

## Incidence and Risk Factors of Urinary Tract Stones in Adults

Dr. Md. Wahiduzzaman\*

Medical Officer, Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

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**\*Corresponding Author:** Dr. Md. Wahiduzzaman, Medical Officer, Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

### Abstract

**Introduction:** A urinary tract stone, or urolithiasis, is the formation of a stone in the kidney, bladder, or urethra. [1] The prevalence of urolithiasis varies significantly from country to country worldwide. Epidemiological statistics indicate that urolithiasis affects 2–20% of the population. This study aimed to identify the incidence and risk factors associated with urolithiasis over the age of 18 years old patients.

**Methods:** This was a retrospective observational study conducted in the Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from July 2017 to June 2018. In our study, we included 100 patients with urinary tract stones aged over 18 years irrespective of gender attending the inpatient and outpatient urology department of our institution.

**Result:** The majority (26%) of our patients were aged between 51-60 years. Most of our study patients (71%) were male & 29% were female. The most common symptoms were flank pain (74%), abdominal pain (37%), dysuria (22%), and hematuria (18%). The high incidence rates found in the 51-60 years age group are 239.44 and 275.86 in men and women respectively, with a significant p-value (0.04). Family history of stones (48%), obesity (42%), smoking (37%), consumption of tea & coffee (31%), and hypertension (29%) were the most common risk factors.

**Conclusion:** The incidence of urinary tract stones in adults varies widely depending on demographic, environmental, and lifestyle factors. Middle age, male gender, obesity, dietary habits, inadequate fluid consumption, diabetes, and hypertension are key risk factors for urinary tract stones in adults.

**Keywords:** Incidence, Risk Factors, Urinary Tract Stones, Adults

### 1. INTRODUCTION

A urinary tract stone, or urolithiasis, is the formation of a stone in the kidney, bladder, or urethra. The prevalence of urolithiasis varies significantly from country to country worldwide. Epidemiological statistics indicate that urolithiasis affects 2–20% of the population. [1-3] It is frequently estimated that the annual incidence of stone formation in industrialized regions is 1,500–2,000 cases per million. [4] Although urolithiasis is still more common in adults, its prevalence in children has increased by 6% to 10% annually over the last 20 years. In contrast to the male preponderance in adults, children do not show a significant general sex preference, except that males are more likely to be affected in their first 10 years of life and girls in their second.

Few studies on the epidemiology of urolithiasis have been conducted in various nations

worldwide. [5–9] Ethnic, cultural, and health variables may influence the prevalence of urolithiasis in different countries. Accurate epidemiology statistics need consideration of geographic location, socioeconomic status, race, age, sex, climate, nutrition, and other environmental and cultural factors. One of the main reasons why urinary stone prevalence varies so much between countries is due to different epidemiological techniques. Most of these researches were not population-based nor used probability samples representative of the general community. [10] Factors such as gender, age, body mass index (BMI), and geographic location increase the predisposition to urinary stones, which can result in a variety of stone fragments with unique clinical characteristics.

Many lower urinary tract disorders, such as urethral stricture, neurogenic bladder, and BPH, have historically been associated with lower urinary tract stones. [11] Infection and urinary

stasis are recognized adverse outcomes of these diseases. The two most common types of lower urinary tract stones are urethral and bladder stones, which account for 0.3% and 5% of all urinary stone diseases, respectively. [11,12]

In this study, we studied the incidence and risk factors associated with urolithiasis over the age of 18 years in patients at a tertiary care center.

**2. METHODOLOGY & MATERIALS**

This was a retrospective observational study conducted in the Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from July 2017 to June 2018. In our study, we included 100 patients with urinary tract stones aged over 18 years irrespective of gender attending the inpatient and outpatient urology department of our institution.

