



ORIGINAL RESEARCH PAPER

General Surgery

STUDY ON PREDISPOSING FACTORS, MODES OF PRESENTATION AND MANAGEMENT OF RENAL CALCULI

KEY WORDS:

Dr. Sivasai Krishna Prasad Kola

Assistant Professor , Department of General Surgery, Gitam Institute of Medical Sciences and Research. Visakhapatnam, Andhra Pradesh, India.

Dr. R. S. Teja Reddy*

Assistant Professor , Department of General Surgery, Gitam Institute of Medical Sciences and Research. Visakhapatnam, Andhra Pradesh, India.
*Corresponding Author

Dr. Janni. Laxman

Associate Professor ,Department of General Surgery, Gitam Institute of Medical Sciences and Research, Visakhapatnam, Andhra Pradesh, India.

ABSTRACT

Urinary stone disease has perplexed physicians for many centuries. The disorder occurs in two forms; endemic bladder stone, which occurs in boys in the developing agricultural countries of the world, and upper urinary tract stone disease, which is becoming increasingly more prevalent, particularly in men among the more affluent nations. Although not all calculi can be cured, patients who develop one of the major types of urinary calculi now have at least 50% chances of cure and control with medical therapy alone. Surgery continues to be one aspect of the treatment of urinary calculi, but it is now only one step in the total therapeutic plan for patients with urinary lithiasis. This study includes 175 cases with upper urinary tract stones treated at Gitam Institute of Medical Sciences and Research, Visakhapatnam. Upper urinary tract calculi were more common in males (68.6%). The male to female ratio was 7:3. The prevalence of upper urinary tract stones is more in the urban population (24%) compared to the rural population (9%). 35% patients had agriculture as their occupation. 92% of the patients had fixed dull aching pain /colicky pain in the flanks. Tenderness in renal angle present in 33.7% of cases. Over all metabolic abnormality was noted in < 5% of cases. IVU showed moderate to severe Hydronephrosis, hydroureteronephrosis and Hydronephrosis with PUJ obstruction in about 35% of cases. 60% cases were managed conservatively . The operative management was done in 40% of cases. PCNL was the commonest procedure performed (37.5%) for renal stones followed by stenting (21.42%). Mixed type of stones were present in 74% of which most common were Calcium oxalate and calcium phosphate stones (28%). Pure stones were present only in 26% with most common being Calcium oxalate (15.6%).

INTRODUCTION

Kidney stones have afflicted humankind since antiquity. The prevalence of urinary tract stone disease is estimated to be 2% to 15%. Urolithiasis is an entity, which has high morbidity and socio-economic impact, and low mortality.

Urinary stones were a major health problem in developed countries until the 1980s, with a significant proportion of patients requiring extensive surgical procedures and a sizeable minority losing a kidney.

The advent of extracorporeal techniques for stone destruction and the refinements in endoscopic surgery, however, have greatly decreased the morbidity associated with stone surgery, and the disorder is changing from a major health problem to a major nuisance. One unfortunate result of this technological success is that advances in the medical management of stone disease and research in prevention have languished. Surgical procedures treat stones but do not prevent them; however, as anyone who has passed a kidney stone can tell, this may be what the majority of patients with stone disease needs.

Visakhapatnam is a metropolitan city located in Northern Andhra Pradesh, India, which comprises Visakhapatnam, Srikakulam, and Vijayanagaram districts. These areas have a high incidence of kidney related disorders, particularly the 'Uddanam' region, which is known for 'chronic kidney disease of unknown origin.'

The present study is taken up to know the incidence, composition, clinical manifestations, and diagnostic features, which help in the management of patients with the stone disease and also prevention of recurrence.

OBJECTIVES OF THE STUDY

1. To study patients with renal stones with regards to various

variables like age, sex, and occupation.

2. To study the mode of presentation of renal stone.

3. To study various predisposing factors of renal calculi.

4. To study the different modes for management of renal stones at GITAM Institute of Medical Sciences and Research, Visakhapatnam.

