

A prospective cohort study of various modes of management of ureteric calculi and its outcomes

Running title: Management and outcomes of ureteric calculi

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Abstract:

Background: Urolithiasis is one of the commonest diseases occurring in humans. There are various modes of management of urolithiasis. The study was conducted to assess various modes of management of ureteric stones and its outcomes.

Methods: This study includes 150 diagnosed patients of ureteric calculi based on inclusion criteria. Clinical manifestation of these patients was studied. Patients with ureteric calculi were treated medically and surgically both open and endourological procedures (ureteroscopy). Statistical analysis was done on Microsoft Excel sheet version 21.

Results: The mean age of presentation was 34.25 ± 15.16 years. Majority of patients were male. The main symptom was radiating pain. The mean stone size was 8.29 ± 6.15 mm.

Majority of patients were managed with ureteroscopy only. Complications were minimal and were managed conservatively.

Conclusion: Ureteric stones can be managed with endourological procedures and conservative management. Rarely it requires open surgical procedures these days.

Key words: Calculi; Endoscopy; Haematuria; Pain

Introduction:

Urolithiasis usually affecting people in the prime of life, causes significant loss of working hours[1]. Urolithiasis is a common problem affecting 1- 5% of the population in industrialized countries[2]. Until 1980s, urinary calculi were a major health problem, with significant proportion of patients requiring extensive surgical procedures and a sizable minority losing their kidney. Stone fragmentation by ESWL (Extracorporeal shock wave lithotripsy) and percutaneous nephrolithotomy and endoscopic techniques has revolutionized stone management[3]. Open surgery is rarely performed in present era; the use of medical expulsive therapy (MET) has been controversial and mainly for smaller stones. The mainstay treatment balances between shockwave lithotripsy (SWL) and ureteroscopy (URS), with the latter usually recommended for larger stones[4].

Ureteric stones account for 2/3 of all urinary calculi brought to attention of doctor[5]. The presentation of the typical patient with ureteral colic is well recognized. The treatment of ureteral stones has undergone a remarkable revolution in the last 15 years.

Majority of ureteral stones pass without any intervention at all. Presently, the treatment options include stenting as definitive therapy, extracorporeal shockwave lithotripsy (ESWL), percutaneous nephroureterolithotomy, retrograde ureteroscopy (URS), laparoscopic ureterolithotomy and occasionally open ureterolithotomy[2]. Because of expenses of

technology classical medical and surgical treatments are still practiced in developing countries.

The study presents various modes of management of ureteric calculi and its outcomes.

Material & Methods:

The prospective study was conducted at tertiary care centre for 3 years after approval from institutional ethics committee (Approval No. SVIEC/ON/MEDI/BNPG11/12163). 150 cases of ureteric calculi admitted to urology unit of General Surgery department of our hospital were included in the study. Informed consent was taken from the patients. Detailed history taken and examination was done. Patient underwent routine investigations including complete blood count, renal function test and urine routine examination. Radiological examinations were done like ultrasonography, IVP (Intravenous pyelography) and KUB (Kidney, ureter, bladder) radiography. The patients were categorised according to mode of treatment and immediate and early postoperative follow up was recorded.

Inclusion Criteria

- Patient informed consent
- Patient can understand to take medication properly
- Confirmation Of Ureteric calculi by radiological investigations

Exclusion Criteria

- Patient not willing to come for follow up
- Patient having bleeding disorders
- Pregnancy
- Patient is not fit for surgery

Criteria for Surgical Intervention

- Calculi greater than 7mm
- Associated hydronephrosis
- Ureteric calculi that is refractory to ESWL and ureteroscopy
- Calculi that do not disintegrate with contact lithotripsy
- Associated ureteral stricture

Criteria for Medical Intervention

- Calculi less than 7mm
- No hydronephrosis
- Pain controlled with oral analgesics
- Free of infection
- Patient does not have urethral obstruction

Statistical analysis was done on Microsoft Office 21 (Excel Sheet). P value calculation was done using chi square test. P value <.05 is considered statistically significant.

