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Expert Consensus Statement: Management of Pediatric Persistent Obstructive Sleep Apnea After Adenotonsillectomy

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Abstract

Objective. To develop an expert consensus statement regarding persistent pediatric obstructive sleep apnea (OSA) focused on quality improvement and clarification of controversies. Persistent OSA was defined as OSA after adenotonsillectomy or OSA after tonsillectomy when adenoids are not enlarged.

Methods. An expert panel of clinicians, nominated by stakeholder organizations, used the published consensus statement methodology from the American Academy of Otolaryngology-Head and Neck Surgery to develop statements for a target population of children aged 2-18 years. A medical librarian systematically searched the literature used as a basis for the clinical statements. A modified Delphi method was used to distill expert opinion and compose statements that met a standardized definition of consensus. Duplicate statements were combined prior to the final Delphi survey.

Results. After 3 iterative Delphi surveys, 34 statements met the criteria for consensus, while 18 statements did not. The clinical statements were grouped into 7 categories: general, patient assessment, management of patients with obesity, medical management, drug-induced sleep endoscopy, surgical management, and postoperative care.

Conclusion. The panel reached a consensus for 34 statements related to the assessment, management and postoperative care of children with persistent OSA. These statements can be used to establish care algorithms, improve clinical care, and identify areas that would benefit from future research.

Keywords

pediatric, children, sleep apnea, obstructive sleep apnea, sleep disordered breathing, sleep endoscopy, lingual tonsillectomy, supraglottoplasty, Down's syndrome, cine MRI, CPAP, tongue base, turbinate surgery, tongue suspension, dental appliance, epiglottopexy, adolescent, allergic rhinitis, sleep study, polysomnography, oximetry, montelukast, nasal steroid, oxygen, shared decision-making, tracheostomy

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Pediatric obstructive sleep apnea (OSA) occurs in 1.2%-5.7% of children in the United States.[1] While adenotonsillectomy (AT) is considered first-line therapy for the treatment of pediatric OSA, persistent OSA after AT occurs in greater than 25% of children.[2–5] The management of persistent OSA can be challenging for

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providers and families as multiple factors such as obesity, medical co-morbidities, other sites of airway obstruction, and medical and surgical treatments need to be taken into account prior to establishing a comprehensive treatment plan. The term persistent OSA was used throughout this document for consistency to refer to children with OSA after AT or tonsillectomy alone, but the statements included in this document also refer to the care of children with recurrence of OSA after a previous AT or after tonsillectomy alone.

Management recommendations can be difficult to provide given the lack of published studies investigating the long-term outcomes of persistent OSA treatment in children. Studies of primary OSA in children with an initial diagnosis of mild to moderate OSA treated with AT have shown moderate improvements in quality of life and behavior with conflicting evidence regarding improvements in attention and neurocognitive performance.[6,7] However, these types of studies have not been extensively carried out in children with persistent OSA, leaving providers with a gap in knowledge when counseling families regarding effective treatment options.

Drug-induced sleep endoscopy (DISE) for evaluation of persistent pediatric OSA has received much attention over the past decade to evaluate children with persistent OSA, and statements from a 2021 expert consensus statement (ECS) regarding its use are consistent with the 4 additional statements concerning DISE that are included in this consensus statement.[8] Recommendations from that expert panel include highlighting DISE's use in children with persistent OSA prior to additional surgery as it may be useful to plan additional sleep surgeries.

While medical management (eg, medication, continuous positive airway pressure [CPAP], weight loss) has been found to be effective as initial management for children with mild primary OSA, medical management has not been extensively studied in children with persistent OSA.[9] In addition, while weight loss is desirable for all children who are overweight or obese, access to and success of weight loss services are limited. Weight loss and CPAP are also recommended for persistent OSA management, but efficacy and tolerance have not been evaluated over long periods after diagnosis.

Similarly, surgical outcomes for children with persistent OSA after selected procedures, such as turbinate reduction, lingual tonsillectomy, supraglottoplasty, remain largely unknown.[10] In addition, multidisciplinary care has been advocated for management, especially in children with complex medical histories, obesity, and craniofacial syndromes, but, outcome data has not provided definitive answers pertaining to optimal management strategies.[11]

There is significant practice variation in the postoperative management of children who have undergone AT for primary sleep disordered breathing (SDB) or OSA.[12,13] Routine clinical follow-up is not universal for these children, and when it does occur, it frequently occurs by phone or electronically, without an in-person evaluation. Additionally, postoperative polysomnography (PSG) may only be recommended in limited clinical scenarios. Optimal timing of postoperative PSG is also not standardized in the management of children with persistent OSA.

Given the frequency of persistent OSA after AT and the lack of well-designed outcome studies, many children stand to benefit from standardized and evidence-based pediatric OSA care. In light of these findings, the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF) Guidelines Task Force (GTF) selected this topic for the creation of an ECS. The AAO-HNSF defines ECS as "statements based on expert opinion and the best available research evidence for which consensus is sought … in order to identify opportunities to improve patient care and clinical outcomes." The goal of this ECS was to establish areas of consensus among a group of experts in the field regarding diagnosis, team-based care, medical therapy, and surgical interventions. The panel members hoped to clarify areas of controversy, identify areas where experts agree on best practices, and identify areas in need of research so that children with persistent OSA have the best possible outcomes.

Methods

This ECS was developed according to an *a priori* protocol[14] (previously used by AAO-HNS to successfully develop multiple other consensus statements) with the following steps: (1) define the subject of the ECS as managing pediatric persistent OSA after AT, (2) recruit the expert development group, (3) vet potential conflicts of interest among proposed development group members, (4) perform a systematic literature review, (5) determine the scope and population of interest for the ECS, (6) develop topic questions and proposed consensus statements for each topic question, (7) develop and implement modified Delphi Method surveys, (8) revise the ECSs in an iterative fashion based on survey results, and (9) aggregate the data for analysis and presentation. The pertinent details of each of these steps will be briefly described.

Determination of the Topic of an ECS, Development Group Recruitment and Vetting

"Persistent OSA" was proposed for an ECS by the AAO-HNS Pediatric Otolaryngology Committee. After deliberation, the AAO-HNS GTF approved and prioritized the topic for an ECS, development group leadership was selected, and administrative support was allocated. Development group membership was strategically chosen

to ensure appropriate representation of all relevant stakeholder groups and organizations within otolaryngology. The stakeholder organizations were contacted regarding the consensus statement project and the requirements and desired qualifications for development group membership; each organization then nominated their own representative content expert to participate. Content expertise was determined by the stakeholder organization.