METHODOLOGY:

The study includes all patients diagnosed with renal calculi in the General surgery department of Gitam Institute of Medical Sciences and Research, Visakhapatnam, from January 2019 to December 2019. A detailed history, complete physical examination routine, and specific investigations were done. The patients diagnosed with stones below the pelviuretric junction were excluded from the study.

All the patients included in the study were investigated with

1. Urine examination macroscopic, microscopic, biochemical, and bacteriological examinations.

2. Routine blood investigations

(Random blood sugar, Blood Urea, Serum Creatinine, Hb %, RBC, and WBC count)

3. Serum Calcium and serum phosphate

4. Radiological investigations: KUB X-ray, ultrasound abdomen, IVU.

After considering the above investigations, the patients requiring operative or other modalities of treatment were admitted.

Management:

All the outpatients, who did not require admission, were treated with conservative approach which included analgesics, antispasmodics, treatment of urinary tract infections and adequate fluid intake.

Inpatients :

During preoperative period, patients were given treatment

for correction of anemia, avitaminosis and malnutrition. Appropriate antibiotics as per urine culture and sensitivity reports were given. The patients were treated according to the site and size of urinary calculi as follows:

Medical expulsive therapy:

This treatment has been directed at treatment combinations to reduce edema and inhibit stone-induced ureterical spasm. Regimes have commonly included a corticosteroid, analgesics and antibiotics, as well as an agent directed towards stone-induced ureteral spasm. The drugs used include Nifedipine and Tamsulosin.

Operative Management:

Patients were subjected to operative treatment following the failure of expectant treatment. Surgeries done for Renal calculi included Pyelolithotomy, Extended Pyelolithotomy, and Nephrectomy. Some of the renal calculi cases also underwent PCNL and ESWL. Surgeries done for ureteric calculi include Laparoscopic Ureterolithotomy, Open Ureterolithotomy and Ureterorenoscopy. General anesthesia was used in all cases.

Stone Analysis:

The stones recovered after the operation or spontaneous expulsion were subjected to chemical analysis after noting their physical characteristics in Central Biochemistry Laboratory, GIMSR.

The patients were given postoperative advice depending upon the chemical analysis of calculus and the biochemical abnormality found by urine and blood analysis.

The cases were followed for varying length of time at regular intervals to monitor urinary tract infection and recurrence of calculi.

RESULTS

During the study period, about 175 cases with Upper urinary tract stones were studied. Among these total number of cases, 105 patients were conservatively managed, and 70 cases underwent surgery.

Out of the 175 patients, 107 patients (61%) were from rural areas and 68 patients (38%) were from urban areas. Upper Urinary tract stones' occurrence was maximum in the 3rd and 4th decade (25.1%). The stones' occurrence was also high in the 5th and 3rd decade at about 16% and 20%. The stones were less common in the 1st decade (3.5%) and after the 6th decade (6.5%).

Upper urinary tract calculi were more common in males (70%). The male to female ratio was 7:3.

In this study, the majority of the patients (35%) had agriculture as their occupation. The second most common occupation was coolie (30%). About 15% were housewives, and 12% were office workers. Only 8% were businessmen.

The source of drinking water for most patients (60%) was either well or borewell water (hard water) with high mineral content, i.e., salts of calcium and magnesium. About 25% of patients used river water, and 15% of patients used tap water for drinking purpose (table-1)

Table-1: Source Of Water

Source	No of cases	Percentage
Well / Borewell water	105	60%
Tap Water	26	15%
River	44	25%

About 62% of patients were vegetarians, and 38% were taking a mixed diet. Patients classified as mixed diet eaters used to take meat occasionally. No particular preference to a

lithogenic diet was noted in any patients.

In the study population, fixed dull aching pain was the most common presenting symptom (65.7%), followed by colicky pain in 34.3% of cases. Fever with chills was present in 17.7% of cases. Nausea and vomiting were present in 24(16.2%). About 28% of the cases had burning micturition. Haematuria was noted in about 15.4% of cases. The frequency of micturition was noted in 3% of cases. No patients had passage of gravel. (table-2)

On examination of physical signs, renal angle tenderness was noted in about 33.7% of patients. 3% of patients had a palpable hydronephrotic kidney. Urine Analysis and blood analysis were done, and results were compared, as shown in table 3 and table 4, respectively.

