



OSA Management ENT Surgical Options Beyond Adenotonsillectomy

Dr Chan Ching Yee MBBS, MRCS, Mmed (ORL), FAMS (ORL)
Associate Consultant, Department of Otolaryngology



Contents

- Overview
- Surgical options according to anatomical site
- Summary
- Conclusion

Nasal Surgery

- Options are limited due to growth centres
- Increase nasal flow
- Medical treatment
- Inferior turbinate procedures
 - Submucosal reduction
 - Turbinate outfracture

Nasal Surgery

Original Article

Nasal Obstruction in Children with Sleep-disordered Breathing

(1) to appreciate the contribution to SDB of untreated enlarged nasal turbinates in prepubertal children; and (2) to report our experience with treatment of enlarged nasal turbinates in young children with SDB. Materials and Methods: Children with enlarged nasal turbinates who underwent adenotonsillectomy (T&A) had significantly less improvement in postoperative apnoea-hypopnoea index (AHI) compared to those treated with concomitant turbinate reduction. Children in the untreated turbinate hypertrophy group subsequently underwent radiofrequency ablation of the inferior nasal turbinates; following this procedure, AHI was no different than AHI of those without hypertrophy. Results: In an analysis of safety and effectiveness of radiofrequency treatment of the nasal turbinates, we found the procedure to be a well-tolerated component of SDB treatment. Conclusions: We conclude that radiofrequency (RF) treatment of inferior nasal turbinates is a safe and effective treatment in young prepubertal children with SDB. When indicated, it should be included in the treatment plan for prepubertal children with SDB. However, the duration of effectiveness is variable and therapy may need to be repeated if turbinate hypertrophy recurs.

However, the duration of effectiveness is variable and therapy may need to be repeated if turbinate hypertrophy recurs.

Ann Acad Med Singapore 2008;37:645-8

Key words: Nasal inferior turbinates, Obstructive sleep apnoea, Pre-pubertal, Radiofrequency

Uvulopalatopharyngoplasty

- Limited studies, not commonly performed
- Combined with T&A – improved outcome in neurologically impaired children*
- Lateral Pharyngoplasty with T&A – appears to be superior to isolated T&A[^], but not for Down's Syndrome Patients[`]

* Kerschner, J. E., Lynch, J. B., Kleiner, H., Flanary, V. A., & Rice, T. B. (2002). Uvulopalatopharyngoplasty with tonsillectomy and adenoidectomy as a treatment for obstructive sleep apnea in neurologically impaired children. *International Journal of Pediatric Otorhinolaryngology*, 62(3), 229–235.

[^] Guilleminault, C., Li, K. K., Khramtsov, A., Pelayo, R., & Martinez, S. (2004). Sleep disordered breathing: surgical outcomes in prepubertal children. *The Laryngoscope*, 114(1), 132–137.

[`]Merrell, J. A., & Shott, S. R. (2007). OSAS in Down syndrome: T&A versus T&A plus lateral pharyngoplasty. *International Journal of Pediatric Otorhinolaryngology*, 71(8), 1197–1203.



Characteristics and Surgical and Clinical Outcomes of Severely Obese Children with Obstructive Sleep Apnea

Gulnur Com, MD¹; John L. Carroll, MD¹; Xinyu Tang, PhD²; Maria S. Melguizo, MS²; Charles Bower, MD³; Supriya Jambhekar, MD¹

¹Department of Pediatrics, Division of Pediatric Pulmonology and Sleep Medicine, University of Arkansas Medical Sciences, Little Rock, AR; ²Department of Pediatrics, Biostatistics Program, University of Arkansas Medical Sciences, Little Rock, AR;

³Department of Otolaryngology, University of Arkansas Medical Sciences, Little Rock, AR

Study Objectives: To describe characteristics and surgical and clinical outcomes of obese children with obstructive sleep apnea (OSA).

Methods: At our institution from 2000 to 2010, 143 obese children with an overnight polysomnography (OPSG) diagnosis of OSA, excluding children with comorbidities, were identified

improved in the majority of children ($p = 0.001$). Similarly, the arousal index, $P_{ET}CO_2$, and SpO_2 nadir improved significantly ($p < 0.002$, $p = 0.019$, $p < 0.001$, respectively). AHI improved significantly in children with mild-to-moderate OSA in comparison to severe OSA ($p < 0.001$). Children with enlarged tonsils and no history of prior surgery benefitted more often

Com, G., Carroll, J. L., Tang, X., Melguizo, M. S., Bower, C., & Jambhekar, S. (2015). Characteristics and Surgical and Clinical Outcomes of Severely Obese Children with Obstructive Sleep Apnea. *Journal of Clinical Sleep Medicine*, 1–8.

Table 3—Efficacy of different airway surgeries on the severity of obstructive sleep apnea (OSA) in obese pediatric patients.

