

Clinicopathological Study Of Urolithiasis In A Tertiary Care Center In North eastern Region Of India

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Abstract:

Background: Urolithiasis is a global problem whose incidence is increasing day by day. Urolithiasis is described by the condition of formation or occurrence of calculi in the urinary tract. The epidemiology of urolithiasis varies in accordance with geography, socioeconomic status, and diet. . Most of the cases are diagnosed by primary care physicians rather than urologists because of increased prevalence of urolithiasis and saturation of health facilities. Therefore, primary care physicians play a major role in the diagnosis, management, referral to specialist, and follow up. Underdiagnosis is also a major challenge. In addition study of chemical composition locally is also lacking. Prevalence of urolithiasis in Manipur is very high, especially that of staghorn calculi. Due to delay in diagnosis or lack of information many patient end up in renal failure following long standing urinary stones. Thus this study aims to give insight on the clinical and pathological aspects of urinary stone disease in tertiary care center, RIMS, Imphal.

Materials and Methods: This study included all the patients attending urology OPD and emergency at RIMS with urinary stone disease. A total of 358 patients were studied in terms of age, gender, family history, comorbidity, predisposing factors, dietary habits, water intake habits, stone location, clinical presentation, complications, mode of treatment, types of stone.

Results: The male to female ratio was 1.12:1. The most common age group was 41-60 years and most common occupation was housewife. Most common location of stone was kidney and multiple stones were found in 40 patients. Most common operation done for renal stone, ureteric stone, bladder stone was PCNL, URSL and CLT respectively. Most common stone composition was calcium oxalate monohydrate in both upper and lower urinary tract.

Conclusion: This study showed almost equal incidence of urinary stone among males and females with most common affected age group is 30-50 years. Aging, demographics, dietary and water intake habits, co-morbidities, family history, personal history of stones all has implications in the occurrence of urinary stones found in our study.:

Key Word: Percutaneous nephrolithotomy, ureteroscopic lithotripsy, kidney stone, ureteric stone, calcium oxalate

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I. Introduction

Urolithiasis is a global problem whose incidence is increasing day by day. Urolithiasis is described by the condition of formation or occurrence of calculi in the urinary tract. The epidemiology of urolithiasis varies in accordance with geography, socioeconomic status, and diet. In India, the lifetime prevalence of urolithiasis was estimated to be 7.9% (5.7 to 10.8 %).¹

The highest prevalence of Urolithiasis was found in whites, followed by Hispanics, Asians, and African-Americans in accordance with the survey in the United States of America.² Prevalence of stones is highest in mountains, deserts, and tropical areas where the climate is hot, arid and dry. Most of the cases are diagnosed by primary care physicians rather than urologists because of increased prevalence of urolithiasis and saturation of health facilities. Therefore, primary care physicians play a major role in the diagnosis, management, referral to specialist, and follow up.³ Underdiagnosis is also a major challenge. In addition study of chemical composition locally is also lacking.

Prevalence of urolithiasis in Manipur is very high, especially that of staghorn calculi.⁴ Due to delay in diagnosis or lack of information many patient end up in renal failure following long standing urinary stones.

There are certain factors that predispose to the development of urolithiasis. Maximum age for development of stone disease is from third to fifth decade and during this period recurrence is widespread.⁵ The risk of developing renal stone is 2-4 times more in men as compared to women, though the gap is

narrowing. Important metabolic risk factors are hypercalciuria, hyperoxaluria, hyperuricosuria, cystinuria and hypocitraturia. Urinary pH variation and urinary tract infection are additional factors associated with urolithiasis.

Abdominal pain is the commonest symptom of urolithiasis, especially flank pain. Besides pain, vomiting, nausea, fever, frequency, oliguria, and hematuria may occur. Occasionally patients may present with renal failure.

The treatment of urolithiasis has undergone a remarkable evolution. Open surgeries have given way to minimally invasive procedures, which have considerably decreased patient morbidity and mortality.

