Care of the Pediatric Patient for Ambulatory Tonsillectomy With or Without Adenoidectomy: The Society for Ambulatory Anesthesia Position Statement

Marjorie P. Brennan, MD, MPH,* Audra M. Webber, MD, FASA,† Chhaya V. Patel, MD,‡ Wanda A. Chin, MD,§ Steven F. Butz, MD, SAMBA-F,¨ and Niraja Rajan, MD, FAAP, SAMBA-F, FASA¶

The landscape of ambulatory surgery is changing, and tonsillectomy with or without adenoidectomy is one of the most common pediatric surgical procedures performed nationally. The number of children undergoing tonsillectomy on an ambulatory basis continues to increase. The 2 most common indications for tonsillectomy are recurrent throat infections and obstructive sleep-disordered breathing. The most frequent early complications after tonsillectomy are hemorrhage and ventilatory compromise. In areas lacking a dedicated children's hospital, these cases are managed by a nonpediatric specialized anesthesiologist and general otolaryngology surgeon. In response to requests from our members without pediatric fellowship training and/or who care for pediatric patients infrequently, the Pediatric Committee of the Society for Ambulatory Anesthesia (SAMBA) developed a position statement with recommendations for

AHRQ = Agency for Healthcare Research and Quality; **ASA =** American Society of Anesthesiologists; **ASC =** ambulatory surgery center; **BMI =** body mass index; **CDC =** Centers for Disease Control and Prevention; **CEBM =** Centre for Evidence-Based Medicine; **ETT =** endotracheal tube; **F**IO_2 = fraction of inspired oxygen; **NSAIDs =** nonsteroidal anti-in□ammatory drugs; **NSQIP =** National Surgical Quality Improvement Program; **OSA =** obstructive sleep apnea; **PACU =** postanesthesia care unit; **PRAE =** perioperative respiratory adverse events; **PS =** physical status; **RCT =** randomized controlled trial; **SAMBA =** Society for Ambulatory Anesthesia; **SDB =** sleep-disordered breathing; **SGA =** supraglottic airway; **SOE =** strength of evidence; **STBUR =** snoring, trouble breathing, unrefreshed; **URI =** upper respiratory infections

Tonsillectomy with or without adenoidectomy is one of the most common pediatric surgeries, with well over a quarter million cases performed annually[1]—an incidence similar to that of endoscopic sinus surgery and rotator cuff repair.[2–4] This number is even more signi cant given its context—pediatric surgeries encompass around 6% to 8% of all surgeries performed annually in the United States.[5] The majority of tonsillectomies are performed on an ambulatory basis, cared for by both general and pediatric anesthesiologists.

The primary indication for tonsillectomy is sleep-disordered breathing (SDB) and obstructive sleep

From the *Department of Anesthesiology, Pain and Perioperative Medicine, The George Washington University School of Medicine, Children's National Hospital, Washington, DC; †University of Rochester School of Medicine and Dentistry, University of Rochester Medical Center, Rochester, New York; ‡Department of Anesthesiology and Pediatrics, Emory School of Medicine, Children's Healthcare of Atlanta, Atlanta, Georgia; §Department of Anesthesiology and Perioperative Medicine, New York University Grossman School of Medicine, NYU Lagone Health, New York, New York;¨ Department of Anesthesiology, Medical College of Wisconsin, Children's Wisconsin Surgicenter; and ¶Department of Anesthesiology, Penn State Milton S Hershey Medical Center, Hershey Outpatient Surgery Center, Hershey, Pennsylvania.

DOI: 10.1213/ANE.0000000000006645

Accepted for publication June 16, 2023.

Funding: None.

The authors declare no con icts of interest.

Reprints will not be available from the authors.

Address correspondence to Marjorie P. Brennan, MD, MPH, Ca6-1.7rdecb'rft9 be avb

apnea (OSA), followed by recurrent infection.[1]

tonsillectomy is independently associated with an increased risk of perioperative complications[20] such as OSA, ventilatory depression, and overnight airway events the night following surgery.[21,22] Finally, adenotonsillectomy for SDB or OSA in obese children is less effective than in nonobese children.[23] The most recent clinical practice guidelines of the AAO/HNS[11] recommend polysomnography in pediatric patients with obesity before tonsillectomy with or without adenoidectomy. However, these guidelines are not consistently followed by surgeons.[23] Clinicians assessing patient suitability for ambulatory surgery must therefore use other criteria to assess risk or to establish exclusion criteria, including BMI percentile. A recent survey of members of the Society for Pediatric Anesthesia found that slightly more than half of ASCs have BMI percentile criteria for pediatric patients, and that pediatric-only ASCs were more likely than mixed ASCs to have these criteria. Of those centers that utilize BMI criteria, approximately half use a cutoff of >95th percentile, and half utilize >99th percentile.[24]

