Perioperative Complications of Adenotonsillectomy in Children with Obstructive Sleep Apnea Syndrome

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We evaluated the rate of complications experienced by children who undergo adenotonsillectomy for obstructive sleep apnea syndrome (OSAS), the safety of a standard anesthetic protocol for these children, and preoperative predictors of complications. Sixty-one children with OSAS, confirmed by polysomnography, and 21 children with recurrent tonsillitis were anesthetized using a standard protocol before adenotonsillectomy (ages 2–16 yr, ASA 1–3). The number of complications and medical interventions in the perioperative period were recorded and correlated with the presence and severity of OSAS. Children with OSAS had more respiratory complications per operation than non-OSAS children (5.7 vs 2.9, $P < 0.0001$). Supraglottic obstruction, breath holding, and desaturation on anesthetic induction and emergence were the most common complications. Increased severity of OSAS, low weight, and young age are correlated with an increased rate of complications. Medical intervention was necessary in more children with OSAS during recovery and emergence than in the non-OSAS group (17/61 vs 1/21, $P < 0.05$). Both groups of children had similar opioid requirements and time to discharge from the recovery room. These findings suggest that children with OSAS are at risk for respiratory complications after adenotonsillectomy, but that these complications do not prolong the time to discharge.
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Sleep-disordered breathing (SDB) in children is a spectrum of disorders ranging from primary snoring to obstructive sleep apnea syndrome (OSAS). OSAS is associated with episodes of hypopnea, apnea, and arterial oxygen desaturation (1). SDB may affect 10% of children (2) while OSAS affects 1%–4% of children (2–4). Adenotonsillectomy is the most common major surgical procedure performed in children (5) and has become an increasingly frequent treatment for OSAS (6). In some institutions, OSAS is the most common indication for adenotonsillectomy (7). In 1996, approximately 274,000 adenotonsillectomies were performed as ambulatory surgery in the United States (8). The total number of procedures is probably higher, since the available statistics are based on data for ambulatory surgery alone (8).

Polysomnography (PSG) is recognized as the "gold standard" for diagnosis and quantification of OSAS. Children presenting for adenotonsillectomy may have undergone PSG previously to confirm a clinical diagnosis of OSAS. However, PSG is expensive, time consuming, and unavailable in many sites where adenotonsillectomy is a common procedure. Consequently, most children undergoing surgical therapy for SDB do not undergo preoperative PSG, and the differentiation between primary snoring and OSAS is not known at the time of surgery.

Previous studies have identified risk factors for postoperative respiratory complications in children having adenotonsillectomy for OSAS (9–14). These retrospective studies are limited by the absence of data from PSG to diagnose and quantify OSAS. This issue is further complicated by the fact that clinical criteria are poor predictors of the presence or severity of OSAS (15). The present report is a prospective study of children with PSG-proven OSAS who underwent adenotonsillectomy and were compared to a control group. The goal of the study was to identify risk factors for perioperative complications in children with OSAS who undergo adenotonsillectomy. We expected that children with OSAS would have a higher rate of complications, stay longer in the recovery room, and have a lower requirement for postoperative morphine.

METHODS

Approval for this study was obtained from the IRB of the University of New Mexico School of Medicine (Human Research Review Committee Approval No. 02-118). Children presenting to the pediatric otolaryngology service for adenotonsillectomy due to adenotonsillitis or sleep disturbance were eligible for the

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study. All children were assessed in the pediatric otolaryngology clinic. The decision to undergo PSG was made before entry into the study. Children had PSG if they had signs or symptoms of a sleep disturbance, including snoring, mouth breathing, and witnessed breath holding for at least 3 mo duration. Informed consent was obtained from the caregivers of these children. Exclusion criteria included age <2 or >16 yr; ASA physical status >3; children having additional surgical procedures with the exception of myringotomy and/or pressure equalization tubes; children with craniofacial abnormalities, Down syndrome, asthma, congenital heart disease; children who had undergone previous adenotonsillectomy; and children with contraindications to general anesthesia. The same surgeon performed all surgeries using electrocautery dissection. One of the two attending pediatric anesthesiologists provided anesthesia using a standardized protocol. Children were classified into two groups for analysis: those having adenotonsillectomy for recurrent infection and those having adenotonsillectomy for OSAS.

