

# The association between pediatric general emergency department visits and post operative adenotonsillectomy hospital return

John N. Bangiyev<sup>a,b,\*</sup>, Prasad J. Thottam<sup>a,b</sup>, Jennifer R. Christenson<sup>a,b</sup>, Christopher M. Metz<sup>c</sup>, Michael S. Hauptert<sup>a,b</sup>

<sup>a</sup> Detroit Medical Center, Department of Otolaryngology, Head and Neck Surgery, United States

<sup>b</sup> Children's Hospital of Michigan, Department of Otolaryngology, Head and Neck Surgery, United States

<sup>c</sup> Michigan State University, College of Osteopathic Medicine, United States

## ARTICLE INFO

### Article history:

Received 10 September 2014

Received in revised form 3 November 2014

Accepted 7 November 2014

Available online 27 November 2014

### Keywords:

Adenotonsillectomy

Tonsillectomy

Post-tonsillectomy ED visits

Post-operative ED visits

Tonsillectomy cost

## ABSTRACT

**Purpose:** To define the association between pre-operative general emergency department visits, gender, and pre-operative diagnosis with post-operative emergency department return following adenotonsillectomy.

**Methods:** Retrospective chart review of 1468 pediatric patients who underwent adenotonsillectomy at a tertiary pediatric hospital between 2011 and 2013.

**Results:** There was a significant relationship between patients who visited the ED pre-operatively, 25% ( $N = 96$ ) returned to the ED post-procedure, compared to 10% who did not have a pre-operative ED visit. There was an overall significant relation between having a pre-operative visit ( $\chi^2 = 53.6$ ,  $df = 1$ ,  $p < 0.001$ ), female gender (female = 56.9%; male = 43.1%;  $\chi^2 = 4.2$ ,  $df = 1$ ,  $p = 0.04$ ), and having a preoperative diagnosis of recurrent strep tonsillitis (OSA and RST = 18%; RST = 17.5%; OSA = 11.8%;  $\chi^2 = 12.8$ ,  $p = 0.002$ ) and having a post-operative ED visit.

**Conclusion:** Generalized pre-operative visits along with gender and diagnosis of recurrent streptococcal tonsillitis were found to be positively associated with post-operative ED visits for common post-operative complaints.

© 2014 Elsevier Ireland Ltd. All rights reserved.

## 1. Introduction

Adenotonsillectomy is currently one of the most common procedures performed on children in the United States. An estimated 530,000 children undergo tonsillectomy (with or without adenoidectomy) in the United States annually [1]. Indications for pediatric tonsillectomy include, but are not limited to, recurrent infections and obstructive sleep apnea [2].

Adenotonsillectomy is considered to be a cost-effective treatment for adenotonsillar hypertrophy [3]. Pain, nausea, vomiting, poor oral intake, and dehydration are frequent complications of surgery [4]. More serious complications include hemorrhage and pulmonary edema [5,6].

It is not uncommon for patients undergoing tonsillectomy to seek care for a perceived complication that is actually a normal post-operative symptom. Revisit rates have been reported to be as

high as 7.6%. Research suggests that of the patients who revisit, 77% will seek out emergency department (ED) care [7]. Previous studies suggest that post-operative emergency department visits significantly contribute to the overall cost of the procedure [8].

Post-tonsillectomy ED visits are not only common but also expensive. Although significant research exists on postoperative complications and symptoms, very little exists on screening patients for post-operative return likelihood. Our goal was to determine if pre-operative ED visits predicted likelihood of post-operative ED return in the pediatric population undergoing adenotonsillectomy.

We hypothesized that patients with higher frequency of emergency room visits for general medical issues preoperatively are more likely to utilize the ED for post-operative care.

## 2. Methods

We retrospectively reviewed the charts of 1468 pediatric patients who underwent adenotonsillectomy at a tertiary pediatric teaching hospital between 2011 and 2013. The surgeries were carried out with three instruments: monopolar cautery, Peak

\* Corresponding author at: 203 E La Salle Ave., Royal Oak, MI 48073, United States. Tel.: +1 573 268 0827; fax: +1 313 745 5848.