Studies have demonstrated that pediatric subspecialty training reduces rates of perioperative ventilatory complications,[25] but most perioperative ventilatory complications are able to be managed by a skilled provider.[18] The majority of studies looking at perioperative ventilatory complications in obese pediatric patients undergoing tonsillectomy with or without adenoidectomy are from academic pediatric institutions staffed by fellowship-trained pediatric surgeons and pediatric anesthesiologists and may not be generalizable to all ASCs. Institutions with less pediatric experience may benefit from more stringent BMI criteria. Additionally, even if the patients meet the criteria to be discharged, the required time and staff intensity for monitoring obese tonsillectomy patients in postanesthesia care units (PACU) is increased compared to their nonobese counterparts.

There is not overwhelming evidence for a specific BMI cutoff for tonsillectomy in ambulatory pediatric patients. However, obese and severely obese children do have higher risks of perioperative respiratory adverse events (PRAE). Until more data are available, we recommend the use of age-specific BMI cutoff at the 95th percentile in freestanding ASCs.

SAMBA recommends a BMI cutoff of the 95th percentile for adenotonsillectomy at freestanding ASCs (low SOE).

How Are Children With SDB Identified?

PRAE remain a significant cause of morbidity and mortality during tonsillectomy.[9] There are several ways to evaluate children for the presence of OSA. Polysomnography is a test to assess OSA severity. However, fewer than 10% of patients scheduled for adenotonsillectomy have a polysomnogram before surgery due to costs and limited availability outside of academic medical centers. Although the AAO-HNS has published specific guidelines for performing polysomnograms before adenotonsillectomy surgery,[11] these are rarely followed.[26]

Children with symptoms consistent with OSA are at increased risk for perioperative complications. Therefore, the challenge is identifying those at risk for SDB/OSA syndrome (OSAS) and evaluating the severity based on clinical criteria alone in most children.

The University of Michigan Snoring, Trouble Breathing, Un-Refreshed (STBUR) scale (Table 2) was developed in 2013.[27] The presence of any 3 STBUR symptoms increased the likelihood of PRAE by 3-fold, and 10-fold when all 5 symptoms were present. The survey tracked well with polysomnography, and the questionnaire is easily administered. The STBUR scale has been validated several times in different studies.[28,29]

A validated adult questionnaire, STOP-Bang, was modified for pediatric use with more typical pediatric risk factors for OSA, but has not been validated in children. The presence of snoring (S), tonsillar hypertrophy (T), obstruction (O), daytime tiredness or neuropsychological-behavioral symptoms such as attention-deficit/hyperactivity disorder or daytime irritability (P), BMI percentile for age (B), age at diagnostic screening (A), presence of neuromuscular disorder (N), and presence of genetic/congenital disease (G) all predict the risk of OSA.[30]

The McGill oximetry score stratifies the severity of OSA in children. The score ranges from 1 (normal or inconclusive) to 4 (severely abnormal) according to the number of clusters and the depth of desaturation events seen during overnight oximetry.[31] The McGill criteria accurately detects OSA of moderate severity, but a negative result does not reliably exclude OSA. This test is not appropriate for patients with syndromes or neuromuscular disorders because desaturations in these situations can be secondary to central events.[32,33]

Table 2. The STBUR Questionnaire

Does your child
1. snore more than half of the time
2. snore loudly?
3. have any trouble breathing or struggle to breathe?
4. stop breathing during the night?
5. feel unrefreshed in the morning after a night of sleep?
When 3 of the 5 symptoms are present the child is 3 times more susceptible to PRAEs.
When all 5 symptoms are present, the child is 10 times more susceptible to PRAEs.

Abbreviations: PRAE, perioperative respiratory adverse event; STBUR, snoring, trouble breathing, unrefreshed.

PRAEs such as bronchospasm, laryngospasm, coughing, desaturation, and airway obstruction occurred less frequently with intravenous induction. In a randomized trial, Ramgolam et al[59] found that an intravenous induction reduces the risk of perioperative ventilatory adverse events in children with certain respiratory symptoms compared to inhalational induction. A systematic review by Porter et al[60] revealed no signi cant difference in the occurrence of perioperative ventilatory adverse events between inhalation induction with sevo urane and intravenous induction with propofol in pediatric patients. More evidence is needed to clearly de ne the perioperative risk differences for inhalation versus intravenous induction in pediatric patients. However, there may be bene ts for those practitioners who do not frequently perform inhalation induction on pediatric patients to utilize intravenous induction.

