

Treatment methods of obstructive sleep apnea (OSA) in children with adenoid hypertrophy and contraindications for adenectomy

Leczenie bezdechu obturacyjnego u dzieci z przerostem migdałka gardłowego i z przeciwwskazaniem do zabiegu adenotomii

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KEYWORDS

obstructive sleep apnea (OSA), obstructive sleep apnea syndrome (OSAS), adenoid hypertrophy, adenectomy, partial adenectomy, submucous cleft palate, velopharyngeal closure, defects of the structure of the palatum, cleft palate

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SUMMARY

Obstructive sleep apnea (OSA) is a common problem in pediatric population, most frequently caused by the adenoid hypertrophy. Improper sleep pattern leads to an inadequate night rest and therefore influences daytime behavior. The easiest method of treatment in such cases is adenectomy, which means the excision of the adenoid (so called "third tonsil"). Obviously, it should be performed only after an objective confirmation of the etiology in the fiberoptics. Children with defects in the palatine, like "overt" and "occult" submucous cleft palate, cleft palate or after palatine reconstructions, stand for an exceptional group of patients. On one hand, all the reconstructive surgeries increase the risk of an obstructive sleep apnea in such children, while on the other hand palatal defects are a classic contraindication for adenectomy. Adenectomy is contraindicated due to an increased risk of velopharyngeal insufficiency, which impairs the act of swallowing and speech. When aggravated symptoms are observed, after specialist phoniatrics consultation, a partial adenectomy should be considered. This procedure means partial excision of the adenoid, where only the superior part of the adenoid, responsible for the blockage of the airflow through posterior choanae, is excised, and at the same time the inferior part is left, providing contact between the adenoid and the soft palate (what is responsible for the preservation of veloadenoidal closure).

STRESZCZENIE

Obturacyjny bezdech senny to częsty problem laryngologiczny w populacji pediatrycznej i najczęściej stanowi objaw wynikający z przerostu migdałka gardłowego. Nieprawidłowy wzorzec snu przyczynia się do nieefektywnego nocnego wypoczynku i ma także odzwierciedlenie w ciągu dnia. Najprostszą metodą leczenia, po potwierdzeniu etiologii problemu w badaniu fiberoskopowym, jest zabieg adenotomii, czyli usunięcia tzw. „trzeciego migdałka”. Szczególną grupą pacjentów są dzieci z wadami w obrębie podniebienia: „jawny” i „utajony” podśluzówkowy rozszczep podniebienia, rozszczep podniebienia czy stany po leczeniu korekcyjnym w obrębie podniebienia. Z jednej strony choroba podstawowa zwiększa u nich ryzyko wystąpienia bezdechu, z drugiej strony z kolei stanowi sztandarowy przykład przeciwwskazania do tego typu zabiegu. Przeciwwskazanie to wynika ze zwiększonego ryzyka powstania powikłania w postaci niewydolności podniebienio-gardłowej prowadzącej do zaburzeń w zakresie aktu połykania oraz mowy. W przypadku nasilonych objawów, po specjalistycznej konsultacji foniatrycznej, zasadne zdaje się być wykonanie adenotomii częściowej, czyli zabiegu polegającego na częściowym usunięciu migdałka gardłowego, a dokładniej jego górnej części odpowiedzialnej za blokadę przepływu powietrza przez nozdrza tylne, przy jednoczesnym pozostawieniu części dolnej zapewniającej kontakt migdałka gardłowego z podniebieniem miękkim (tzw. zachowanie zwarcia podniebienio-migdałkowego).

INTRODUCTION

Obstructive sleep apnea (OSA) is a disorder resulting from recurrent episodes of partial or complete obstruction of the upper respiratory tract during sleep, what impairs one's ventilation and sleep pattern. It is not only a "night symptom", but a group of symptoms caused by hypoxia. As a result, it can lead to behavioral disorders, but also increases the risk of cardiovascular diseases (1).