The ECS development group included representatives from the Society of Otorhinolaryngology and Head-Neck Nurses (SOHN), the International Surgical Sleep Society (ISSS), the American Academy of Sleep Medicine (AASM), and appropriate committees within the AAO-HNS, including the Board of Governors, the Sleep Disorders Committee, the Pediatric Otolaryngology Committee, the Pediatric Otolaryngology Education Committee, and the Section for Residents and Fellows. The methodologist and staff were nonvoting members of the development group.

All development group members were in active clinical practice, were content experts in persistent OSA, and agreed in advance of the appointment to participate in all verbal discussions (performed via teleconference) and voting. Once the development group was assembled, full disclosure of potential conflicts of interest were reported and vetted. Conflicts of interest were managed consistent with the Council of Medical Specialty Societies (CMSS) Code for Interactions with Companies,[15] which requires that the chair and a majority of the participants do not have a relevant conflict with the topic. The development group chair and assistant chair led the development of the consensus statements and the Delphi process with input from a senior consultant/methodologist from AAO-HNS leadership and the GTF, and with administrative support from an AAO-HNS staff liaison.

Literature Review and Determination of the Scope of the Consensus Statement

Two systematic literature reviews were performed by an information specialist, using keywords identified by the development group, to identify current evidence regarding persistent OSA. The literature searches were conducted in March 2021 and April 2021 and included all relevant publications in English from PubMed, EMBASE, Cochrane Database of Systematic Reviews, Web of Science, Agency for Healthcare Research & Quality (AHRQ), ECRI National Guideline Clearinghouse, Canadian Medical Association (CMA) Infobase, The National Institute for Health and Care Excellence (NICE UK), TRIP Database, National Library of Guidelines (UK), Scottish Intercollegiate Guidelines Network (SIGN), New Zealand Guidelines Group, Australian National Health & Medical Research Council, Guidelines International Network (GIN), Cumulated Index to Nursing and Allied Health Literature (CINAHL), Health Services/Technology Assessment Texts (HSTAT), Proquest Central, Joanna Briggs Institute EBP database, Scopus, Google Scholar, NHS Evidence ENT & audiology (UK), and BIOSIS. The second search was undertaken to address more specific questions that were not included in the first literature search. The results of these searches were available for all panel members and were reviewed by the chair and assistant chair who summarized them for the group.

The following terms were used in the search:

(Persistent, pediatric, children, sleep apnea, sleep disordered breathing, pediatric sleep endoscopy, pediatric lingual tonsillectomy, supraglottoplasty and sleep apnea, Down's syndrome and sleep apnea and persistent, pediatric cine MRI, CPAP and persistent pediatric sleep apnea, pediatric tongue base and sleep apnea, pediatric turbinate surgery and sleep apnea, obstructive sleep apnea, drug-induced sleep apnea with persistent or recurrent obstructive sleep apnea, tongue suspension and pediatric obstructive sleep apnea, dental appliance and pediatric obstructive sleep apnea, epiglottopexy, adolescent, allergic rhinitis and pediatric obstructive sleep apnea, sleep studies/polysomnography for persistent snoring/sleep issues, oximetry and persistent/recurrent snoring/sleep disordered breathing, montelukast, nasal steroid and oxygen coupled with persistent pediatric OSA, myofunctional therapy, expansion pharyngoplasty, mandibular distraction, jaw surgery, palate surgery, rapid maxillary expansion, tracheostomy, septoplasty, nasal surgery, hypoglossal nerve stimulator, montelukast, nasal steroids, high flow nasal cannula therapy, oxygen, CPAP, BiPAP, AutoPAP, antihistamines, glossectomy, observation.)

The *target audience* of the ECS was defined as clinicians caring for this condition. These largely include otolaryngologists (ENT), pediatricians, and sleep medicine doctors. The *population* included children 2-18 years of age who had previously undergone AT or tonsillectomy if adenoids were not enlarged.

Delphi Survey Method Process and Administration

A modified Delphi Survey Method was utilized to assess consensus for the proposed statements,[14] with multiple anonymous surveys completed to minimize bias within the development group and facilitate consensus.[16] Web-based software (www.surveymonkey.com) was used to administer confidential surveys to development group members. The survey period was divided into 2 Delphi rounds. All answers were de-identified and remained confidential to development group members; however, names were collected by staff to ensure proper follow-up, if needed.

Each development group member was asked to provide 5 topics and 1 statement. A potential topic list of 43 questions and draft statements was compiled during the first call. The topics and questions were then ranked by the group.

Based on the outcomes of the top ranked topic list choices and resulting discussion, the development group chair and assistant chair developed the first Delphi survey which consisted of 60 statements. Prior to dissemination to the development group, the Delphi surveys were reviewed by the methodologist for content and clarity. Questions in the survey were answered using a 9-point Likert scale with anchor points of 1 = strongly disagree, 3 = disagree, 5 = neutral, 7 = agree, and 9 = strongly agree. The surveys were distributed, and responses were aggregated, distributed back to the development group, discussed via teleconference, and revised, if warranted. The purpose of the teleconference was to provide an opportunity to clarify any ambiguity, propose revisions, or drop any statements recommended by the development group.

The criterion for consensus was established a *priori* and followed the criteria below[14]:

- Consensus: Statements achieving a mean score of 7.00 or higher and having no more than 1 outlier, defined as any rating 2 or more Likert points from the mean in either direction.
- Near consensus: Statements achieving a mean score of 6.50 or higher and having no more than 2 outliers.
- No consensus: Statements that did not meet the criteria of consensus or near consensus.

Three iterations of the Delphi survey were performed. All group members completed all survey items. The development group extensively discussed (via teleconference) the results of each item after the first Delphi survey. Most of the items that reached consensus were accepted; however, 15 consensus statements were revised for improved clarity. Items that did not meet consensus were discussed to determine if wording or specific language was pivotal in their not reaching consensus. The second iteration of the survey was used to reassess items for which there was consensus, near consensus, or for items for which there were suggestions for significant alterations in wording that could have affected survey results. Nine statements were removed due to redundancy. The remaining statements either achieved consensus or did not reach consensus due to a true lack of consensus (i.e., not attributed to wording or other modifiable factors). The third iteration of the Delphi survey offered a final opportunity to reassess the 2 statements that were near consensus; both reached consensus and resulted in a total of 34 statements that reached consensus.

The final version of the ECSs was grouped into several specific areas: General Statements, Patient Assessment, Management of Children with Obesity, Medical Management, DISE Statements, Surgical Management, and Postoperative Management. The final manuscript was drafted with participation and final review from each development group member.

