Epidemiological Trends in Pediatric Urolithiasis at United States Freestanding Pediatric Hospitals

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Abbreviations and Acronyms

ICD-9-CM = International Classification of Diseases, 9th revision, clinical modification

KID = Kids' Inpatient Database

PHIS = Pediatric Health Information System

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Purpose: Anecdotal and lay press reports suggest that the incidence of pediatric urolithiasis is increasing but reliable data are lacking. The objective of this study was to examine trends in the epidemiology of urolithiasis at pediatric hospitals nationwide.

Materials and Methods: The Pediatric Health Information System database is a national database covering 42 freestanding United States pediatric hospitals that captures inpatient admissions, and emergency department and outpatient surgery visits. We searched the Pediatric Health Information System database to identify children (18 years old or younger) treated for urolithiasis between 1999 and 2008. Patients with urolithiasis were measured as a proportion of the total number of patients seen per hospital annually. Trends were verified by comparing results to 2 other common pediatric diagnoses—appendicitis and viral bronchiolitis.

Results: We identified 7,921 children diagnosed with urolithiasis during the study period. The total number of children with urolithiasis seen in Pediatric Health Information System hospitals increased from 125 in 1999 to 1,389 in 2008. Mean number of stone cases per hospital per year increased from 13.9 to 32.6. Compared to total hospital patients, the proportion of patients with pediatric urolithiasis increased from 18.4 per 100,000 in 1999 to 57.0 per 100,000 in 2008, an adjusted annual increase of 10.6% ($p < 0.0001$). Urolithiasis also increased compared to appendicitis ($p < 0.0001$) and bronchiolitis ($p < 0.0001$).

Conclusions: Even after correcting for increases in total patient volume at Pediatric Health Information System hospitals, there has been a significant increase in the number of children diagnosed with and treated for urolithiasis at these hospitals in the last decade.

Key Words: epidemiology, nephrolithiasis, pediatrics, urolithiasis

NUMEROUS lay press reports have recently suggested that the incidence of pediatric urolithiasis is increasing, based primarily on anecdotal evidence from large academic medical centers.[1,2] The mechanisms underlying this increase are purported to include increased rates of overweight and obesity, excessive animal protein and caloric intake, and increased dietary sodium intake in United States children, all of which have been linked to an increase in urolithiasis diagnoses among adults.[3–5] Several studies have shown an increased incidence of urolithiasis among adults, and these observations have often been assumed to be true for children as well. However, other than anecdotal reports, few rigorous studies have demonstrated an increase in the number of stone diagnoses through

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time.[6] In a retrospective series from a single pediatric hospital, VanDervoort et al reported a 5-fold increase in the number of urolithiasis diagnoses at their institution during a 10-year period.[7]

There are multiple possible explanations for why any single institution could experience an increase in the number of children with urolithiasis, including increased marketing of stone management services, increased referral patterns to pediatric stone centers, increased pediatric urological staffing and increased hospital capacity due to the acquisition of new technology or equipment. Interestingly a recent study by Yasui et al revealed no significant change in the incidence of urolithiasis among Japanese children between 1965 and 2005.[8]

To our knowledge no multi-institutional or population based data support the contention that urolithiasis is currently becoming more common among children throughout the United States. The aim of this study was to identify trends in the epidemiology of urolithiasis during a 10-year period among children seen at freestanding United States pediatric hospitals.

PATIENTS AND METHODS

Data Source

We used the PHIS, a national database of administrative and billing data from 42 freestanding pediatric hospitals affiliated with the Child Health Corporation of America (Shawnee Mission, Kansas). The PHIS database is composed of more than 125 discrete data points annually drawn from more than 100,000 pediatric patient encounters. It includes data from all inpatient admissions (including those less than 24 hours), ambulatory short stay areas (such as outpatient surgery units) and emergency departments but does not include any outpatient clinic visits, even hospital affiliated outpatient clinics. PHIS data accuracy is screened on a quarterly basis through the joint efforts of the Child Health Corporation of America, an independent data manager (Thomson Healthcare, Durham, North Carolina) and each participating hospital. Data are accepted into the PHIS only when classified errors occur in less than 2% of hospital quarterly data. It is noteworthy that some hospitals contributed varying levels of data (ie inpatient data only vs all inpatient, emergency and short stay data) to the PHIS during the study period. We included data only from those hospitals that contributed all patient data on all inpatient, emergency and short stay visits for a given year. Institutional review board approval was obtained from Children's Hospital Boston and administrative approval was obtained from PHIS before data collection or analysis.

Patient Population

We identified all hospital encounters occurring between January 1999 and December 2008 for patients younger than 18 years with an ICD-9-CM diagnosis code for urolithiasis (592.0 or 592.1). For each year of the study period we tabulated the total number of unique patients with urolithiasis seen at any PHIS hospital. To account for variations in overall hospital volume that might affect these counts, we adjusted for the total number of children who were seen at the inpatient, emergency and/or short stay areas at each PHIS hospital during each year. From these data we calculated the proportion of children diagnosed with urolithiasis per 100,000 children treated at PHIS hospitals. Trends in hospital based urolithiasis patient counts were also compared against 2 other common pediatric diagnoses—acute appendicitis (ICD-9-CM code 540.0) and acute bronchiolitis due to respiratory syncytial virus (466.11). These conditions were chosen because they are relatively common pediatric diagnoses and because recent trends in their epidemiology are well documented.[9–11]

Statistical Methods

Trends in hospital based epidemiology were assessed using a Poisson regression model. We performed bivariate tests of association between predictor variables and treatment outcomes using Fisher's exact, Cochran-Mantel-Haenszel trend or Wilcoxon rank sum test as appropriate based on data characteristics. All analyses were performed using SAS®, version 9.2. All tests were 2-sided and $p < 0.05$ was considered significant.

RESULTS

Cohort Demographics

We identified 7,921 children diagnosed with urolithiasis at PHIS hospitals during the study period. Patient demographics are detailed in table 1. Mean ± SD patient age was 11.9 ± 4.8 years. Of the patients 72% were white and 47% were male. After stratifying by age group urinary stones appeared to be more common in younger males than in younger

Table 1. *Patient demographics*

No. pts	7,921
No. hospital encounters	13,230
No. yrs age (%):	
Less than 1	343 (4)
1–2	250 (3)
3–5	496 (6)
6–11	2,337 (30)
12–18	4,495 (57)
No. gender (%):	
M	4,212 (53)
F	3,709 (47)
No. race/ethnicity (%):	
White	5,719 (72)
Black	681 (9)
Hispanic	888 (11)
Other	633 (8)
No. insurance type (%):	
Private	2,433 (31)
Public	5,460 (69)
No. census region (%):	
Northeast	824 (10)
Midwest	3,527 (45)
South	2,730 (35)
West	822 (10)