26     | Observation is reasonable for management of asymptomatic children with mild persistent OSA.                                              | 8.27 | 0        |

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**Table 6. Surgical Management: Statements That Reached Consensus**

| Number | Statement                                                                                                                                                                  | Mean | Outliers |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 12     | Tracheostomy is an effective treatment for patients with severe persistent OSA in whom other medical and surgical treatment modalities have failed or are contraindicated. | 8.63 | 0        |
| 37     | Lingual tonsillectomy is a safe and effective treatment for children with persistent OSA who have lingual tonsillar hypertrophy identified using endoscopy.                | 7.54 | 1        |
| 38     | Turbinate reduction surgery is a safe and effective treatment for children with persistent OSA who have turbinate hypertrophy.                                             | 7.72 | 1        |
| 39     | Supraglottoplasty is a safe and effective treatment for children with persistent OSA who have sleep dependent laryngomalacia identified on DISE.                           | 8.00 | 0        |
| 40     | Expansion pharyngoplasty is a safe and effective treatment for children with persistent OSA who have lateral wall collapse identified on DISE.                             | 7.45 | 1        |
| 42     | Mandibulomaxillary distraction is a safe and effective treatment for children with severe persistent OSA who have mandibulomaxillary insufficiency.                        | 7.09 | 1        |
| 43     | Hypoglossal nerve stimulator implantation is a safe and effective treatment for severe persistent OSA in children with Down syndrome.                                      | 7.63 | 0        |
| 44     | Craniofacial surgery is beneficial for children with craniofacial abnormalities and severe persistent OSA.                                                                 | 7.45 | 1        |

Abbreviations: DISE, drug-induced sleep endoscopy; OSA, obstructive sleep apnea.

**Table 7. Postoperative Management: Statements That Reached Consensus**

| Number | Statement                                                                                                 | Mean | Outliers |
|--------|-----------------------------------------------------------------------------------------------------------|------|----------|
| 46     | Overnight observation minimizes complications for children who undergo surgery for severe persistent OSA. | 7.80 | 1        |

Abbreviation: OSA, obstructive sleep apnea.

# Refractory OSA – Statements simplified

- Defines what it is
- Benefit from multidisciplinary team (ENT, sleep medicine, PCP etc)
- PSG useful
  - 3 months post op
- Weight loss/nutrition counseling helpful
- Trial of CPAP reasonable
- Trial intranasal steroids/montelukast

# Refractory OSA – Statements simplified

- Observation reasonable with mild persistent OSA
- DISE directed surgery may improve QOL, AHI, O2 nadir
- What is a DISE?
  - Drug induced sleep endoscopy
  - OR
  - Mimic sleep state
  - Observing upper airway sites of obstruction
  - Nose, palate, tongue base, larynx

# DISE - Nose

| Site          | No Obstruction                                                                                                                           | Partial Obstruction                                                                                                                                        | Significant Obstruction                                                                                                                |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Nasal Airway† |  <p>Airway is patent at anterior inferior turbinate</p> |  <p>Airway narrowed to less than 2mm at anterior inferior turbinate</p> |  <p>Anterior inferior turbinate contacts septum</p> |