Table - 2: Symptoms At Presentation

Symptom	No. of Patients (%)
Fixed Dull aching pain	113 (65.7%)
Colicky Pain	62 (34.3%)
Pain referred to Penis	Nil
Fever with Chills	31 (17.7%)
Frequency of micturition	10 (3%)
Haematuria	27 (15.4%)
Passage of Gravel	Nil
Burning micturition	49 (28%)
Nausea and vomiting	24(16.2%)

Table- 3: Urine Analysis

Urine analysis	No of Cases (percentage)
PH Acidic	144 (82.3%)
PH Alkaline	31 (17.7%)
Albumin	14(8%)
RBC's	52(30%)
Pus cells	17(9%)
Oxalate crystals	3(1.5%)

Table - 4: Blood Investigation

Investigation	No of cases	Percentage
Hb% (<9 gms)	31	17.7%
S . calcium > 11mg%	9	5%
S.uric Acid levels Elevated	8	4.5%
S. Phosphorus < 4 mgs	3	2%
S. Protein Normal	All cases	100%
B .Urea > 4 mgs	5	2.4%
Leucocytosis	32	18.3%

Imaging :

Plain X-ray KUB was done in all the cases after proper preparation. The radio-opaque stones were detected in all cases.

Intravenous Urogram was employed in all cases of renal and ureteric calculi confirmed by plain X-Ray KUB and ultrasound abdomen and also in suspected radiolucent stones.

The majority of the cases (70%) had normally functioning kidneys with no abnormality except for the presence of stones. About 15% of cases had hydronephrosis, and about 10% of cases had hydroureteronephrosis. Hydronephrosis with obstruction was noted in 5% of cases. The hypofunctioning and Nonfunctioning were noted in only 2 cases in each category. (fig-1)

All the outpatients were treated by conservative method with analgesics and antispasmodics .

Table -5: Management

Type	No: of cases	Percentage
Operative	70	40%
Conservative	105	60%
Total	175	100%

In our study, about 70 cases underwent operative management for calculi. Some cases underwent multiple procedures. Percutaneous Nephrolithotomy (PCNL) was the most common procedure that was performed (46.75%). The second most common procedure that was performed was stenting followed by RIRS (19.48%). Pyelolithotomy was performed in 15.58% cases. About 10.39% of cases underwent RIRS.

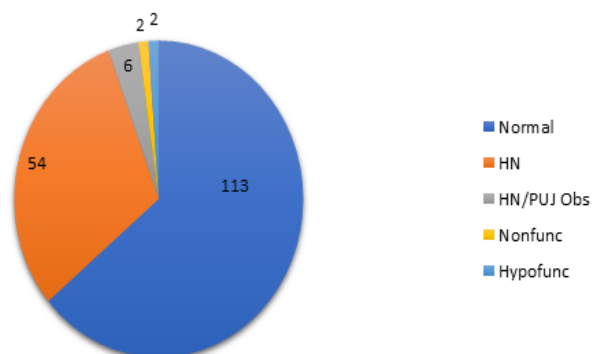


Fig-1 : Functional Changes On IVU

Post-operatively, 4 cases had wound infection. There were no deaths, recurrence and urinary fistula.

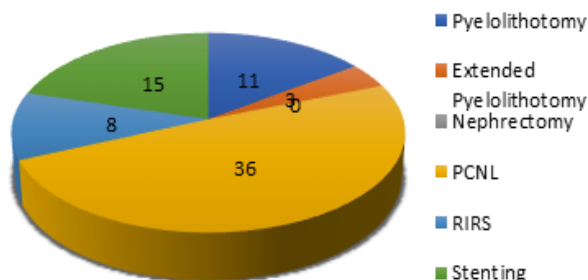


Fig 2: Surgical Management

In our study, about 64 stones were recovered from operated cases. The most common type of stones was Calcium oxalate + Ca. Phosphate stones (28%). The second most common stones were Ca. Oxalate + Ca. Carbonate (18%). Pure Ca. Oxalate and Triple Phosphate stones were present in 15.6% of cases. Pure Ca. Phosphate stones were found in 9% of cases. Pure uric acid and Phosphate + Urates stones were present in 6.25% of cases. (table-6)