Results

The first literature search yielded 1795 articles, with 106 remaining after the titles and abstracts were screened for relevance. The remaining 106 articles were reviewed independently by the chair and assistant chair and classified per the Oxford Centre for Evidence-Based Medicine's 2011 levels of evidence.[17] Based on the evidence levels, there were 24 Level 1 articles, 44 Level 2 articles, 4 Level 3 articles, 12 Level 4 articles, and 22 Level 5 articles. Thus, most relevant articles were small case series.

The second literature search yielded 502 articles, with 65 remaining after the titles and abstracts were screened for relevance. The remaining 65 articles were reviewed independently by the chair and assistant chair and classified per the Oxford Centre for Evidence-Based Medicine's 2011 levels of evidence.[17] Based on the evidence levels, there were 0 Level 1 articles, 8 Level 2 articles, 26 Level 3 articles, 28 Level 4 articles, and 3 Level 5 articles. Again, most relevant articles were small case series. This literature search was summarized for the consensus group prior to the creation of the consensus statements.

A total of 60 consensus statements were developed for assessment. After 3 iterations of the Delphi survey and removal of duplicative and similar statements, 34 statements met the standardized definition for consensus (**Tables 1–7**), and 18 did not (**Table 8**). The expert statements were organized into specific subject areas.

General Statements

All 5 general statements regarding persistent pediatric OSA reached consensus (**Table 1**). These statements focused on the definition of persistent OSA, symptoms associated with this condition and the importance of shared decision making. Symptoms agreed upon included: snoring, mouth breathing, secondary enuresis, difficulty with attention, fatigue, behavioral problems, underweight/overweight, restless sleep, and hyperactivity.

There was significant discussion regarding the PSG cutoffs that define persistent pediatric OSA. While the consensus statements include children with an apnea hypopnea index (AHI) of 1 event/hour and greater, there

Table 1. General Statements: Statements That Reached Consensus

Number	Statement	Mean	Outliers
2	Children have persistent OSA if they have an AHI of greater than 1 event/hour with symptoms: or an AHI of greater than 5 events/hour without symptoms after tonsillectomy.	7.72	1
3	Shared decision making (including the likelihood of success/cure of additional interventions) assists families and children to determine their optimal surgical and nonsurgical management of persistent OSA.	8.40	0
16	Children have persistent OSA if they have mild to moderate OSA (obstructive AHI between 1 and 10 events/hour) with associated daytime and/or nighttime OSA symptomatology after AT.	7.90	1
17	Children with persistent OSA after AT benefit from multidisciplinary treatment with specific practitioners determined by the medical needs of the child. These providers can include primary care physicians, sleep medicine clinicians, dentists, otolaryngologists, and pulmonologists, among others.	8.81	0
18	Symptoms suggesting persistent OSA include snoring, mouth breathing, secondary enuresis, difficulty with attention, fatigue, behavioral problems, underweight/overweight, restless sleep, and hyperactivity.	8.27	1

Abbreviations: AHI, apnea hypopnea index; AT, adenotonsillectomy; OSA, obstructive sleep apnea.

Table 2. Patient Assessment: Statements That Reached Consensus

Number	Statement	Mean	Outliers
4	PSG is useful after medical or surgical treatment of severe persistent OSA or mild or moderate persistent OSA with symptoms.	7.90	0
5	When PSG is not readily available or when children cannot tolerate an in-laboratory PSG, alternate testing in children (eg, oximetry, home sleep testing, or cardiorespiratory study) can be used to evaluate persistent OSA.	7.72	1
23	A PSG is useful after treatment[a] for persistent OSA to direct management for asymptomatic children with factors that increase the likelihood of persistent OSA that include Down syndrome, obesity, craniofacial syndromes, and neurologic impairment.	7.72	1
25	Waiting 3 months to obtain a PSG after surgical or medical treatment[a] in a child with persistent OSA allows for surgical recovery and establishment of normal sleep schedule.	7.90	0
29	Instruments to evaluate symptom burden and QOL, such as the PSQ and OSA-18, are useful tools in assessing children at baseline and the impact of treatment and treatment modalities in children with persistent OSA.	7.90	0
30	Evaluation for recurrent adenoid hypertrophy is indicated for children with nasal obstruction and persistent OSA after AT.	8.36	0

Abbreviations: AT, adenotonsillectomy; CPAP, continuous positive airway pressure; OSA, obstructive sleep apnea; OSA-18, obstructive sleep apnea-18; PSG, polysomnography; PSQ, Pediatric Sleep Questionnaire; QOL, quality of life.
[a]Treatment refers to any medical or surgical treatment for persistent OSA after AT which may include upper airway surgery, medical therapy, CPAP, and observation.

Table 3. Management of Children With Obesity: Statements That Reached Consensus

Number	Statement	Mean	Outliers
19	Weight loss is part of a multipronged approach to treat overweight and obese children with persistent OSA.	8.18	1
20	Weight loss in children with obesity and persistent OSA improves their OSA.	7.36	1
21	Nutritional counseling is a necessary part of the multidisciplinary care for children with obesity and persistent OSA.	7.72	1
22	Children with obesity and persistent OSA benefit from treatment by weight-loss professionals, including but not limited to nutrition, endocrinology, and bariatric surgery.	7.54	1

Abbreviation: OSA, obstructive sleep apnea.

was extensive debate regarding whether asymptomatic children have persistent OSA with an AHI of 1 or greater if a higher AHI should be consider the cutoff value. There was also conversation regarding the use of the AHI versus an obstructive AHI (oAHI) when defining persistent pediatric OSA. Some panel members felt that any child with an AHI > 1 had OSA regardless of symptoms while other felt that AHI cutoffs up to 5 were warranted in asymptomatic children. This differentiation was ultimately noted to be more consistent with the

Table 4. Medical Management: Statements That Reached Consensus

Number	Statement	Mean	Outliers
7	In children with persistent OSA and surgically modifiable sites of obstruction, surgery or a trial of CPAP are both reasonable options.	8.72	0
8	AutoPAP is a useful therapy in select children with persistent OSA who are awaiting CPAP titration study or further surgical management.	8.27	0
10	Intranasal steroids are a safe and effective treatment for children with mild or moderate persistent OSA and nasal obstruction.	7.90	1
11	Montelukast is an effective treatment for children with mild or moderate persistent OSA and symptoms of SDB.	7.63	1
13	CPAP is a reasonable treatment option for children with obesity and persistent OSA.	8.45	0
26	Observation is reasonable for management of asymptomatic children with mild persistent OSA.	8.27	0

Abbreviations: CPAP, continuous positive airway pressure; OSA, obstructive sleep apnea; SDB, sleep disordered breathing.