# DISE - Adenoids



Less than 25% choana blocked or no adenoid



25-75% of choana blocked



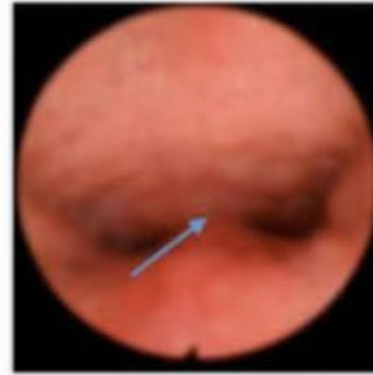
More than 75% of choana blocked

# DISE - Palate

Palate



No movement in respiratory cycle, no obstruction



Airway narrows causing partial obstruction



Completely closes oropharyngeal airway

# DISE – Oropharynx (Tonsils, lateral pharyngeal walls)



Less than 25% airway obstruction



25-75% obstruction of airway

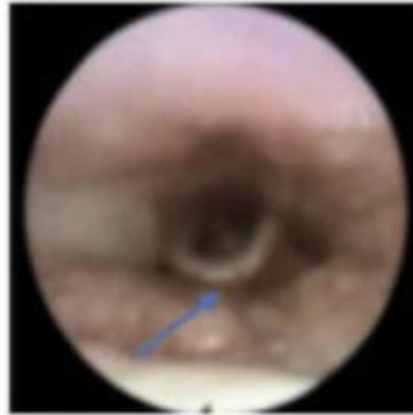


More than 75% obstruction of airway

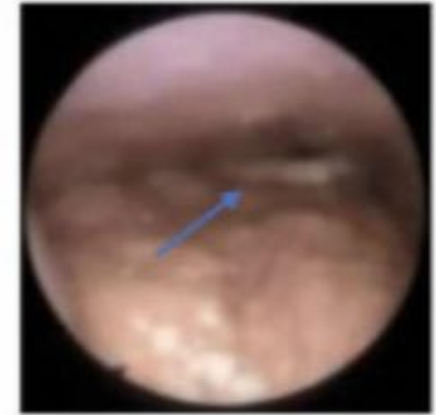
# DISE – Tongue Base



Widely patent retrolingual airway, no movement during respiration



Fills vallecula partially or completely but epiglottis is well positioned



Pushes epiglottis posteriorly such that epiglottis touches posterior pharyngeal wall

# DISE – Lingual Tonsils



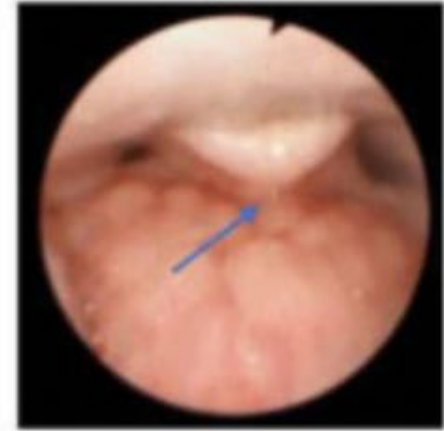
Not enlarged or absent

Patent vallecula



Fills vallecula but epiglottis does not completely obstruct airway

Vallecula partially filled by lingual tonsil or tongue base



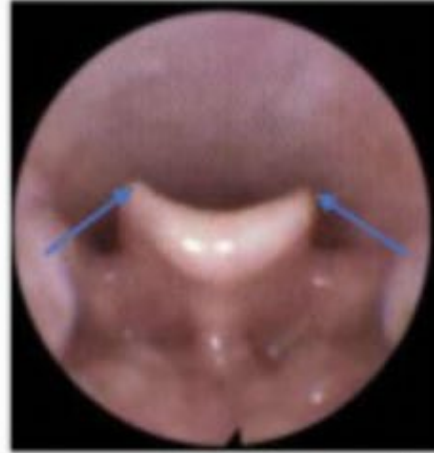
Displaces epiglottis posteriorly such that epiglottis touches posterior pharyngeal wall