Results:

The mean age of patients was 34.25 ± 15.16 years. Majority of the patients were male with male to female ratio of 1.7:1 (Table 1). The difference was not significant statistically ($p > .05$). Youngest patient was of 8 years and oldest was 80 years.

In the present study all the patients had pain abdomen with 90% (n=135) had radiation from lumbar region to the groin, genital or to the thigh. 16% (n=24) of the patients had haematuria. Burning micturition (24%) and vomiting (26%) were other common symptoms (Table 2).

Most case had lower ureteric calculi (n=102) followed by upper ureteric stones (n=36) (Figure 1). Right sided ureteric calculi (n=60) were slightly higher than left side (n=56) (Figure 2).

Majority of the patients had stone size less than 10mm (n=105). 35 cases had stone size between 11-20mm and 10 cases had size of more than 20mm. The mean stone size was 8.29 ± 6.15 mm (Figure 3). Solitary calculi were predominant finding in present study (n=80) (Table 3).

Patients having small stones (n=50) with normal urinary tract were managed medically. Patients having stone size of 7-14mm with hydronephrosis underwent URS while 20 patients required open ureterolithotomy. The results were statistically significant ($p < .05$) (Table 4). Stent was put in all 20 patients of open ureterolithotomy and 55 patients of ureteroscopic patients. Main reason for putting stent in these patients was that there was manipulation, hydronephrosis, stone is of larger size, longer duration and difficulty to remove. All Patients were called up for follow up after 3 weeks for removal of stent and x-ray KUB was done before stent was removed. All the patients on follow up were asymptomatic.

A total of seventy-five patients had post operative complications. 57 had haematuria and 10 patients had UTI. 6 patients had wound site infection and 2 had urinary leak (Figure 4). All patients were managed conservatively.

Discussion:

Urinary tract stones are known for centuries and since then many different techniques and procedures were used to treat the symptoms or removal of stones have been practised since then. The present study shows the various modalities of treatment of ureteric stones based on the size of stones and their outcome.

Majority of the patients in present study were of age group 21-30 years followed by 31-40 years (Table 1). The study was consistent with study conducted by Morse et al where 30% patients belong to age group of 31-40 years [6]. Vyas et al reported maximum number of cases in age group of 21-40 years (66%) [7].

Dasgupta et al [8] shows the average age of ureteric stone patients was 49.5 years which was higher than present study where mean age was 34.25 ± 15.16 years. Mean age reported by Alabi et al was 48.2 ± 12.4 years [9]. The difference could be due to difference in sample size.

Men most commonly experience their first episode between 30 and 40 years of age, whereas for women, the age at first presentation is somewhat later[10]. The age of onset shows a bimodal distribution in women, with episodes peaking at 35 and 55 years. Recurrence rates are estimated at 50% over a 10-year and 75% over 20- year period, with some people experiencing ten or more episodes over the course of a lifetime[10,11].

The incidence among males were higher than female patients in present study (Table 1). Similar results were shown by Morse et al[6] where male to female ratio was 1.8:1. Vyas et al reported that out of 50 cases 31 were males[7]. The male preponderance is probably due to increased testosterone levels, which results in increased endogenous oxalate formation and predominantly outdoor occupation in males. Increased urinary citrate in females may aid in protecting females from urolithiasis[12]. However female predominance is seen in certain studies of particular region with no known reason[9].

The patients presented mainly with pain abdomen with radiation of pain seen in 90% of patients (Table 2). Radiating pain remained the most common presenting feature of ureteric colic as shown by previous studies[6-8]. Urinary tract infection and haematuria were higher in present study which is consistent with the study conducted by Dasgupta et al[8] where UTI was seen in 24% cases. However, Morse et al showed 18% cases of UTI and only 3% patients had haematuria[6]. The reason could be late presentation of patients to hospital after several episodes of pain.

