

ONLINE FIRST

Complications of Adenotonsillectomy in Patients Younger Than 3 Years

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Objective: To evaluate the complication rate for adenotonsillectomy in children younger than 3 years, without a diagnosis of severe obstructive sleep apnea, to assess the necessity for postoperative inpatient admission.

Design: Retrospective medical record review (January 1, 2003, through October 31, 2009).

Setting: Tertiary care academic medical center.

Patients: Retrospective medical record review of 105 patients younger than 3 years who underwent adenotonsillectomy performed by a single surgeon. Nineteen patients were excluded from our review because of incomplete medical records or severe underlying disease, leaving a total of 86 patients with medical records available for inclusion in our study. Patient medical records were deidentified and reviewed for age, sex, indications for surgery, intraoperative and perioperative interventions, and postoperative complications. One child with a diagnosis of severe obstructive sleep apnea was excluded from the study.

Main Outcome Measures: Complications, including bleeding, dehydration requiring admission, and airway intervention, during the intraoperative or perioperative period were recorded.

Results: The mean age of the study population was approximately 27.5 months (range, 13-35 months), with

most children (76.5%) between 23 and 31 months of age. Among the patients whose records were reviewed, 80 (93.0%) did not experience any intraoperative or postoperative complications. Dehydration was the most common complication and was the cause of all documented readmissions (4.7%) in our patients who ranged in age from 14 to 30 months. Two patients had other complications, reactive airway disease (n=1) and postoperative fever (n=1), which were identified and treated in the postanesthesia care unit, resulting in same-day discharge. No airway complications were noted in our study.

Conclusions: Our study reveals a low complication rate in children younger than 3 years. The recommendations for mandatory admission for children younger than 3 years should be reexamined. Criteria for inpatient admission for children younger than 3 years should be based on preoperative and postoperative clinical evaluation of the patient and an evaluation of the family resources for adequately caring for young children at home in the postoperative period. These recommendations apply only to otherwise healthy children (American Society of Anesthesiologists classifications I and II) without a diagnosis of severe obstructive sleep apnea syndrome.

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AT AN ANNUAL RATE OF APPROXIMATELY 250 000 cases, adenotonsillectomy remains one of the most frequently performed surgical procedures by otolaryngologists in the United States.¹ Primary and secondary hemorrhages are the major complications for all patients undergoing adenotonsillectomy. Minor complications, such as dehydration and refractory emesis, are of particular concern in the very young, in part because of this population's limited hemodynamic reserve. In 1996, the Pediatric Otolaryngology Committee of the American Academy of Otolaryngology/

Head and Neck Surgery (AAOHNS) set guidelines recommending children younger than 3 years be treated in the inpatient service after adenotonsillectomy.² These recommendations were based on studies from the 1980s and early 1990s that documented young patients to be at greater risk for postoperative complications, requiring readmission and inpatient care.

In addition to age, the AAOHNS recommends that candidates for outpatient tonsillectomy who are undergoing surgery in a nonemergency fashion meet physical status criteria consistent with the American Society of Anesthesiologists

(ASA) classifications I and II.³ Furthermore, children being considered for outpatient treatment should not exhibit symptoms of severe obstructive sleep apnea-hypopnea syndrome as defined by the American Thoracic Society 1996 guideline and should live in reasonable proximity to a hospital.⁴ In recent years, obstructive breathing has replaced infection as the most common indication for adenotonsillectomy in pediatric patients.⁵⁻⁸ With a strict adherence to current academy recommendations, a significant portion of patients undergoing adenotonsillectomy because of obstructive disease may be excluded from consideration for outpatient procedures.

Changes in surgical technique during the past 14 years include not only the widespread transition from “cold/classic” tonsillectomies to electrocautery “bovie” tonsillectomy but also the practice of partial tonsillectomy using a microdebrider or coblation device. Although largely documented for older patients, numerous studies⁸⁻¹⁰ have validated that these newer techniques demonstrate improved outcomes, such as decreased incidence of primary hemorrhage and shorter recovery time. More recent studies reexamining complications in the very young along with institutional and personal experiences in the operative setting have caused some surgeons to question the need for overnight admission in young patients. Sufficient data are still needed, however, to effectively produce an evidence-based justification for challenging these longstanding guidelines. Our study seeks to address this need for additional data by retrospectively examining the outcome of adenotonsillectomy performed in 105 very young children.