However, urinary stone disease is notorious for high recurrence rates even with modern management. The likelihood of recurrent stone formation is about 10% at 1 year; 30-40% at 5 year; 50-60% at 10 years and possibly 95-100% at 20-25 years^{7, 8, 9} and consequently, strategies aimed at stone prevention are attractive.

In the US the various types of renal stones seen are, mixed calcium oxalate and calcium phosphate (37%), Calcium oxalate (26%), Uric acid (5%), Struvite (22%), and Cystine (2%).¹⁰ Calcium oxalate is the most common type of stone reported in India.^{11, 12} Stone analysis is a very important facet to the therapy and aftercare of residual and recurrent stones. It is utmost necessary to find out association of microbes in the stone so that we can give proper antibiotic therapy to prevent infectious complications and subsequent recurrence after surgical removal.

Thus with regards to the above discussion this study aims to give insight on the clinical and pathological aspects of urinary stone disease in tertiary care center, RIMS, Imphal.

II. Material And Methods

Hospital based cross sectional study done in the department of Urology, RIMS, Imphal. Sample size was all inpatients with urinary stone disease that were undergone treatment at urology department from April, 2021 to March, 2023. Total of 358 patients were included in the study. All patients were given informed consent. Institutional ethical committee clearance was obtained before starting the study (Ref no).

Inclusion Criteria:

Patients presenting with urinary stone disease.

Exclusion Criteria:

Patients not willing to give consent to participate in the study.

Procedure methodology:

Study variables were age, gender, family history, comorbidity, predisposing factors, dietary habits, water intake habits, stone location, clinical presentation, complications, mode of treatment, types of stone.

Patient were evaluated with history, physical examination, urine analysis, urine culture and sensitivity, complete blood count, renal function tests, X-ray KUB, USG KUB, and Plain and contrast enhanced computed tomography / IVP.

History of the patients included age, gender, religion, occupation, dietary habits, presenting complaints, previous history of stone disease, family history, any co-morbid illness like diabetes, hypertension, urinary tract infection etc.

After taking history physical examination was be done.

Routine investigations like complete blood count, kidney function test, blood sugar, routine urine examination and culture sensitivity, were done to record any abnormality. Serum analysis was done to check levels of calcium, sodium, potassium, chloride, uric acid, and phosphate.

Kidney stones, ureteric stones, and bladder stones are diagnosed with X- ray KUB or NCCT KUB and USG KUB. Ultrasound also detected hydronephrosis, pyonephrosis.

Urethral stones were diagnosed with X- ray of pelvis up to midhigh along with X- ray KUB.

For functional study of kidney CT urogram or IVP was done.

Appropriate operative procedure was done according to the location of stone and size of stone. The treatment options were Conservative, ESWL, PCNL, URSL, CLT, and medical expulsion therapy (MET), PCN or DJ stent placement, open SPC etc.

The stone was collected from the same patient and then analysis was done.

Statistical analysis:

Statistical analysis was done by using IBM SPSS Version 22 for Windows. For descriptive statistics percentage and ratio were calculated using tabular and graphical presentation of analysis.

< 0.05 was considered as the cutoff value or significance.

III. Result

Table 1: Socio-demographic parameters of the study population

Gender:

This study involved both gender, however there was a greater number of male patients (53.1%) than female patients (46.9%) in the study with the ratio being 1.12:1.(Table 1, Figure 1).

Table 1: Gender wise distribution of patients with urinary stones (n = 358)

Gender	Frequency	Percent (%)
Female	168	46.9
Male	190	53.1

Age:

Patients in the study ranged from 8 years to 76 years. Maximum number of patient were from the age group of 41-60 years (50%), followed by 21-40 years (43.58%) and the lowest number of patients were in between 61-80 years (3.64%) and 1-20 years (2.8%) (Table 2, Figure 2).

