

ORIGINAL ARTICLE

TRENDS IN THE OCCURRENCE OF UROLITHIASIS IN ETHIOPIA: A 13-YEAR RETROSPECTIVE ANALYSIS OF CASES AT ST. PAUL'S REFERRAL HOSPITAL

Tilahun Alelign, MSc^{1,2*}, Asfaw Debella, PhD³, Beyene Petros, PhD¹

ABSTRACT

Introduction: Recent studies have reported an increasing occurrence of urolithiasis worldwide. However, studies that evaluate the occurrence of stone diseases in Ethiopia are scarce.

Objective: This study was intended to determine trends in the occurrence of urolithiasis at the St. Paul's Referral Hospital during the last 13 years, and its associated comorbidities.

Methods: A total of 32,370 patients who underwent surgical treatment was included in the study. Thirteen years retrospective data were retrieved from medical records (registry books and electronic databases) at St. Paul's Tertiary Referral Hospital from September 2005 to 2017. Cases with open surgical treatments related to urolithiasis were identified through a review of patient medical records. Data were analyzed using descriptive statistics, and using Graph Pad Prism 6 Software.

Results: Among 32,370 surgically treated patients referred from all over the country, 2.3%(757) urolithiasis cases were determined in the last 13 years. The mean (SD) age at which the stones treated was 42.5(±23.7) years. The occurrence of stone diseases was found to be higher in males (68.2%) than females (31.8%). Nearly one quarter (22.2%) of the cases with urolithiasis occurred in the age group 30 and 39 years. Urolithiasis increased in men and declined in women as age increased. In nearly one-half (46.5%) of the patients the stones were located in the kidneys, with a higher proportion in the left kidney. Stone surgeries in recurrent stone formers constituted 1.32%. The most common co-morbidity associated with urolithiasis was benign prostatic hyperplasia, and reduced urinary output complications.

Conclusion: The occurrence of cases with urolithiasis increased over the 13- year period at the referral hospital in this study. This finding will raise awareness of physicians, researchers and policy makers for appropriate actions.

Keywords: Ethiopia, Prevalence, Occurrence, Retrospective, Trend, Urolithiasis

INTRODUCTION

Urolithiasis is a public health problem, the prevalence of which has been increasing worldwide (1,2). Urolithiasis refers to the formation of stone(s) in the urinary tracts (3). This includes nephrolithiasis (renal calculi, or kidney stones), ureterolithiasis (ureter calculi), and cystolithiasis (bladder calculi) (4,5). Urolithiasis is mostly lodged in the kidneys (6), and is the third common disease of the urinary tract (7). Nephrolithiasis is a systemic disorder and has been associated with chronic kidney disease (CKD), the end-stage renal failure (8-10), cardiovascular diseases (11), *Itus*, hypertension and obesity (12,13). The clinical manifestations of nephrolithiasis include renal colic, blockage of urine flow, kidney swelling, bloody urine and secondary bacterial infection (14).

The cause for kidney stones is multi-factorial including epidemiological, biochemical, and genetic factors (15-17). The pathogenesis of kidney stone formation is a complex biochemical process and remains incompletely understood (18).

A kidney stone is formed as the result of an imbalance between promoters and inhibitors in the urine and the kidneys (17). The types of kidney stones are calcium stones, struvite or magnesium ammonium phosphate stones, uric acid stones or urate, cystine or ammonium acid citrate stones and drug-induced stones (19). Calcium stones comprise about 80% of the urinary tract stones (20). After the first episode of a stone, the 10-year recurrence rate is more than 50% (21, 22).

Globally, the prevalence of kidney stones is between 2% and 20% (23, 24) including infants (25). In the United States, a National Health Survey report for kidney stone prevalence was 5.2% (from 1988 to 1994) (1), and it affects approximately 1 in 11 people in the United States (26). In Germany, the prevalence of stone disease was 4.7% (2). This prevalence may be influenced by variations in sex, age, race, and changes in dietary practices and global warming (3).

¹ Department of Microbial, Cellular, and Molecular Biology, Collage of Natural and Computational Sciences, Addis Abeba University.

² Department of Biology, Debre Birhan University.

³ Ethiopian Public Health Institute, Traditional and Modern Medicine Directorate, Ethiopia

*Corresponding Author E-mail: tilalewa@gmail.com

Similarly, variations in stone disease prevalence among the different studies may be linked to differences in the study design, duration of the study, and geographical locations.