METHODS

A retrospective medical record review was performed analyzing 105 pediatric patients younger than 3 years who underwent sequential adenotonsillectomy performed by a single surgeon in a metropolitan-based practice. Institutional review board approval from Weill Cornell Medical College was granted before the study's onset. Medical records were reviewed from operations performed from January 1, 2003, through October 31, 2009, at New York–Presbyterian Hospital, a tertiary care medical center in New York City. Patient medical records were deidentified and reviewed for age, sex, indications for surgery, intraoperative and perioperative interventions, and postoperative complications. For the purposes of this study, *intraoperative* and *perioperative* interventions were defined as any treatment or intervention not part of routine care during the first 24 hours after surgery. *Postoperative complications* were defined as any event serious enough to require readmission to a hospital or an emergency department or requiring operative intervention. Expected scenarios that met this criterion include hemorrhage (primary or secondary) and severe pain that resulted in significant impairment of oral intake. Files were examined for postoperative complications that may have occurred within 3 weeks of surgery. Children with obstructive sleep apnea deemed “severe” by a preoperative sleep study were excluded from analysis. All children with significant comorbid medical conditions, such as severe asthma, heart disease, or bleeding disorders, were also excluded from consideration.

All surgical procedures were supervised by a single pediatric otolaryngologist (J.E.J.), allowing for a generally standardized technical method and preferred anesthesia protocol. Patients were allowed clear liquids up to 2 hours before their

surgical procedure. Tonsillectomy was performed using electrocautery dissection with a Valley Laboratory device with a power setting of 18 on the coagulation mode or powered, intracapsular, microdebrider-aided techniques with electrocautery at a power setting of 20 in the coagulation mode used to control bleeding, according to the techniques as previously described in the literature.^{11,12} Adenoidectomy was performed using a combination of adenoid curette excision and St Clair–Thompson forceps. All bleeding was controlled with Bovie coagulation. Patients also routinely received a single intraoperative dose of antibiotics, an acetaminophen suppository, dexamethasone (0.5 mg/kg) at a maximum dose of 10 mg, and dolasetron (0.35 mg/kg) at a maximum dose of 12.5 mg. All patients received “blow-by” supplemental room air oxygen therapy in the recovery room as per our standard postoperative protocol. No other supplemental oxygen therapy was administered to children either during recovery or as an inpatient except as noted in the section describing complications. The use of intraoperative and postoperative narcotics was determined by the attending pediatric anesthesiologist. No consistent protocol for the use of narcotics was used. From 1990 to 2003, all patients who were 3 years or younger were routinely scheduled for admission. From approximately 2003 to the current time, only patients younger than 23 months were scheduled for elective overnight admission and were reevaluated at a minimum of 6 hours postoperatively to be considered for discharge. Discharge criteria for this group of patients were based on postoperative fluid intake, the absence of the need for supplemental oxygen, stable vital signs without evidence of desaturations (with special attention paid to vital signs during sleep), and parental comfort with caring for their child at home in the immediate postoperative period.

RESULTS

PATIENT POPULATION

Of the 105 patients whose medical records were reviewed, 19 were excluded because of inadequate postoperative follow-up records (n=15), a prior diagnosis of severe obstructive sleep apnea (n=1), or the presence of severe underlying medical conditions unrelated to their need for adenotonsillectomy (n=3). The resulting 86 patients were determined to be healthy with or without very mild systemic disease as is consistent with the physical status of ASA classifications I and II.

Eighty-three of the 86 patients (96.5%) underwent surgery for an obstructive airway-related disease with an admitting diagnosis of either adenotonsillar hypertrophy or obstructive sleep apnea. Two patients (2.3%) underwent adenotonsillectomy for chronic or recurrent tonsillitis. Eighty-one patients (94.2%) underwent electrocautery adenotonsillectomy procedures, whereas 5 patients (5.8%) underwent operations aided by a microdebrider device. The mean age of the study population was approximately 27.5 months (range, 13–35 months), with most (76.5%) 23 to 31 months of age. A total of 66.0% of the population was male and 34.0% female.