The presence of OSAS was confirmed by preoperative PSG at the University of New Mexico sleep study laboratory. Data collected included the oxygen saturation nadir and the respiratory disturbance index (RDI). The RDI was defined as the number of apneas or hypopneas per hour. According to the University of New Mexico sleep laboratory, an apnea was defined as a decrease in flow of >90% for two breaths or more and a hypopnea was defined as a decrease in flow of 50% or more, coupled with a 3% decrease in saturation or an electroencephalogram arousal. An RDI of 2 or more was necessary for a diagnosis of OSAS. Observers were blinded to the outcome of PSG and diagnosis of the child.

A history and physical examination were obtained from all children before surgery. Anxiety scores were evaluated using the modified Yale Preoperative Anxiety Scale (mYPAS) (16). A sedative premedication of 0.33 mg/kg of oral midazolam was administered 10–15 min before induction of anesthesia. Children were brought to the operating room (OR) and standard monitors established. Induction of anesthesia was accomplished using 8% sevoflurane in 100% oxygen. After induction, when the patient reached stage 3 of anesthesia, a peripheral IV catheter was established and morphine 0.1 mg/kg, dexamethasone 0.5 mg/kg (maximum 10 mg), and ondansetron 0.1 mg/kg were given. A few positive pressure breaths were delivered to insure that an adequate depth of anesthesia was attained and the trachea was intubated with an age-appropriate oral RAE endotracheal tube. A tracheal air leak at 10–30 cm H_2O was confirmed. Sevoflurane was reduced to attain an end-tidal concentration of 1.5%. Lactated Ringer's solution (20 mL/kg) was given over the course of the procedure. Patients were maintained on positive pressure ventilation until they showed signs of spontaneous ventilation. At this point, they were allowed to resume spontaneous ventilation. Upon completion of surgery, sevoflurane was discontinued and the oronasopharynx and stomach were suctioned by the surgeon. All children were awake with eye opening and purposeful movement for tracheal extubation. When steady spontaneous ventilation was established, they were taken to the recovery room. Children age 3 yr or older with a pain score of 4/10 or more on the Wong–Baker scale (17) or age <3 yr on the FLACC score (18) received 0.025 mg/kg of IV morphine. Pain was assessed on complaint and every 15 min. The attending anesthesiologist evaluated any postoperative nausea or vomiting (PONV). Nausea persisting for 5 min or one episode of vomiting was treated with IV ondansetron 0.1 mg/kg. All children received oxygen during transport to the recovery room and until room air saturations could be maintained above 92%. Children with OSAS and all children <3 yr of age were admitted to monitored pediatric beds postoperatively. Non-OSAS children older than 3 yr were discharged home. The usual admission criteria for children having adenotonsillectomy at the University of New Mexico were followed.

The study period was divided into four discrete time frames: induction/intubation; maintenance of anesthesia; emergence from anesthesia; and postoperative recovery. The induction/intubation period extended from the time oral midazolam was administered to the time of successful intubation. Maintenance of anesthesia began at the time of tracheal intubation and continued until the completion of surgery. Emergence was defined as the time from the finish of surgery until the patient left the OR. Postoperative recovery was from the time the patient left the OR until discharge from the recovery room. Discharge criteria were met by achieving a modified Aldrete score of 9 (19). Aldrete scores were recorded by the recovery room nurse at 15-min intervals and confirmed by the attending anesthesiologist before patient discharge. The following data were recorded during the time periods: duration of each time frame; number of events of breath-holding; number of events of bronchospasm; supraglottic obstruction; number of events of laryngospasm; Cormack–Lehane (20) score for difficulty of visualization of the laryngeal opening at intubation (Grade 1: no difficulty, Grade 2: posterior glottis only seen, Grade 3: only epiglottis seen, Grade 4: epiglottis not visible); number of attempts at intubation; number of mild (<92%) and severe (<85%) desaturation events; need for reintubation during emergence; need for postoperative pain medication; and occurrence of treated PONV. Supraglottic obstruction was defined as the need for an oral airway or, in recovery, persistent jaw thrust. The need for placement of an oral airway or jaw thrust was determined clinically based on observation of work-of-breathing, retraction, and tidal volumes. A complication was defined as an airway event which, if left undetected or untreated, could

