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Pediatric sialolithiasis is not related to oral or oropharyngeal infection: A population-based case control study using the Korean National Health Insurance Database



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ABSTRACT

Objectives: Poor oral hygiene is one of the risk factors for sialolithiasis particularly in adults; however the etiology of sialolithiasis in pediatric patients remains largely unknown. The purpose of this study is to identify the association between sialolithiasis and the oral/oropharyngeal infections in the pediatric population, as surrogate indicators for oral hygiene and retrograde infections to the affected salivary gland.

Methods: This was a population based case-control study using the Korean National Health Insurance Database. We identified 10,095 pediatric patients, diagnosed with sialolithiasis, as cases (study period 2011–2015) and 50,475 age/gender/residence matched subjects without sialolithiasis, but with unrelated diseases (e.g., simple trauma in extremities) were set as controls. Logistic regression analyses were conducted to evaluate the association of sialolithiasis with oral or oropharyngeal infections.

Results: The morbidity rate of sialadenitis was much higher in the cases than the controls (32.92% vs 0.72%, $p < 0.0001$). By contrast, the prevalence of oral or oropharyngeal infections (stomatitis, gingivitis, periodontitis, and pharyngo-tonsillitis) was significantly lower in pediatric sialolithiasis patients in all age (0–18) groups. The adjusted odds ratios of the multivariate analyses also confirmed significantly less prevalence of the oral and oropharyngeal infections in pediatric sialolithiasis patients.

Conclusion: Oral or oropharyngeal infections were inversely associated with pediatric sialolithiasis, suggesting that pediatric sialolithiasis may result from the intrinsic factors of the salivary gland itself, not from oral or oropharyngeal infections.

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1. Introduction

Sialolithiasis is diagnosed most often in patients over 40 years of age and rarely in pediatric patients [1]. Pediatric sialolithiasis represents only 3% of all sialolithiasis patients [2]. Compared with sialolithiasis in adult patients, pediatric sialolithiasis has different

clinical characteristics such as a short duration of symptoms, more distal location, and relatively small size of stones [3]. These manifestations can be explained by the facts that the pediatric population is less exposed to various infections and has intact salivary gland function [3]. This suggests that pediatric sialolithiasis may have a different etiology forming salivary calculi compared with adult-onset sialolithiasis [3].

Some risk factors of sialolithiasis have been reported particularly in adult patients, including abnormalities in calcium metabolism [4,5], dehydration [6], poor oral hygiene [7,8], poor eating [9], use of certain medications [9], tobacco smoking [10], trauma to the salivary glands [11], and gout [12]. Among them, poor oral hygiene and ascending infections seemed to be strongly linked to sialolithiasis [7,8,13]. One population-based study demonstrated an

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association between chronic periodontitis and sialolithiasis [7].

Despite this body of knowledge in adult sialolithiasis, few reports have studied the possible etiologic or risk factors of pediatric sialolithiasis. Thus, based on the findings in adult sialolithiasis, we hypothesized that poor oral hygiene should be one of the risk factors in pediatric sialolithiasis and assumed that oral and oropharyngeal infections are representative diseases resulting from poor oral hygiene. The purpose of this study was to assess the prevalence of oral and oropharyngeal infections in pediatric sialolithiasis patients compared with a control population, using big data from the National Health Insurance Database in Korea.

2. Materials and methods

2.1. Study database

This was a population-based case-control study, which retrieved sample subjects from the Korean National Health Insurance Database [= the National Health Insurance Review and Assessment (HIRA) service database in Korea]. In Korea, the public health insurance system applies to all citizens. The information about the diseases of each patient was accessed through the HIRA service database with permission. This study was approved by the Institutional Review Board (SMC 201606029) and permitted to get data from the HIRA service database by the authority.

2.2. Selection of cases and controls

The cases were extracted using the following inclusion criteria: 0–18-year-old subjects who had been diagnosed as having sialolithiasis (International Statistical Classification of Diseases and Related Health Problems 10th revision [ICD-10 Version 2016] code K11.5) between January 2011 and December 2015. From the database, 10,095 pediatric sialolithiasis patients were retrieved. Information including gender, age, residence, and all diseases of each patient was collected.

The controls were randomly extracted from the patients with unrelated diseases (simple trauma in extremities) who had never been diagnosed with sialolithiasis. Comparing with cases, the number of age group, gender, and residential area-matched control subjects were selected to be five times larger than the number of case patients ($n = 50,475$), where the age groups were infant [age < 2 years old], early child [2–6 years old], child [7–11 years old], and adolescence [12–18 years old]. Co-morbidity information was also collected for the control subjects.