Table - 6: Stone Analysis

Composition	No: of cases	Percentage
Calcium oxalate + Ca. Phosphate	18	28%
Ca. Oxalate + Ca. Carbonate	12	18%
Ca. Oxalate	10	15.6%
Ca. Phosphate	6	9%
Triple Phosphate	10	15.6%
Uric Acid	4	6.25%
Phosphate + Urates	4	6.25%
Total	64	100%

DISCUSSION

The world prevalence is estimated between 1 to 5%, in developed countries 2-13% (with a great variation among them), and in developing countries, 0.5-1%. The overall probability of forming stones differs in various parts of the world: 1-5% in Asia, 5-9% in Europe, 13% in North America, 20% in Saudi Arabia. 1

The incidence of urolithiasis throughout India was estimated to be 10 per 1,00,000 population. The incidence of urolithiasis varies in different parts of India. The highest incidence of stones was found in Punjab and lowest in Southern India. The

stone incidence in India has been mostly determined by studying the hospital admission.

The majority of patients in this study are from rural areas of Srikakulam district, Vizianagaram district. Many of the people living in these areas are a tribal population who live in deeper parts of eastern ghats without proper access to clean drinking water. In our study, the majority of patients were from rural areas. (62%).

The peak incidence of urinary calculi is in the 3rd and 4th decade of life. The mean age was 37 years in our study population, with the highest incidence of stones noted in patients of the age group of 20 to 40 years. (54%) which concurs with existing literature- Lee SK et al. 2, reporting highest incidence on age distribution showed in 20 to 40 years (61. 0%) and Rao T.V.R.K. et al., also reporting highest incidence in the age group of 25-45 years (39%).

Soucic and associates (1994) observed a trend in the male-to-female ratio of the lifetime incidence of stone disease of 3.4 among Asians, 2.6 among whites, 2.1 among Hispanics, and 1.8 among African Americans. Michaels and coworkers (1994) also noted a reversal of the male predisposition to stone disease in Hispanics and African Americans, reporting a male-to-female ratio of 1.8 among Asians, 1.6 among whites, 0.7 among Hispanics, and 0.5 among African Americans. 1

In our study (n=175), 120 were males, and 55 were females, and the male is to female ratio was 2.1:1. Lee SK et al, 2 noted the sex ratio of male and female was about 9.2:5.9.

Several investigators have commented on the apparently equal tendency toward urinary lithiasis in males and females during childhood 3 This observation, coupled with reports that increased serum testosterone levels resulted in increased endogenous oxalate production by the liver 4, led Finlayson to postulate that lower serum testosterone levels may contribute to the protection women and children have against oxalate stone disease 5 A study has found that men have mean higher oxalate concentrations than women. In other study was concluded that androgens increase whereas estrogens decrease urinary oxalate excretion, plasma oxalate concentration, and kidney calcium oxalate crystal deposition 6.

Blacklock reported that the incidence of urinary calculi was higher in administrative and sedentary personnel of the royal Navy than in manual workers 7. Other study has confirmed that professional and managerial groups had an incidence that was much higher than expected and manual workers had a much lower than expected frequency of urinary calculi 8 It becomes difficult to assess whether occupation is a primary factor in stone disease or whether it merely establishes other aspects of environment, such as diet, heat exposure, and water drinking. Alterations in these factors may be the actual instigators of urolithiasis. 8

In contrast, in our study, majority of the patients (35%) had agriculture as their occupation. The second most common were manual laborers (30%). About 15% of were house wives and 12% were office workers. Only 8% of were business men. As majority of cases were agriculturists and coolie, working in hot and humid climates resulting in dehydration and concentration of urine, coupled with diet poor in vitamins may predispose these patients to urolithiasis.

In this study, majority of patients (60%) consumed well / bore well water. (hard water) with high mineral content i.e., salts of calcium and magnesium. About 25% of patients used river water and 15% of patients used tap water for drinking purpose. As majority of patients were using well/borewell water for drinking, the high mineral content of the water may be a contributory factor for urolithiasis.