lead to patient harm and included the following: breath holding; supraglottic obstruction; bronchospasm; laryngospasm; oxygen desaturation <92%; oxygen desaturation <85%; more than one attempt at intubation; the need for postoperative pain medication and/or postoperative antiemetics; or the need for reintubation. Medical intervention in recovery was defined as the need for oral airway, oxygen to keep O_2 saturations more than 92%, assisted ventilation and reintubation.

Analysis of previous surgical records showed that the diagnosis of OSAS was about three times as common as adenotonsillitis as the presenting cause for adenotonsillectomy. To calculate an appropriate sample size, it was assumed that children with OSAS present for surgery three times as often as children without OSAS, and that the number of complications per anesthetic was four in children with OSAS and two in children without OSAS. We postulated that complications were twice as common in OSAS patients having adenotonsillectomy and that a doubled rate of complications would be clinically significant. This analysis indicated that a sample size of 32 is adequate to detect a significant difference in the number of complications per anesthetic between the two groups with 80% power and $\alpha = 0.05$.

To assess the impact of the relative severity of OSAS on complication rates, a "cut score" analysis was done as follows. Data on complications for children with OSAS were tabulated by increasing intervals of 5 U on the RDI score. Data were tabulated and analyzed as the number of children who had a specific complication. For example, 4/20 means 4 of 20 children had a certain complication. Fisher's exact test was used to make two types of comparisons of complication rates: 1) between children with OSAS and children without OSAS and 2) between groups of children with OSAS but with different RDI scores. Logistic regression was used to define likely sets of complications.

When a child may have had more than one event of a particular complication during the anesthetic, for example desaturation <92%, "event rates" were calculated. Event rates were tabulated as the number of occurrences of a certain complication experienced by all the children in one group. For example, an event rate of 7/20 means that a total of seven events of a complication were experienced by a group of 20 children. These seven events may have occurred in fewer than seven children. It was assumed that event rates, which are not independent variables, followed a Poisson distribution instead of a normal distribution. The analysis of event rates was verified using Poisson regression; the Poisson rates were analogous to the event rates and the P values similar.

A P value <0.05 was used to establish the statistical significance of differences between groups. SAS/STAT® 9.1 software protocols were used in power and statistical calculations (SAS Institute, Cary, NC).

Table 1. Characteristics of Children in the Study Population

	OSAS	Non-OSAS
Number of children	61	21
Male	34 (56%)	11 (52%)
Female	27 (44%)	10 (48)
Age (mean yr, range)	6.5 (2.1–13.3)	7.0 (3.4–12.9)
Weight (mean kg, range)	25.9 (10.3–61)	25.5 (14.7–68.8)
BMI (mean, range)	17.2 (11.6–27.8)	16.3 (12.6–24.4)
mYPAS (mean, range)	5.5 (5–10)	5.8 (5–9)
Total complications per patient (mean, range)	5.7 (2–17)	2.9 (1–7)

OSAS = children with obstructive sleep apnea syndrome; BMI = body mass index; Non-OSAS = children without obstructive sleep apnea syndrome; mYPAS = modified Yale perioperative anxiety score.