Obstructive sleep apnea syndrome (OSAS) is diagnosed based on diagnostic criteria settled by AASM (American Academy of Sleep Medicine) (1). According to this classification a diagnosis is made when a patient fulfills the criteria from 2 groups.

The first group represents symptoms observed in children, such as:

- snoring,
- labored, paradoxical, or obstructed breathing during the child's sleep,
- sleepiness, hyperactivity, behavioral problems, or learning problems.

To fulfill the criteria at least one of the symptoms is required. The second group is based on polysomnography results, what helps in objectification and confirmation or exclusion of the respiratory disorders. In this group criteria are as follows:

- one or more obstructive or mixed apneas, or obstructive hypopneas, per hour of sleep,
- a pattern of obstructive hypoventilation, defined as at least 25% of total sleep time with hypercapnia ($*\text{PETCO}_2 > 50 \text{ mmHg}$) and/or arterial oxygen desaturation in association with one or more of the following: snoring, flattening of the inspiratory nasal pressure waveform, and paradoxical thoracoabdominal motion.

Again, compulsory is one of the criteria.

Once the diagnosis is made, we can assess the severity of the OSAS with the use of apnea hypopnea index (AHI), and then categorize OSAS as mild (AHI 1–4.9), moderate (AHI 5–9.9), or severe (AHI > 10) (1).

In pediatric population, apart from the classic risk factors of obstructive sleep apnea, like obesity, muscular disorders, craniofacial deformities, the most frequent pathogenic factor for obstructive sleep apnea is adenoid hypertrophy (2). That's why the most common method of treatment is adenectomy alone or combined with tonsillotomy or tonsillectomy (in foreign literature mostly tonsillectomy, in Poland we usually start with tonsillotomy as a 1st line treatment) (1). Among standard contraindications for this surgical procedure are palatal defects, not only in a form of cleft palate, but also children after reconstructive surgeries and submucous cleft palate or other palatal dysfunctions. However, when aggravated symptoms impairing child's everyday life are observed, after specialist phoniatrics consultation, a partial adenectomy should be considered (3-6).

We analyzed published literature concerning the problem of palatal deformities and its functional disorders in

children, as well as treatment options and qualifications criteria in patients with contraindications for adenectomy. Conclusions are summarized below. We also described 2 clinical cases illustrating the importance of a specialist phoniatrics consultation.

CASE REPORTS

Below we would like to present 2 clinical cases, in which phoniatrics consultation was crucial for the right choice of further treatment options; in one child as a qualification tool for surgical procedure, in other to assess improper speech after adenectomy in another center.

The first case is a 2-years-old girl that stayed under laryngological care due to the delayed speech development. She suffered from chronic otitis media with effusion. During examination a bifid uvula suggesting improper palatal function was remarkable. Due to persisting effusion in both tympanic cavities and inflammatory changes in the right mastoid she was qualified for the right mastoidectomy with bilateral ventilation tube placement, with satisfactory improvement. In the meantime, a specialist phoniatrics consultation was arranged, in which adenoid hypertrophy (obstruction of the nasopharynx ranging 90%; fig. 1) and incomplete veloadenoidal closure (fig. 2), meaning contraindication for a potential adenectomy, were stated. At the time of consultation, the possibility of partial adenectomy was not considered due to the lack of severe symptoms (e.g. no obstructive sleep apnea) associated with adenoid hypertrophy.



Fig. 1. Adenoid hypertrophy, 90% nasopharynx obstruction (own clinical material)



Fig. 2. Incomplete veloadenoidal closure (own clinical material)

Our second case is a boy that was hospitalized in our clinic due to some other reason, but his abnormal speech in a form of slurred pronunciation and hypernasality were remarkable. In his medical history he had had adenotonsillectomy at the age of 3 in another laryngological center. He has never been consulted with a phoniatrics before. Such consultation was performed for the 1st time in our ward. Laryngological examination revealed shortened soft palate and not split uvula, but fiberoptic (fig. 3a, b) showed incomplete nasopharyngeal closure. There was no evidence for significant adenoid regrowth. Therefore, this is an example of an "occult", easy to be overlooked, palatal dysfunction, where adenectomy worsened the character of speech. Our patient was qualified for the velar electrostimulation.