Table 2: Age wise distribution of patients with urinary stones (n = 358)

Age group (years)	Female	Male	Total
1-20	6(1.68%)	4(1.12%)	10(2.8%)
21-40	67(18.72%)	89(24.87%)	156(43.58%)
41-60	87(24.31%)	92(25.7%)	179(50%)
61-80	8(2.24%)	5(1.4%)	13(3.64%)

Religion:

Religion of the patient was recorded. Out of 358 patients, 235 (65.65%) followed Hindu religion and 100 (27.94%) of them belonged to Muslims religion. A small number of people (6.43%) believed Christianity. (Table 3, Figure 3)

Table 3: Shows burden of religiously different patients with urinary stones (n = 358)

Religion	Sex		Total
	Female	Male	
Hindu	118(32.97%)	117(32.69%)	235(65.65%)
Christian	6(1.68%)	17(4.75%)	23(6.43%)
Islam	44(12.3%)	56(15.65%)	100(27.94%)

Occupation

The occupation of the patients in the study were the majority housewives (24.87%) followed by office workers (18.44%). 12.85% had their own business, students (10.34%) and teachers (10.34%). Other occupation of the patients include farmers (9.22%), labourers (4.75%), doctors(4.47%), police (2.24%), unemployed(1.4%), defence force (1.12%), retired (1.12%), athlete (0.84%) and nurses (0.84%). (Table 4)

Table 4: Shows occupation of patients with urinary stones in the study sample (n = 358)

Occupation	Number	Percentage
Army/Defence	4	1.12%
Athlete	3	0.84%
Business	46	12.85%
Doctor	16	4.47%

Farmer	33	9.22%
Housewife	89	24.87%
Labourer	17	4.75%
Nurse	3	0.84%
Office Worker	66	18.44%
Police	8	2.24%
Retired	4	1.12%
Student	37	10.34%
Teacher	37	10.34%
Unemployed	5	1.4%)

Family History

The likelihood of developing a condition or disease is greater when the occurrence is observed in the family. 30.44% of patients had family history of Kidney diseases. (Table 5)

Table 5: Shows patients according to family history (n = 358)

Family history	Sex		Total
	Female	Male	
No	112(28.4%)	131(36.5%)	249(69.56%)
Yes	56(15.64%)	59(16.48%)	109(30.44%)

Diet

Diet can have an impact on our health and may influence the risk of developing diseases. It was observed that majority of the patients (82.13%) had mixed diet (both vegetarian and non-vegetarian) whereas 17.88% patients were vegetarian. (Table 6).

Table 6: Shows dietary habits of the patients with urinary stones (n = 358)

Diet	Sex		Total
	Female	Male	
Vegetarian	29(8.11%)	35(9.78%)	64(17.88%)
Mixed Diet	139(38.83%)	155(43.3%)	294(82.13%)

Water Intake:

Kidney stones can result from inadequate water intake. Understanding the crucial link between water intake and kidney stone development is essential for maintaining optimal renal health. In this study more than half of the patients had decreased water intake (57.55%), whereas 42.46% patients had normal intake of water (Table 7).

Table 7: Shows water intake habits of the patients with urinary stones (n = 358)

Water Intake	Sex		Total
	Female	Male	
Normal	74(20.68%)	78(21.79%)	152(42.46%)
Decreased	94(26.26%)	112(31.29%)	206(57.55%)

Clinical Presentations

Subjective evidence indicating the diseases is tabulated below. Patients commonly presented with loin pain (62.57%), LUTS (7.55%) and acute urinary retention (13.08%), few patients had multiple presentations in the form of fever, haematuria, colic etc.(Table 8).

Table 8: Clinical presentation of patients with urinary stones in the study sample (n = 358)

Clinical presentation	Number	Percentage
Acute Urinary Retention	11	13.08
Anuria	1	0.28%
Asymptomatic	3	0.84%
Fever, loin pain	11	13.08%
Fever, ureteric Colic	1	0.28%
Haematuria	18	15.03%
Haematuria And Pain	3	0.84%
Haematuria And Ureteric Colic	1	0.28%
Haematuria, LUTS	1	0.28%
LUTS	27	7.55%
LUTS And Fever	2	0.56%
LUTS, Colic	1	0.28%
Suprapubic pain and LUTS	1	0.28%
Loin pain	235	65.64%
Pain, haematuria	1	0.28%
Loin pain, decreased urine output	1	0.28%
Renal Colic	1	0.28%
Renal lump	2	0.56%
Strangury	1	0.28%
Ureteric Colic	19	5.30%
Ureteric Colic And LUTS	17	4.74%

Site of stone:

It was observed that most of the patients (51.4%) had renal stone followed by stone in ureter (27.1%) and bladder (8.66%). Few patients (1.68%) had urethral calculi and some had calculi in multiple sites (11.18%).(Table 9).