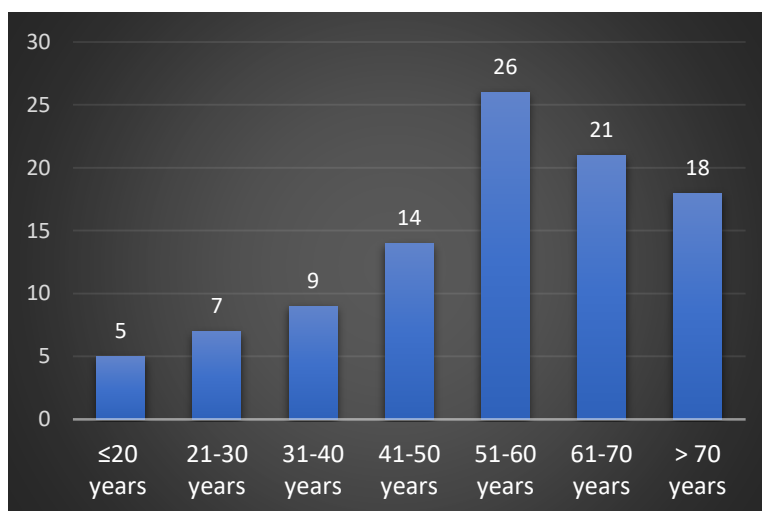
These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged more than 18 years; b) Patients with urinary tract stones; c) Patients who were willing to participate were included in the study And a)

Patients with mental disorders such as mental retardation; b) Patients with Coagulopathy or receiving anticoagulant; c) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.) were excluded from our study.

**Statistical Analysis:** All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. The differences between groups were analyzed by chi-square ( $X^2$ ) test. A p-value <0.05 was considered as significant. Statistical analysis was performed by using SPSS 16 (Statistical Package for Social Sciences) for Windows version 10.

**3. RESULTS**

Anterior vaginal wall biopsy: multiple fragments of hyperplastic glycogenated stratified squamous epithelium and fragment of dense fibrous tissue lined by similar epithelium. The stroma is infiltrated by chronic inflammatory cells.



**Figure 1.** Age distribution of our study patients

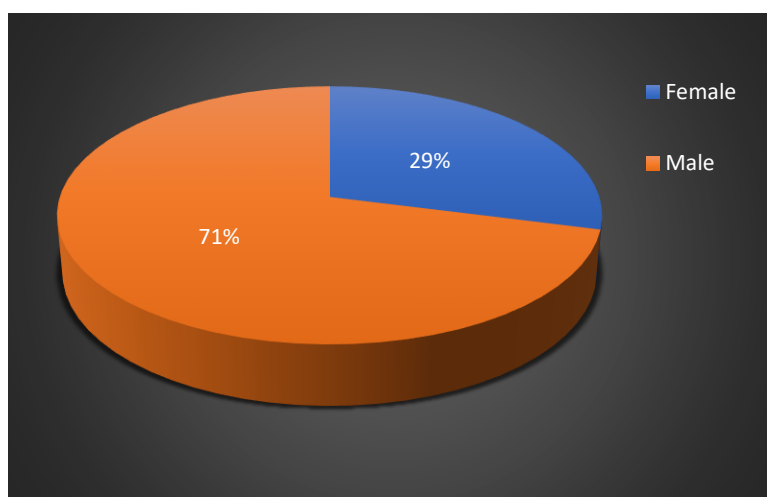
Figure 1 shows that the majority (26%) of our patients were in the age group of 51-60 years, followed by 21% of them aged 61-70 years, 18% & 14% of patients were in the >70 & 41-50 years age group respectively. Only 5% of patients were aged ≤20 years old. The mean age of our patients was 57.39±18.92 years.

