Sleep nasopharyngoscopy in children: rationale and facts

Hamdy El-Hakim FRCS(Ed) FRCS(ORL)
Associate Professor
Pediatric Otolaryngology
Division of Otolaryngology Head & Neck Surgery
The Stollery Children’s Hospital & The University of Alberta Hospitals
Edmonton (Alberta) Canada
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Objective

• Introduce more modern concepts on the pathogenesis of SDB
• Discuss the rationale behind the use of endoscopy under pharmacologically induced sleep
• Demonstrate the findings in some high risk group patients
Aims of approach

- Identify operable situations (T&A and others)
- Avoid operating on high risk patients who unlikely to benefit
- Interpret a structured examination in the light of the individual “diagnosis” or “risk group”
- Have a plan B
- Counsel on the achievable
Reports on adenotonsillectomy resolving sleep disordered breathing

- 14 studies (n 355), success rate 82.9%
- 22 studies (n 1079), success as defined per individual study 66.3% (24 - 100%)


How otolaryngologists reach the diagnosis

- Do not use routinely polysomnography
- Neither symptoms nor the awake examination can predict or relate to the gold standard

Literature on modalities that identify surgical targets

• Do not use routinely polysomnography
• Neither symptoms nor the awake examination (included X-ray) can predict or relate to the reference standard

Weatherly RA et al. Sleep Medicine 2003

Questionnaires

Tools for
• Screening (PSQ)
• QOL assessment (OSA 18)
• The sensitivity of any individual symptom or combination was low
• The specificity of snoring, sleepiness and learning disabilities was high in some studies
Tonsil size (0-4) and OSAS

- The association between subjective pediatric tonsil size using 0-4 scale and objective OSAS severity is weak at best.
- Level 4

Nolan & Brietzke OHNS 2011

Cine MRI

- Statistically significant differences in upper airway measurements and collapse between 16 children with OSA and controls
- Down Syndrome relative macroglossia (74%); glossoptosis (63%), recurrent & enlarged adenoids (63%); enlarged lingual tonsils (30%), & hypopharyngeal collapse (22%)

Cine MRI

- Excellent demonstration of collapses and obstructions of the airway
- Digitized volumetric assessment
- Delineation of soft tissues and parapharyngeal structures, and
- Does not expose the child to radiation.
- Still requires anaesthesia or sedation,
- Expensive
- Not readily accessible.

Literature on sleep endoscopy in children
An early description

- Awake examination
- Four types of obstruction / collapse were described.

Type 1
Type 2
Type 3
Type 4
Sleep endoscopy in the literature


No correlation to reference standard

More recently

- Multi-level problems post T&A: (n 13) nose, tongue base, adenoidal re-growth
- VOTE; velum, oropharyngeal lateral walls, tongue base, and/or epiglottis
- Truong et al: velum, oropharynx, tongue base, and supraglottis


Adult literature

- DISE (drug induced sleep endoscopy).
- Two validation studies; two expert sleep endoscopists
- Collapse may predict failure of surgical treatment as was recently claimed

Kezirian E et al. Archives of Otolaryngology Head and Neck Surgery 2010;136(4):393
Koutsourelakis I et al.. Laryngoscope 2012..
Bottom line messages

- Reserve for special populations and after T&A
- Inhalational abandoned for TIVA
- Concerns regarding ‘pharmacological sleep’
- No validation
- Tonsil and adenoid size irrelevant

Technique
Indication

- Symptoms of SDB
- ≥ 12 months (except infants)
- Trialed medical treatment if appropriate
- With or without planned surgery

Uniform algorithm

- Flexible bronchoscope (2.2 mm)
- Topical anesthesia (1% Lignocaine) - only nasal
- Intravenous General anesthesia (Propofol / Remifentanil - infusion or bolus)
- Minimal application of drugs
- Does not mimic physiological sleep

Remifentanil 2-2.5mcg/ml and infusion rates of Propofol varied from 200-350 mcg/kg/min depending on response to stimulation
Endoscopic examination from nose to larynx

Reporting the findings

- **Obstruction**
  chronic hypertrophic rhinitis
  deviated nasal septum,
  oropharyngeal tonsils,
  laryngeal, tracheal or bronchial

- **Collapse**
  lateral hypopharyngeal wall or circumferential,
  tongue base,
  laryngeal, tracheal, bronchial
Ordinal scale 1 or 0

- **Collapse**: any paradoxical movement reducing the lumen > 50%
- **Obstruction**: any encroachment on the airway caliber > 50%