Table 5. DISE Statements: Statements That Reached Consensus

Number	Statement	Mean	Outliers
14	Children undergoing DISE-directed surgery for persistent OSA may experience improvement in SDB symptoms and quality of life.	7.81	0
31	The nose is a common site of obstruction in children with persistent OSA and should be assessed.	7.5	0
32	DISE allows for identification of sites of obstruction before performing additional airway surgery for children with persistent OSA.	8.63	0
33	Children undergoing DISE-directed surgery for persistent OSA may experience improvement in the apnea-hypopnea index and oxygen saturation nadir.	7.72	0

Abbreviations: DISE, drug-induced sleep endoscopy; OSA, obstructive sleep apnea; SDB, sleep disordered breathing.

Table 6. Surgical Management: Statements That Reached Consensus

Number	Statement	Mean	Outliers
12	Tracheostomy is an effective treatment for patients with severe persistent OSA in whom other medical and surgical treatment modalities have failed or are contraindicated.	8.63	0
37	Lingual tonsillectomy is a safe and effective treatment for children with persistent OSA who have lingual tonsillar hypertrophy identified using endoscopy.	7.54	1
38	Turbinate reduction surgery is a safe and effective treatment for children with persistent OSA who have turbinate hypertrophy.	7.72	1
39	Supraglottoplasty is a safe and effective treatment for children with persistent OSA who have sleep dependent laryngomalacia identified on DISE.	8.00	0
40	Expansion pharyngoplasty is a safe and effective treatment for children with persistent OSA who have lateral wall collapse identified on DISE.	7.45	1
42	Mandibulomaxillary distraction is a safe and effective treatment for children with severe persistent OSA who have mandibulomaxillary insufficiency.	7.09	1
43	Hypoglossal nerve stimulator implantation is a safe and effective treatment for severe persistent OSA in children with Down syndrome.	7.63	0
44	Craniofacial surgery is beneficial for children with craniofacial abnormalities and severe persistent OSA.	7.45	1

Abbreviations: DISE, drug-induced sleep endoscopy; OSA, obstructive sleep apnea.

Table 7. Postoperative Management: Statements That Reached Consensus

Number	Statement	Mean	Outliers
46	Overnight observation minimizes complications for children who undergo surgery for severe persistent OSA.	7.80	1

Abbreviation: OSA, obstructive sleep apnea.

Table 8. Statements That were Classified as No Consensus

Number	Statement	Mean	Outliers
Management of children with obesity			
10 (Delphi Survey 1)	CPAP is first line therapy for obese patients with persistent OSA after AT. No consensus.	6.54	3
12 (Delphi Survey 1)	The morbidly obese patient with persistent OSA after AT should not be considered for surgery.	4.72	4
Medical management			
25 (Delphi Survey 1)	AutoPAP is useful for the treatment of children with persistent OSA after AT prior to performance of a CPAP titration study.	6.36	3
27 (Delphi Survey 1)	CPAP failure is defined as an inability to tolerate CPAP for 3 months or a lack of symptomatic improvement after 3 months of use.	6.81	5
28 (Delphi Survey 1)	For children with poor PAP compliance and severe persistent OSA after AT, surgical intervention provides improved clinical outcomes than continued PAP use.	6.9	6
52 (Delphi Survey 1)	Intranasal steroids are a safe and effective treatment for children with persistent OSA after AT regardless of the presence of nasal obstruction.	5.81	5
15 (Delphi Survey 2)	Observation is reasonable for management of asymptomatic children with moderate OSA.	6.18	6
Patient assessment			
15 (Delphi Survey 1)	PSG is necessary after medical or surgical treatment of severe persistent OSA or mild to moderate persistent OSA with symptoms.	6.81	5
16 (Delphi Survey 1)	A PSG is useful after treatment for persistent OSA to direct management for asymptomatic children with moderate to severe OSA prior to treatment. No consensus	7	8
17 (Delphi Survey 1)	PSG does not provide useful clinical data after treatment for persistent OSA for asymptomatic children who had mild OSA prior to treatment.	6.45	8
20 (Delphi Survey 1)	PSG are needed only if a child has persistent symptoms of SDB after AT.	3.18	1
34 (Delphi Survey 1)	Assessment for craniofacial abnormalities by a dentist or oral and maxillofacial surgeon is useful for the patient with OSA after AT.	6.72	3
35 (Delphi Survey 1)	Evaluation for recurrent adenoid hypertrophy is indicated for children with Down syndrome and persistent OSA after AT.	7.09	3
6 (Delphi Survey 2)	When PSG is not readily available or when children cannot tolerate an in-laboratory PSG, alternate testing in children can be used to evaluate persistent OSA.	6.80	8
Surgical management			
46 (Delphi Survey 1)	Septoplasty is a safe and effective treatment for children with persistent OSA after AT who have septal deviation.	6.63	4
51 (Delphi Survey 1)	Posterior midline glossectomy is a safe and effective treatment for children with persistent OSA after AT and tongue base obstruction.	6.7	4
56 (Delphi Survey 1)	Tongue-base reduction is a safe and effective treatment for children with persistent OSA after AT who have tongue base collapse.	6.72	4
41 (Delphi Survey 2)	Epiglottopexy is a safe and effective treatment for children with persistent OSA who have independent collapse of the epiglottis identified on DISE.	6.81	4

Abbreviations: AT, adenotonsillectomy; CPAP, continuous positive airway pressure; DISE, drug-induced sleep endoscopy; OSA, obstructive sleep apnea; PSG, polysomnography.

differentiation between OSA syndrome (OSAS) and OSA. In addition, most panelists felt that the obstructive AHI was most useful, but given that the incidence of central events is very low in children, it was decided that it was not necessary to differentiate between obstructive AHI and AHI.

Patient Assessment

Six statements reached consensus (**Table 2**), and 7 statements did not (**Table 8**). The expert panel agreed that PSG is useful but felt that the use of the word "necessary," as it pertains to recommending PSG after surgical treatment of severe persistent OSA or mild to moderate persistent OSA with symptoms, was not supported by the literature. There is a paucity of data regarding children with persistent OSA who have undergone multiple upper airway surgeries and continue to have severe OSA or mild to moderate OSA with symptoms of SDB. The group could not reach a consensus on the value of subsequent sleep studies for children with asymptomatic moderate disease nor mild disease on PSG after AT, due to a lack of studies demonstrating long-term physiologic, neurocognitive, or behavioral deficits. The group identified that in many locations, in-lab PSG can be difficult to carry out, thus alternate testing means may be of benefit to the clinical decision-making team. The panel also recognized the

importance of assessing potential causes of nasal obstruction, especially turbinate hypertrophy, in children with persistent OSA.

