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Tomasz Lis, *Lidia Zawadzka-Głos

# Treatment and management of a child with obstructive sleep apnea: an overview

## Leczenie i postępowanie z dzieckiem z obturacyjnym bezdechem sennym: przegląd

Department of Pediatric Otolaryngology, Medical University of Warsaw, Poland
Head of Department: Associate Professor Lidia Zawadzka-Głos, MD, PhD

**Keywords**

obstructive sleep apnea,
sleep-related breathing disorder, T&A,
adenotonsillectomy

**Summary**

Obstructive sleep apnea (OSA) is a common disorder in children characterized by recurrent episodes of upper airway obstruction while asleep. It can lead to many adverse health consequences affecting cardiovascular, neurocognitive and metabolic systems. Child with diagnosis of OSA should receive an appropriate management without delay to prevent serious negative health consequences. In this review article we discuss available surgical and non-surgical OSA treatment modalities and when to use them. First-line surgical treatment remains adenotonsillotomy, yet other surgical techniques are beeing introduced, depending on the level of airway obstruction. Non-surgical approach is based on using anti-inflammatory medications (such as intranasal corticosteroids and leukotriene modifier montelukast), positive airway therapy, orthodontics (including rapid maxillary expansion and mandibular advancement devices) as well as other adjucant therapies. Current and new surgical and non-surgical treatment modalities are still beeing developed and may be used to treat especially complex patients with multi-level obstruction or these with persitent OSA.

**Słowa kluczowe**

obturacyjny bezdech senny, zaburzenia oddychania podczas snu, ATT, adenotonsillektomia

**Streszczenie**

Obturacyjny bezdech senny (OBS) jest częstym schorzeniem u dzieci charakteryzującym się nawracającymi epizodami obturacji górnych dróg oddechowych w trakcie snu. Może to prowadzić do wielu negatywnych konsekwencji zdrowotnych dotykających układu sercowo-naczyniowego, poznawczego i metabolicznego. Dziecko ze zdiagnozowanym OBS powinno jak najszybciej otrzymać odpowiednie leczenie aby zapobiec poważnym negatywnym skutkom zdrowotnym. W tym artykule przeglądowym omawiamy dostępne zabiegowe i niezabiegowe metody leczenia OBS i kiedy ich użyć. Chirurgicznym leczeniem pierwszego rzutu pozostaje adenotonsillektomia, następuje jednak szybki rozwój innych metod w zależności od poziomu obturacji górnych dróg oddechowych. Postępowanie zachowawcze jest oparte na użyciu leków przeciwzapalnych (takich jak sterydy donosowe i lek wpływający na leukotrieny montelukast), dodatniego ciśnienia w drogach oddechowych, leczeniu ortodontycznym (włączając szybkie poszerzanie szczęki i aparaty wysuwające żuchwę) jak rózwież inne leczenie wspomagające. Obecne i nowe chirurgiczne i niechirurgiczne metody leczenia są ciągle rozwijane i mogą być użyte szczególnie u złożonych pacjentów z wielopoziomową obturacją oraz tych z przetrwałym OBS.

## Introduction

Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder and is characterized by recurrent episodes of complete and/or partial upper airway obstruction which results in abnormal ventilation. OSA in children is associated with behavioral, neurocognitive and academic consequences (1, 2) as well as metabolic (3) and cardiovascular derangements (3, 4). It is assumed universally that each mentioned condition should benefit from adequate treatment of OSA, even though in many cases there is a lack of randomized controlled trials providing compelling proof of it. In previous study (5) we focused on diagnosis and evaluation of a child suspected for OSA. The aim of this particular study was to present different approaches of treating OSA in children, depending on the cause of it.

## Management

Management of a child with OSA may be surgical or non-surgical. Depending on OSA severity and pre-existing risk factors, each child suffering from OSA, especially persistent one, should be treated using an individualized strategy.

## Surgical management

### Adenoidectomy and tonsillectomy/tonsillotomy

The traditional first-line treatment of OSA has been adenotonsillectomy (T&A) – surgical removal of the tonsils and adenoid. Partial tonsillectomy, or tonsillotomy is a more limited procedure in which the majority of tonsillar tissue is removed but the tonsillar capsule remains in place. This intracapsular procedure has fewer complication rates compared to standard tonsillectomy (6). However it exhibits a much higher risk of OSA recurrence since it carries a risk of tonsillar regrowth especially in younger children (7). There are many surgical techniques of tonsils removal, but according to American Academy of Pediatrics guidelines, the current data is insufficient to recommend one surgical technique over the other (8). Risk factors of persistent OSA after T&A include age > 7, severe disease, asthma, and obesity (9).

**Fig. 1.** Intracapsular tonsillectomy

## Other surgical techniques

Surgical procedures beyond T&A are typically reserved for children with multi-level obstruction or these with residual OSA after T&A. Potential causes of airway obstruction at a certain level with a designated procedure, are presented in table 1.

