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A tonsillectomy increased the risk of chronic rhinosinusitis among children: A three-year follow-up study



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ABSTRACT

Objectives: The study aimed to estimate the risk of developing chronic rhinosinusitis (CRS) among children who had undergone a tonsillectomy by utilizing a cohort study based on a population-based database.

Methods: Data for this retrospective cohort study were sourced from the Taiwan "Longitudinal Health Insurance Database 2000". We included 202 children who had undergone a tonsillectomy as the study group and 2020 sex- and age-matched children as the comparison group. We used stratified Cox proportional hazard regressions to calculate the hazard ratio (HR) and its corresponding 95% confidence interval (CI) for CRS during the 3-year follow-up period.

Results: Of 2222 sampled children, the incidence rate of CRS during the 3-year follow-up period was 3.2 (95% CI = 2.0–4.8) 1000 person-years; 18.2 (95% CI = 9.1–32.5) per 1000 person-years and 1.7 (95% CI = 0.8–3.0) per 1000 person-years for the study and comparison group, respectively. The stratified Cox proportional analysis showed that the adjusted hazard ratio for CRS during the 3-year follow-up period was 8.28 (95% CI = 3.24–21.16) for children who had undergone a tonsillectomy than comparison patients.

Conclusions: We demonstrated that the risk of developing CRS is significantly increased among children who have undergone a tonsillectomy.

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1. Introduction

A tonsillectomy is a surgical procedure in which each tonsil is removed from a recess in the side of the pharynx called the tonsillar fossa. The procedure is performed in response to recurrent throat infections, recurrent tonsillar infections, sleep-disordered breathing, and obstructive sleep apnea [11]. Complications of a tonsillectomy have long been of interest to surgeons and are widely known to include short-term complications such as bleeding and

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long-term complications such as nasopharyngeal stenosis [7]. Interestingly, most studies focused on short-term and perioperative complications [1,5,12,14]. Kayqusuz et al. compared patients' immune functions after a tonsillectomy to those of control subjects, and found that a tonsillectomy did not compromise the immune functions of children, as the humoral and cellular immune functions of patients had recovered compared to their early-stage immune status (at 1 month), and they had similar immune capacities compared to age-matched healthy controls in both the early and late stages [9]. Nevertheless, another long-term follow-up study showed that the prevalence of chronic disease was greater in a post-tonsillectomy group than in a comparison group [8].

As chronic rhinosinusitis (CRS) is known to be affected by pathogens in the oral cavity, it was particularly interesting that

being a neighboring structure, impacts of a tonsillectomy on the sinuses have never been reported [6]. Therefore, the purpose of this study was to provide an estimation of the risk of developing CRS among children who had undergone a tonsillectomy procedure through a cohort study using a population-based database in Taiwan.

2. Methods

2.1. Database

Data for this retrospective cohort study were sourced from the “Longitudinal Health Insurance Database 2000” (LHID2000). Taiwan has implemented a National Health Insurance (NHI) program since 1995. The LHID2000 includes registration files and original medical claims for 1,000,000 enrollees randomly selected from all enrollees listed in the 2000 Registry of Beneficiaries under the NHI program ($n = 23.72$ million) by the Taiwan National Health Research Institute. The LHID2000 enables researchers in Taiwan to longitudinally follow-up utilization of medical services for these selected 1,000,000 enrollees since the beginning of the NHI in 1995. Therefore, data from Taiwan present a unique opportunity to identify the relationship between a tonsillectomy and the subsequent risk of CRS among children. This study was exempt from full review by the Institutional Review Board of National Defense Medical Center because the LHID2000 consists of de-identified secondary data released to the public for research purposes.

2.2. Study sample

This study features a study group and a comparison group. For the study group, we first retrieved data on 235 children (aged ≤ 16 years of age) who had undergone a tonsillectomy (ICD-9-CM procedure code 28.2 or 28.3) between January 1, 2002 and December 31, 2009. We defined the date of the tonsillectomy as the index date. We then excluded those children who had a history of CRS (ICD-9-CM code 473) prior to their index date ($n = 35$). Ultimately, 202 children who had undergone a tonsillectomy were included in the study group.