There is no evidence of dysplasia or malignancy. Cervical biopsy: fragments of fibrous tissue lined by stratified squamous epithelium. The larger piece is polypoid. The squamous epithelium is histologically unremarkable. The stroma is oedematous and contains scattered spindle

shaped cells, variably sized blood vessels and a patchy lymphocytic infiltrate. Some blood vessels show a mild perivascular hyaline change. The spindle shaped stromal cells stain positively with ER and PR and negatively with SMA, desmin, CD34, S100, melanA, PanCK, MNF116, BCL2, CD117 and CK7. Ki67 shows proliferative activity in less than 2% of cells. CD34 highlights the vascular proliferation. CD99 immunostain is difficult to evaluate due to background staining. Posterior fornix biopsy: fragments of tissue lined by glycogenated stratified squamous epithelium. The stroma is oedematous and contains scattered chronic

inflammatory cells. Bladder biopsy: fragments of fibrous tissue and a fragment of bladder tissue. The bladder tissue shows oedema of the lamina propria and infiltration by chronic inflammatory cells. The urothelium is histologically unremarkable. The two pieces of fibrous tissue show a dense infiltrate of lymphocytes, plasma cells, histiocytes and eosinophils, associated with scattered stromal spindle shaped and stellate cells and collagen fibers. Some of these stromal cells contain enlarged vesicular nuclei with small nucleoli. The stromal cells stain negatively with ER, PR, ALK1, CD34, PanCK, MNF117,

MelanA, BCL2 and CK7. CD117 is positive in some cells. CK7 immunostain highlight an epithelial lining in the two pieces of fibrous tissue with the spindle cell lesion, confirming that these two pieces are also from the bladder. There is a vascular proliferation with perivascular condensation of inflammatory cells. Occasional mitotic figures are present. There is no evidence of necrosis. The Ki67 stain shows high proliferative activity, but some of this activity is probably in the inflammatory cells, although many large stromal cells also stain positively (**Figure 1**).



**Figure 2.** Gender distribution of our study patients

The pie chart shows that most of our study patients (71%) were male and 29% were female.

The male and female ratio was 2.45:1 in our study.

**Table 1.** Distribution of our study patients by clinical presentations

Clinical presentations	N	P (%)
Flank pain	74	74.0
Abdominal pain	37	37.0
Dysuria	22	22.0
Hematuria	18	18.0
Two or more stone episodes	21	21.0

Table 1 shows the distribution of study patients by clinical presentation. The most common clinical presentation at the time of diagnosis was flank pain (74%), followed by abdominal pain (37%), dysuria (22%), and hematuria (18%). Out

of all subjects, 21% of them with urolithiasis stated that they had suffered from urolithiasis several times. Only 3% had five or more stone episodes.

**Table 2.** Incidence of urolithiasis based on gender

Age group	Men (n=71)	Women (n=29)	P-value
≤20 years	56.34	34.48	0.07
21-30 years	70.42	68.97	0.04
31-40 years	112.68	34.48	0.02
41-50 years	169.01	68.97	0.03
51-60 years	239.44	275.86	0.04
61-70 years	183.1	275.86	0.01
> 70 years	169.01	241.38	0.06

Table 2 shows the high incidence rates found in the 51-60 years age group which are 239.44 and 275.86 in men and women respectively, with a significant p-value (0.04). Followed by the incident rates of 169.01 & 241.38 were found in the age group of >70 years among men and

women respectively, with a non-significant p-value (0.06). The low incidence rates of 56.34 & 34.48 were found in men and women respectively who were in the age group of ≤20 years.

**Table 3.** Distribution of study patients by predisposing risk factors

Risk Factors	N	P (%)
Family history of stone	48	48
Did not drink required water (2-3 lit/day)	22	22
Obesity	42	42
Consumption of coffee and tea ≥2 cups a day	31	31
Consumption of soft drinks	24	24
Consumption of cola	18	18
Consumption of protein	16	16
Smoking	37	37
Hypertension	29	29
Diabetes	14	14
UTI	19	19

Table 3 shows that a family history of stones was the most common (48%) risk factor among our study patients, followed by obesity (42%), smoking (37%), consumption of tea & coffee

(31%), hypertension (29%), and not drinking required water (22%). The patients who had DM, and UTI disease as comorbidity had a prevalence rate of 14%, and 19% respectively.