SAMBA recommends that providers utilize the induction technique they are most familiar with and recognizes that intravenous induction may be advantageous in patients with a history of airway reactivity (low SOE).

Is Ketorolac an Acceptable for Pain Management in Patients Having Tonsillectomies?

The use of ketorolac in patients u 5vl1bc g 0(-)Tj 0 -005 Tc 0.355ts 0 -1.2 Td [(tionomyth a hoith anoul)]ce o

cerients u 5vlo cleadvry piat dtheyos0useinc8 (eactisat urr)1J 0 Tw (g 0(-)6 -26 Td ( )Tj 0 -005 Tc 0.3553Tw 0 --6 -26 T2 Td

scores.[74] This contrasts with a 2013 Cochrane review of 5 articles with 438 patients that showed no advantage of dexmedetomidine compared to the effects of fentanyl or morphine on emergence delirium because the con dence intervals were too wide. The doses of dexmedetomidine ranged from 0.25 to 4 μg/kg in the studies.[75] Franz et al[70] used 1 μg/kg of dexmedetomidine to maintain or decrease discharge times.

SAMBA recommends that dexmedetomidine can be considered in patients likely to bene t from the drug when balanced against possibly prolonged sedation (low SOE).

Do Supraglottic Airway Devices Have Advantages During Tonsillectomies?

The use of a supraglottic airway (SGA) for tonsillectomy with or without adenoidectomy has increased. Advantages of an SGA over an endotracheal tube (ETT) include increased OR ef ciency due to ease and speed of placement,[76–78] improved hemodynamic stability during induction and emergence, and reduced anesthetic requirements, including avoidance of neuromuscular blockade.[4] Studies of ventilatory complications comparing SGA and ETT are equivocal, with some studies reporting a higher incidence of laryngospasm and oxygen desaturations[77] while others note lower incidences of coughing, sore throat, and immediate postoperative pain[78] and improved oxygen saturations with the use of an SGA, especially in patients with respiratory infections.[76]

While some studies noted decreased surgical visualization with SGA use in adenotonsillectomy,[79] other studies did not nd limited surgical access,[78,80] especially when reinforced or exible SGAs were utilized.[81] Disadvantages noted with the use of SGAs are air leaks and environmental contamination with inhalational agents.[82] There is a need to keep a low fraction of inspired oxygen (Fio_2) to reduce the risk of airway res. The comorbidities of some patients having adenotonsillectomies may require higher Fio_2 to prevent desaturation.

Failure rates of SGA use, as de ned by the need to reposition or replace the device, range from 0.6% to 11%.[77,80] Risk factors associated with increased failure rates of SGA are age, mode of ventilation (controlled versus spontaneous), and surgical experience with the device.[77,78]

SAMBA recommends that airway management is based on patient characteristics and surgical and anesthesia team expertise (low SOE).

Are Intraoperative Opioids Advantageous and Safe for Patients Having Adenotonsillectomies?

Data support the use of multimodal analgesia during pediatric adenotonsillectomies. Avoidance of or low-dose intraoperative opioids with multimodal adjuvants has been shown to have similar outcomes compared to the use of intraoperative opioids.[83,84] Avoiding opioids or using the lowest doses may be prudent given the associated comorbidities of SDB and OSA. Patients with severe OSA may bene t signi cantly from a reduction in intraoperative opioid use.[69,84] Avoiding long-acting opioids is recommended.[85] Several studies have shown that postoperative pain scores and PACU durations are similar in patients who received intraoperative opioids and those receiving nonopioid modalities.[86,87] Opioid-free anesthetics are associated with decreased postoperative nausea and vomiting rates.[87] The use of nonopioid analgesics and anesthetic adjuvants for perioperative pain control is highly recommended. Nonopioid adjuvants, including NSAIDs, dexmedetomidine, ketamine, acetaminophen, and dexamethasone improve pain control and decrease opioid requirements.[10,87–89]

SAMBA recommends using opioid-sparing multimodal analgesic techniques in patients having adenotonsillectomies due to the unknown degree of OSA, but there is inadequate evidence to support clinical bene t of opioid-free techniques in pediatric populations (moderate SOE).

Is Deep Extubation Safe After an Adenotonsillectomy?