Management of Children With Obesity

Four statements met consensus (**Table 3**), and 2 statements did not (**Table 8**). There was significant discussion regarding surgical and CPAP therapy for children with obesity. Many members felt that obesity, as a singular factor, should not exclude a child with persistent OSA from having additional airway surgery. In general, the panel felt that children with obesity should undergo a similar evaluation for sites of upper airway obstruction as children who were not obese, and that children with obesity should not be provided CPAP as a default treatment without proper physical exam evaluation of the airway. The panel felt that the rationale for this recommendation was that children who were candidate for upper airway surgery may consider surgery as a primary management option instead of CPAP therapy. The group also felt strongly that a multidisciplinary approach to obesity management was paramount to the successful treatment of these children.

Medical Management

Six statements met consensus (**Table 4**) and 5 did not meet consensus (**Table 8**). The use of auto-adjusting CPAP therapy (aka AutoPAP) as a management strategy in children was debated among the group, and although its use has not been thoroughly studied in children, it was agreed that its use was beneficial in select children. These children include those with moderate to severe OSA waiting for in-laboratory PAP titration studies. Medical management with intranasal steroids and montelukast is a useful strategy based on the current literature and the group's clinical experience for children with nonsevere persistent OSA. The panel felt that montelukast was effective although they recognized that there is a US Food and Drug Administration (FDA) "black box" warning linking the use of montelukast with serious mood and behavior-related changes. This is explored further in the discussion section. Observation for children with mild, persistent OSA was felt to be a reasonable treatment option, but consensus could not be reached regarding whether observation is also appropriate in the management of children with asymptomatic moderate persistent disease. Severe persistent disease as the group agreed that severe disease should be treated regardless of symptoms.

DISE Statements

DISE was recognized as an important tool to evaluate children with persistent OSA, and the panel created 4 statements regarding this topic, all of which reached consensus (**Table 5**). These statements focused on the utility of DISE in children with persistent OSA to identify sites of obstruction prior to additional surgical intervention. Panel members also agreed that DISE may result in improvement in PSG parameters when used to manage persistent pediatric OSA, including AHI and the oxygen saturation nadir, as well as quality of life and symptom burden.

Surgical Management

A total of 8 statements reached consensus regarding the surgical management of persistent pediatric OSA (**Table 6**). There were 4 that did not reach a consensus (**Table 8**). In general, the expert panel noted that upper airway surgery for persistent OSA can be safe and effective when site-directed. In addition, it was acknowledged that surgery for children with persistent OSA should focus on sites of obstruction identified during the diagnostic workup, including those mentioned in the patient assessment and DISE sections.[13] These recommendations were based on data such as that reported in a 2019 meta-analysis, noting that site-directed upper airway surgery after DISE or CINE MRI for persistent pediatric OSA was found to improve the AHI and minimum oxygen saturation.[10] The 4 procedures that did not reach consensus were septoplasty, posterior midline glossectomy, tongue-base reduction, and epiglottopexy. Lack of consensus primarily centered around concerns that there was limited evidence in children.

Postoperative Management

The importance of overnight postoperative monitoring after sleep surgery for children with severe OSA was recognized by the panel. A single statement regarding postoperative management was created and reached a consensus (**Table 7**). This statement was consistent with the guidance given in the AAO-HNSF Clinical Practice Guideline: Tonsillectomy in Children.[18] There was no significant controversy regarding this statement except for a conversation regarding whether this should also include children with moderate OSA. There was consensus that children with severe OSA should be included, and there was some intentional vagueness in not including a specific cutoff for the definition of severe OSA in order to allow for differences between sleep laboratories and provider discretion.

Discussion

General Statements

While there is little guidance regarding the definition of persistent or recurrent pediatric OSA in children, the AASM defines pediatric OSA PSG findings of 1 or more obstructive apnea, mixed apnea or hypopnea per hour, OR a pattern of obstructive hypoventilation associated with (1) snoring, (2) flattened inspiratory nasal pressure waveforms, and/or (3) paradoxical thoracoabdominal motion.[18] There was broad agreement that treatment for children with persistent OSA should occur for those with an AHI of 1 or greater when there were symptoms

present, but a few panelists were not comfortable defining persistent OSA for children with an AHI of 1-5 events/hour with no symptoms present resulting in 2 statements (2 and 16 in **Table 1**) regarding the definition of persistent OSA.

Given the multiple medical and surgical treatment options for children with persistent OSA, the development group agreed that multidisciplinary treatment is beneficial for these children. This is supported by a large case series which reported that management plans were frequently adjusted and that the SDB improved in some patients which "suggested benefit to a coordinated, multidisciplinary approach."[11]

With the exclusion of mouth breathing, fatigue, and restless sleep,[1,19] the symptoms suggested for screening in the consensus statement are consistent with those described for children with OSA prior to tonsillectomy in the 2019 AAO-HNSF Tonsillectomy in Children practice guideline, as well as those in the Pediatric OSAS guideline published by the American Academy of Pediatrics in 2012. Moreover, mouth breathing and restless sleep are common symptoms reported in association with SDB, with restless sleep included in the obstructive sleep apnea-18 (OSA-18) survey, and mouth breathing included in both the OSA-18 and the Pediatric Sleep Questionnaire (PSQ).[20] Fatigue is a nonspecific term that is often used by patients to define tiredness and thus was included in the consensus statement symptom list.

Given the multitude of treatment options for children with persistent OSA, and the importance of the motivation and participation of both patient and parents, the panel noted that shared decision-making between providers and caregivers improves decision making. Shared decision-making is a process in which the patient/family and provider contribute to the decision-making and both agree on the final treatment decision. The shared decision-making statement is consistent with a study published by Bergeron et al.[21] which found that decisional conflict was lower for families of children with persistent OSA counseled with shared decision-making tools than for those who were not.[21] For those families who used shared decision-making, they were more likely to follow through on the agreed management plan, and CPAP compliance was higher.[22]

Patient Assessment Section

There was a consensus among group members that a PSG should be obtained after medical or surgical treatment for children with severe persistent OSA (with or without symptoms). PSG may also be considered after treatment for those with mild to moderate persistent OSA with symptoms. The rationale for this recommendation is that patients with persistent severe OSA may be at higher risk for residual OSA after further treatment, either surgically or medically. Patients with mild and moderate persistent OSA with residual symptoms after further management should also be considered for PSG. Several studies have demonstrated that clinical and parent-reported assessment and examination are often poor predictors of the presence of respiratory PSG findings.[19,23] The use of PSG can provide objective data regarding the severity of OSA, avoid unnecessary or ineffective surgery in children with primarily nonobstructive events, and provide useful information to counsel caregivers.[24]