Sun exposure enhances vitamin D production which leads to an increase in 25-hydroxy vitamin D (27) and the classic effect of vitamin D is to facilitate the intestinal absorption of calcium by mediating active calcium transport across the intestinal mucosa (28). It was reported that most kidney stones are frequently formed in men than in women between 20 and 49 years old (15). In addition, Ahuja et al. (29) reported higher stone occurrences in men than in women between the ages of 30 and 39.

The urinary stones cause not only pain and distress in patients, but also impose a significant economic burden due to loss of working days and associated health care costs. The analysis of stone chemical compositions may influence the choice of intervention (30). Currently, less invasive surgical therapies such as extracorporeal shock-wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), or ureteroscopy (URS) have revolutionized acute and complex stone management. However, these often result in incomplete stone clearance. In Ethiopia, reports on the prevalence of urolithiasis is scarce. Therefore, the present study was intended to estimate trends in the occurrence of urolithiasis among patients that attended St. Paul's Hospital, Millennium Medical College (SPHMC), Ethiopia, over a period of 13 years (2005 - 2017).

PATIENTS AND METHODS

Thirteen years retrospective data were extracted from medical records (surgical theatre registry books and electronic databases) between September 2005 and September 2017 from SPHMC, Addis Ababa, Ethiopia. Electronic medical records were available only for the last 2 years (2015-2017).

The study population was patients who had been admitted to the SPHMC during the study period. Among all patients who underwent open surgery, those identified as stone cases were enrolled in the study. The data retrieved include the age, sex, anatomical positions of stones in the urinary system, co-morbidities or conditions associated with stones, and the history of stone recurrence. Patient records with incomplete information and did not appear readable were excluded from the study. Data in the clinical records were entered into Microsoft Excel and analyzed using descriptive statistics and Graph Pad Prism Version 6 software.

The research protocol was approved by the College of Natural Sciences Institutional Review Board (CNS-IRB) (Approval Minute No. IRB/021/2016), Addis Ababa University. Furthermore, permission was also obtained from the SPHMC Institutional Review Board (Ref. No. PM23/285/2016). Patients' names were assigned code identifiers, and data were used only for the intended study.

RESULTS

Among 32,370 patients who underwent surgical treatment, 757(2.3%) of patients had stone diseases (open stone removal). The patients' theatre registry information, which were completely filled and readable was included in the study. In terms of gender, urolithiasis was more prevalent among males accounting for 68.2% (516), as compared to 31.8% (241) in females. During the 13 year retrospective study period, the prevalence of urolithiasis showed an increasing trend from 2012 to 2017 in spite of the decreasing number of surgeries in stone disease surgery performed each year (Figure 1; Figure 2).

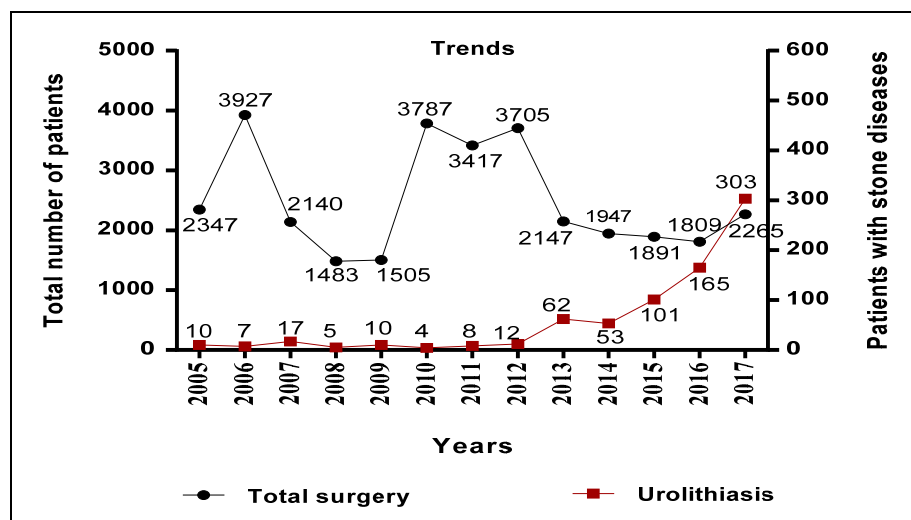


Figure 1: Trends in urolithiasis prevalence from September 2005 to 2017 at St. Paul's Hospital, Millennium Medical College.