We retrieved data for the comparison group from the remaining enrollees in the registry of beneficiaries of the LHID2000. We first excluded all patients who had ever undergone a tonsillectomy. Since the NHI program began in 1995, the LHID2000 did not allow us to identify those who had undergone a tonsillectomy before 1995. However, this bias, if present, would skew the findings of the study toward the null hypothesis. Then, we randomly selected 2020 children ≤ 16 years of age (ten for every child who underwent a tonsillectomy) matched with study group in terms of sex, age, and the year of the index date with the SAS proc surveyselect program (SAS System for Windows, vers. 8.2, SAS Institute, Cary, NC). The year of the index date was the year in which the study group underwent a tonsillectomy. For the comparison cohort, the year of the index date was a matched year in which they had a healthcare utilization. Furthermore, we designated their first healthcare use occurring in the index year as the index date for the comparison group. We also assured that none of the selected comparison children had a history of CRS before their index date. We further assured that none of the selected comparison children had undergone a tonsillectomy during the 3-year follow-up period.

Ultimately, 2222 sampled children were included in this study. We then individually tracked each child for a 3-year period from their index date to discriminate those children who subsequently received a diagnosis of CRS. In this study, only those diagnosed with CRS by a certified otolaryngologist were included in order to increase the diagnostic validity.

2.3. Statistical analysis

We used the SAS system for all statistical analyses. Pearson Chi-squared tests were performed to compare differences between children who underwent a tonsillectomy and comparison children in terms of geographical location (northern, central, eastern, and southern Taiwan) and urbanization level of the patient's residence (five levels with 1 being the most and 5 being the least urbanized). Furthermore, we used stratified Cox proportional hazard regressions (stratified by sex, age group, and the year of the index date) to calculate the hazard ratio (HR) and its corresponding 95% confidence interval (CI) for CRS during the 3-year follow-up period between children who underwent a tonsillectomy and comparison children. We used a significance level of 0.05.

4. Results

Table 1 presents the distributions of demographic characteristics according to the presence or absence of a tonsillectomy. It shows that after being matched for sex, age, and the year of the index date, there were significant difference in geographic location ($p < 0.001$) and allergic rhinitis ($p < 0.001$) between children who underwent a tonsillectomy and comparison children.

Table 2 presents the incidence of CRS during the 3-year follow-up period stratified by the presence of a tonsillectomy. Of 2222 sampled children, the incidence rate of CRS during the 3-year follow-up period was 3.2 (95% CI = 1.80–4.44) per 1000 person-years; 18.2 (95% CI = 9.1–32.5) per 1000 person-years and 1.7 (95% CI = 0.8–3.0) per 1000 person-years for the study and comparison group, respectively. The log-rank test revealed that children who underwent a tonsillectomy had a greater tendency to have CRS compared to comparison children ($p < 0.001$).

Table 2 also presents the crude and adjusted HRs for CRS. The

Table 1
Demographic characteristics of sampled patients (N = 2222).

Variable	Patients who underwent a tonsillectomy N = 202		Comparison patients N = 2020		p value
	Total no.	Column%	Total no.	Column%	
Male	137	62.6	1370	62.6	>0.999
Age (years)					>0.999
4	13	6.4	130	6.4	
5	29	14.4	290	14.4	
6	29	14.4	290	14.4	
7	33	16.3	330	16.3	
8	21	10.4	210	10.4	
9	17	8.4	170	8.4	
10	14	6.9	140	6.9	
11	10	5.0	100	5.0	
12	10	5.0	100	5.0	
13	9	4.5	90	4.5	
14	7	3.5	70	3.5	
15	6	3.0	60	3.0	
16	4	2.0	40	2.0	
Urbanization level					0.077
1 (most)	66	32.7	527	26.1	
2	45	22.3	624	30.9	
3	37	18.3	317	15.7	
4	28	13.9	274	13.6	
5 (least)	26	12.9	278	13.8	
Geographic region					<0.001
Northern	103	51.0	826	40.9	
Central	59	29.2	623	30.8	
Southern	34	16.8	539	26.7	
Eastern	6	3.0	32	1.6	
Allergic rhinitis	68	33.7	279	13.8	<0.001

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