While PSG is the gold standard for the diagnosis of OSA,[25] the overnight in-laboratory PSG is labor intensive, time consuming, expensive, and sometimes not readily available.[26] Furthermore, some children may not tolerate in-laboratory testing. In such an instance, alternate testing in children can be considered to evaluate persistent OSA. While the AASM does not recommend home tests (HSAT) for children for OSA, they recognize that it may be technically feasible if trained technicians are available to apply electrodes.[27] They note that HSAT is better at predicting severe OSA than mild to moderate OSA in children and that false-negative tests may be a result of the inability to detect isolated hypoventilation. Limited home testing in the form of nocturnal pulse oximetry, has been used in isolation and may provide useful information. A systematic review of 25 articles assessing nocturnal home pulse oximetry showed that at least 3 clusters of desaturation events (>4%) and oxyhemoglobin desaturation with at least 3 SpO_2 drops below 90% were indicative of moderate to severe OSAS.[28,29] In addition, the combined use of the PSQ with pulse oximetry improved sensitivity when screening for OSA.[30] Testing such as this can be useful if positive but underestimates the presence of OSA partly because rapid eye movement (REM) sleep may not be captured and the majority (55%) of obstructive events occur during REM. In addition, sensitivity may be reduced because children with OSAS have fewer obstructive events than adults but more significant gas abnormalities.[31] Moreover, there is a paucity of studies for these alternate testing options for persistent OSA. Both the provider and the caregiver should be aware of the limitations of such tests. The expert panel felt that a PSG is the most useful test to obtain after treatment for persistent OSA to direct management for asymptomatic children with factors that increase the likelihood of residual OSA. This includes children with Down syndrome, hypotonia, obesity, craniofacial anomalies, neurologic, and neuromuscular impairment. These high-risk children may have persistent OSA even after further medical or surgical management of other sites of obstruction. Moreover, these patients are at higher risk of surgical or anesthetic complications. Improving diagnostic accuracy in these high-risk populations while defining the severity of their OSA may optimize their management.[19]

There is also little information in the literature regarding the optimal timing to obtain a PSG after surgical or medical treatment in children with persistent OSA. The panel members felt that waiting 3 months after

intervention would allow for surgical recovery, including resolution of residual edema. It has been demonstrated that sleep architecture is disturbed, and the AHI can increase, after surgical intervention. Performing PSG too soon after initiation of medical or surgical therapy may under- or overestimate the level of OSA. Moreover, allowing 3 months of recovery after further management would also allow for the establishment of a normal sleep schedule that may have been altered during the course of treatment. The AAP clinical practice guideline suggests waiting to perform a posttreatment PSG for a minimum of 6-8 weeks after surgical treatment to allow for healing and full cardiac, respiratory, and central nervous system recovery, but recognizes that objective data are not available.[1]

Validated instruments to evaluate symptom burden and quality of life, such as the PSQ and OSA-18, have proven to be useful tools in assessing the impact of treatment and treatment modalities in children with persistent OSA.[32–35] Such validated instruments are useful for both monitoring symptoms and counseling families regarding treatment options and shared decision-making regarding care. Studies have demonstrated that persistent OSA can have a significant impact on severity and quality of life for both the patients and the family.[33,34] Monitoring such scores might be a better predictor of the impact of persistent OSA on patients and families. PSQ symptom items, in contrast to PSG results, reflect subjective measures of OSA-related impairment of behavior, quality of life, and sleepiness, and predict their improvement after AT.[36]

Evaluation for recurrent adenoid hypertrophy is indicated for children with nasal obstruction and persistent OSA after AT. However, the revision rate of symptomatic adenoid hypertrophy is infrequent and reported to be less than 1%-2%.[37,38] Recurrent adenoid hypertrophy is unlikely in the first year after the initial surgery, as the mean interval between initial procedure and revision is reported to be approximately 1.5-3 years.[38–40] Possible causes of recurrent adenoid hypertrophy include tubal tonsillar hyperplasia, regrowth of residual adenoid tissue, and extraesophageal reflux.[38] A younger age (<3 years old) at initial surgery has been inconsistently reported as a risk factor for recurrent adenoid hypertrophy.[38,40] Flexible fiberoptic nasal endoscopy and lateral neck X-ray are the two most common diagnostic tools used to assess adenoid hypertrophy.[41] Flexible nasal endoscopy is well tolerated in most children, allows for direct visualization of the adenoids, and was considered the best initial choice for evaluation adenoid size when not considering aerosol exposure.[41]

Management of Children With Obesity

Higher rates of persistent OSA are reported in overweight or obese children compared to their normal-weight counterparts following AT, although surgical intervention remains effective at reducing AHI severity.[42] The prevalence of persistent OSA in children with obesity ranges from 33% to 76%, while in patients who are not obese, the rate of persistent OSA is only 25%-37%.[43] Quality of life OSA scores are also expected to be lower in children with obesity following AT.[44] In patients treated specifically for persistent OSA, second-stage surgeries such as midline posterior glossectomy portend a worse prognosis in patients with obesity; however, studies such as these are underpowered.[45] Similarly, small case series suggest that uvulopalatoplasty and tongue base surgery have limited effectiveness as well.[42] The panel recognized the disparity in surgical outcomes for patients who are overweight and obese and reached a consensus in 4 statements regarding management to improve OSA in this patient population.

The panel reached a consensus that weight loss is part of a multipronged approach to treat children who are overweight and obese with persistent OSA.[42,43,45–47] The panel also reached a consensus that weight loss in patients with obesity may improve OSA.[46] A 2019 study by Andersen et al. found that AHI reduction significantly correlated with a reduction in BMI after 6 months of weight loss therapy.[48] Studies that investigated children undergoing bariatric surgery also found that patients with OSA preoperatively had improvement in OSA scores following weight loss surgery.[46,47] Less extreme weight loss measures have also been found to be successful in treating OSA for children who are obese, despite the difficulty to achieve and maintain these results even with appropriate regimens.[46]

The panel reached a consensus that nutritional counseling is a necessary part of the multidisciplinary care for children who are obese with persistent OSA.[49,50] Notably, weight loss achieved through diet alone is not recommended in this patient population without a multidisciplinary approach that includes exercise to improve sleep architecture.[49,50] The panel also reached a consensus that children who are obese with persistent OSA will benefit from treatment by weight-loss professionals, including but not limited to nutritionists, endocrinologists, and bariatric surgeons.[46–48,50] Bariatric surgery, when used in combination with multidisciplinary weight loss measures, can reduce AHI by 14 events/hour in the best of circumstances for children who are morbidly obese.[47] However, there was some debate between panelists regarding the efficacy of bariatric surgery on improving OSA outcomes, suggesting the need for more research on the subject. While the panel felt that weight loss was important in the management of obese children, there was recognition that weight loss is challenging, and many children have difficulty in achieving it. Moreover, while multicomponent behavior-changing interventions (nutrition, exercise, etc.) may be beneficial in achieving small reductions in body weight, these small weight reductions do not seem to persist beyond short-term follow-up.[51] Thus, the panel advised against weight loss

as the sole treatment for severe OSA; instead weight loss should be included paired with surgery or CPAP.