RESULTS

Eighty-three children were considered and 82 were enrolled in the study, 61 with a diagnosis of OSAS and 21 with recurrent adenotonsillitis (non-OSAS group). One child with OSAS refused consent and was not enrolled. Data on all 82 children were completed and analyzed. Table 1 shows the characteristics of the children. There were no significant statistical differences between the groups with respect to age, weight, height, body mass index, ratio of male to female and mYPAS scores. There were no differences in characteristics of the children or complication rates between the two anesthesia providers. One provider anesthetized 36 children and the other 46 children. The OSAS group had RDI values ranging from 2 to 88 (mean 16.8, SD 19.4) and oxygen saturation nadir ranging from 33%–95% (mean 84, SD 8.5). OSAS children had more complications per patient than non-OSAS children (5.7 vs 2.9, $P < 0.0001$).

Children with OSAS experienced more complications during anesthetic induction (Table 2). They were more likely to have a Cormack–Lehane score ≥2 (16/61 vs 1/21, $P < 0.05$). Requirement of more than one attempt at tracheal intubation did not reach statistical significance (17/61 vs 2/21, $P = 0.13$). The incidence of supraglottic obstruction on induction was higher in the OSAS group (38/61 vs 5/21, $P = 0.005$), as was desaturation <92% on induction (18/61 vs 0/21, $P = 0.009$). Children with OSAS also had more episodes of breath holding on induction, but this did not reach statistical significance (20/61 vs 3/21, $P = 0.16$).

Children in the OSAS group had more complications on emergence (Table 3). More children had episodes of breath holding on emergence (28/61 vs 1/21, $P < 0.001$) and supraglottic obstruction on emergence (9/61 vs 0/21, $P = 0.1$) as well as desaturation. Desaturation to <92% occurred in 9/61 children with OSAS versus 1/21 in children without OSAS ($P > 0.5$). The event rate (total number of episodes of desaturation for the whole group) for OSAS children was higher (26/61 vs 1/21). Desaturation to <85% occurred in seven children with OSAS compared to one child without OSAS. Again, the event rate for desaturation to <85% was higher in the

Table 2. Number of Children with Complications During Induction Phase of Anesthesia

Complication	OSAS ($n = 61$)[a]	Non-OSAS ($n = 21$)[a]	*P*-value
Cormack–Lehane ≥2	16 (26)	1 (5)	<0.05
More than one attempt at intubation	17 (28)	2 (9.5)	0.13
Supraglottic obstruction	38 (62)	5 (24)	0.005
Oxygen saturation <92%	18 (30)	0 (0)	0.009
Oxygen saturation <85%	9 (15)	0 (0)	0.1
Breath holding	20 (33)	3 (14)	0.16

OSAS = patients with obstructive sleep apnea syndrome; Non-OSAS = patients without obstructive sleep apnea syndrome.

[a] Values in parentheses indicate percentage values.

Table 3. Number of Children with Complications During the Emergence Phase of Anesthesia

Complication	OSAS ($n = 61$)[a]	Non-OSAS ($n = 21$)[a]	*P*-value
Breath holding	28 (46)	1 (5)	<0.001
Supraglottic obstruction	9 (15)	0	0.1
Desaturation <92%	9 (15)	1 (5)	0.44
Event rate of desaturation <92%	26	1	0.23
Desaturation <85%	7 (11)	1 (5)	0.67
Events rate of desaturation <85%	16	1	0.34

OSAS = patients with obstructive sleep apnea syndrome; Non-OSAS = patients without obstructive sleep apnea syndrome.

[a] Values in parentheses indicate percentage values.

Table 4. Number of Children with Complications During the Recovery Phase of Anesthesia in the Postanesthesia Care Unit

Complication	OSAS($n = 61$)[a]	Non-OSAS($n = 21$)[a]	*P*-value
Medical intervention (the need for oral airway, oxygen to keep O_2 saturations >92%, assisted ventilation and reintubation in recovery)	17 (28)	1 (5)	0.03
Additional postoperative morphine	35 (57)	11 (52)	0.8

OSAS = patients with obstructive sleep apnea syndrome; Non-OSAS = patients without obstructive sleep apnea syndrome.