Vallecula completely filled by lingual tonsil or tongue base

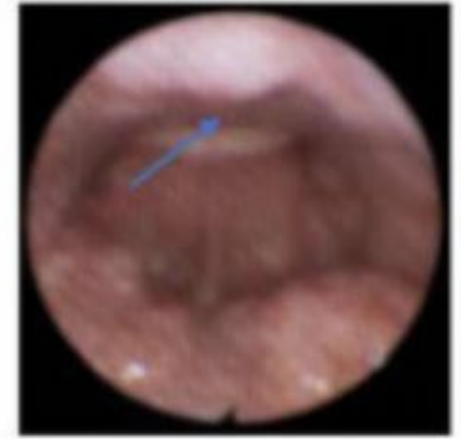
# DISE - Epiglottitis



Vertical, airway widely patent



Two-point contact with posterior pharyngeal wall,  
airway patent but narrowed

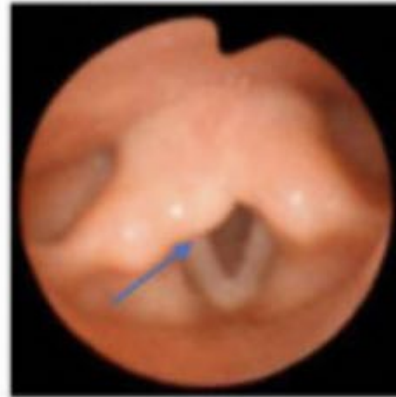


Touches posterior pharyngeal wall and  
obstructs airway

# DISE – AE folds/arytenoids



True and false cords visualized easily



Mild shortening, partially retracting epiglottis, vocal cords seen



Part of true cords not seen as arytenoid pulled forward by short AE folds



Vertical, no collapse



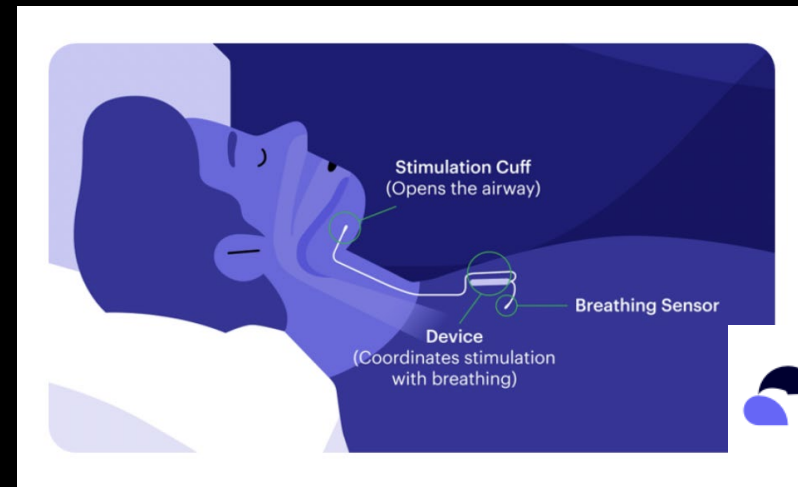
Movement anteriorly and/or medially during respiration