**4. DISCUSSION**

In the current study, most of the stones were located in the kidney and/or ureter. The most common clinical presentation was flank pain, abdominal pain, dysuria, and hematuria. This study assessed the incidence and risk factors associated with the formation of stones among adult patients.

female ratio (1.15:1) which is lower than in most of the previous studies. [10,15,19] In our study, the prevalence was 71% for males and 29% for females. These numbers are 6 and 1.8% in Korea, [15] 9.6 and 4.5% in Japan,[17] and 5.5 and 4% in Germany [19] respectively.

In large countries, variations in climatic zones, differences in eating and drinking habits, different degrees of industrialization, different sunlight indices, and different mean annual temperatures pose additional problems for epidemiological studies.[10] The prevalence rate of urinary stones has been variably reported to be 3.5–18.5%, depending on the countries or regions in which the surveys were performed. [13-15] In our study, the prevalence rate of urolithiasis was 100%. Safarinejad MR found the overall prevalence was 5.7%. [10] Yoshida et al. found that the prevalence of urolithiasis increased from 4.4% to 5.4% over ten years (1975–1985). [16] The reported prevalence rate of urolithiasis was 7% in Japan,[17] 8% in the USA,[18] 4.7% in Germany,[19] and 3.5% in Korea. [15]

In the current study, a family history of stones was the most common (48%) risk factor among our study patients. Those who have had stones are more likely to have a first-degree relative with stones than those who have not.[20] Thun et al. also found a significant frequency of stones in the families of stone formers.[21] The present study found that 16% of patients with urolithiasis consumed protein. Robertson et al. were the first to identify the link between higher protein consumption and the formation of stones. Meat consumption is higher among subjects affected by urolithiasis than in the rest of the population of the same age, whereas cereals, milk, and dairy products are eaten less. [22]

The fact that males are more prone than women to develop urinary stones is well known. [20, 21] In the current study, the male and female ratio was 2.45:1. Safarinejad MR found the male-to-

Usually, water is consumed less often among urolithiasis subjects than among the rest of the participants. Dehydration brought on by insufficient fluid intake when exposed to high ambient temperatures raises urine concentration and acidity, which encourages the development of stones. [23, 24] In this study, the prevalence of not drinking the required water in patients with urolithiasis was 22%.

Many studies have seen a direct relationship between the increase in BMI and the formation of kidney stones. [25-27] Physiologically, obesity is related to increased excretion of calcium and uric acid, as well as increased urinary acidity, all of which contribute to an increased risk of kidney stone formation. [25]

In the present study, hypertension (29%) was found to be another risk factor for the formation of stones. Taylor et al in their study did not find a direct relationship in this regard. [28] Diabetic individuals (14%) in our study had urinary tract stones; the results of another study were similar to ours. [25]

In this study, smoking (37%) was a risk factor for urolithiasis. However, some other studies have identified smoking as an independent risk factor for developing urinary tract stones. [29-31]

### 5. LIMITATIONS OF THE STUDY

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

### 6. CONCLUSION AND RECOMMENDATIONS

The incidence of urinary tract stones in adults varies widely depending on demographic, environmental, and lifestyle factors. The findings of the present study showed that middle age, male gender, obesity, dietary habits (high salt and protein intake), inadequate fluid consumption, diabetes, and hypertension are key risk factors for urinary tract stones in adults aged 40–70 years. Genetic factors and living in warmer climates significantly increase the risk of developing urinary tract stones. Recognizing these risks is crucial for creating effective prevention strategies, such as encouraging healthy eating habits and staying well-hydrated. Identifying people at higher risk early on can help manage the condition better and reduce the impact on both individuals and healthcare systems.

Further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

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**CONFLICT OF INTEREST:** None declared

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