[a] Values in parentheses indicate percentage values.

Table 5. A Comparison of the Number of OSAS Children Experiencing Complications with an RDI Above or Below the Cut Score

Complication	RDI cut score	Complication rate with RDI > cut score[a]	Complication rate with RDI < cut score[a]	*P*-value
Laryngospasm on emergence	30	3/10 (30)	0/51	0.003
Oxygen desaturation <2% on emergence	30	4/10 (40)	4/51 (8)	0.019
Oxygen desaturation <85% on emergence	30	4/10 (40)	3/51 (6)	0.01
Breath holding on induction	20	11/16 (69)	9/45 (20)	0.001
Additional postoperative morphine	5	30/42 (71)	6/19 (32)	0.005

OSAS = patients with obstructive sleep apnea syndrome; RDI = respiratory disturbance index.

[a] Values in parentheses indicate percentage values.

OSAS group (16/61 vs 1/21). Minutes to intubation, minutes to extubation, and duration of emergence tended to be greater in the OSAS group, but differences for these variables between the two groups were not statistically significant.

Children with OSAS had more frequent requirements for medical intervention in the recovery room when compared to children without OSAS (17/61 vs 1/21, $P < 0.05$) (Table 4). Time to reach the discharge criterion of a modified Aldrete score of 9 or more, incidence of nausea (3/61 vs 2/21), and requirement for additional morphine postoperatively (35/61 vs 11/21) did not differ between groups. One child in the OSAS group was reintubated in the recovery room for postoperative bleeding and reoperation.

There were no statistically significant differences between the two groups during the maintenance period.

OSAS children with higher RDI scores experienced a higher rate of some complications than OSAS children with a low RDI score. The RDI score at which the increased rate of complications became statistically significant was different for different complications (Table 5). With an RDI of 30 or more an OSAS patient was more likely to have laryngospasm on emergence (3/10 vs 0/51, $P = 0.003$), desaturation to <92% on emergence (4/10 vs 4/51, $P = 0.019$), and desaturation to <85% on emergence (4/10 vs 3/51, $P = 0.01$). At an RDI of 20 or more an OSAS patient was more likely to have breath holding on induction (11/16 vs 9/45,

$P = 0.001$). At an RDI of 5 or more an OSAS patient was more likely to require additional morphine in the recovery room (30/42 vs 6/19, $P = 0.005$).

Within the OSAS group, Spearman's correlation coefficients correlated young age with supraglottic obstruction on induction (Spearman = 0.26, $P = 0.016$); desaturation to <92% on induction (Spearman = 0.22, $P = 0.049$), desaturation to <92% on maintenance (Spearman = 0.25, $P = 0.025$); and desaturation to <85% on maintenance (Spearman = 0.22, $P = 0.049$) and emergence (Spearman = 0.22, $P = 0.049$). Lower weight in the OSAS group correlated with desaturation to <92% (Spearman = 0.23, $P = 0.042$) and to <85% (Spearman = 0.24, $P = 0.033$) during maintenance. PSG saturation nadir correlated with breath holding (Spearman = 0.27, $P = 0.04$) and supraglottic obstruction on induction (Spearman = 0.3, $P = 0.027$). Logistic regression showed the most likely set of complications among children with OSAS was supraglottic obstruction on induction, desaturation to <92% on induction, and supraglottic obstruction on emergence.

DISCUSSION

This study shows that adenotonsillectomy in children with OSAS is associated with an increased incidence of perioperative respiratory complications. These complications require more medical intervention in children with OSAS. Most complications occurred either during induction from anesthesia or emergence from anesthesia. Children with more severe OSAS as measured by PSG experienced more severe complications. The duration of postoperative recovery and the need for analgesic and antiemetic medication were similar in children, with or without OSAS. Severe complications such as laryngospasm and bronchospasm were uncommon.