**Tab. 1.** Surgeries considered for OSA patient by level of obstruction (based on (13))

| Source | Procedure |
|---|---|
| Nasal cavity | |
| Septal deviation | Septoplasty |
| Enlarged turbinates | Turbinate reduction |
| Nasopharynx | |
| Adenoid hypertrophy | Adenoidectomy |
| Maxillary hypoplasia | Maxillary advancement |
| Oropharynx | |
| Tonsillar hypertrophy | Tonsillectomy/tonsillotomy |
| Soft palate redundancy | Uvulopalatopharyngoplasty |
| Tongue | |
| Lingual hyperthropy | Lingual tonsillectomy |
| Retroglossal narrowing | Posterior midline glossectomy |
| Glossoptosis | Tongue suspension, hyoid myotomy and suspension |
| Micrognathia/retrognathia | Genioglossal/mandibular advancement |
| Larynx | |
| Laryngomalacia | Supraglottoplasty |

Nasal obstruction may result from e.g. a deviated nasal septum or enlarged nasal turbinates. Although nasal obstruction is rarely the primary cause of OSA, it could contribute to OSA. Treatment of nasal blockage in affected children may therefore be favorable.

Obstruction at the level of oropharynx, besides tonsils may be influenced by soft palate redundancy. Published articles reporting the usefulness and success of uvulopalatopharyngoplasty as a method of treatment in children, are limited to case series.

Tongue base obstruction in children can be addressed using a number of procedures with the most common one – lingual tonsillectomy. Besides above mentioned surgery, the efficacy of most of these procedures is better documented in the adult literature.

Supraglottoplasty is the procedure that may be performed in children with OSA and either sleep exclusive laryngomalacia or congenital laryngomalacia. It has been proven that this procedure improves respiratory indices but in most cases does not fully cure OSA (10).

In severe multi-level airway obstruction morbidities, more extensive surgical approaches may be needed, although in children there is limited evidence available. In one study of 48 children, Prager et al. described an 8.2% incidence of oropharyngeal scarring and stenosis, multilevel surgery that included lingual tonsillectomy (11).

Tracheotomy is the definitive surgical treatment for severe OSA in patients who have failed to respond to other treatment approaches or do not qualify for them. Such patients have either severe craniofacial abnormalities or neuromuscular disorders (12). Although such children remain tracheostomy dependent, the procedure can also be considered as a temporary measure to manage severe OSA while awaiting other surgical treatment.

## Non-surgical treatment

### Medications

As pediatric OSA is mostly caused by lymphatic tissue overgrowth, inhibition of adenotonsillar proliferation and inflammation, may be beneficial for especially mild OSA patients. Anti-inflammatory medications comprise nasal corticosteroids, and the leukotriene modifier montelukast. Recent meta-analysis has shown that montelukast improved the apnea-hypopnea index by 55% when used alone and by 70% when used in combination with intranasal corticosteroids in children with mild OSA (14). These therapies may be proposed as an alternative to surgery in mild uncomplicated OSA in children.

### Positive airway pressure

Among children who are not surgical candidates, e.g. because of no evidence of enlarged tonsils and adenoids, those who have persistent OSA after T&A, or whose parents decline surgery, positive airway pressure (PAP) therapy during sleep should be considered. The application of positive pressure prevent upper airway collapse and therefore maintains airway patency. Effectiveness of this therapy has been widely reported in adults but also in selected group of children (15). Unfortunately PAP therapy in most cases has suboptimal adherence in children. Also besides obvious compliance problems (e.g. mask discomfort, air leaks) it is described that long-term use of the PAP can even lead to facial flattening because of the longstanding pressure of the mask on growing facial structures (16).

### Orthodontics

There are few dental procedures that by widening intraoral and upper airway introitus space, can improve upper airway patency. These comprise rapid maxillary expansion (RME) and therapies using mandibular advancement devices (MAD). The above-mentioned are thought to reduce or eradicate OSA in some children with dentofacial abnormalities. RME is based on increasing the width of the hard palate using a dental appliance fixed to opposing maxillary teeth. This device has an expansion system used to open the midpalatal suture, therefore using it, is only possible prior to midline fusion of the maxilla and usually after eruption of at least part of permanent dentition. Although the current evidence on the effects of using RME is limited and based on small uncontrolled studies with a relatively short follow-up period, this therapy hold promise as potential treatment for patients with malocclusion or high-arched palate and OSA (17). MAD is an oral appliance that moves the tongue and mandible forward, thus increasing airway diameter. It can be used in selected children with OSA and e.g. retrognathia, although efficacy of its usage is supported by insufficient evidence in children (18).

### Adjunct therapies

Since obesity is considered to be a major contributing factor to OSA, obese children with OSA may benefit from weight loss (19). Environmental agents such as tobacco smoke or allergens may cause nasal congestion and increased upper airway resistance in susceptible patients. Avoiding these factors may be beneficial as adjunct therapy of OSA. Besides these obvious proceedings, there are others with much less proofs, especially in children among which data is scarce. These include positional therapy (avoidance of certain position during sleep, mostly prone), myofunctional therapy (specific focused oropharyngeal exercises). In some patients nocturnal supplemental oxygen could also be a temporal solution until adequate therapy is provided (20).