Table 9: Shows different sites of urinary stones in the study sample (n = 358)

Site of stone	No of Patients (%)
Renal	184(51.4%)
Ureteric	97(27.1%)
Vesical	31(8.66%)
Urethral	6(1.68%)
Multiple	40(11.18%)

Stones at multiple sites:

Table 10: Shows stones at multiple sites (n=40):

Sites	No of patients (%)
Stones at multiple site in the kidney	26(65%)
Renal stone + ureteric stone	5(12.5%)
Renal stone + bladder stone	7(17.5%)
Ureteric stone + bladder stone	2(5%)

TREATMENT MODALITY

Renal Stone:

PCNL was the most common procedure done for renal stone in our study (65.21%). Open pyelolithotomy was the second most common procedures performed for renal stones followed by ESWL. Seven cases of nephrectomy was done for obstructed and infected system with non-functioning kidney (with opposite side normal functioning kidney). Nephrolithotomy was done in cases where it was not possible to completely clear the renal stones through PCNL or pyelolithotomy based upon preoperative CT scans. PCN or DJ stenting was done as a diversion procedure till definitive operation in 5 patients in whom kidney function was compromised or who were not fit for operation or in whom pyonephrosis was there. (Table 17)

IV.Discussion:

Our study showed almost an equal prevalence in male and female with a ratio of 1.12:1. The gap has been narrowing in the recent years, which may be related to the change in dietary habit and the increase in the incidence of metabolic syndrome. Throughout the century, a persistent male predominance has been found in the prevalence and incidence of Urolithiasis, exact rate differs between studies. Early epidemiologic studies showed incidence of renal stone disease in men is 2.2-3.4 times that of women¹³. In Malaysia, a study that was reported by Sreenevasan et al. in 1980 also showed an overall gender ratio of 3:1.¹⁴ A recent report in the United States showed that although males were more likely to be affected by urinary stones than females, there has been a decrease from 1.7 to 1.3.¹⁵

Peak age incidence of Urolithiasis in our study is between 30-50 years which is in accordance to a study done by Sanjay S. Kale et al.¹⁶

In our study majority of patients are of Hindu religion which may be due to the fact that our Institute is situated in an area where Hindu population is more. It is in accordance to a study done by Apurba M et al.¹⁷

In our study majority of patients were housewives (24.87%), followed by office workers (18.44%) and businessmen (10.00%). 9.22% of patients were farmers. Sedentary lifestyle professional had higher incidence of urinary calculi according to a study by Leiske JC.¹⁵ It may be related to differences in the diet but also may be because of physical activity. Physical activity may agitate the urine and dislodge crystal aggregation.

In our study we have observed that the incidence of stone was more in patients with low water intake. Study by Curhan GC et al demonstrated that daily water intake of more than 2.5 liter results in lower incidence of urinary stones.¹⁸ Stone formation has been directly associated with lack of fluid intake and is by far the one of the most common causes of stone formation. Low fluid intake leads to concentrated urine and supersaturation of minerals contributing to formation of kidney stones as suggested by Curhan GC et al.¹⁸

We observed that 109 (30.44%) of our patients had family history of urinary stone disease while literature varies according to studies. This may be because of different genetic makeup. Study by Ljunghall S. et al. have revealed that Positive family history has been reported to be present in 17–37% of patients with stone disease when compared with 4–22% of normal healthy control subjects.¹⁹ In a study by Curhan GC et al, about 25% of patients with urinary stones have been found to be associated with a positive family history.¹⁸

Epidemiologic investigations of adult patients done by Curhan GC et al. and Taylor et al. have suggested that certain medical conditions, such as diabetes mellitus (DM), hypertension (HTN), and obesity, metabolic syndrome are independently associated with kidney stone disease.^{18,20} In our study 44 patients had DM, 36 patients had HTN, 8 patients had CVD, 7 patients had obesity etc.