The current study shows higher incidence of lower ureteric stones (n=102) and least in mid ureter (n=12) (Figure 1). The study is consistent with study conducted by Morse et al which

shows 72% of calculi in lower ureter [6]. Alabi et al also showed higher incidence of lower ureteric calculi (54.2%) in their initial study [9]. However, Grasso et al showed in their study that the incidence of lower ureter calculi is only 50% while in mid ureter it is 18% [13]. Calculus in lower ureter causes physiological narrowing of the ureter and compression of the ureter causing hydronephrosis.

There is a slightly higher incidence of right-side stones (40%) than left side (37%) (Figure 2). However, the difference is not significant. Similar findings were observed by Alabi et al where right-side stones were seen in 45% cases while left side stones seen in 35% cases [9].

The stone size in present study in majority of cases was <10mm (n=105) (Figure 3). Mean stone size was 8.29 ± 6.15 mm. The findings are consistent with study of Alabi et al where they found the mean size of stone was 9.7 ± 2.5 mm with range varying from 6mm to 18mm [9]. Vyas et al reported mean stone size of 10.54 ± 3.6 mm in his study [7]. Yan et al reported mean stone size of 11.5 ± 4.1 mm (range, 4-28 mm), and the mean total stone burden was 17.5 ± 5.7 mm (range 15-46 mm). Majority of patients (n=305, 79.8%) had a stone burden ≤ 20 mm [14]. The reason for lower stone size is that majority of patients had lower ureteric calculi and diagnosis was made earlier due to pain with migration.

Nearly half of the patients were managed by URS only (n=80) (Table 4). 20 patients required open ureterolithotomy while rest were managed conservatively. No patient went for ESWL. The study is consistent with study of Holmen et al where majority of patients were managed with URS only [15]. Over the 20-year period from 2000 to 2020 there was a remarkable 257% increase in URS cases. There was a further decline in open surgery for upper ureteric stone disease by 40% [16]. Ureterolithotomy has been considered for larger stones occasionally [4]. The overall success rate of ureteroscopy were reported to be 97% for distal ureteric stones while 50% for proximal and 80% for mid ureteric stones [17].

Post operative complications were seen in 50% of patients. All were managed conservatively. Main complication was post-operative haematuria which subsided itself and doesn't require any other intervention. In a study Turk et al reported a stone free rate of 95% for ureteroscopic removal of stones in the lower third of ureter with a 5% short term complication rate and no long-term sequelae[18]. Vyas et al reported UTI as most common complication in all procedures but with URS fever was commonest post operative complication[7]. Yan et al also reported fever as main post operative complication. However intraoperatively five patients had bleeding which were managed conservatively[14].

Conclusion

The present study shows that ureteric stones were common among male population in 3rd or 4th decade of life. Ureteroscopy remain the mainstay of treatment with open surgery to be left for failure cases or larger stones.

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Tables:

Table 1: Demographic profile

Age group in years	Number of patients		Total
	Male	Female	
<21	10	9	19
21-30	25	15	40
31-40	21	17	38
41-50	16	7	25
51-60	11	5	16
>60	11	3	14
Total	94	56	150

Mean SD (years)	36.05±15.97	31.41±12.93	34.25±15.16
P value	.46		

Table 2: Presenting symptoms

Symptoms	Number
Pain	150(100%)
Radiation	135(90%)
Haematuria	24(16%)
Burning micturition	36(24%)
Vomiting	39(26%)

Table 3: Number of calculi

Number of calculi	Number of cases
Single	80(53.33%)
Multiple	40(26.67%)
Associated with renal calculi	25(16.67%)
Associated with bladder calculi	05(0.03%)

Table 4: Mode of intervention according to size of stone

Size of stone	No. of patients	Mode of intervention	P value
<7mm	50(33.33%)	Medical management	0.00001

7-14mm	80(53.33%)	URS	
>14mm	20(13.34%)	Open ureterolithotomy	

Figure Legends:

Figure 1: Site of calculi

Figure 2: Side of calculi

Figure 3: Size of calculi

Figure 4: Post operative complications