	Postsurgery OSA				Total	p value
	None	Mild	Moderate	Severe		
Uvulopharyngopalatoplasty (UPPP) Only (n = 8)						
Presurgery severity						
Mild OSA	0% (0/0)	0% (0/0)	0% (0/0)	0% (0/0)	0% (0/8)	p = NS
Moderate OSA (2)	0% (0/2)	50% (1/2)	0% (0/2)	50% (1/2)	25% (2/8)	
Severe OSA (6)	17% (1/6)	0% (0/6)	0% (0/6)	83% (5/6)	75% (6/8)	
Tonsillectomy + Adenoidectomy (n = 23)						
Presurgery severity						
Mild OSA (4)	25% (1/4)	25% (1/4)	25% (1/4)	25% (1/4)	17% (4/23)	p = 0.008
Moderate OSA (6)	67% (4/6)	17% (1/6)	0% (0/6)	17% (1/6)	26% (6/23)	
Severe OSA (13)	23% (3/13)	38% (5/13)	31% (4/13)	8% (1/13)	57% (13/23)	
Adenoidectomy + UPPP (n = 11)						
Presurgery severity						
Mild OSA (1)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)	9% (1/11)	p = 0.317
Moderate OSA (1)	0% (0/1)	100% (1/1)	0% (0/1)	0% (0/1)	9% (1/11)	
Severe OSA (9)	11% (1/9)	0% (0/9)	11% (1/9)	78% (7/9)	82% (9/11)	
Tonsillectomy + Adenoidectomy + UPPP (n = 27)						
Presurgery severity						
Mild OSA (2)	0% (0/2)	0% (0/2)	0% (0/2)	100% (2/2)	7% (2/27)	p = 0.072
Moderate OSA (5)	20% (1/5)	0% (0/5)	40% (2/5)	40% (2/5)	19% (5/27)	
Severe OSA (20)	20% (4/20)	30% (6/20)	10% (2/20)	40% (8/20)	74% (20/27)	

In addition to the surgeries above, one patient underwent tonsillectomy only, one patient had tonsillectomy and UPPP, and 7 patients underwent nasal turbinate trim and tongue base suspension surgery.

TONGUE PROCEDURES


Tongue Procedures

Eur Arch Otorhinolaryngol (2017) 274:2981–2990
DOI 10.1007/s00405-017-4545-4



REVIEW ARTICLE

Tongue surgeries for pediatric obstructive sleep apnea: a systematic review and meta-analysis

Macario Camacho¹  · Michael W. Noller² · Soroush Zaghi³ · Lauren K. Reckley⁴ · Camilo Fernandez-Salvador⁴ · Erika Ho⁵ · Brandyn Dunn⁶ · Dylan Chan⁷

Received: 16 November 2016 / Accepted: 20 March 2017 / Published online: 4 April 2017
© Springer-Verlag Berlin Heidelberg (outside the USA) 2017

Abstract

Objectives To evaluate the international literature for studies reporting outcomes for obstructive sleep apnea (OSA) in children undergoing isolated tongue surgeries.

Methods Two authors searched from inception through November 14, 2016 in four databases including PubMed/

(BOT) reduction ($n=114$), tongue suspension ($n=1$), and hypoglossal nerve stimulation ($n=1$). The pre- and post-BOT reduction surgeries decreased apnea–hypopnea index (AHI) from a mean (M) and standard deviation (SD) of $16.9 \pm 12.2/h$ to $8.7 \pm 10.6/h$ (48.5% reduction) in 114 patients. Random effects modeling (109 patients)

Lingual Tonsillectomy

- Often performed after tonsillectomy
- Lingual tonsils frequent site of residual obstruction

Lingual Tonsillectomy for Treatment of Pediatric Obstructive Sleep Apnea

RESULTS This meta-analysis consisted of 4 studies (mean sample size, 18.25 patients), with a total of 73 unique patients (mean [SD] age, 8.3 [1.1] years). Fifty-nine percent (27 of 46) of the patients were male, and 1 of the 4 studies did not specify number of males. Lingual tonsillectomy was indicated for persistent OSA after adenotonsillectomy in all cases. Lingual tonsil hypertrophy was evaluated using computed tomography or magnetic resonance imaging in 1 study, sleep endoscopy in 2 studies, and cine magnetic resonance imaging in 1 study. The mean change in the AHI after lingual tonsillectomy was a reduction of 8.9 (95% CI, -12.6 to -5.2) events per hour. The mean change in the minimum oxygen saturation after lingual tonsillectomy was an increase of 6.0% (95% CI, 2.7%-9.2%). The overall success rate was 17% (95% CI, 7%-35%) for a postoperative AHI less than 1 and 51% (95% CI, 25%-76%) for a postoperative AHI less than 5. Postoperative complications that developed included airway obstruction, bleeding, and pneumonia.