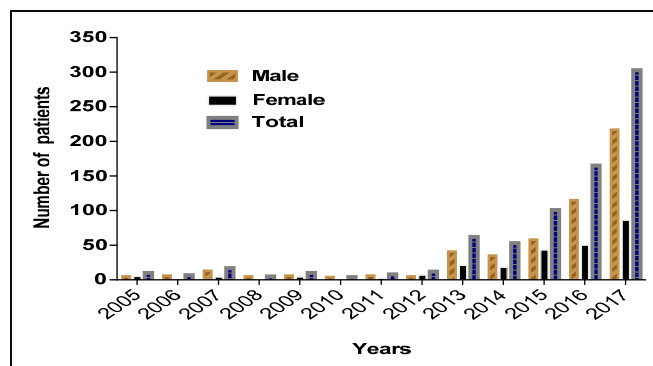


Figure 2: Proportions in stone surgery as it relates to gender at the St. Paul's Hospital, Millennium Medical College, September 2005 - 2017.

The age of the study population ranged between three and 84 years and the mean (SD) age was 42.5 (± 23.7) years. The majority of stone patients (22.2%) were in the age group 30-39 years. In this group, the hospital prevalence of urolithiasis was 20.5% among males and 25.7% among females.

In general, most cases with urolithiasis were between 20 and 49 years of age (Figure 3). As age increased, urolithiasis raised in men and declined in women (Figure 4).

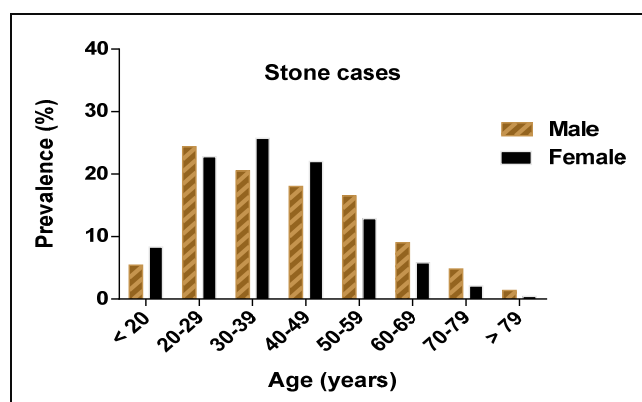


Figure 3: Age related frequency of urolithiasis among 757 patients at the St. Paul's Hospital, Millennium Medical College, September 2005 - 2017.

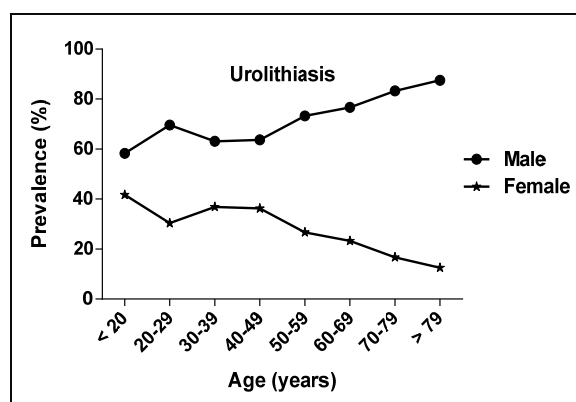


Figure 4: Percentage of patients with urolithiasis as it relates to gender and age among 757 cases at St. Paul's Hospital Millennium Medical College, September 2005 - 2017.

In 46.5% of the cases, the stones were located in the kidneys. The location of stones was more on the left kidney (47.7%) than the right kidney (37.5%). There were some patients whose stone locations not defined or recorded in the registry books (Table 1).

Table 1: The frequency of urolithiasis anatomical locations among 757 cases at St. Paul's Hospital Millennium Medical College, September 2005 - 2017.

Urolithiasis locations	Number of cases (%)
Urolithiasis (n=757)	
Kidneys	352 (46.5)
Ureter	314 (41.5)
Bladder	89 (11.7)
Urethra	2(0.3)
Kidney stones (n=352)	
Right	132(37.5)
Left	168(47.7)
Not defined	52(14.8)
Ureteric stones (n=314)	
Right	153(48.7)
Left	126(40.1)
Not defined	35(11.2)

Among 757 stone patients, 13.61% (103) of the urinary stones were associated with comorbidities or complications. The major comorbidity was benign prostatic hyperplasia (BPH), and major complications

include decreased urinary output (UOP) and hydronephrosis. Stone surgeries due to recurrent stone formation constituted 1.32% (Table 2).

Table 2: Common co-morbidities and complications associated with urolithiasis among 757 cases at St. Paul's Hospital, Millennium Medical College, September 2005-2017.