The most common symptom of upper urinary tract stones was fixed dull aching pain /colicky pain in the flanks present in about 92% of the patients. The next common symptom was nausea and vomiting present in about 33% of cases, followed by fever and hematuria present in 28 and 15% of cases respectively. Lee SK et al², noted clinical symptoms of upper urinary tract showed flank pain in 91.8%, nausea & vomiting: in 57.8%. Hematuria in 47.8%. These values are almost comparable with our study.

Comparison Of Presenting Symptoms

	Our study	Shin CS et al. ⁹	Serinken M et al ¹⁰	Lee SK et al ²
Flank pain	84-92%	78.7%	82.9	91.8%
Nausea ,vomiting	33%	47%	8.5	57.8%
Haematuria	15%	36%	6.8	47.8%

Serinken M et al, noted that In the upper urinary tract stones, mostly the patients complained of flank pain (82.9%), gastrointestinal symptoms (8.5%) and gross hematuria (6.8%). Shin CS et al. noted that in the upper urinary tract stones, mostly the patients complained of flank pain (78.7%), gastrointestinal symptoms (47.0%) and gross hematuria (36.0%). The results of our study are comparable to that in the literature- Shin CS et al., Serinken M et al and Lee SK et al.

The most common sign elicited in our study was tenderness in renal angle in 33.7% of cases. Serinken M et al¹⁰ noted that flank tenderness (FT) is the most common finding in the physical examination of upper urinary tract calculi patients (58.7%) which is more compared to our study.

All the cases included in the study underwent urine analysis. Urine specific gravity was normal in all the cases. The reaction of urine in majority of cases was acidic (82.3%) and alkaline (17.7%) in the rest of cases. RBC's were detected in 30% of cases of upper urinary tract calculi. Pus cells were present in only 9% of cases. Oxalate crystals were detected in only 2 cases. Lee SK et al,² noted microscopic hematuria in 88.8% and pyuria in 65.3% which is significantly different from the results of our study.

Anemia i.e. (Hb% < 9 gms) was present in about 17.7% of cases, hypercalcemia in 5% of cases, hyperurecemia in 4.55% of cases hypophosphatemia in 2% of cases, serum alkaline phosphatase elevated in 8% of cases, blood urea elevated in 2.36% of cases and leucocytosis noted in 20% of cases. The serum proteins were normal in all the cases. Over all metabolic abnormality was noted in < 5% of cases.

Plain X ray KUB was employed after preparation of the patient. Almost all the cases had renal and ureteric calculi on the radiograph.

Although upper urinary tract calculi are best diagnosed with plain CT Abdomen and IVU, USG abdomen can be used as the initial screening modality for evaluation of renal colic. In our study it was found to be a very useful non invasive procedure in detecting upper urinary tract calculi. USG showed sensitivity of 80% in detecting hydronephrotic changes (IVU used as confirmatory test).

Intra venous Pyelogram was employed in all cases except those with CRF after confirming the diagnosis by Plain X-Ray KUB and ultrasound abdomen. 5% radiolucent stones were noted in our study. A normal IVP except the presence of stone was noted in majority of cases. Moderate to severe Hydronephrosis, hydroureteronephrosis and Hydronephrosis with PUJ obstruction were noted in about 30% of cases. The hypofunctioning due to pyonephrosis was noted in only 0.7% of cases. Lee SK et al, noted a moderate hydronephrosis in 34.9% of cases in his study. Shin CS, ET al. noted moderate hydronephrotic changes were detected in 32.8% non-

visualization in 6.3% of cases in his study. Our data is almost comparable with these studies.

Comparison Of Functional Changes In IVU

Studies	Present study	Shin CS, et al ⁹	Lee SK et al ²
Hydronephrotic changes	30%	32.8%	34.9%
Non-visualization	0.7%	6.3%	

In our study most of the cases were managed conservatively in about 60% of cases. The operative management was done in about 40% of cases. Among operative intervention, posterior Pyelolithotomy was the commonest procedure performed (37.5%) for renal stones and ureterolithotomy for ureteric stones. (20.4%) Lee SK et al, noted that (58.0%) of urolithiasis were treated with surgical intervention.