## Conclusions

To prevent short-term and potentially long-term adverse effects of pediatric OSA, current and new treatment modalities should be intensively investigated. Undoubtedly, T&A remains the first line of treatment in a large majority of patients, but other approaches are becoming more widely applied, especially in persistent OSA children. Either it is surgical or non-surgical approach, more outcomes research is needed to determine which patients are best treated with each treatment method.

**Conflict of interest**
**Konflikt interesów**

None
Brak konfliktu interesów

**References/Piśmiennictwo**

1. Beebe DW, Ris MD, Kramer ME et al.: The association between sleep disordered breathing, academic grades, and cognitive and behavioral functioning among overweight subjects during middle to late childhood. Sleep 2010; 33(11): 1447-1456.
2. Mitchell RB, Kelly J: Behavior, neurocognition and quality-of-life in children with sleep-disordered breathing. Int J Pediatr Otorhinolaryngol 2006; 70(3): 395-406.

**Correspondence**
**Adres do korespondencji**

*Lidia Zawadzka-Głos
Klinika Otolaryngologii Dziecięcej
Warszawski Uniwersytet Medyczny
ul. Żwirki i Wigury 63A, 02-691 Warszawa
tel.: +48 (22) 317-97-21
laryngologia.dsk@uckwum.pl

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3. Sun SS, Grave GD, Siervogel RM et al.: Systolic blood pressure in childhood predicts hypertension and metabolic syndrome later in life. Pediatrics 2007; 119(2): 237-246.
4. Marcus CL, Greene MG, Carroll JL: Blood pressure in children with obstructive sleep apnea. Am J Respir Crit Care Med 1998; 157(4 Pt 1): 1098-1103.
5. Lis T, Zawadzka-Głos L: Diagnosis and evaluation of a child suspected for obstructive sleep apnea: an overview. New Medicine 2020; 3.
6. Wang H, Fu Y, Feng Y et al.: Tonsillectomy versus tonsillotomy for sleep-disordered breathing in children: a meta analysis. PLoS One 2015; 10(3): e0121500.
7. Ericsson E, Graf J, Lundeborg-Hammarstrom I, Hultcrantz E: Tonsillotomy versus tonsillectomy on young children: 2 year post surgery follow-up. J Otolaryngol Head Neck Surg 2014; 43(1): 26.
8. Marcus CL, Brooks LJ, Draper KA et al.: Diagnosis and management of childhood obstructive sleep apnea syndrome. Pediatrics 2012; 130(3): e714-755.
9. Bhattacharjee R, Kheirandish-Gozal L, Spruyt K et al.: Adenotonsillectomy outcomes in treatment of obstructive sleep apnea in children: a multicenter retrospective study. Am J Respir Crit Care Med 2010; 182(5): 676-683.
10. Manickam PV, Shott SR, Boss EF et al.: Systematic review of site of obstruction identification and non-CPAP treatment options for children with persistent pediatric obstructive sleep apnea. Laryngoscope 2016; 126(2): 491-500.
11. Prager JD, Hopkins BS, Propst EJ et al.: Oropharyngeal stenosis: a complication of multilevel, single-stage upper airway surgery in children. Arch Otolaryngol Head Neck Surg 2010; 136(11): 1111-1115.
12. Rizzi CJ, Amin JD, Isaiah A et al.: Tracheostomy for Severe Pediatric Obstructive Sleep Apnea: Indications and Outcomes. Otolaryngol Head Neck Surg 2017; 157(2): 309-313.
13. Ehsan Z, Ishman SL: Pediatric Obstructive Sleep Apnea. Otolaryngol Clin North Am 2016; 49(6): 1449-1464.
14. Liming BJ, Ryan M, Mack D et al.: Montelukast and Nasal Corticosteroids to Treat Pediatric Obstructive Sleep Apnea: A Systematic Review and Meta-analysis. Otolaryngol Head Neck Surg 2019; 160(4): 594-602.
15. Marcus CL, Rosen G, Ward SL et al.: Adherence to and effectiveness of positive airway pressure therapy in children with obstructive sleep apnea. Pediatrics 2006; 117(3): e442-451.
16. Roberts SD, Kapadia H, Greenlee G, Chen ML: Midfacial and Dental Changes Associated with Nasal Positive Airway Pressure in Children with Obstructive Sleep Apnea and Craniofacial Conditions. J Clin Sleep Med 2016; 12(4): 469-475.
17. Villa MP, Rizzoli A, Rabasco J et al.: Rapid maxillary expansion outcomes in treatment of obstructive sleep apnea in children. Sleep Med 2015; 16(6): 709-716.
18. Carvalho FR, Lentini-Oliveira DA, Prado LB et al.: Oral appliances and functional orthopaedic appliances for obstructive sleep apnoea in children. Cochrane Database Syst Rev 2016; 10: CD005520.
19. Verhulst SL, Franckx H, Van Gaal L et al.: The effect of weight loss on sleep-disordered breathing in obese teenagers. Obesity (Silver Spring) 2009; 17(6): 1178-1183.
20. Marcus CL, Carroll JL, Bamford O et al.: Supplemental oxygen during sleep in children with sleep-disordered breathing. Am J Respir Crit Care Med 1995; 152(4 Pt 1): 1297-1301.