No.	Co-morbidities/ Complications	Urinary stones
		Number of Patients(%)
1	Benign prostatic hypertrophy	24(3.17)
2	Reduced UOP	58(7.66)
3	Hydronephrosis	6(0.79)
4	Kidney failure	4(0.53)
5	Diabetes mellitus (Type 2)	1(0.13)
6	Recurrent	10(1.32)
7	Null	654 (86.39)

DISCUSSION

Urolithiasis is a public health problem caused by an imbalance between stone promoters and inhibitors in the kidneys. The SPHMC is one of the tertiary hospitals in Ethiopia, in receiving patients referred from all over the country. The increasing trend in stone disease prevalence through the years in Ethiopia may be a reflection of the changes in the life-style of the population such as diet and reduced daily activities. There are indications that the increase in prevalence of stone diseases may be associated with increasing consumption of animal proteins and salts, decrease in calcium-rich products, and climate change as reviewed by Alelign and Petros (17). The analysis results of trends in urolithiasis prevalence were low and similar across the years 2005 to 2012, but started to rise thereafter until 2017. This might be due to improvements in diagnosis of the disease and availability of surgical services at the hospital.

Similar increasing trends in stone disease prevalence were reported from USA by Raheem *et al.* (32). In Japan, the prevalence of renal stones rose from 4 to 5.4% within 10 years (1975–1985)(33). It was also shown that, recurrent urinary tract infections (urease-producing microorganisms) enhanced the prevalence of urolithiasis (7,34). The findings that most stones were located in the kidneys is similar to previous reports from Tunisia and Saudi Arabia (35,36). The retrospective prevalence of urolithiasis (2.3%) was substantially higher than the prevalence (0.24%) from the USA (37), and in Iran (5.7%) (38). The majority of stones were located in the left kidney, probably due to its larger size, which would increase the chance of crystal depositions.

Patients with ureteric stones (41.5%) had surgical interventions, although the non-invasive treatment options such as ESWL were available, though there are problems with their functionality. Therefore, open surgery remains the mainstay of urinary stone treatment.

The finding that the prevalence of kidney stone in men was higher than women, may be explained by the fact that the female sex hormone (estrogen) inhibits calcium oxalate stone formation (39), whereas male hormones, testosterone (40) and androgen (42) promote. Similar studies from other countries had indicated that urolithiasis was more frequent among men than women (1,26,38,43,48) indicating study from the USA also showed that males have a three times higher urinary stone incidence compared to females and provided an explanation that urolithiasis mainly occurred in the third and fourth decades of life when the level of serum testosterone is the highest (41).

However, as Lieske *et al.* (45) reported from Rochester, Minnesota, USA there is a decreasing trend during the past 30 years in the male-to-female ratio in kidney stone disease, in the developed countries. In the present study, the life expectancy in the country is in the sixties and a small number of patients in the 70's may come to the hospital for support. Moreover, one of the possible reasons for gender variation might be due to gender equity, in which females may not have equal opportunity to go to health setup.

The mean age of 42.5 (± 23.7) at the time of stone treatment was similar to that reported from USA, 45 years in men and 41 years in women (45), but was different from what was reported from Iceland (30 to 79 years) (23). However, there is also another study that showed younger age groups not to be fully free from developing kidney stones (31). Thus, age does not appear to be a risk factor for stone disease formation in the kidneys. Also, although *Diabetes mellitus* and hypertension have been significantly associated with stone diseases, affecting children as young as 5 years old (47), these were not associated with urolithiasis in the current study.

The limitation of the study is that the retrospective study sample falls short of being a fair representative of the general Ethiopian population since it is based on patients that came to the hospitals seeking treatment, as a result of which it may overestimate the prevalence of stone diseases. Furthermore, patients' clinical records were taken only from surgically operated patients in one referral hospital. Also, it is possible that some erroneous and incomplete coding of patients' medical information could have limited the effort to capture all stone disease hospital admitted cases. In addition, since the ESWL treatment performed on outpatients, was not included under surgical treatment records, this will also lead to under reporting of stone diseases.

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Conclusions

The findings showed that urinary stone prevalence was increasing and the disease remains a public health problem in Ethiopia. The overall prevalence of stone disease in the past 13-years (2005 to 2017) among patients admitted to the St. Paul's referral Hospital was 2.3%. This provides baseline information for researchers and would guide policy makers to institute preventative measures to minimize stone diseases in the population.

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Conflict of Interest

The authors declare that they have no competing interests.

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