



Causes, costs, and risk factors for unplanned return visits after adenotonsillectomy in children



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ABSTRACT

Objective: To review the causes, costs, and risk factors for unplanned return visits and readmissions after pediatric adenotonsillectomy (T&A).

Methods: Review of administrative database of outpatient adenotonsillectomy performed at any facility within a vertically integrated health care system in the Intermountain West on children age 1–18 years old between 1998 and 2012. Data reviewed included demographic variables, diagnosis associated with return visit and costs associated with return visits.

Results: Data from 39,906 children aged 1–18 years old were reviewed. A total of 2499 (6.3%) children had unplanned return visits. The most common reasons for return visits were bleeding (2.3%), dehydration, (2.3%) and throat pain (1.2%). After multivariate analysis, the main risk factors for any type of return visits were Medicaid insurance (OR = 1.64 95% CI 1.47–1.84), Hispanic race (OR = 1.36 95% CI 1.13–1.64), and increased severity of illness (SOI) (OR = 11.29 95% CI 2.69–47.4 for SOI = 3). The only factor associated with increased odds of requiring an inpatient admission on return visit was length of time spent in PACU ($p < 0.001$). A linear relationship was also observed between the child's age and the risk of post-tonsillectomy hemorrhage.

Conclusion: Children with increased severity of illness, those insured with Medicaid, and children of Hispanic ethnicity should be targeted with increased education and interventions in order to reduce unplanned visits after T&A. Further studies on post-tonsillectomy complications should include evaluating the effect of surgical technique and post-operative pain management on all complications and not solely post-tonsillectomy hemorrhage.

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1. Introduction

A major priority of current healthcare reform has been transitioning from a volume-based to a value-based health delivery system. This shift centers on reimbursement models based on quality of care rather than the quantity of care delivered. One approach includes bundled payment plans, in which reimbursement is provided for the entire episode of care related to a specific diagnosis or problem. In this model, costs for anticipated complications would need to be adjusted for in the bundled payment.

With 530,000 procedures performed annually, tonsillectomy is the most common major operation performed in children in the United States [1]. Tonsillectomy could be an ideal procedure to employ value-based approaches to healthcare reform. However, understanding the causes and costs for postoperative complications and patient populations more at risk for complications would be critical for effective implementation of bundled payment plans. Complications of tonsillectomy have been well described. In addition to major complications that occur rarely, common complications include fever, throat pain, dehydration, nausea and vomiting and hemorrhage. However, the incidence and costs for these complications are not well known. While there have been numerous studies reviewing risk factors for post-tonsillectomy hemorrhage [2–6], there are few reports in the medical literature evaluating the risk factors associated with unplanned return visits to the emergency department or hospital readmissions in children after surgery [7–9].

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One study of inpatient Medicaid tonsillectomy by Sun et al. showed an added cost of \$1828 for children with a post-tonsillectomy hemorrhage and \$30,081 for children requiring mechanical ventilation as compared to children without post-tonsillectomy complications [10]. A study of outpatient tonsillectomy by Curtis et al. estimated that post-tonsillectomy complications increased the cost of the procedure by 10% or a mean added cost of \$1402 [11].

The primary goals of this study were to (1) review the causes and costs for unplanned return visits after T&A in a large multi-hospital case series to determine the burden of these visits on resource utilization and (2) better understand risk factors associated with these unplanned visits.

2. Methods

This study was approved by the Institutional Review Boards at the University of Utah and Intermountain Healthcare. Intermountain is a not-for-profit, vertically integrated health care system serving the Intermountain West that includes a tertiary care children's hospital as well as a network of regional and community hospitals and outpatient clinics. Intermountain maintains a large Enterprise Data Warehouse (EDW) that contains administrative, financial (including both costs and charges), and clinical data. The EDW has costs (not charges) derived from the hospital's cost-accounting program, the Standard Cost Master, which is a transaction-based microcosting system. This system identifies and aggregated the variable- and fixed-cost components of patient activities, hospital services, and products according to the date of service. This database has been previously used to compare outcomes and costs for T&A between surgeons in a single hospital and across the entire system [12]. The EDW was queried for encounters with ICD-9 procedure code 28.3 (tonsillectomy with adenoidectomy (T&A)) in children age 1–18 years old between 1998 and 2012. Data regarding the surgical procedure and subsequent visits to any of the 24 Intermountain facilities within 21 days of the procedure was evaluated. Twenty-one days was used as a cut-off as it is thought that visits occurring after this period would be unlikely to be related to the T&A. Inclusion criteria were children age 1–18 years old having undergone a T&A as an outpatient at an Intermountain facility between 1998 and 2012. Exclusion criteria included post-operative outpatient overnight observation or inpatient admission, children having undergone a tonsillectomy or an adenoidectomy alone or children having undergone other concomitant surgical procedures. The database excluded procedures where the surgeon could not be identified and to reduce variation with surgeons who rarely perform the procedure, surgeons performing less than 100 procedures (combined inpatient and outpatient T&A volume) over the 15 years were excluded from the analysis.