Since children with OSAS experience more perioperative complications after adenotonsillectomy, some practitioners have advocated an altered anesthetic regimen for these children (1,9). For the present study, we designed an anesthetic technique for children without OSAS and used the same technique on children with OSAS to verify its safety. It has also been asserted that the use of sedative premedication is contraindicated in children with OSAS (21,22). However, there is little evidence against the use of sedative premedication for these children (23). Sevoflurane is widely used in children and can be used for both induction and maintenance of anesthesia. Morphine was chosen for its long duration of action. Double therapy with dexamethasone and ondansetron was used to reduce the high rate of PONV associated with adenotonsillectomy (24).

Several studies have indicated that children with OSAS have behavioral problems, including inattention, hyperactivity, and increased anxiety (25–27). We evaluated all children in the study using the mYPAS and observed no differences in preoperative anxiety levels between children with OSAS and children without OSAS. This implies that differences in complication rates between the two groups cannot be explained by variation in levels of anxiety.

All children were anesthetized to stage 3 of anesthesia to allow easy placement of a peripheral IV line and laryngoscopy. Children with OSAS took longer to achieve this depth of anesthesia. They had more episodes of supraglottic obstruction, breath holding, and oxygen desaturation. These events may have resulted from decreased muscle tone, since children with OSAS rely more on upper airway tone to maintain airway patency, and have airway closing pressures above atmospheric pressure (28). As a result, minute ventilation could be decreased thus prolonging the time to achieve adequate depth of anesthesia. Oxygen desaturation may also result from episodes of airway obstruction and breath holding or decreased minute ventilation. Children with OSAS had higher Cormack–Lehane scores but the likelihood of requiring multiple attempts at tracheal intubation was not statistically significant. Perhaps the tonsils of children with OSAS are larger, or the decreased oropharyngeal tone and resultant airway collapse reduces visibility of the laryngeal inlet. Children with OSAS not only required a longer time for induction, but also had a prolonged emergence and time to extubation. These delays may be the result of a slow return of upper airway tone that makes it more difficult to attain regular spontaneous respiratory patterns.

In previous reports, an RDI more than 10 has been identified as a risk factor for postoperative desaturation to <70% or postoperative hypercapnia to more than 45 mm Hg (9). It has also been reported that an RDI more than 40 is a significant predictor of postoperative upper airway obstruction and desaturation to <80% (11). In this study, the complication rate on both induction and emergence increased as RDI increased in children with OSAS. Children with an RDI more than 20 were predisposed to breath holding on induction and children with an RDI more than 30 were more likely to experience laryngospasm on emergence and oxygen desaturation to <92% and as low as 85% on emergence.

Children with OSAS not only had more frequent complications during induction and emergence but also were more likely to require supplemental oxygen, oral airway use, or assisted ventilation in the immediate postoperative period. However, there was no significant difference in the time taken to reach the discharge criterion of a modified Aldrete score of 9, implying that these complications may resolve quickly. This finding is similar to that seen in adults in whom the diagnosis of OSAS is not a risk factor for unanticipated admission or adverse events after outpatient surgery (29). However, we cannot draw a similar conclusion on the basis of the present data. Unanticipated admission was not measured in our study, since

all OSAS children and children <3 yr of age were scheduled for admission regardless of their condition in the postoperative recovery unit. There were no unanticipated admissions among those scheduled for same day discharge. The demonstration that discharge criteria are not delayed for OSAS children may imply that some of these children do not need admission. Despite PSG data to suggest that OSAS children have significant improvement in symptoms by the night after surgery (23), a prospective study of admitted children that records postoperative obstructive and respiratory complications would be necessary to identify the characteristics of children who do not require admission.