CONCLUSIONS AND RELEVANCE Lingual tonsillectomy is an effective surgical management for children with OSA caused by lingual tonsil hypertrophy, and it achieves significant improvement in the AHI and the minimum oxygen saturation. However, children frequently have residual OSA after lingual tonsillectomy, and postoperative complications must be carefully managed.

Kang, K.-T., Koltai, P. J., Lee, C.-H., Lin, M.-T., & Hsu, W.-C. (2017). Lingual Tonsillectomy for Treatment of Pediatric Obstructive Sleep Apnea. *JAMA Otolaryngology–Head & Neck Surgery*, 143(6), 561.

Midline Posterior Glossectomy

- Macroglossia
- Glossoptosis
- Can be performed together with lingual tonsillectomy
- Success rate 59% in patients with Down Syndrome with persistent OSA (failed T&A)*

* Clark S, Lam D, Heubi C, et al: Posterior Midline Glossectomy for Treatment of Post-Adenotonsillectomy Obstructive Sleep Apnea in Children. Abstract Presented at 2011 American Society of Pediatric Otolaryngology Annual Meeting, Chicago, Illinois, 2011.

Tongue Base Advancement

- Tongue base advancement to treat prolapse
- Screw placed in mandible and a suture is passed through the tongue base
- 1 study reported use with RF tongue/UPPP/Lingual tonsillectomy. (Failed T&A)
Success - AHI <5: 61%*
- Long term results unknown

*Wootten, C. T., & Shott, S. R. (2010). Evolving therapies to treat retroglossal and base-of-tongue obstruction in pediatric obstructive sleep apnea. *Archives of Otolaryngology—Head & Neck Surgery*, 136(10), 983–987

Tongue tie release

A frequent phenotype for paediatric sleep apnoea: short lingual frenulum

Christian Guilleminault, Shehlanoor Huseni and Lauren Lo

Affiliation: Stanford University Sleep Medicine Division, Redwood City, CA, USA.

Correspondence: Christian Guilleminault, Stanford University Sleep Medicine Division, 450 Broadway, (Pavillion C 2nd floor), Redwood City, CA 94063, USA. E-mail: cguil@stanford.edu

ABSTRACT A short lingual frenulum has been associated with difficulties in sucking, swallowing and speech. The oral dysfunction induced by a short lingual frenulum can lead to oral-facial dysmorphism, which decreases the size of upper airway support. Such progressive change increases the risk of upper airway collapsibility during sleep.

Clinical investigation of the oral cavity was conducted as a part of a clinical evaluation of children suspected of having sleep disordered breathing (SDB) based on complaints, symptoms and signs. Systematic polysomnographic evaluation followed the clinical examination. A retrospective analysis of 150 successively seen children suspected of having SDB was performed, in addition to a comparison of the findings between children with and without short lingual frenula.

Among the children, two groups of obstructive sleep apnoea syndrome (OSAS) were found: 1) absence of adenotonsils enlargement and short frenula (n=63); and 2) normal frenula and enlarged adenotonsils (n=87). Children in the first group had significantly more abnormal oral anatomy findings, and a positive family of short frenulum and SDB was documented in at least one direct family member in 60 cases.

A short lingual frenulum left untreated at birth is associated with OSAS at later age, and a systematic screening for the syndrome should be conducted when this anatomical abnormality is recognised.

Guilleminault C, Huseni S, Lo L. A frequent phenotype for paediatric sleep apnoea: a short lingual frenulum. *ERJ Open Res* 2016 1-8

SUPRAGLOTTOPLASTY

Supraglottoplasty

- Laryngomalacia contributes to upper airway obstruction
- State dependent laryngomalacia – occurs only in sleep

Supraglottoplasty

ORIGINAL ARTICLE

Supraglottoplasty for Occult Laryngomalacia to Improve Obstructive Sleep Apnea Syndrome

Dylan K. Chan, MD, PhD; Mai Thy Truong, MD; Peter J. Koltai, MD

Objective: To evaluate the polysomnographic outcomes after supraglottoplasty (SGP) performed for obstructive sleep apnea syndrome (OSAS) associated with occult laryngomalacia.

Design: Retrospective case series with medical chart review.

Setting: Tertiary pediatric medical center.

Patients: Twenty-two patients aged 2 to 17 years met the inclusion criteria of polysomnography-proven OSAS and occult laryngomalacia seen on flexible fiber-optic sleep endoscopy. Infants with congenital laryngomalacia were excluded.

Intervention: Carbon dioxide laser SGP was performed either alone or in conjunction with other operations for OSAS.

Main Outcome Measure: Preoperative and postoperative nocturnal polysomnographic data were paired and analyzed statistically.