SURGICAL OUTCOMES

Among the 86 patients whose medical records were reviewed, 80 (93.0%) did not experience any intraoperative or postoperative complications (**Table 1**). No pa-

Table 1. Rates of Complications by Patient Age

Age, mo	Total No. of Patients	Complications, No. (%) in Age Range
12-15	2	1 (50.0)
16-19	4	1 (25.0)
20-22	5	0
23-26	17	2 (11.8)
27-31	49	2 (4.1)
32-36	9	0

Table 2. Documented Complications According to Patient Demographics

Patient No./Sex/Age, mo	Complication	Postoperative Day
1/F/24	Dehydration	2
2/M/18	Dehydration	6
3/F/14	Dehydration	6
4/M/30	Dehydration	2
5/F/30	Reactive airway	0 ^a
6/M/24	Fever	0 ^a

^aPostoperative day 0 denotes that the complication was treated in the postanesthesia care unit on the same day as the surgery.

tients who underwent microdebrider-aided procedures (n=5) were observed to experience complications.

Dehydration was the most common complication and was the cause of all documented readmissions (4.7%) in our patients who ranged in age from 14 to 30 months. Our readmissions occurred between postoperative days 2 and 6. The sex ratio for incidence of dehydration was 1:1 among readmitted patients. Two patients experienced other complications, reactive airway disease (n=1) and postoperative fever (n=1), which were identified and treated in the postanesthesia care unit (PACU), resulting in same-day discharge (**Table 2**). The only patient to receive additional oxygen therapy was the patient treated for reactive airway disease in the recovery room.

HOSPITAL EVALUATION BEFORE DISCHARGE

Patients spent on average approximately 152 minutes in the PACU, excluding the 11 (12.8%) who were scheduled for 24-hour inpatient observation postoperatively. Patient stay in the PACU ranged from 60 to 360 minutes (**Table 3**). Patients who were electively admitted postoperatively because of their age were evaluated in the inpatient unit at a minimum of 6 hours postoperatively for possible discharge. No patient who was electively admitted received supplemental oxygen therapy.

COMMENT

The American Academy of Pediatrics and AAOHNS guidelines state that all children younger than 3 years who were undergoing adenotonsillectomy should be admitted overnight for postoperative observation. Our experience in caring for these children during the past several years re-

Table 3. Duration of Hospital Stay After Adenotonsillectomy

Age, mo	Mean Time in PACU, ^a min	24-Hour Planned Observation, No. (%) in Age Range
12-15		2/2 (100)
16-19	215	2/4 (50.0)
20-22	210	2/5 (40.0)
23-26	181	1/17 (5.9)
27-31	137	4/49 (8.2)
32-36	133	0

^aExcluding the 28.0% of patients who were electively admitted for 24-hour inpatient service.

vealed to us that many children who were electively admitted overnight meet all the criteria to be discharged home within 6 hours of completion of their surgery and therefore perhaps did not require inpatient admission. We therefore undertook the process of a retrospective review of our patient population of children younger than 3 years undergoing adenotonsillectomy to further address this question.

In our retrospective analysis of patients younger than 3 years, complications after adenotonsillectomies were generally mild and were typically linked to dehydration. Only 2 patients experienced perioperative complications that required additional interventions in the recovery room. No patients experienced severe airway complications or hemorrhage in this study. Although all complications were observed in patients who underwent electrocautery adenotonsillectomy procedures, the significantly smaller sample size of patients who underwent microdebrider-aided surgical procedures precludes a statistically relevant determination of a relative safety profile between the 2 techniques.

Our study demographic had a lower frequency of patients 12 to 26 months of age than patients older than 27 months. Significantly, in the 5-month span of patient ages from 27 to 31 months, we report on 49 adenotonsillectomy cases, constituting 57.0% of our total study patient population. The overrepresentation of patients in this particularly defined age range necessarily limits the trends that might be extrapolated from age extremes of the included patients in the study. Statistical significance was not reached when using the *t* test to compare the study's overall complication rate (6 of 86, 7.0%) with rates from the grouped cohorts 12 to 26 months of age (4 of 28, 14.3%; *P* = .12) and 27 to 36 months of age (2 of 58, 3.45%; *P* = .18). When viewed collectively, however, this study's overall complication rate falls beneath the proposed 10% complication rate ceiling deemed acceptable for ambulatory procedures as proposed by some in the field.¹³

The geographic location from which these data were acquired may also affect the results observed. Our patient population was completely composed of children from a metropolitan area-based practice. All patients were cared for at home and lived in a family setting where a responsible adult was readily available to care for the child during the postoperative period. All patients lived within a 1½ hour commute of the hospital.

