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Population-based survey of inpatient pediatric tonsillectomy and postoperative hemorrhage in Taiwan, 1997–2012

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ABSTRACT

Objective: Tonsil surgery in children is a common surgical procedure, and is mostly performed as an inpatient procedure in Taiwan. This study elucidates the epidemiology and postoperative hemorrhage of inpatient tonsillectomies in Taiwanese children.

Methods: This study used the Taiwan National Health Insurance Research Database for analysis. From 1997 to 2012, all in-hospital children (aged < 18 years) who underwent tonsillectomies were identified through the International Codes of Diseases (9th Revision). Incidence rates and trends of inpatient pediatric tonsillectomies during the study period were identified. Major complications, including readmission, reoperation, and mortality were identified. The factors associated with major complications were analyzed.

Results: From 1997 to 2012, 17326 children received inpatient tonsillectomies (mean age, 8.6 ± 3.8 y; 65% boys). The overall incidence rate was 20.6 per 100,000 children. The incidence rate was highest in children who were 6–8 years of age, and boys exhibited a higher rate than girls ($P < 0.001$). Longitudinal data indicated that the incidence rate increased from 1997 (15.7/100,000 children) to 2012 (19.2/100,000 children) (P trend < 0.001). The proportions of readmission for any reason, readmission for bleeding, and reoperation were 1.8%, 0.9%, and 0.3%, respectively. No mortality occurred within 30 days of the tonsillectomy. A multivariable logistic model indicated that toddlers were associated with an increased risk of readmission for any reason (OR, 2.70; 95% CI 1.60–4.56), and adolescents were at risk of bleeding-related readmission (OR, 2.81; 95% CI 1.91–4.14) and reoperation (OR, 2.86; 95% CI 1.47–5.55). Children with comorbidities (OR, 3.14; 95% CI 1.93–5.09) or a surgical indication of tumor (OR, 11.73; 95% CI 4.93–27.91) had a higher risk of readmission. The use of nonsteroidal anti-inflammatory drugs or steroids is associated with an increased risk of readmission or reoperation. Moreover, concurrent procedures (i.e., adenoidectomy, ear surgery, or nasal surgery) did not increase the risk of readmission or reoperation.

Conclusions: The incidence rate and indications of obstructive sleep disorders for inpatient pediatric tonsillectomy increased during 1997–2012 in Taiwan. Postoperative readmission and reoperation were rare. Age, surgical indication, comorbidities, and drug administration were associated with readmission or reoperation in this study cohort.

1. Introduction

Tonsillectomy is one of the most common surgeries conducted on children by otolaryngologists [1,2]. According to the clinical practice

guidelines established by the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HSN), children who fulfil the Paradise criteria or those who suffer from recurrent sore throat accompanied by modifying factors such as multiple antibiotic allergy,

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periodic fever, or a history of peritonsillar abscess may benefit from a tonsillectomy [2]. On tonsillectomy for recurrent infection, a recent review by Morad et al. disclosed that tonsillectomy is associated with reduction in short-term throat infections but insufficient for long-term reduction [3]. Moreover, a tonsillectomy is also an effective procedure for the management of pediatric obstructive sleep apnea (OSA) or sleep-disordered breathing (SDB) [4–10]. A recent meta-analysis by Todd et al. showed significant improvements in short-term (≤ 6 months) and long-term (> 6 months) quality-of-life scores after adenotonsillectomy as compared with preoperative values [11].

The epidemiological data on tonsillectomies vary between countries and races [12]. As a result of cultural differences and the absence of consent for surgical indications, clinicians make variable clinical judgements [13]. Rates of pediatric tonsillectomy have changed over the past decades [14,15]. Furthermore, several publications have demonstrated that the main purpose of a tonsillectomy has altered from recurrent infections to OSA and SDB [3,15–20].

Postoperative hemorrhaging is a highly concerning issue relating to tonsillectomies [21]. Occasionally, a severe postoperative hemorrhage results in tragedy [22,23]. Realizing the risk factors that contribute to postoperative hemorrhage helps to optimize the procedure and perioperative care. Incidence rates and risk factors related to postoperative hemorrhage have been identified in various investigations [24–28]. However, many of these investigations were hospital based studies [29,30]. Referral bias may be present in these limited data. By contrast, population-based studies diminish such limitations and provide more accurate information on clinical practices.