Shin CS et al,⁹ noted surgical intervention was needed in 63.9%, expectant treatment in 25.2% and ureteral catheterization in 9.7%.

In contrast to these studies our study has more number of cases managed by conservative approach. This may be because, in our study a sizeable population studied were outpatients, in contrast to other studies in which most cases were inpatients.

Post operative complications like wound infection was present in 4 cases. These patients were treated with appropriate antibiotics as per the culture and sensitivity report of the discharge. Mortality and urinary fistula were not observed in any of the cases.

The most common type of stones were mixed type present in about 74% of the cases. Among them most common were the Calcium oxalate and calcium phosphate stones. (28%). Pure stones were present only about 26% of cases. The most common among them were Calcium oxalate (15.6%). Uric acid stones were present in only about 13% of cases. Pure uric acid stones were noted in only 6.25%.

Rao TV R K et al.¹¹ observed that total of 81.6% stones were of mixed type, containing calcium oxalate, phosphate, magnesium ammonium phosphate (struvite), uric acid, ammonium urate etc., in two or more combinations. Among the mixed stones, a great majority (48%) were calcium oxalate and phosphate. Only a total of 18.4% stones were found to be of pure (single constituent) type. These mostly consisted of calcium oxalate or calcium phosphate or uric acid. Most of the pure stones were calcium oxalate ones.

Singh et al.¹² observed that 98.9% were of mixed type containing calcium oxalate, phosphate, magnesium ammonium phosphate (struvite) etc in two or more combinations. Among the mixed stones, a great majority (80%) were calcium oxalate and phosphate. Only a total of 1.1% stones were found to be of pure (single constituent) type.

Tosukhowong P et al,¹³ observed that 59.77% were of mixed type containing calcium oxalate, phosphate, magnesium ammonium phosphate (struvite) etc in two or more combinations. Among the mixed stones, a great majority (47.66%) were calcium oxalate and phosphate. Pure stones formed 40% of the total observed cases.

The results of our study are almost comparable with that the above studies.

Comparison of Stone Analysis

Studies	Our study	Rao TV R K et al ¹¹	Singh et al ¹²	Tosukhowong P et al ¹³
Mixed	74%	81.6%	98.9%	59.77%

Pure	26%	18.4%	1.1%	40.23%
CaOx+Ca Po ₄	28%	48%	80%	47.66%
CaOx+oth ers	40%	30%	18.9%	8%
Pure CaOx	15.6%	13.2%	-	21.09%

The patients were followed up for varying length of time from 3 months to 10 months. Recurrence was noted in four patients during this period. Since this period of observation was very short, inference regarding the recurrence of stone cannot be drawn.

SUMMARY

- During the study period 175 cases with Upper urinary tract stones were studied.
- The occurrence of Upper Urinary tract stones was maximum in the 3rd and 4th decade (25.1%)
- Upper urinary tract calculi were more common in males (68.6%). Male to female ratio was 7:3
- The prevalence of upper urinary tract stones is more in rural population (62%) compared to urban population (38%).
- Majority of the patients (35%) had agriculture as their occupation.
- The most common symptom was fixed dull aching pain /colicky pain in the flanks present in 92% of the patients.
- The most common sign was tenderness in renal angle elicited in 33.7% of cases.
- The reaction of urine in majority of cases was acidic (82.3%).
- Over all metabolic abnormality was noted in < 5% of cases.
- IVU showed moderate to severe Hydronephrosis ,hydronephrosis and Hydronephrosis with PUJ obstruction in about 35% of cases.
- 60% of cases in this study were managed conservatively and 40% had operative intervention.
- PCNL was the commonest procedure performed (37.5%) for renal stones followed by stenting with RIRS (21.42%)
- Wound infection was the only complication observed.
- The most common type of stone was mixed type present in 74% of the cases. Among them most common were the Calcium oxalate and calcium phosphate stones (28%). Pure stones were present only in 26% of cases. The most common among them were Calcium oxalate (15.6%).

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