2.3. Exposure assessment

Oral and oropharyngeal infections were identified with the following disease classifiers found in medical records: stomatitis (ICD-10 code K12.0 or K12.1), acute gingivitis or periodontitis (ICD-10 code K05.0 or K05.2), chronic gingivitis or periodontitis (ICD-10 code K05.1 or K05.3), acute pharyngitis or tonsillitis (ICD-10 code J02 or J03), chronic pharyngitis or tonsillitis (ICD-10 code J31.2 or J35.0), and sialadenitis (ICD-10 code K11.2) in medical records. The study flow diagram is illustrated in Fig. 1.

2.4. Statistical analysis

All analyses were performed using the SAS® Enterprise Guide 5.1® (SAS Institute, Cary, NC, USA), which allowed remote access to the HIRA database. Chi-squared tests were performed to examine differences in demographic characteristics between the cases and controls. Conditional logistic regression analyses (conditioned on gender, age, and residence) were performed to determine the

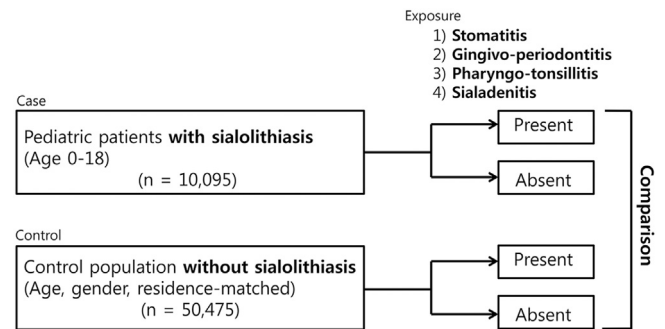


Fig. 1. Study diagram of this population based case-control study.

possible association of sialolithiasis with oral/oropharyngeal infections. Statistical significance was set at $p < 0.05$.

3. Results

A total of 10,095 pediatric sialolithiasis patients were identified; 5485 males (54.33%) and 4610 females (45.67%) with a mean age of 13.04 years. The age, gender and residential area matched control group consisted of 50,475 patients; 27,425 males (54.33%) and 23,050 females (45.67%) with a mean age of 13.01 years (Table 1). Pediatric sialolithiasis was frequently diagnosed in the adolescent period (age 12–18, 67.85%) and was extremely rare in the infant group (age < 2, 0.41%).

The relative prevalence of the oral and oropharyngeal infections showed striking differences between the cases and controls, when comparing crude odds ratio and 95% confidence intervals (Table 2). In control subjects, acute pharyngo-tonsillitis was the most prevalent infection in the oral cavity and oropharynx (77.24%), followed by gingivo-periodontitis (7.42 and 8.98%). However, acute pharyngo-tonsillitis was diagnosed in only 11.67% of pediatric sialolithiasis patients, which was significantly less than that of control subjects ($p < 0.0001$). Similarly, other oral and oropharyngeal infections occurred less frequently in case patients. Meanwhile, sialadenitis could be a causative or resultant manifestation of sialolithiasis. The prevalence of sialadenitis was significantly higher in cases than in controls (32.98% vs. 0.72%, $p < 0.0001$). The odds ratio of sialadenitis for cases was 67.36 with a 95% confidence interval of 60.28–72.27. In short, pediatric sialolithiasis was associated with an increased occurrence of sialadenitis, although oral and oropharyngeal infections were significantly less diagnosed in these

Table 1
Demographic characteristics of the study subjects enrolled ($n = 60,570$).

Baseline characteristics	Patients with sialolithiasis ($n = 10,095$)		Controls ($n = 50,475$)		p-value
	No.	%	No.	%	
Age (years, mean \pm SD)	13.04 \pm 4.11		13.01 \pm 4.12		0.5350
Age group (years)					0.8899
Infant (<2)	41	0.41	208	0.41	
Young Child (2–6)	879	8.71	4494	8.90	
Child (7–11)	2326	23.04	11,498	22.78	
Adolescent (12–18)	6849	67.85	34,275	67.90	
Gender					1.0000
Male	5485	54.33	27,425	54.33	
Female	4610	45.67	23,050	45.67	
Residence					1.0000
Metropolitan	4685	46.41	23,425	46.41	
City	5164	51.15	25,820	51.15	
Country	246	2.44	1230	2.44	

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