In previous studies, the rate of postoperative respiratory compromise requiring medical intervention in children undergoing adenotonsillectomy for OSAS ranged from 21%–36% (9–12). The choice of anesthetic technique had no obvious effect on postoperative complication rates in these studies. When a variety of techniques were analyzed, the rates were similar to our standardized protocol (9,12). In the present study, 5% of the non-OSAS group and 28% of the OSAS group required medical intervention postoperatively. Young age correlated with supraglottic obstruction on induction, desaturation to <92% on induction and maintenance, and desaturation to <85% on maintenance and emergence. This is supported by previous reports identifying age of <3 yr as a risk factor (9,11). Oxygen saturation nadir correlated with breath holding and supraglottic obstruction on induction, as has been previously reported (11,12).

Previous observations have shown a correlation between weight less than the 5th percentile and increased perioperative complications (11). Our study showed a correlation between low weight and desaturation to <92% and to <85% during maintenance of anesthesia. However, there was no increased tendency to obstruction on induction or to oxygen desaturation on induction and emergence in low weight children. We did not analyze weight as a function of percentile for different age groups. Such an analysis would require a larger study population.

It has been reported that children with OSAS have a reduced opioid requirement after adenotonsillectomy (30) and have specific sensitivity to opioids (31). This is also a common clinical expectation. In the present study, children with OSAS had the same morphine requirement as those without OSAS. However, children with OSAS who had an RDI >5 were more likely to require supplemental morphine than those with an RDI <5. Though unexpected, these data reflect the observation that adults with OSAS are more likely to require unanticipated admission for pain management after outpatient surgery than adults without OSAS (29). The perioperative use of long-acting opioids in the present study did not appear to increase complications or prolong recovery times.

The strengths of this study are the use of objective data from PSG to quantify the severity of OSAS and use of a standardized protocol involving only a single surgeon and two anesthesiologists to collect prospective data.

The limitations of the study are the relatively small size of the study population and the inability to collect data on all children after discharge from the recovery room. Therefore, we are unable to address the issue of the required duration of observation before discharge of patients who have been admitted. We also did not perform PSG on children with recurrent adenotonsillitis. Of course, some children have both recurrent infections and sleep disturbance before tonsillectomy. It is therefore possible that some of these children had OSAS that remained unrecognized. Ideally, all patients would have had PSG. We can only correlate complications with RDI for patients who had PSG and a RDI >2. Intuitively, RDI <2 would follow the same correlative trend. Over the last 20 yr there has been a trend towards performing more tonsillectomies, particularly in younger children, for OSAS. However, regional differences are likely to play a role in the proportion of children per institution who undergo tonsillectomy for a sleep disturbance versus recurrent infection. Our data are from a large tertiary care facility in an ethnically diverse state and may not closely reflect national trends.

The size of the study population did not provide sufficient statistical power to show significant differences in some clinically relevant complications, such as desaturation on induction to <85%, breath holding on induction (OSAS 20/61, non-OSAS 3/21), or in supraglottic obstruction on emergence for the two groups of children studied. Event rates of desaturation to <92% on emergence (OSAS 26/61, non-OSAS 1/21) and desaturation to <85% on emergence (OSAS 16/61, non-OSAS 1/21) are provided only as clinical observations, since they were not statistically significant.

Having confirmed prospectively that OSAS children do have increased perioperative respiratory complications, the most important research question is to define what subgroup of adenotonsillectomy children requires postoperative admission, and for how long. Though no anesthetic technique has been shown to alter the complication rate, there have been insufficient prospective studies comparing different techniques.

An anesthetic technique designed for non-OSAS children may be used in OSAS children and, in fact, OSAS children may require and tolerate more opioid analgesia than previously thought. Even though perioperative complications are common in these children, they occur mainly on induction and emergence, can be easily managed, and resolve quickly so as not to extend time spent attaining recovery room discharge criteria. However, additional risk factors such as young age and increased RDI must be considered. Fortunately, there was no increased risk of severe, immediate complications in OSAS children. Children

having adenotonsillectomy for OSAS do have an increased rate of minor respiratory complications, but may have a standard anesthetic which includes a sedative premedication and a long-acting opioid.

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