Costs included all facility, medication and supply costs, but excluded the surgeon and anesthesiologist's professional fees. Patients with missing information on any given variable were included in the univariate analysis, but excluded from the multivariate analysis. Costs were reported as adjusted for December 2012 dollars using the Bureau of Labor Statistic's Seasonally Adjusted Consumer Price Index for All Urban Consumers (CPI) Medical Care inflation rate [13].

Three main clinical outcomes were evaluated: any visit to an IHC hospital within 21 days of surgery; visit to the emergency room within 21 days of surgery; hospital admission within 21 days of surgery. Emergency department visits unrelated to T&A were excluded by reviewing the ICD-9 codes associated with the visits. Possible risk factors for an unplanned return visit that were evaluated included age, gender, ethnicity, health insurance

coverage, surgical technique, institution, surgeon and severity of illness. We expect that the majority of children included in this study would have been free of major comorbidity given that the majority of children with comorbidities would likely have been either observed overnight or admitted following their surgery and patients identified with ICD-9 codes corresponding to complex chronic conditions as described by the paper by Feudtner et al. [14] were excluded in the query. However, some children with comorbidities might have undergone this surgery as an outpatient and we attempted to control for this by using the severity of illness indicator. The Severity of Illness score is obtained using the All Patient Refined – Diagnosis Related Group (APR-DRG) Severity of Illness (SOI) score. This hospital-based scoring system is based on a 4-point scale that accounts for medical conditions that increase a patient's complexity of care. However certain conditions that may increase the risk of revisit, such as an oral aversion, may not be accounted for with the SOI score. Surgeons were divided in three groups based on their surgical volumes. Group 1 included surgeons with less than 100 outpatient T&A, Group 2 were those performing 100–499 outpatient procedures, and surgeons in Group 3 had performed 500 or more outpatient operations. Facilities were evaluated based on their volume of tonsillectomy and divided in 3 equal groups based on their surgical volume.

t-Test and chi-square were used for the univariate analysis. A multivariate logistic regression model with forward addition was used. A *p*-value of equal or less than 0.05 was considered significant. The statistical analysis was performed using Stata IC version 12 (StataCorp LP, College Station, TX).

3. Results

A total of 39,906 outpatient T&A were performed on children age 1–18 years old at an Intermountain Health Care facility (IHC) between 1998 and 2012. Procedures were performed at 24 facilities by 91 surgeons. A total of 2499 children (6.3%) had at least one unplanned encounter in the 21 days following surgery. It included 1823 children (4.6%) with at least one emergency department visit, 289 children (0.7%) with a return visit and overnight observation and 227 children with a return visit and inpatient admission (0.6%). Some children had more than one type of return visit and 308 children (0.8%) had two to four return visits. Nearly half (49.6%) of the return visits occurred within the first four post-operative days, while 60.0% of the hospital readmissions occurred within the first three post-operative days. When examining the child's age, there was a bimodal distribution with age groups most likely to have return visits to the ED being children aged 1–2 years old (5.7%) and 17–18 years old (7.1%). The mean age of children returning to the ED was 7.6 years old (SD 4.5) while the mean age of children requiring inpatient admission was 7.0 years old (SD 4.6).

3.1. Diagnosis at return visit

The most common diagnosis associated with return visits were bleeding in 2.3% (935), dehydration in 2.3% (898), throat pain in 1.2% (470), vomiting in 1.0% (405) and fever in 0.6% (221). The overall rate of post-tonsillectomy hemorrhage was 2.3%. 1.2% (463) of children required a return visit to the operating room to control bleeding. This included 10 children that returned to the operating room within 24 h of their surgery in order to control a primary post-tonsillectomy hemorrhage. The mean age of children returning with post-tonsillectomy hemorrhage was 9.2 years old and the mean age of children returning for dehydration was 6.7 years old. Diagnosis at return visit based on the child's age is presented in Fig. 1.

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