E-mail address: [jbangiyev@gmail.com](mailto:jbangiyev@gmail.com) (J.N. Bangiyev).



PlasmaBlade and radio frequency ablation. Reasons for surgery included obstructive sleep apnea (OSA), recurrent streptococcal tonsillitis (RST), or a combination of the two (OSA & RST). All surgeries were overseen by one of four fellowship trained pediatric otolaryngologists. Data were collected by four separate otolaryngologists. Any discrepancy between collected data was reviewed and re-coded by author (PJT). The pre and post operative ED visit data were coded. Univariate ANOVA and Chi-square analysis evaluated differences between number of pre- and post-operative ED visits, reasons for pre- and post-operative visits, and demographic variables. Multiple regression was performed to identify predictors of post-operative ED return frequency.

### 3. Results

Among the 1468 patients, mean age was 6.8 years and there was an equal number of males and females. Although the average number of pre-operative ED visits for all patients was 0.5 (SD = 1.2), among those that did visit the ER pre-operatively ( $N = 384$ ) the average number of visits was 2.0 (SD = 1.7). There was a low rate of post-operative ED visits for the entire sample (mean = 0.2, SD = 0.5). Among those that did return ( $N = 204$ ) the average number of post-operative visits was 1.18 (SD = 0.50). Reasons for post-operative ED visits included: uncontrolled pain ( $n = 62$ ), bleeding ( $n = 50$ ), dehydration ( $n = 30$ ), infection ( $n = 15$ ), and other ( $n = 47$ ).

Among the 384 patients who visited the ED pre-operatively, 25% ( $N = 96$ ) returned to the ED post-procedure, compared to a 10% return rate for those who did not have a pre-operative ED visit (Fig. 1). There was an overall significant relation between having a pre-operative visit and having a post-operative ED visit ( $\chi^2 = 53.6$ ,  $df = 1$ ,  $p < 0.001$ ). The odds of having a post-operative ED visit were 3.0 times more likely if there was a pre-operative ED visit. There was no difference in proportion of pre-operative ED visits by gender (female = 51.8%; male = 48.2%;  $\chi^2 = 0.5$ ,  $df = 1$ ,  $p = 0.46$ ), but female pediatric patients had more post-operative visit than males (female = 56.9%; male = 43.1%;  $\chi^2 = 4.2$ ,  $df = 1$ ,  $p = 0.04$ ). Children undergoing adenoidectomy alone were less likely to have a post-operative ED visit than children who received both an adenoidectomy and tonsillectomy ( $A = 8.6\%$ ;  $A \& T = 14.7\%$ ;  $\chi^2 = 5.3$ ,  $p = 0.022$ ).

Similar to other analyses, there was no difference in the likelihood of having a pre-operative ED visit and patient diagnosis (OSA & RST, RST, or OSA). However, there was a difference in the likelihood of having a post-operative ED visit by diagnosis (OSA & RST = 18%; RST = 17.5%; OSA = 11.8%;  $\chi^2 = 12.8$ ,  $p = 0.002$ ).

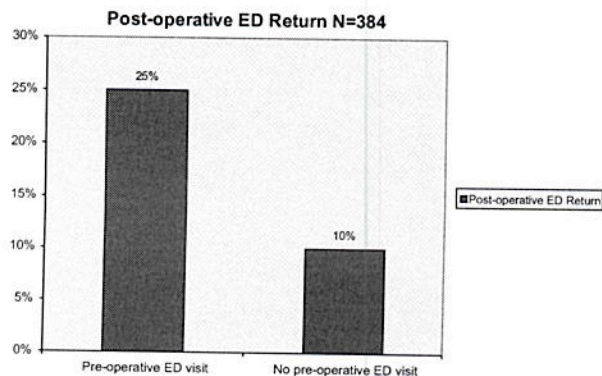


Fig. 1. Comparison of post-operative ED return visits between those that had pre-operative ED visits ( $N = 95$ , 25%) and those that did not ( $N = 288$ , 10%). There was an overall significant effect between having a preoperative ED visit and having a post-operative ED visit ( $\chi^2 = 53.6$ ,  $df = 1$ ,  $p < 0.001$ ).