In Taiwan, the Taiwan National Health Insurance was established in 1995, and provides coverage for 99% of country's 23 million inhabitants [31,32]. The National Health Insurance Research Database (NHIRD) is a medical claims database of the entire insured population [31,32]. The NHIRD allows clinicians to conduct population-based epidemiologic analyses of diseases and procedures [33]. In Taiwan, a pediatric tonsillectomy is mostly performed as an inpatient procedure [34,35], and a search revealed no population-based surveys of post-tonsillectomy bleeding in the population of Taiwan. The objective of this study is to disclose the demographic information and risk factors relating to inpatient post-tonsillectomy bleeding in Taiwan by analyzing the NHIRD from 1997 to 2012.

2. Materials and methods

The Ethics Committee of Taipei Hospital, Ministry of Health and Welfare, Taiwan approved this research protocol (IRB No. TH-IRB-0014-0022). The private information of each individual was deidentified. Therefore, the present study was exempted from customary requirements of informed consent.

2.1. Database and patient identification

This study included all inpatient pediatric tonsillar surgeries during 1997–2012 from the NHIRD. In Taiwan, a tonsillectomy is mostly performed as an inpatient intervention. Children (aged < 18 years) who received inpatient tonsillectomy were identified from the International Codes of Diseases 9th Revision, Clinical Modification (ICD-9-CM procedure codes: 282, 283). The index date was defined as the date of admission for receiving a tonsillectomy.

The basic information regarding participants was retrieved from the NHIRD claim data, and consisted of each patient's gender, date of birth, underlying comorbidities, and level of in charging hospital. The ages of the participants when they underwent operations were calculated using the date of admission for surgery and the patient's date of birth. According to age, the patients were divided into four groups: toddler (0–2.9 y/o), preschool (3–5.9 y/o), school (6–11.9 y/o), and adolescence (12–18 y/o) [36]. Through examining the patients' catastrophic illness cards, we identified their underlying comorbidities before the

index admission. Indications for requiring a tonsillectomy were identified from the ICD-9-CM diagnosis codes during the index admission. The indications were classified into three categories, namely (1) infectious and inflammatory disease; (2) obstructive indications (OSA/SDB); and (3) tumor (benign and malignant) [3]. This study also acquired information relating to concurrent procedures (i.e., adenoidectomy, tympanostomy tube, and nasal surgeries) and perioperative regimens (i.e., analgesics, antibiotics, and steroids) from the inpatient claim data. Other demographic data such as distribution of gender, hospital levels, perioperative care measures, events of blood transfusion, and intensive care unit stays of pediatric tonsillectomy patients between 1997 and 2012 were also included for analysis in this study.

2.2. Major complications: readmission and reoperation for bleeding

Readmission for any reason, readmission related to bleeding, reoperation related to bleeding within 30 days of first admission, and mortality were defined as major surgical complications [37]. The factors that relate to these issues were further investigated.

The timing of reoperation for bleeding was defined as primary bleeding for those occurring within the initial 24 postoperative hours, and as secondary bleeding for those occurring after the initial 24 postoperative hours [38]. In this study, reoperation a day after a tonsillectomy was regarded as primary bleeding.

2.3. Incidence and trend of inpatient pediatric tonsillectomy

The incidence rate of inpatient pediatric tonsillectomies was presented as events per 100,000 population in a given year in Taiwan. The coverage rate of the NHI was also calculated. The general population level during the study interval was acquired from a web-based report provided by the Department of Statistics, Ministry of the Interior, Taiwan [39]. In addition, this study compiled the number of events in the index year of admission and stratified them into four age groups of each gender. In the following section, trends of the incidence rate and indications for the requirement of pediatric tonsillectomy were analyzed.

2.4. Statistical analysis

Data were analyzed using SPSS software version 22 (IBM SPSS, Armonk, NY: IBM Corp). Descriptive statistics were calculated to analyze the basic demographics of the study population. Continuous data were expressed as mean and standard deviations, and categorical data as numbers and percentages. The trend of the incidence of tonsillectomies across the study years was tested using a Poisson regression model in which the logarithm of the mid-year population in Taiwan was set as an offset variable, and the number of events was treated as a response variable. The trend of variable distribution (i.e. indications) across the study years was examined using the Cochran-Armitage chi-square test. The incidence rate was calculated for each year and stratified by age and gender groups during the study periods. Both univariate analyses (chi-square test) and multivariable logistic regression analyses were applied to identify the factors associated with readmission and reoperation for bleeding. A P value of < 0.05 was considered statistically significant.

3. Results

3.1. Study population

A total of 17326 children younger than 18 years old were identified as having undergone inpatient tonsillectomies. Besides, during the years 2010–2012, a total of 3029 children underwent tonsillectomies in Taiwan. Of these procedures, 2931 (97%) tonsillectomies were performed as inpatient procedures, while 98 (3%) tonsillectomies were

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