

## What is New in Sinonasal and Snoring Surgery in Children?

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Obstructive Sleep Apnea Syndrome (OSAS) and rhinosinusitis are common health problems in children; many people suffer from both conditions at the same time. Both OSAS and rhinosinusitis may be associated with otitis media, allergic rhinitis and chronic rhinorrhoea. They are both multifactorial diseases and need thorough evaluation for effective treatment.

### **Obstructive sleep apnea syndrome**

OSAS is a disorder of breathing during sleep characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction (obstructive apnea) that disrupts normal ventilation during sleep and normal sleep patterns.<sup>(1)</sup> Severity of sleep-disorder breathing ranges from increased respiratory effort and related arousals, an upper airway resistant syndrome (UARS), to obvious hypopnea and apnea, obstructive sleep apnea syndrome. If left untreated, OSAS may lead to substantial morbidity including impaired neurocognitive and cardiopulmonary func-

tion, behavioral disturbance, and compromised somatic growth. Despite many unanswered questions about the natural history, the adverse consequences of OSAS in children clearly mandate the institution of early and effective therapy for this condition. Snoring is a hallmark symptom that leads the parents to take their children for evaluation. Approximately 10 % of children snore on all or most nights and most of them have what is termed primary snoring (PS).<sup>(2)</sup> PS is snoring that occurs without apnea, associated gas exchange abnormalities, or excessive arousals. It is considered benign and may resolve over time. Treatment is not recommended for PS. It is estimated that up to 2% of all children having OSAS.<sup>(2)</sup> OSAS and PS have some clinical features in common. History and physical findings may not provide an accurate diagnosis of OSAS and identify the children who really need treatment. Signs and symptoms of OSAS may also not accurately reflect the severity of the disease. Most of children with OSAS have snoring with adenotonsillar hypertrophy and

should be treated by an otolaryngologist. Children with OSAS may be referred to a pediatrician for a treatment of failure-to-thrive. Sleepy children may be sent to neurologist, and children with behavioral problems may visit a psychologist. A variety of specialists should be involved to address the interdisciplinary nature of this disease.

### Diagnostic tests for childhood OSAS

1. Nocturnal polysomnography
2. Nap polysomnography
3. Overnight pulse oximetry
4. Audiotaping and videotaping

Polysomnography (PSG) is considered the gold standard for diagnosis and severity assessment. However, the availability and cost of the test are major problems. Time-consuming evaluation of data tracings needs to be done by an expert not a computer. A variety of diagnostic tests have been used but none can be relied upon as being completely accurate. Most of the tests tend to be helpful if results are positive, but they have a poor predictive value if results are negative. Direct observation of a child experiencing apnea, retractions and paradoxical respirations during sleep by medical personnel or even educated parents may allow for a diagnosis of OSAS.

### Nonsurgical management

CPAP and BiPAP have been proven to be effective therapies that help to distend the oro- and hypopharyngeal airway during sleep. The discomfort from the instruments decreases the patients' compliance for long-term use. Polysomnography has to be

performed periodically for titration of the pressure level setting. Using CPAP and BiPAP on patients during early post-operative period is also helpful.

Weight reduction is recommended for all overweight patients, but it is rarely successful in resolving OSAS and only delays the inevitable surgery. A study of 216 overweight patients showed resolution of OSAS by means of weight loss alone in 24 patients (11.1%).<sup>(3)</sup> During an 8-year follow-up period, half of them had regained the weight that was lost and half of the patients who maintained their weight also redeveloped OSAS. This study concluded that weight reduction resulted in long-term relief of OSAS in 3% of the patients.

Emergency treatment of severe OSAS may begin with artificial airway such as nasopharyngeal and oral airways. They are effective for short-term use while waiting for definitive surgery.