The general lineal model was used to evaluate the difference between number of tonsil-related pre-operative visit and non-tonsil-related pre-operative visits (repeated measure factor). In this analysis, diagnosis was the between subjects factor and the number of post-operative ED visits was included as a covariate. After controlling for the number of post-operative ED visits, there was an overall main effect of visit type with more non-tonsil related pre-operative ED visits than tonsil related ( $F = 24.9$ ,  $df = 1$ ,  $p < 0.001$ ). There was a significant interaction between visit type and diagnosis ( $F = 12.3$ ,  $df = 2$ ,  $p < 0.001$ ). Although children with OSA had the highest number of non-tonsil related pre-operative ED visits, they had the lowest number of tonsil-related pre-operative visits. Conversely, children with recurrent strep tonsillitis had the lowest number of non-tonsil-related pre-operative visits, yet the highest number of pre-operative tonsil-related visits (see Fig. 2).

To evaluate all potential predictors, a linear multiple regression was performed. The regression model included the following covariates: number of pre-operative ED visits, age of patient, sex of patient, pre-operative ED visit type (each type a yes/no variable), diagnosis (dummy coded), and procedure. Results identified that the likelihood of having a post-op ED visits was predicted by the frequency of generalized pre-op ED visits ( $\beta = 0.23$ ;  $p < 0.001$ ), having a tonsil-related pre-operative ED visit type ( $\beta = 0.08$ ,  $p = 0.005$ ), and having a diagnosis of recurrent strep tonsillitis ( $\beta = -0.09$ ,  $p = 0.017$ ).

### 4. Discussion

In our study we examined the operative and ED records of 1468 patients who underwent adenoidectomy or adenotonsillectomy. When all variables were taken into account, pre-operative visits proved to be a significant predictor of post-operative ED visits with common post-surgical complaints ( $p < 0.001$ ). In addition, number of visits for the most common and expected complications of surgery (dehydration and pain) were significantly correlated with the total number of pre-operative ED visits. In contrast, those returning to the ED with serious post-operative complications, such as bleeding, lacked this association. In other words, serious post-operative complications following adenotonsillectomy that warrant urgent medical care were seen in equal proportions among those with and without pre-operative ED visits, while common post-surgical complaints were more predominant in patients with track records of frequent pre-operative ED utilization.

This data suggests that patients with a history of generalized ED visits pre-operatively are more likely to return to the ED after

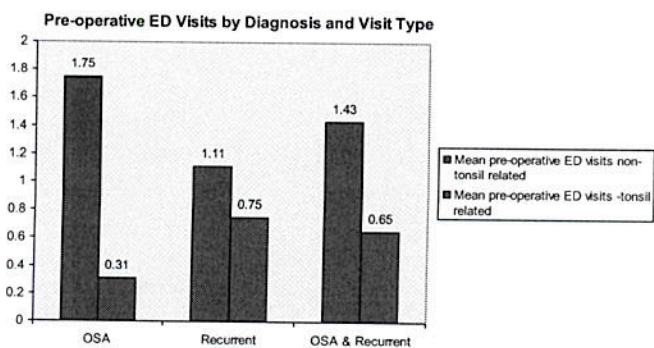


Fig. 2. Comparison of pre-operative visits by diagnosis and visit type reveals that those patients with a diagnosis of OSA had the highest number of non-tonsil related pre-operative ED visits but the lowest number of tonsil related visits. Conversely, patients with recurrent strep tonsillitis had the lowest number of non-tonsil related pre-operative visits, and the highest number of pre-operative tonsil related visits.



undergoing adenotonsillectomy, regardless of other variables. Previous studies have found correlations between ED overutilization and low socioeconomic level, pediatric age group, lack of access to primary care centers, female gender, minority status, and having public insurance [9]. The overall healthcare burden of these non-emergent visits has previously been examined in the literature. Seshamani et al. [8] found that in the adult population, an uncomplicated adenotonsillectomy costs approximately \$3832, versus \$5763 and \$4708 for surgery complicated by post-operative ED visits with dehydration and pain respectively. This represents a substantial and potentially avoidable burden to an already overloaded healthcare system. Utilizing the newly recognized markers (generalized pre-operative ED visits, female gender, and diagnosis of RST) along with previously cited indices (public insurance, minority status, and lack of access to primary care) as screening tools to identify at-risk individuals prior to surgery may reduce overall healthcare cost associated with adenotonsillectomy.