Medical Management Section

There was consensus that surgery on modifiable sites of obstruction, and/or a trial of CPAP are reasonable options for children with persistent OSA. PAP devices deliver pressurized air via nasal or oronasal interfaces to distend the upper airway and ameliorate OSA. PAP utilization is associated with significant reductions in co-morbidities associated with OSA.[52] In children, PAP settings are typically determined during an in-laboratory titration study. The AAP guideline on the management of OSA recommends referral for CPAP management for symptoms of persistent OSA.[1] There is no evidence that there is an advantage to using bi-level pressure over CPAP with regards to efficacy or adherence in children. The guideline also recognized that compliance with therapy is a concern which may be improved with behavioral modification to facilitate the usage of the device. The use of auto-adjusting CPAP (AutoPAP) is well recognized for adult OSA; the device uses proprietary algorithms to adjust the delivered pressure based on detected resistance and flow patterns with the ability to forgo a separate titration sleep study. One study involving children 13 years and older demonstrated that auto CPAP-derived pressures correlated with the pressures derived during an in-laboratory sleep study and supported its use for adolescents.[53] Given this, the panel agreed that in select children, such as those awaiting surgery for persistent OSA or an in-laboratory CPAP titration study, treatment with auto-adjusting CPAP is a reasonable alternative.

There was a strong consensus among group members to offer the use of intranasal steroids for children with mild or moderate persistent OSA and nasal obstruction. The AAP guideline on the management of OSA also supports the use of intranasal corticosteroids for mild postoperative OSAS.[1] The AAP recommends that response to treatment should be objectively measured after 6 weeks of treatment. Although intranasal corticosteroids can be considered in the management of severe persistent OSA, panel members felt that they are less likely to be of benefit in this population, particularly if used as monotherapy. Multiple meta-analyses of RCT's reviewed the use of medications for the treatment of OSAS in children and supported its ability to improve the AHI and sleep efficiency better than placebo.[9,54]

There was a consensus among panel members that montelukast is an effective treatment for children with mild or moderate persistent OSA and symptoms of SDB. In a small study of children with persistent OSA, researchers found combined anti-inflammatory therapy that consisted of oral montelukast and intranasal budesonide effectively improved and/or normalized respiratory and sleep disturbances compared to children who were not prescribed either medication.[55] In otherwise healthy, surgically naïve children with mild to moderate OSA, multiple randomized controlled trials showed that intranasal corticosteroids and/or montelukast are effective in reducing the oAHI and can therefore offer benefit, at least in the short term. There is, however, no evidence with regards to long-term safety and efficacy or impact on patient-centered outcomes such as cognitive function, daytime sleepiness, or school performance.[56] Although current literature focuses on the use of these medications in surgically naïve children with OSA, the panel believes that these medications are effective in the context of persistent OSA because they target inflammatory pathways and reduce lymphoid proliferation of lymphoid tissue in Waldeyers ring as well as decrease inflammation, particularly in the nasal cavity.[57] The panel also discussed the US FDA "black box" warning linking the use of montelukast with serious mood and behavior-related changes. The development group agreed that montelukast is an effective treatment for children with mild or moderate persistent OSA and symptoms of SDB, particularly for children without previous mood or behavioral issues. However, the panel agreed that the "black box" warning by the FDA should be discussed with families prior to use and is an opportunity to incorporate shared decision-making in the care of these children. Montelukast should be avoided in children with a history of depression and suicidal ideation.

In addition, there was a consensus among panel members that CPAP is a reasonable treatment option for obese patients with persistent OSA. This is consistent with the AAP clinical practice guideline, which recommends that clinicians refer patients who are exhibiting symptoms of persistent OSA for CPAP.[1] While OSA may improve after AT even in children with obesity, a significant number of these patients require CPAP postoperatively. CPAP has been found to be effective in the treatment of OSA, but adherence remains a major barrier.[1]

The panel members felt that observation was reasonable for the management of asymptomatic children with mild persistent OSA. There is no randomized controlled trial to compare observation versus further management for such patients. Studies and clinical experience have demonstrated that children with less severe forms of OSA sometimes improve without treatment.[35] Some studies, most notably the Childhood AT Trial (CHAT), compared AT with watchful waiting in children over 5 with OSA. Among their conclusions, they noted a nonnegligible spontaneous improvement in some children (46%) without treatment. Similar results have been shown for younger patients (2-4 years old).[35] While these studies are for surgically naïve patients, asymptomatic children with mild persistent OSA may benefit from observation after shared decision making with caregivers.

DISE Statements

In a 2021 ECS from the AAO-HNSF,[8] the panel agreed that children with persistent pediatric OSA benefit from DISE. This statement was based on evidence including a 2017 systematic review[58] which found that DISE was able to identify at least one site of obstruction in 100% of 162 children presenting with persistent OSA; sites of obstruction included tongue base, adenoids (secondary to regrowth), inferior turbinates, velum, supraglottis, and lateral oropharynx.[12,59] Furthermore, in a small series of children with persistent OSA, Collu et al.[60] found that DISE resulted in a change in the initial surgical plan based on clinical assessment in over 70% of patients.[60]

While DISE can accurately identify sites of obstruction in children with persistent disease, data regarding the impact of DISE on pediatric OSA surgical outcomes is still emerging. Despite this, the panel agreed that DISE-directed surgery could result in improvements in PSG outcomes, quality of life, and symptoms. They acknowledged that there is a lack of randomized, prospective trials examining the efficacy of DISE. However, they based their opinion on a growing number of studies which demonstrate that pediatric DISE yields improvement in PSG parameters and symptomatology. Wootten et al.[61] demonstrated that DISE-directed multilevel sleep surgery led to improvement in both AHI and symptomology among 31 children with persistent OSA (50% of whom had Down syndrome).[61] In a 2019 prospective study, Esteller et al.[62] noted that DISE-directed surgeries for persistent OSA ($n = 20$), such as pharyngoplasty and lingual tonsillectomy, were effective in improving the AHI, and 85% of patients had an AHI less than 3 events/hour on postoperative PSG.[62] However, other reviews have highlighted those children at risk for residual OSA even after DISE-directed surgery for persistent OSA.[63] The panel agreed that further prospective, randomized trials are needed to definitively demonstrate the utility and outcomes of DISE-directed surgery.