Pharmacotherapy with short course oral prednisolone showed no significant reduction in OSAS symptoms and home PGS indices.<sup>(4)</sup> Studies of topical intranasal steroid showed some temporary benefit in otherwise healthy patients with mild to moderate OSAS.<sup>(5)</sup> This approach seems to have a therapeutic role in some selected patients who have sinonasal obstruction. A 30-day course of amoxicillin with clavulanic acid reduced the need for surgery during 1-3 month follow-up period.<sup>(6)</sup> Then, the number of patients requiring surgery increased with time. This approach may temporarily relieve the symptoms and defer the definitive treatment if immediate surgery would incur unaccept-

able risk.

### Surgical treatment

Treatment plan is considered on an individual case basis and depends on the site of obstruction and underlying diseases. Burstein FD, et al<sup>(7)</sup> proposed the airway zone concept for selection of the proper management of OSAS in children (figure 1). In most of the cases, obstruction occurs at the I-II level. Physical examination alone usually is adequate for diagnosis and establishing the likely location of obstruction. Lateral neck radiography is useful to evaluate adenoid size; however, it does not predict the presence or severity of OSAS. Sleep fluoroscopy is a valuable adjunct to endoscopy when hypopharyngeal collapse or

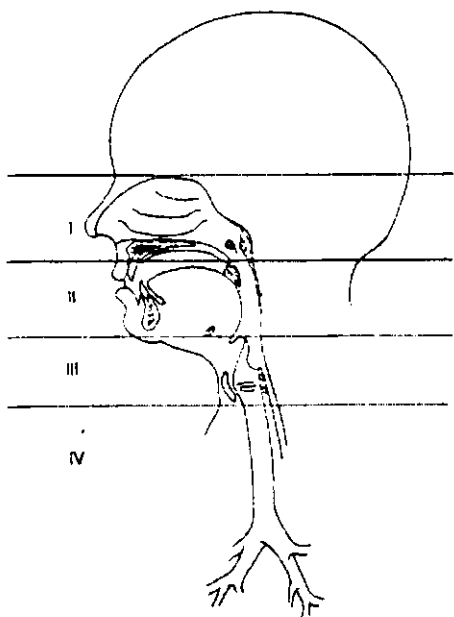
multiple levels of obstruction are suspected.<sup>(8)</sup> The aim of surgical treatments is to improve the airway by addressing the location of the problem by means of the followings:

1. Tissue removal
2. Framework suspension and advancement
3. Obstruction bypass

Tonsillectomy and adenoidectomy are tissue removal procedures commonly performed in children. They are effective in 80% of the cases because adenotonsillar hypertrophy is the major cause of OSAS in children. This is widely accepted as the first step of surgical treatment if there is no other obstruction site demonstrated. Many techniques and instruments have been developed in order to reduce the operative time, blood loss, and postoperative pain.

Excision of the whole tonsil with unipolar or bipolar electrical cauterization, laser, harmonic scalpel, and radiofrequency wave (RF) have been proven to have some benefit in term of reduced operative time and bleeding control over the traditional cold knife method.<sup>(9, 10)</sup> However, patients still suffer from postoperative pain and poor oral intake. Recently, partial tonsillectomy, preserving the inner capsule and anterior pillar, in OSAS children have been reported to reduce postoperative pain and analgesic need while helping the patients to resume oral diet and their normal activities earlier.<sup>(11-13)</sup> This procedure can be performed with laser, RF, and microdebrider devices.

Adenoidectomy has been traditionally performed using a curettage technique. It is a partially blinded procedure



**Figure 1** Airway zones: I=nares to velum; II=lips to hypopharynx; III=epiglottis to trachea; and IV=subglottis to bronchi

because the operative field is obscured by bleeding and there is limited space for using a mirror and a curette at the same time. Using suction cautery and/or microdebrider, the surgeon can perform the procedure under clear vision with precise removal of the adenoid tissue. These instruments are superior to a curette for reaching and removing adenoid tissue in the area around the eustachian tubes' opening and higher in the choanas without injury to adjacent structures. To prevent nasopharyngeal insufficiency, precise partial adenoidectomy can be accomplished with the help of these instruments. They also facilitate the operation by reducing the operative time and results in no more bleeding than does the curettage technique.<sup>(14,15)</sup>