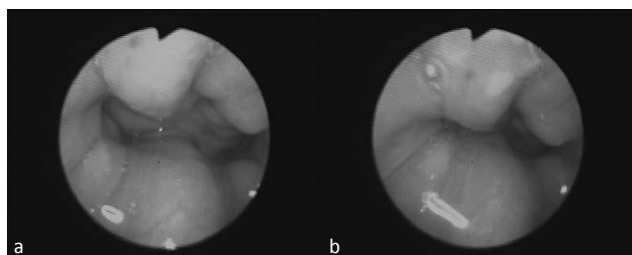


Fig. 3a, b. No significant adenoid regrowth, incomplete velopharyngeal closure due to the shortened soft palate, effective closure reached only on the level of uvula (own clinical material)

DISCUSSION

An appropriate palatine function results from the ability to reach a complete palatopharyngeal closure, what enables the correct act of swallowing and speech (4, 6).

Palatopharyngeal closure is the effect of synchronous movements of the palatine and posterior pharyngeal wall muscles, frequently called a sphincter mechanism (what underlines its coordinated movements). During this process medium 1/3 of the soft palate moves anteriorly and posteriorly, at the same time opening and closing an airway passage through the nasopharynx. Lateral pharyngeal walls move medially at the level of and inferiorly to the Eustachian tube ostia, and posterior pharyngeal wall moves anteriorly to facilitate the contact with soft palate. Within the posterior pharyngeal wall, we can distinguish 2 components: an adenoid and a Passavant's ridge (6, 7). The inferior part of the adenoid usually reaches the level of the 1st vertebra (Atlas), where the posterior pharyngeal wall is mostly composed of the pharynx sphincter muscle, whose contraction in axial plane at the level of adenoid forms so called Passavant's ridge. During one's growth we observe a change of the sphincter mechanism from veloadenoidal to velopharyngeal, what happens in adolescence along with the Passavant's ridge development and gradual absorption of the adenoid (8). In adults, due to the growth of the midface and associated with this vertical enlargement of the nasopharynx, even if there is a residual adenoid it stays above the level of closure. Once, it used to be said that there

is a different mechanism of child's and adult's closure, but it turned out that the mechanism stays the same and only anatomical conditions change. Constant remains the level of closure at the point of hard palate. The maximal medial movement of the lateral pharyngeal walls is observed at the level of the hard palate and fully lengthened soft palate (8).

Palatopharyngeal dysfunction means an inadequate velopharyngeal closure of the nasopharynx during speech and/or swallowing. As a result, an inappropriate character of speech in a form of hypernasality occurs and there is a risk of regurgitation during swallowing (the consistency of permeable food depends on the severity of the disorder) (6). Such dysfunction may be the consequence of 3 major causative factors:

- functional disorders- associated with neurological factors leading to impaired control under motor functions,
- structural disorders- lack or deficiency of structural tissues responsible for the closure (e.g. cleft palate, submucous cleft palate),
- improperly developed pattern of velopharyngeal closure.

Palatopharyngeal incompetence is a rare complication of adenectomy in healthy patients, estimated as 1:1500 to 1:10 000 cases (7). Previously unknown or overlooked palatal defect is the most frequent risk factor for its development (according to some authors ranging up to 63,5% cases) (6, 7).

In some patients with shortened soft palate or lowered ability to lift and lengthen the soft palate (with or without previous palatine correction) there is still a possibility to reach a satisfactory closure, what is achieved thanks to the stronger participation of the pharyngeal component (6), sometimes in a form of Passavant's ridge (9). This has been confirmed in the videofluoroscopic examinations (10). If satisfactory closure is reached there is a full compensation, and if not, there is an incompetence. 20-30% is an acceptable level of palatine incompetence after cleft palate reconstructive surgeries (7).