Surgical Management Statements

There was 1 statement related to turbinate reduction, as the panel noted that nasal obstruction is frequently encountered in children with persistent OSA. This is reinforced by the inclusion of nasal obstruction in multiple proposed standardized rating scales for pediatric DISE.[64] Retrospective data have shown that inferior turbinate reduction at the time of AT in children with OSA improved physical and emotional symptoms, daytime function, caregiver concerns, and overall OSA-18 scores when compared to those children who underwent AT alone.[65] However, no data exists for the persistent OSA population. Panelists agreed that turbinate surgery could be useful to treat persistent pediatric OSA; however, they noted that prospective studies are needed to clarify the role of this procedure in the management of persistent OSA and provide more information about long-term outcomes.

One statement noted expansion pharyngoplasty to be safe and effective for children with lateral wall collapse. This recommendation was based on the fact that the palate is a frequent anatomic site of obstruction in children with persistent OSA,[66] uvulopalatopharyngoplasties (UPPP), and expansion pharyngoplasties are frequently performed after DISE evaluation for children with OSA,[63] and that UPPP is effective at reducing the AHI in children with persistent OSA.[67,68] There was no comment specific to traditional UPPP as described by Fujita[69] in 1981 as there is limited data in children.

Two statements related to tongue base obstruction reached consensus, with 1 focused on the treatment of lingual tonsil hypertrophy and 1 supporting the use of hypoglossal nerve stimulation in children with Down syndrome. This was based on data showing that obstruction at the tongue base has been identified in approximately 30%-80% of children with persistent OSA[58,66,70] and that surgical options for tongue base obstruction should be selected based on the underlying etiologies, such as glossoptosis versus hypertrophy of the lingual tonsils.[13,71–73] While the panel felt that lingual tonsillectomy was safe and effective for the treatment of persistent OSA, the panel did not make a statement affirming the use of additional tongue base procedures, such as tongue suspension or partial glossectomy.

Preliminary data from studies examining hypoglossal nerve stimulation for the treatment of persistent OSA are promising in that they show positive PSG and quality of life findings for older children and adolescents with pediatric Down syndrome. However, there is a lack of data regarding long-term outcomes. In addition, further research is needed to identify whether there are additional children, beyond those with Down syndrome, who will benefit from this therapy. Discussion included assessment of children with cerebral palsy, those younger than 10 years of age, children with moderate OSA, or those without genetic syndromes.

One statement was focused on the use of supraglottoplasty as safe and effective treatment for children with persistent OSA with sleep-dependent laryngomalacia identified. This is based on evidence in a 2016 meta-analysis that supraglottoplasty improved AHI for children with sleep-state dependent laryngomalacia.[74]

Two additional statements focused on the role of craniofacial surgery, supporting the use of mandibulomaxillar distraction and craniofacial surgery for children with severe persistent OSA. This is based on research regarding children with craniofacial anomalies where midface and mandibular distraction improved respiratory status in children with upper airway obstruction[75] and avoided tracheostomy tube placement.[76] In addition, in a prospective cohort of patients with Pierre Robin Sequence, mandibular distraction resulted in an increase in total mandibular length and hypopharyngeal airway volume,[77] along with higher

oxygen saturations and lower AHI.[78] For those undergoing craniofacial surgery, there was debate whether children with moderate OSA should be included in the statement but it was ultimately decided that they should be excluded.

The last statement, regarding the use of tracheostomy for children with severe persistent OSA, was based on salvage care for children for whom other medical and surgical treatment modalities had failed or been contraindicated. The panel noted that medical or surgical management prior to tracheostomy was ideal, if possible, but that tracheostomy was more commonly used for children with OSA associated with a syndromic diagnosis.[79]

There was also a recognition that evidence regarding surgical treatment for children with persistent pediatric OSA is limited and this area would benefit from future research.

Postoperative Management

There was a single statement regarding postoperative management in which the panel agreed that overnight observation for children with severe OSA who undergo surgery minimizes complications. Lingual tonsillectomy, for instance, carries a risk of airway obstruction, bleeding, and pneumonia.[72] There are no large-scale studies of at-risk populations for individual upper airway procedures, but as a group, these surgeries likely have similar risk profiles to that of AT. In a 2017 systematic review, Rivero and Durr[71] wrote that "lingual tonsillectomy had similar adverse rates as tonsillectomy." In addition, the tonsillectomy clinical practice guidelines state that "clinicians should arrange for overnight, inpatient monitoring of children after tonsillectomy if they are <3 years old or have severe OSA (apnea-hypopnea index ≥10 obstructive events/hour, oxygen saturation nadir <80%, or both)."[19]

Based on this information, the panel agreed that overnight inpatient observation likely decreases morbidity and mortality in children undergoing surgery for severe persistent OSA. In addition, some of the panelists felt that observation should include children with moderate OSA as well, but this did not reach a consensus. Pabla et al.[80] noted "continuing uncertainty around the prediction of the level of postoperative care which any individual child might require." Based on this concept, the group felt that surgeons should err on the side of caution in children with severe OSA, particularly in those children who are members of high-risk populations.

Conclusions

A panel of clinicians invested in the management of pediatric OSA, including otolaryngologists, a pediatric pulmonary sleep physician, and a head and neck nurse practitioner, developed an ECS regarding persistent/recurrent pediatric OSA management based on available evidence and expert opinion using a published protocol. The panel reached consensus for 34 statements and agreed on the definition of persistent pediatric OSA and the associated symptoms. In addition, they agreed that DISE was useful for assessment of children with persistent OSA, as is PSG, after medical and surgical treatment. The panel agreed that symptom assessment and quality of life should be assessed before and after treatment and that useful treatment include weight loss, nutritional counseling, and AutoPAP in select children. They also agreed that a number of surgical procedures are safe and effective in the treatment of persistent OSA as are medical treatments including intranasal steroids and montelukast in children with mild or moderate disease.

While there were many areas of consensus, areas of disagreement existed. These included the care of the asymptomatic child. This was evident in the definition of persistent OSA and whether asymptomatic children with an oAHI between 1 and 5 events/hour should be treated. In addition, the need for PSG in asymptomatic children was controversial, as was the use of CPAP and observational treatment. There was also disagreement regarding the care of children with obesity as well as concern that multiple surgical options did not have enough evidence in children. In addition, the panel noted the need for further evidence and the value of multi-institutional studies for almost every topic of discussion.

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Disclosures

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