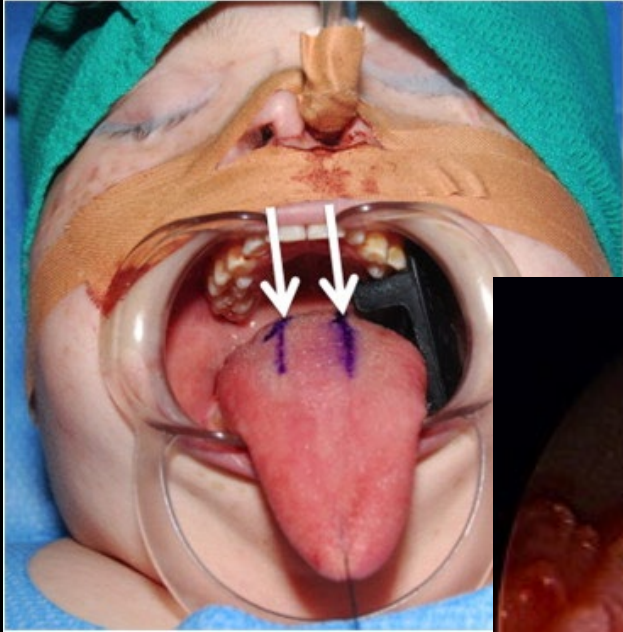
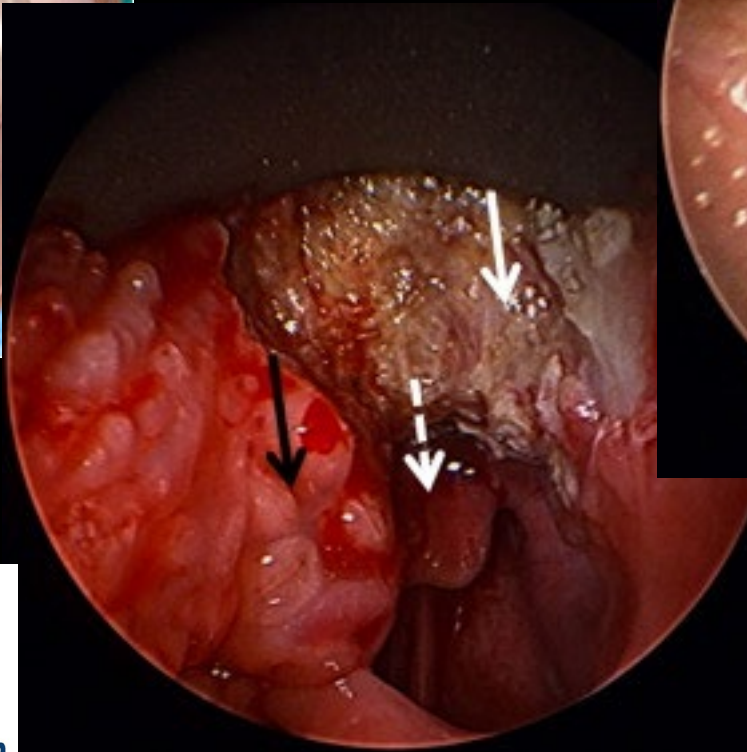
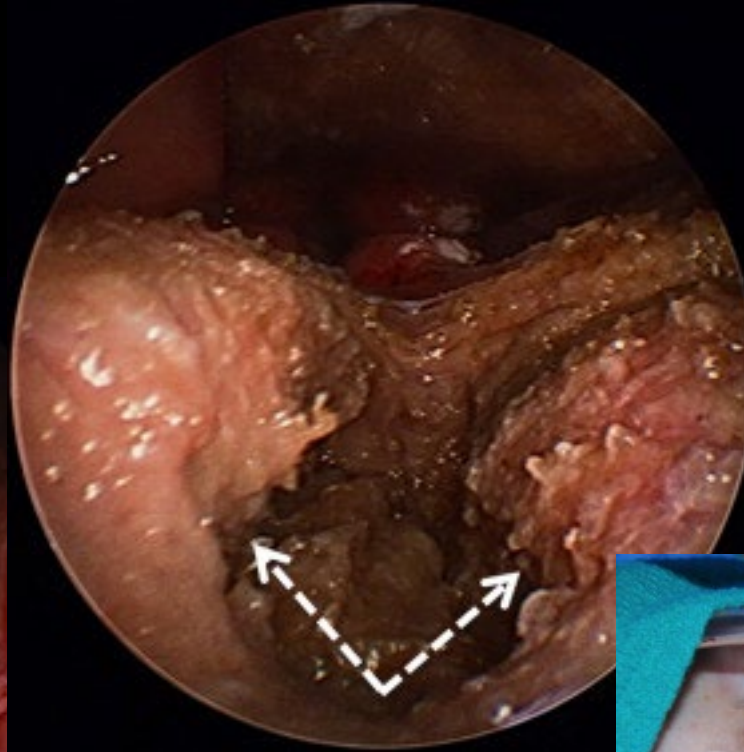
Complete collapse into glottis

# What after a DISE?

- Address sites of obstruction – usually at time of DISE
  - Some do under separate anesthetic
- Sometimes needs to be staged
- Tracheostomy is always a definitive option in severe OSA
- Hypoglossal nerve stimulation is an option for Down syndrome
  - Older than 13
  - AHI 10-50



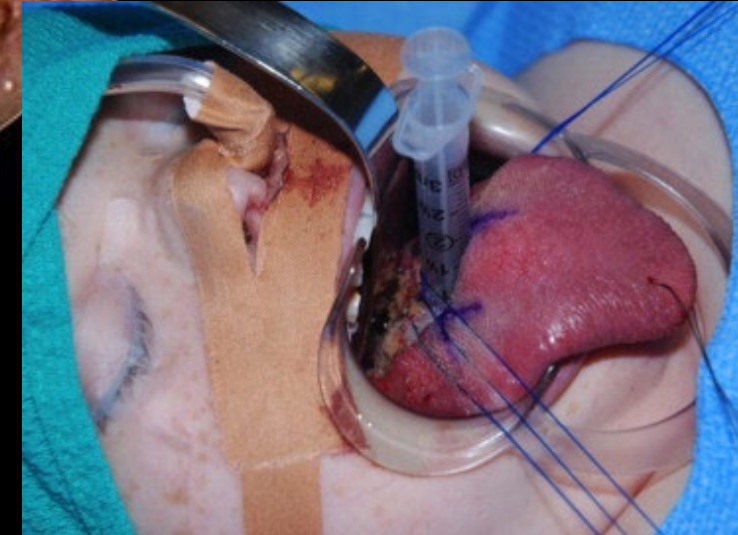
# Lingual tonsillectomy/Midline glossectomy