Nearly 15 years have passed since the AAOHNS established guidelines recommending that adenotonsillectomy in children younger than 3 years be performed on an inpatient basis. The recommendations were based on data showing that this patient population requires additional observation due to a higher incidence of complications in the immediate postoperative period. The limited number of studies undertaken to date that aim to revisit this longstanding guideline have fostered no clear consensus in the field. Many factors may account for differences in complication rates observed among studies, including population sample size, physical status inclusion and exclusion criteria for procedure, anesthetic preferences, and availability of patients at the youngest ages. These differences have led some investigators to validate the concern of increased risks in the very young,^{5,14,15} whereas others support the safety of outpatient procedures in this same demographic.^{9,16,17}

In a study similar in sample size and design to our own, Mitchell and colleagues⁹ retrospectively reviewed the medical records of 102 patients younger than 3 years old who were undergoing adenotonsillectomy. They found no incidents of major complications, such as airway distress or hemorrhage, within their 72-hour postoperative follow-up window. They documented an unplanned admission rate of approximately 9.8%, where poor oral intake was the most common causative perioperative and postoperative complication.⁹ Rakover and colleagues¹⁶ similarly noted no cases of postoperative hemorrhage in their study's patient population aged 12 to 35 months, although the subgroup of 13 patients constituted only 4% of their total study population (n=320). In both studies, the lack of primary hemorrhage is consistent with other reports in the literature^{8,13,18-20} of an appreciably low incidence of bleeding in pediatric patients undergoing adenotonsillectomy. Kim et al⁸ described a postoperative bleeding rate of 0%, whereas Lee¹⁸ reported a postoperative bleeding rate of 0.6%, and Capper and Randall¹⁹ noted a postoperative bleeding rate of 0.78%. The results of these studies reinforce our findings of a significantly low rate of bleeding in the postoperative period for very young children.

The limited hemodynamic reserve in small children has also been proposed as an indication for overnight admission in young children.⁹ Kim et al⁸ reported a higher incidence of spontaneous resolution in postoperative bleeding in children younger than 11 years compared with older children and adults who more commonly required surgical intervention to control postoperative bleeding. This observation likely resulted from the higher incidence of adenotonsillar hypertrophy as an indicator for surgery in younger children, although blood composition differences in concentrations of hemoglobin, thrombocytes, and coagulation factors have been shown to exist between children younger than 6 years and postpubescent children.¹⁰

Our results show a low risk of complications from adenotonsillectomy in very young children. We believe that several factors contributed to our low rate of complications. All procedures were performed at a large teaching hospital with the ability to provide anesthesiologists and nurses with extensive experience in caring for pediatric

populations. Shared familiarity with treating young patients ensures heightened vigilance during the critical perioperative observation period when most significant upper airway and primary hemorrhagic complications typically occur for this age group.^{14,15,21} Our hospital nursing staff also performs obligatory follow-up telephone calls to patients' parents on the first postoperative day to address postoperative concerns (including poor oral intake) before escalation to dehydration occurs.

Advancements in the use of anesthetics during the past 10 years have also had an effect on morbidity in the immediate postoperative period. For instance, standardization of our anesthetic technique now includes the routine use of dexamethasone to decrease postoperative airway edema. In addition, our administration of newer classes of antibiotics and antiemetics also likely contributes to the low postoperative morbidity seen in our analysis. In 2 separate studies, Ross et al²² and Postma and Folsom¹⁴ also noted the beneficial effect of corticosteroids and newer centrally acting (serotonin 5-HT₃ receptor antagonist) antiemetics on decreasing postoperative morbidity in patients after adenotonsillectomy.

The results of our retrospective study support the findings of other authors that adenotonsillectomy can safely be performed in young children with minimal complications. Furthermore, these results provide evidence-based justification for reevaluating the need for mandatory admission of all children younger than 3 years. Our current practice, after analyzing our data, is to admit all children 24 months or younger and reevaluate them 6 hours after admission for possible discharge. Children older than 24 months are scheduled for ambulatory admission and admitted only if postoperative complications arise. Careful selection of patients preoperatively, a dedicated pediatric team of nurses and anesthesiologists, and communication with families during the postoperative period have allowed us to more efficiently use our health care resources and provide young children with a more comfortable home setting for recovery after adenotonsillectomy.

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