Skolnick at al. investigated the problem regarding movements of the palate and posterior pharyngeal wall in 3 planes during phonation in children after reconstructive surgeries with the use of videofluoroscopic examinations (8, 9). It enabled them to gather and present possible variants of compensation in patients with initial palatine dysfunction (8, 9). In one of their analysis there was a significant participation of the inferior part of the adenoid in all patients, and in 1/3 of cases Passavant's ridge was an additional point of contact (8).

Interestingly, children with cleft palate are at risk of obstructive sleep apnea, estimated as 22-65% (3, 10). It results from the anatomical factors leading to initially narrower respiratory tract (poorly developed midface, retrognathia) (3, 10). What is more, it is additionally enhanced due to reconstructive surgeries as they lead to further narrowing

of the airway's lumen (3, 10). Sometimes enlarged superior poles of the tonsils may also affect palatine function and therefore the airflow in the naso- and oropharynx (3).

Adenectomy alone or in combination with tonsillectomy (tonsillectomy) is a gold standard surgical method in the treatment of obstructive sleep apnea (1). However, the procedure of adenectomy is classically contraindicated in children with palatine incompetence (6). Children after reconstructive surgeries are at significant risk of velopharyngeal incompetence (6). Nevertheless, it is said that in justified cases in this population the procedure of partial adenectomy may help in reduction of severe obstructive sleep apnea (3-6, 10). The main aim of partial adenectomy is prevention of the velopharyngeal closure with reduction of the blockage of the posterior choanae at the same time (6, 7). For the time being, there are no multicenter research and analysis concerning this topic. Most conclusions are based on series of case reports.

Some authors suggest special precautionary measures in perioperative care in such children (6). It is advisable to minimize the use of electrocoagulation to reduce the scar formation, what may further narrow the lumen of the respiratory tract (3). Optimally, it would be useful to perform a polysomnography examination pre- and postoperatively, as well as speech assessment, with particular emphasis on nasality (3). In one paper in all children a significant decrease of AHI was observed, in 70,6% elimination of obstructive apnea, but most importantly without significant speech deterioration (3).

According to the recommendations, if either adenectomy or partial adenectomy are contraindicated we should use positive airway pressure in a form of ventilation masks assistance during night breathing (BiPAP, CPAP) (2).

Another important and easy to be overlooked is the issue of the submucous cleft palate (6). It's a type of a disorder,

in which there is an improper connection between muscles of the soft palate with preserved mucous of the nose and pharynx. According to the literature its prevalence is estimated as 0,02-0,08% (11). We can distinguish 2 types of this disorder, an "overt" (11) type that fulfills certain anatomical criteria, and an "occult" (12) type, without typical anatomical features. Among characteristic features that should arouse suspicions of a submucous cleft palate we can distinguish:

- bifid uvula,
- diastasis of the levator veli palatini muscle, separation in the midline that is covered by an intact mucous that causes blue discoloration (so called "zona pellucida")
- an absent posterior nasal spine leading to a notch on the posterior border of the hard palate (6, 11).

CONCLUSIONS

Obstructive sleep apnea (OSA) is a significant clinical problem that may lead to many "nocturnal" and "daily" symptoms, as well as long-term consequences, e.g. an impact on cardiovascular system. It is therefore important to be correctly diagnosed and treated. In pediatric population the most common cause of these syndromes is adenoid hypertrophy, so adenectomy is usually advisable (1). In cases where such treatment method is contraindicated a procedure of partial adenectomy (3-6, 10) or conservative methods enabling to hold constant positive airway pressure during sleep (BiPAP, CPAP) (1) should be considered.

Because of an "overt" and "occult" submucous cleft palate risk (11, 12) a thorough clinical examination of each patient qualified for adenectomy should be performed. In doubtful cases a specialist phoniatrics consultation is essential in an appropriate assessment of the palatine, what helps to reduce the risk of a serious complication, which is a palatopharyngeal incompetence.

CONFLICT OF INTEREST KONFLIKT INTERESÓW

None

Brak konfliktu interesów

CORRESPONDENCE ADRES DO KORESPONDENCJI

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