Normal tone
Sleep nasopharyngoscopy patterns & findings

How did clinical & endoscopic examination agree on tonsillar obstruction?
Kappa value 0.44 (95% CI 0.33-0.55)  
n 248  
(moderate agreement according to Landis & Koch 1977)

<table>
<thead>
<tr>
<th>SNP</th>
<th>Clinic</th>
<th>Obstructive</th>
<th>Non obstructive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructive</td>
<td>77</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Non obstructive</td>
<td>13</td>
<td>99</td>
<td></td>
</tr>
</tbody>
</table>

Sites of pathology: 49 patients had single level

<table>
<thead>
<tr>
<th>Condition</th>
<th>N of patients (total 241)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral collapse</td>
<td>85</td>
</tr>
<tr>
<td>Circumferential collapse</td>
<td>39</td>
</tr>
<tr>
<td>Larynx/trachea</td>
<td>36</td>
</tr>
<tr>
<td>Tongue collapse</td>
<td>30</td>
</tr>
<tr>
<td>Tonsils</td>
<td>141</td>
</tr>
<tr>
<td>Deviated septum</td>
<td>20</td>
</tr>
<tr>
<td>Chronic rhinitis</td>
<td>180</td>
</tr>
<tr>
<td>Adenoids</td>
<td>190</td>
</tr>
</tbody>
</table>

4 years  
Mean age 5.9 years (0.6-16.5 yrs)  
M:F is 132:109
An index lesion

The prevalence of *laryngomalacia* in children presenting *primarily with SDB*

- 3.9% - 358 consecutive patients
- 8.2% - 75 consecutive ≤ 3 years old
Patterns in high risk populations

Current beliefs on obese patients

- Existing information suggest a non dynamic obstruction unique to obese individuals
  Welch KC, et al. Sleep, 2002

- Only one study using respiratory gated MR demonstrates wide variation in cross sectional area of the upper airway
Investigating obese airways and comparing them to age and gender matched controls

- Case control
- Compared proportions of collapse, obstruction & mixed patterns
- 70 obese children
- 15 were excluded (missing height / weight; no matching controls; syndromic & other confounders)

Distribution of patterns

<table>
<thead>
<tr>
<th>Groups</th>
<th>Obstruction only</th>
<th>Mixed</th>
<th>Collapse only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td><strong>3</strong></td>
<td>48</td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Control</td>
<td>23</td>
<td>26</td>
<td>2</td>
</tr>
</tbody>
</table>

Fisher’s exact $P < 0.0001$
Young children or early onset SDB

- Higher incidence of respiratory complications
- Poor response to adenotonsillectomy
- Scant research identified GERD as a potential association

Diagnoses linked to SDB via pharyngeal dysfunction

- Gastroesophageal reflux disease (GERD) / Eosinophilic Esophagitis (EE)
- Prematurity
- Hypotonia

M. Bortolotti et al. OSA is treated by the prolonged treatment of GERD with omeprazole, Dig. Liver Dis. 38 (2) (2006), pp. 78–81
Causes of Pharyngeal Dysfunction

<table>
<thead>
<tr>
<th></th>
<th>GERD / EE</th>
<th>Prematurity</th>
<th>Swallowing Dysfunction</th>
<th>Asthma</th>
<th>Obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Onset n=73</td>
<td>22</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Control I n=75</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Control II n=72</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2: Causes of pharyngeal dysfunction are significantly different between groups

Proportions of patterns

<table>
<thead>
<tr>
<th>Groups</th>
<th>Obstruction only</th>
<th>Mixed</th>
<th>Collapse only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>1</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Early onset</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Control</td>
<td>11</td>
<td>13</td>
<td>1</td>
</tr>
</tbody>
</table>
## Latest work

<table>
<thead>
<tr>
<th>Inter rater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted kappa</td>
</tr>
<tr>
<td>Observed 0.71</td>
</tr>
<tr>
<td>SE 0.067</td>
</tr>
<tr>
<td>95% CI 0.57 - 0.85</td>
</tr>
<tr>
<td>Proportions of agreement</td>
</tr>
<tr>
<td>Observed 0.73</td>
</tr>
<tr>
<td>Maximum 0.83</td>
</tr>
<tr>
<td>Chance 0.39</td>
</tr>
<tr>
<td>95% CI 0.61-0.82</td>
</tr>
</tbody>
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## Conclusions

- SNP demonstrates more operable sites
- It shows some agreement to the gold standard
- Its patterns are different in various groups of interest & that these patterns may correlate to the severity of the SDB
- Taken in context of individual risk groups it suggests that other elements may override structural alterations
Lingual tonsillectomy

Powered turbinoplasty
Declaration

• No conflict of interest
• No financial support
• ERB obtained for all projects