An awake extubation following adenotonsillectomy is often advised as the standard technique, given the concern for postoperative airway obstruction and ventilatory complications. This technique is recommended for children who are at increased risk of aspiration of gastric contents, those with concerns of a dif cult airway, or children with a history of OSA or SDB because deep extubation may increase the incidence of postoperative airway obstruction.[90–92]

Studies evaluating deep extubation after adenotonsillectomy have shown some advantages over awake extubation without signi cant differences in complication rates.[92] The exception to this nding may be in patients of lower weight (≤14 kg).[90] Advantages of deep extubation are a decreased incidence of coughing,[91,93,94] decreased oxygen desaturations, and a reduced risk of perioperative adverse events in patients with concomitant respiratory infections.[91]

Most studies were done in tertiary care centers and support the decision for extubation technique to be determined by provider experience and systems-based supports such as appropriately trained PACU nursing staff.[90] Additionally, there is evidence that deep extubation with the patient recovering in a lateral position instead of supine may decrease postextubation ventilatory complications.[95]

SAMBA recommends extubation techniques based on the expertise of the anesthesia team and patient factors (low SOE).

Name: Chhaya V. Patel, MD.
Contribution: This author helped with literature review, writing-original draft preparation, writing-reviewing and editing.
Name: Wanda A. Chin, MD.
Contribution: This author helped with literature review, writing-original draft preparation, writing-reviewing and editing.
Name: Steven F. Butz, MD, SAMBA-F.
Contribution: This author helped with literature review, writing-original draft preparation, writing-reviewing and editing.
Name: Niraja Rajan, MD, FAAP, SAMBA-F, FASA.
Contribution: This author helped with contributed to conceptualization, literature review, writing-original draft preparation, writing-reviewing and editing.
This manuscript was handled by: Girish P. Joshi, MBBS, MD, FFARCSI.

REFERENCES

1. Hall MJ, Schwartzman A, Zhang J, Liu X. Ambulatory surgery data from hospitals and ambulatory surgery centers: United States, 2010. *Natl Health Stat Report*. 2017:1–15.
2. Pynnonen MA, Davis MM. Extent of sinus surgery, 2000 to 2009: a population-based study. *Laryngoscope*. 2014;124:820–825.
3. Yanik EL, Chamberlain AM, Keener JD. Trends in rotator cuff repair rates and comorbidity burden among commercially insured patients younger than the age of 65 years, United States 2007-2016. *JSES Rev Rep Tech*. 2021;1:309–316.
4. Truong NM, Cevallos N, Lansdown DA, Ma CB, Feeley BT, Zhang AL. Arthroscopic rotator cuff repair results in lower two-year reoperation rates compared with open rotator cuff repair in a large cross-sectional cohort. *Arthrosc Sports Med Rehabil*

e.
74 (,Swed<<Dav Td [(cially insEuM A.426 0ch Oto.426 0hinol sur)1)ger than the age(w (-).464 Tw 0 -1.176 Td [15;272:737y ce747.524 0 123-based study)111 (

Zhan[(W)9>>>orki EMG(r)18 (up/collabor)37s. PROSPECT guideline in low628-1.176 Td [(Zhang f000tonsi6 h oomy Esyste*
TwPea.ls; t. 3Td [(popul ed78-based study)111 (.)]TJ /T1_7 1 Tf 0 Tw (Laryngoscope)Tj /T1_5 1 TfT (15Tf (. 2021;*

31. Brouillette RT, Morielli A, Leimanis A, Waters KA, Luciano R, Ducharme FM. Nocturnal pulse oximetry as an abbreviated testing modality for pediatric obstructive sleep apnea. *Pediatrics*. 2000;105:405–412.
32. Coverstone AM, Bird M, Sicard M, et al. Overnight pulse oximetry for evaluation of sleep apnea among children with trisomy 21. *J Clin Sleep Med*. 2014;10:1309–1315.
33. Nixon GM, Kermack AS, Davis GM, Manoukian JJ, Brown KA, Brouillette RT. Planning adenotonsillectomy in children with obstructive sleep apnea: the role of overnight oximetry. *Pediatrics*. 2004;113(1 Pt 1):e19–e25.
34. Brietzke SE, Katz ES, Roberson DW. Can history and physical examination reliably diagnose pediatric obstructive sleep apnea/hypopnea syndrome? A systematic review of the literature. *Otolaryngol Head Neck Surg*. 2004;131:827–832.
35. Lin SC, Davey MJ, Horne RS, Nixon GM. Screening for obstructive sleep apnea in children with Down syndrome. *J Pediatr*. 2014;165:117–122.
36. Chervin RD, Weatherly RA, Garetz SL, et al. Pediatric sleep questionnaire: prediction of sleep apnea and outcomes. *Arch Otolaryngol Head Neck Surg*. 2007;133:216–222.
37. Marcus CL, Brooks LJ, Draper KA, et al; American Academy of Pediatrics. Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics*. 2012;130:576–584.
38. Thongyam A, Marcus CL, Lockman JL, et al. Predictors of perioperative complications in higher risk children after adenotonsillectomy for obstructive sleep apnea: a prospective study. *Otolaryngol Head Neck Surg*. 2014;151:1046–1054.
39. Katz SL, Monsour A, Barrowman N, et al. Predictors of postoperative respiratory complications in children undergoing adenotonsillectomy. *J Clin Sleep Med*. 2020;16:41–48.
40. Jaryszak EM, Shah RK, Vanison CC, Lander L, Choi SS. Polysomnographic variables predictive of adverse respiratory events after pediatric adenotonsillectomy. *Arch Otolaryngol Head Neck Surg*. 2011;137:15–18.
41. Wilson K, Lakheeram I, Morielli A, Brouillette R, Brown K. Can assessment for obstructive sleep apnea help predict postadenotonsillectomy respiratory complications? *Anesthesiology*. 2002;96:313–322.
42. J hinTJ /T1_3 j 0.015 Tc -0.015 T1.176 Td (54.)Tj 0 Tc 0.25;79:1838tualTe009>>> d o29>>> BDC -1.647 -1.176 Td ( )Tj EMC T* (37.)T
espiratory