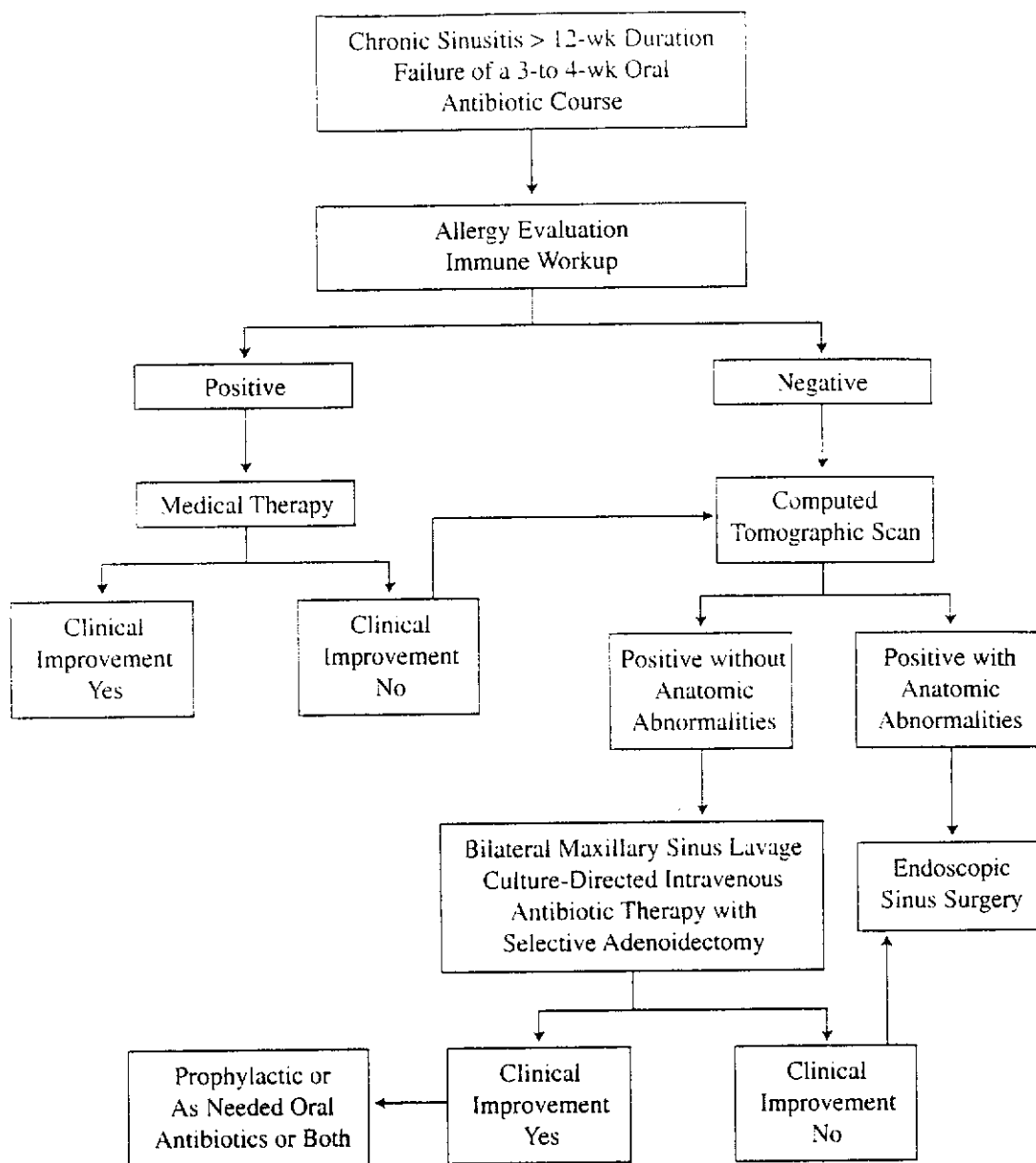
Surgical techniques that have been advocated in addition to T&A include uvulopalato-pharyngoplasty, uvulectomy, epiglottoplasty, distraction osteogenesis, mandibular advancement, tongue reduction, septoplasty and turbinectomy. They are indicated in selected cases based on the location of obstruction. Aggressive surgical intervention has been proven to be effective in the treatment of OSAS in complicated cases such as in patients with Down's syndrome, cerebral palsy and craniofacial deformities. Long-term tracheotomy can be avoided resulting in a better quality of life.