**Lingual tonsillectomy and midline posterior glossectomy in children with obstructive sleep apnea**

Evan J. Propst, MD, MSc, FRCSC<sup>a,b</sup>

*From the <sup>a</sup>Department of Otolaryngology—Head & Neck Surgery, Hospital for Sick Children, Toronto, Ontario, Canada; and the <sup>b</sup>Department of Otolaryngology—Head & Neck Surgery, University of Toronto, Toronto, Ontario, Canada*

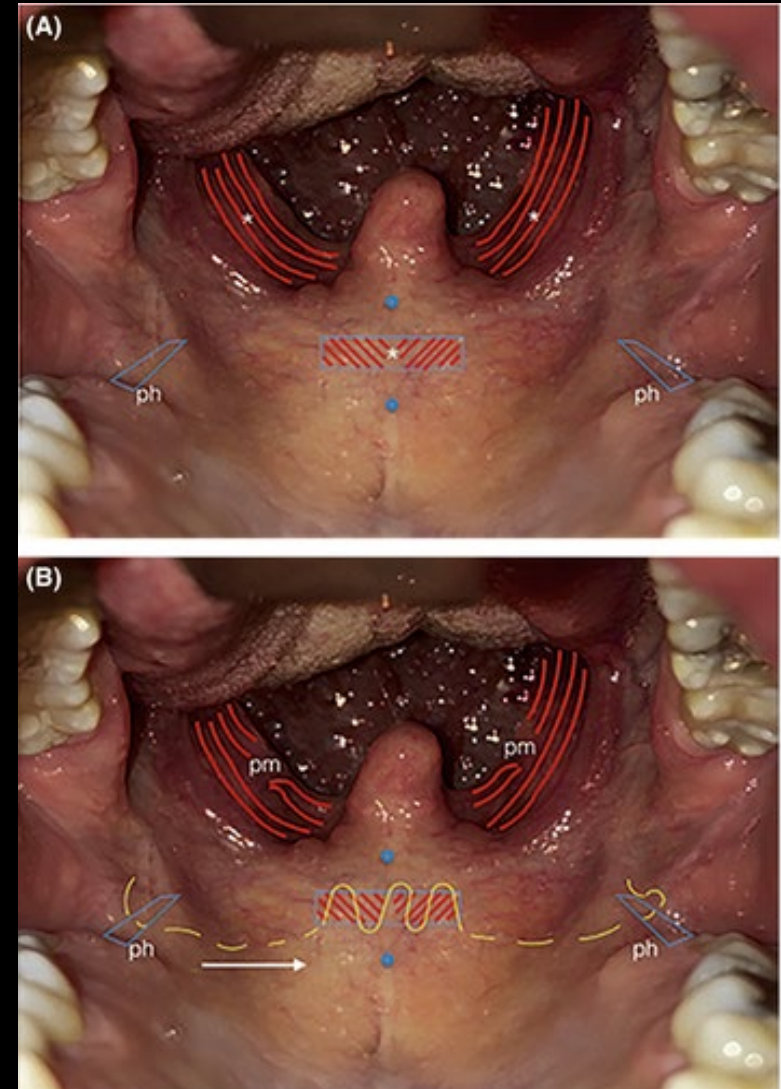


# Pharyngoplasty/Palatoplasty



Place sutures into palatopharyngeus pedicle

surgeries