100. Morris LG, Lieberman SM, Reitzen SD, et al. Characteristics and outcomes of malpractice claims after tonsillectomy. *Otolaryngol Head Neck Surg*. 2008;138:315–320.
101. Goldman JL, Baugh RF, Davies L, et al. Mortality and major morbidity after tonsillectomy: etiologic factors and strategies for prevention. *Laryngoscope*. 2013;123:2544–2553.
102. Kou YF, Mitchell RB, Johnson RF. A cross-sectional analysis of pediatric ambulatory tonsillectomy surgery in the United States. *Otolaryngol Head Neck Surg*. 2019;161:699–704.
103. Kong DK, Kong AM, Wasserman I, Villavisanis DF, Hackett AM. Ambulatory tonsillectomy for children with severe obstructive sleep apnea without risk factors. *Am J Otolaryngol*. 2020;41:102467.
104. Friedman NR, Meier M, Tholen K, et al. Tonsillectomy for obstructive sleep-disordered breathing: Should they stay, or could they go? *Laryngoscope*. 2022;132:1675–1681.
105. Gilani S, Bhattacharyya N. Revisit rates for pediatric tonsillectomy: an analysis of admit and discharge times [published correction appears in Ann Otol Rhinol Laryngol. 2021 Aug;130(8):980]. *Ann Otol Rhinol Laryngol*. 2020;129:110–114.
106. Coté CJ, Posner KL, Domino KB. Death or neurologic injury after tonsillectomy in children with a focus on obstructive sleep apnea: Houston, we have a problem!. *Anesth Analg*. 2014;118:1276–1283.
107. Brown KA, Laferrière A, Lakheeram I, Moss IR. Recurrent hypoxemia in children is associated with increased analgesic sensitivity to opiates. *Anesthesiology*. 2006;105:665–669.
108. Adler AC, Chandrakantan A, Nathanson BH, von Ungern-Sternberg BS. An assessment of opioids on respiratory depression in children with and without obstructive sleep apnea. *Paediatr Anaesth*. 2021;31:977–984.
109. Mann GE, Flamer SZ, Nair S, et al. Opioid-free anesthesia for adenotonsillectomy in children. *Int J Pediatr Otorhinolaryngol*. 2021;140:110501.
110. Stanko D, Bergesio R, Davies K, Hegarty M, von Ungern-Sternberg BS. Postoperative pain, nausea and vomiting following adeno-tonsillectomy - a long-term follow-up. *Paediatr Anaesth*. 2013;23:690–696.
111. Diercks GR, Comins J, Bennett K, et al. Comparison of ibuprofen vs acetaminophen and severe bleeding risk after pediatric tonsillectomy: a noninferiority randomized clinical trial. *JAMA Otolaryngol Head Neck Surg*. 2019;145:494–500.
112. Dean L, Kane M. Codeine Therapy and CYP2D6 Genotype. 2012 Sep 20 [Updated 2021 Mar 30]. In: Pratt VM, Scott SA, Pirmohamed M, et al., eds. *Medical Genetics Summaries [Internet]*. National Center for Biotechnology Information (US), 2012.
113. Sadhasivam S, Myer CM. Preventing opioid-related deaths in children undergoing surgery. *Pain Med*. 2012;13:982–983.
114. http://wayback.archive-it.org/7993/20170722185707/https://www.fda.gov/Drugs/DrugSafety/ucm339112.htm
115. https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-restricts-use-prescription-codeine-pain-and-cough-medicines-and