In our study renal calculus (51.4%) was the most common diagnosis followed by ureter (27.1), vesical (8.66%) and urethral stones. 11.8% of patients had multiple stones in our study. The incidence of Urolithiasis differs according to location. This is in accordance to a study by Chand RB et al. that reported 75.03% of renal stones, 13.62% of ureteric stones, 1.74% of bladder stones.²¹ The observations in this study matches worldwide trends.

Among the renal stones, most common stone is staghorn stones followed by renal pelvic stones in our study. In Manipur incidence of staghorn stone is high according to a study done by Singh P et al.⁴ Right sided

preponderance was seen in both renal stones (51.09%) and ureteric stone (53.61%) which is in accordance to a study done by Ngugi et al.²² Among the Ureteral stones, upper ureter followed by lower ureter with UVJ was the most common site and right side preponderance was seen (53.61%). In developing countries, there is high incidence of staghorn stones according to a study by Flannigan R et al.²³

Loin pain was the most common symptom although many patients presented with fever and haematuria. LUTS was the most common presentation of vesical stones. In a study done by Liesake J.C. on urolithiasis patients, most common symptom was loin pain (73% to 94%).¹⁷

Regarding treatment of renal stones, PCNL (65.21%) was the most common procedure done as most of the renal stones are staghorn stones and the operative procedure of choice for staghorn and large renal stone is PCNL as stated by Kallidonis P. et al.²⁴ and in those cases where PCNL was not possible, pyelolithotomy was done. Next common procedure done was open pyelolithotomy followed by ESWL. PCN/DJ stenting was done in 5 patients who presented with obstructive uropathy with severely compromised renal function or pyonephrosis where definitive treatment could not be contemplated.

For Ureteral stone the most common procedure done was URSL. Open ureterolithotomy was done for large stones and some stones in upper ureter in whom URSL was not possible. The treatment for multiple site stones was planned depending on the side/ site of obstruction and the clinical presentation.

CLT was the most common procedure done for vesical stones. For urethral stone pushback and CLT was the most common procedure done. In two cases of urethral calculus associated with urethral stricture OIU was done along with retrieval of urethral stone. These findings are in accordance to a study done by Abergelet al.²⁵

Most common composition of urinary stones in our study was the combination of calcium oxalate monohydrate (35.48%) followed by calcium phosphate (17.04%) and calcium oxalate and phosphate (12.57%). Struvite stone was found only in 3 cases. According to Ansari *et al.* analysis of 1050 urinary stones recovered from patients in Northern India, calcium oxalate was the most predominant component present in 93.04% of the cases.²⁶ Our study showed that most common constituent of urinary bladder calculi was calcium oxalate followed by uric acid. F T Hammad et al. in their study found calcium oxalate as the most common constituent of bladder calculi.²⁷

V. Conclusion

Incidence of urinary stone disease was almost equal among males and females with most common affected age group being 30-50 years of age. Aging, demographics, dietary and water intake habits, family history, personal history of stones all has implications in the occurrence of urinary stones found in our study. Most of the patients had renal stones mostly staghorn stones followed by isolated lower calyceal, PUJ/ renal pelvic stones. Most of the renal and ureteric stones had right sided preponderance. Most of the patients presented with loin pain although other symptoms like colic, haematuria, fever were also found alone or in combination in many cases. Those who came late for treatment presented with non functioning kidney, renal failure. Most of the renal stones were treated with PCNL but open surgeries also played a key role in the management of renal stones in our study. For ureteric and vesical stone endoscopic procedures were preferred but for ureteric stone especially in upper ureteric stone open surgeries were also contemplated in view of better stone clearance. Most of the stones in our study were composed of calcium oxalate and phosphate stones. Better understanding of Clinicopathology of Urolithiasis is important to plan the effective treatment guideline and prevention strategies in practice.

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