This study was not designed to elicit the reason for these patients being more likely to seek care in the ED, but rather to discover predictive factors to assist in pre-operative identification of this subgroup. Patient education, financial status, and access to health-care for post-adenotonsillectomy patients should be evaluated in future studies to ascertain their role in overutilization of the ED postoperatively.

The large population size in this study allowed us to elicit subtle effects of various pre-operative variables in determining post-op ED visit rates. All surgeries were performed by one of four fellowship trained pediatric otolaryngologists, eliminating individual variability between surgeons. Weaknesses of this study included the retrospective nature of data collection with its inherent limitations. These limitations were controlled by strict adherence to uniform data sampling technique and proper inter-rater controls.

## 5. Conclusion

Post-operative ED visits are a common complication of pediatric adenotonsillectomy. In this study the number of pre-operative ED visits by an individual demonstrated to be a significant predictor of post procedure ED return along with known common procedure

complications. Using pre-operative ED visits as a predictor, future prospective studies may address the development of screening tools for patients in need of additional education in normal and abnormal postoperative symptomatology or healthcare support. This may ultimately lower post-operative emergency department visits and overall healthcare cost associated with this procedure.

## Conflicts of interest

No conflicts of interest exist for these authors.

## Acknowledgements

The authors would like to recognize Dr. James Dworkin, Ph.D. and Dr. Lisa Chiodo, Ph.D. as mentors in Research Methodology and Statistical Analysis, as well as for their contributions to analyzing and editing this study and manuscript.

## References

- [1] K.A. Cullen, M.J. Hall, A. Golosinskiy, Ambulatory Surgery in the United States. National Health Statistics Reports 2009, 2006, 1–25.
- [2] R.F. Baugh, S.M. Archer, R.B. Mitchell, et al., Clinical practice guideline: tonsillectomy in children. *Otolaryngology – Head Neck Surg.: Off. J. Am. Acad. Otolaryngol. – Head Neck Surg.* 144 (2011) S1–S30.
- [3] J.J. Chang, P. Buchanan, C. Geremakis, K. Sheikh, R.B. Mitchell, Cost analysis of tonsillectomy in children using medicaid data, *J. Pediatr.* 164 (1346–1351) (2014) e1341.
- [4] S. Ploner, E. Gruber, F. Mantovan, The effect of corticosteroids in children and adolescents after tonsillectomy in the prevention of postoperative nausea and vomiting, pain and bleeding. *Kinderkrankenschwester* 33 (2014) 169–174.
- [5] N. Sonuwan, A. Pornlert, K. Sawanyawisuth, Risk factors for acute pulmonary edema after adenotonsillectomy in children, *Auris Nasus Larynx* 41 (2014) 373–375.
- [6] E.V. Nosulia, Peculiarities of blood supply of palatal tonsils and the potential risk of hemorrhage during tonsillectomy: the literature review and case report, *Vestn. Otorinolaringol.* (2014) 75–78.
- [7] S. Shay, N.L. Shapiro, N. Bhattacharyya, Revisit rates and diagnoses following pediatric tonsillectomy in a large multistate population, *Laryngoscope* (2014 Jun 17), <http://dx.doi.org/10.1002/lary.24783> [Epub ahead of print].
- [8] M. Seshamani, E. Vogtmann, J. Gatwood, T.B. Gibson, D. Scanlon, Prevalence of complications from adult tonsillectomy and impact on health care expenditures, *Otolaryngology – Head Neck Surg.: Off. J. Am. Acad. Otolaryngol. – Head Neck Surg.* 150 (2014) 574–581.
- [9] A. Chukmaitov, A. Tang, H. Carretta, N. Menachemi, R. Brooks, Characteristics of all, occasional, and frequent emergency department visits due to ambulatory care-sensitive conditions in Florida, *J. Ambul. Care Manag.* 35 (2) (2012) 149–158.