Results: Supraglottoplasty for occult laryngomalacia resulted in statistically significant reduction in the apnea-hypopnea index (AHI) (from 15.4 to 5.4) ($P < .001$). Subgroup analysis of children who underwent either SGP alone or in combination with other interventions showed comparable reductions in AHI. Medical comorbidities were associated with worsened postoperative outcomes, although still significantly improved compared with baseline. Overall, 91% of children had an improvement in AHI, and 64% had only mild or no residual OSAS after SGP.

Conclusion: Supraglottoplasty is an effective technique for the treatment of OSAS associated with occult laryngomalacia.

Arch Otolaryngol Head Neck Surg. 2012;138(1):50-54

Supraglottoplasty

1. Supraglottoplasty is an effective surgery for children with OSA and laryngomalacia, and results in an AHI reduction of 8.9 events/h and a MinSaO₂ increase of 3.7%.
2. After surgery, 28% of all patients had an AHI <1, and 72% had an AHI <5.
3. The children receiving supraglottoplasty as a primary treatment had a similar success rate to that of children receiving supraglottoplasty as a secondary treatment (33% vs 19% for postoperative AHI < 1; 77% vs 61% for AHI < 5).
4. The success rate for children with and without comorbidities was 25% vs 21% according to a postoperative AHI <1, and 62% vs 84% according to an AHI <5.

ARTICLE INFO

Article history:

Received 23 February 2016
Received in revised form
20 April 2016
Accepted 15 May 2016

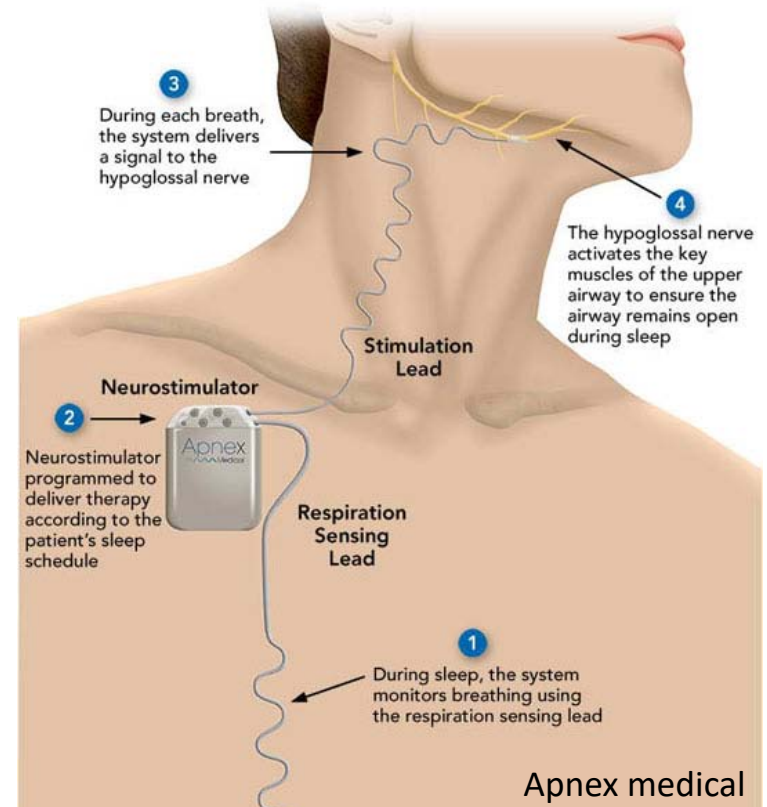
ABSTRACT

Objective: To comprehensively review changes in sleep parameters and the success rate of supraglottoplasty for treating obstructive sleep apnea (OSA) in children. In particular, to elucidate treatment modalities and factors affecting treatment outcomes in children with both laryngomalacia and OSA.

Methods: The study protocol was registered on PROSPERO (CRD42015027053). Two authors independently searched databases including PubMed, MEDLINE, EMBASE, and the Cochrane Review database.

Inspire – Hypoglossal Nerve Stimulation

- Upper Airway Stimulation
- Current FDA criteria
 - >22 years old
 - Failed CPAP
 - Moderate-severe OSA AHI 20 – 65



Surgical Treatment Summary

Level of obstruction	Procedure	Cure rate (AHI <1) %	Success rate (AHI <5) %
Oropharynx	T&A	50 – 66	84
	UPPP	18	50
Nasal		None with cure	None so far
Hypopharynx	Lingual tonsillectomy	17	51
	Other tongue procedures		61
	Supraglottoplasty	28	72
	Hypoglossal N +		66
Others	Tracheostomy	100	

Conclusion

- Tonsillectomy & Adenoidectomy works
 - Counsel to prolong lifespan of T&A – weight gain, nasal breathing
 - Treat other risk factors – allergic rhinitis, reflux
 - Try CPAP first
- Assess levels of obstruction in residual and recurrent OSA after T&A
- Targeted therapy for best outcome