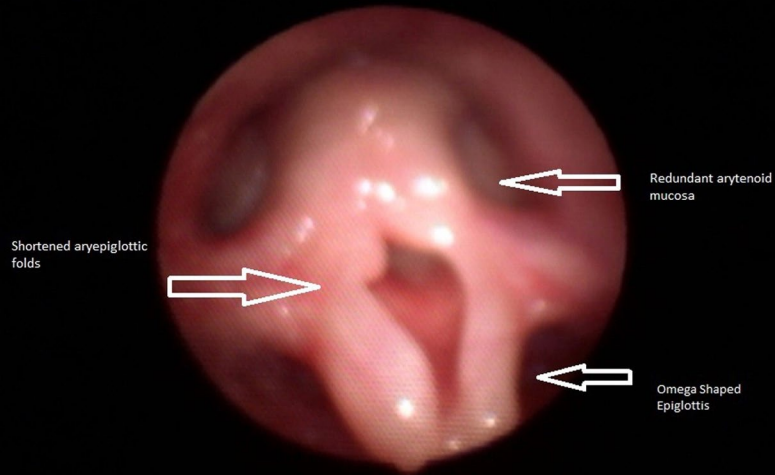
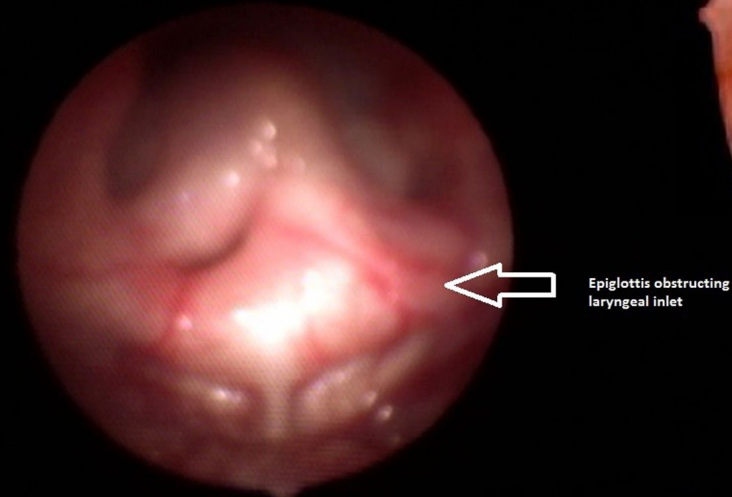
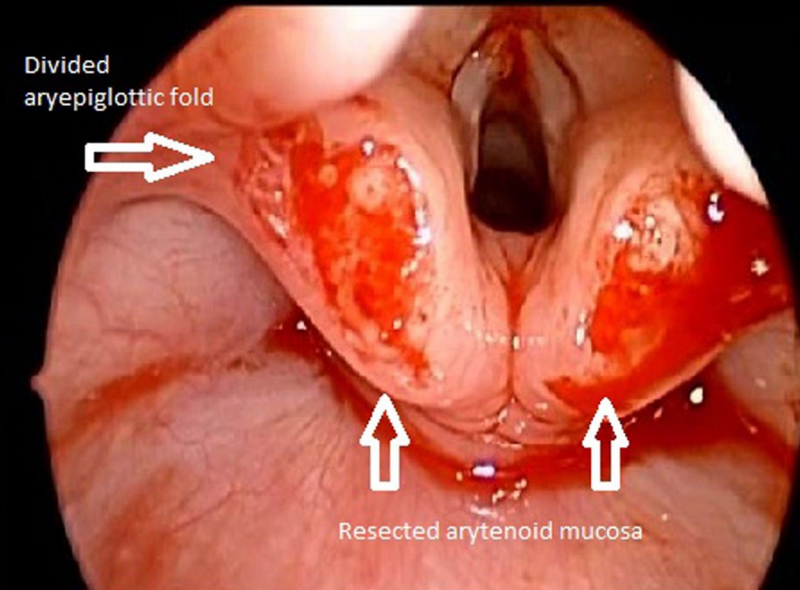
# Supraglottoplasty

Mini-symposium: Upper Airway Abnormalities

## Laryngomalacia: Review and Summary of Current Clinical Practice in 2015

Marc C. Thorne, Susan L. Garetz \*

Department of Otolaryngology-Head and Neck Surgery, Division of Paediatric Otolaryngology, University of Michigan Health System, 1540 East Hospital drive SPC 4241, CW-5-702, Ann Arbor, Michigan 48109-4241



# Questions?