Tracheotomy is still the definite treatment of OSAS in children. It should be the last treatment when there is no better option. There are potential complications from pediatric tracheotomies but, with good care, they are minor and preventable. It is

frightening for parents and caregivers to take care of a child with a tracheotomy. Home care also required instruction and proper instruments. The physician and parents have to discuss whether or not the child should go through the complicated aggressive surgery or have a simple tracheotomy. Results from a questionnaire to parents showed improved quality of life in the children without tracheotomy; however, the patients did not give their own answers. In cases of severe cerebral palsies, patients may fully recover from OSAS and enjoy life with a tracheotomy instead of suffering from multisession complicated surgeries and inadequate improvement of OSAS.

### Rhinosinusitis

Pediatric sinusitis is one of the leading causes for antibiotic prescription. Although new effective antimicrobial agents have been developed, recalcitrant pediatric sinusitis cannot be cured due to the multifactor nature of the disease. The treatment is to get rid of the infection and ensure adequate ventilation of the sinuses. Underlying conditions such as allergy, smoking in the household, and day care attendance have to be controlled. Without underlying diseases, pediatric refractory sinusitis tends to improve spontaneously over time due to maturation of systemic immunity, anatomy and physiology of the sinuses. Management should start with less to more invasive treatments as depicted in a stepwise protocol (figure II).<sup>(16)</sup> Surgery is considered at the end of the treatment list after less invasive treatments have failed to produce results.



**Figure II** Stepwise protocol for refractory chronic sinusitis

### Surgical options

Antral aspiration is the gold standard for diagnosis of sinusitis. It also helps to relieve the symptoms and get a specimen that can be cultured for diagnosis and prescription

of the appropriate antimicrobial agent. Indications for sinus aspiration are the presence of severe symptoms, medical failure, an immunocompromised host and suppurative complications.

Adenoid hypertrophy causes mechanical obstruction, stasis of nasal secretions and a cycle of inflammation and infection. Adenoidectomy has been reported to relieve the patients' symptoms of sinusitis. However, the diagnosis of chronic pediatric sinusitis is difficult; it may be a misdiagnosis of chronic obstructive adenoiditis and/or recurrent episodes of upper respiratory tract infection. A significant correlation of sinonasal infection symptom scores with colony-forming units of adenoid core pathogens has been reported.<sup>(17)</sup> The identical strains of bacteria were present in adenoids and lateral nasal wall simultaneously.<sup>(18)</sup> These findings support the concept that adenoid tissue may be a reservoir of potential bacterial pathogens and cause acute bacterial rhinosinusitis concomitantly. Thus adenoidectomy seems to be a reasonable first surgical step for children with chronic sinusitis.

Pediatric functional endoscopic sinus surgery (FESS) has been recommended as an effective treatment for chronic sinusitis or recurrent acute sinusitis that has failed to resolve with maximal medical treatment. The aim of the procedure is to create adequate sinus drainage and preserving the normal sinonasal mucosa as much as possible using the maximal visualization of rigid rod-lens endoscopes. The procedure in children is similar to that in adults but more conservative. Because the disease is mostly confined to the anterior ethmoid sinus, the common procedures are endoscopic ethmoidectomy and enlargement of the osteomeatal complex. Concerning future

facial growth, studies of quantitative anthropomorphic analysis, expert qualitative analysis and CT volumetric studies showed that long-term facial growth was not affected after pediatric FESS.<sup>(19,20)</sup> The use of proper technique, cutting instruments, microdebrider, and preoperative CT scanning can make the procedure safe and effective.

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