

## Observational Study of Clinical Features, Biochemical Analysis and Management of Urinary Tract Stones

Dr. Sudershan Kapoor<sup>1</sup> Dr. Amarbir Singh<sup>2</sup>, Dr. Jasmeet Singh<sup>3</sup>,  
Dr. Inderpal Kaur<sup>4</sup>, Dr. Ashwani Kumar<sup>5</sup>

<sup>1</sup>Professor and Head, Department of Surgery- Guru Nanak Dev Hospital, Govt. Medical College Amritsar

<sup>2</sup>Assistant Prof. Department of Surgery- Guru Nanak Dev Hospital, Govt. Medical College Amritsar

<sup>3</sup>Junior Resident, Department of Surgery-Guru Nanak Dev Hospital, Govt. Medical College Amritsar

<sup>4</sup>Assistant Prof. Department of Pharmacology- Government Medical College, Amritsar

<sup>5</sup>Associate Professor, Department of Surgery- Guru Nanak Dev Hospital, Govt. Medical College Amritsar.

Corresponding Author: Dr. Amarbir Singh

### Abstract:

**Background:** The present study was conducted to find out incidence of urinary tract stones, their types and management in patients attending the outpatient department/inpatient ward

**Methods:** The present study was a prospective observational study consisted of 100 clinically and radiologically evaluated cases of urinary stone. The patients were selected from the OPD of Department of Surgery, Government Medical College, Amritsar from Jan 2017 to July 2018 for the period of one and half year. In this study an attempt has been made for the evaluation of clinical trends.

**Results:-** 56 males and 44 females have presented with urinary tract stones. Maximum number of patients were between the age group of 40-49 years and there were 20 males and 6 females in this age group. Only 7 patients in age group 10-19 years and 9 patients in age group of 60-69 years reported with urinary tract stones. Amongst the vegetarians 31 were females and 27 were males whereas 29 males and 13 females were non vegetarian. There was a statistically significant difference in both the groups ( $p < 0.05$ ) Maximum number of patients (33) presented with history of symptoms of urinary tract stones since 1-2 months whereas only 5 patients reported immediately within 1 week. 27 patients had symptoms from less than 1 month and 12 patients gave a prolonged history of symptoms from more than 3 months. 23 patients were in the study group from 2-3 months. 59 had single stone, 9 had staghorn and 32 were diagnosed with single stone. Majority of patients were managed by open surgical procedure (41%) whereas Per Cutaneous Nephrolithotomy was done in 15% of the cases. 28% were medically managed and 16% were managed using Extracorporeal shock wave lithotripsy. Amongst the various open surgical procedures pyelolithotomy was done in 19 cases, ureterolithotomy in 17 cases and 5 cases were managed by cystolithotomy. In our study according to the chemical composition of the urinary stones, most of the stones examined were of calcium oxalate + uric acid 20%, calcium oxalate 20%, calcium oxalate + calcium phosphate 20%, pure uric acid 5% and calcium oxalate + calcium phosphate + uric acid 6%.

**Conclusion:** It can be concluded that the incidence of urinary tract stone is more in males than females. Most frequent type of stone both in female and male subjects is of calcium type and there is significant correlation between duration of symptoms and presence of hydronephrosis.

**Keywords:** Pyelolithotomy, Per Cutaneous Nephrolithotomy, Extracorporeal shock wave lithotripsy, Cystolithotomy, Calcium oxalate

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### I. Introduction

Urinary tract stones are commonly seen in kidney, ureter and bladder. Incidence of these stones was higher in males than in females but now women affected by urinary tract stone disease has outpaced that of men. Nephrolithiasis is still more common in men, the incidence rate ratio of men to women with urinary tract stones has narrowed from 3.4 to 1.3(1).

The most important factor for the stone formation is supersaturation of the urine by stone-forming constituents, including calcium oxalate, and uric acid. These crystals can act as nuclei, upon which ions from the supersaturated urine form microscopic crystalline structures.(2) Diet that is high in fruits and vegetables, moderate in low-fat dairy products and low in animal proteins and salt is associated with a lower relative supersaturation for calcium oxalate and a marked decrease in risk of incident stone formation.(3) Commonest presentation in these patients is colic and the patient's writhes around in agony as location and quality of pain

are related to position of the stone within the urinary tract. Pain usually starts in the loin about the level of the costovertebral angle and moves to the groin, with tenderness of the renal angle. Moving stones cause more severe pain than static ones and the site of pain keeps changing with migration of the stone. Various modalities used for diagnosing urinary tract stones are conventional radiography (KUB), intravenous urography (IVU), ultrasound (US), magnetic resonance urography, and computed tomography (CT) scans. Various modalities used for diagnosing urinary tract stones are conventional radiography (KUB), intravenous urography (IVU), ultrasound (US), magnetic resonance urography, and computed tomography (CT) scans

Many drugs have been proved to be useful for the expulsion of stones especially calcium channel blockers, alpha one antagonist alone or in combination with steroid deflazacort. These drugs augment stone expulsion rate, lower analgesic requirements, colic episodes, and hospitalisations.(4) Various drugs like thiazides, allopurinol, potassium citrate and estrogens are recommended for different disease specific urinary calculi.(5) Goal of management of patients with urinary stones is to remove the stone safely, efficaciously and economically. Various surgical procedures used for managing these patients include shock wave lithotripsy the cornerstone for most small renal stones, percutaneous lithotripsy is preferred for large stones and in combination with extra corporeal shock wave lithotripsy ESWL for staghorn calculi. Upper ureteral stones should be pushed back to the kidney for ESWL, if possible; otherwise they should be treated in situ. Lower ureteral stones are preferentially managed with ureteroscopy, but ESWL may also be used. (6)

## **II. Material And Method**

The present study was conducted to find out incidence of urinary tract stones, their types and management in patients attending the outpatient department/inpatient ward of Department of Surgery of Guru Nanak Dev Hospital, Government Medical College, Amritsar.

This will be prospective and an observational study comprising of 100 patients with urinary stone disease and will be conducted in department of surgery Government Medical College Amritsar. A detailed record of the patient was recorded along with additional information from medical records and prescription slips of the patients. The patients were specially asked about the history of any other disease, intake of over the counter medications or any treatment for chronic disease.

## **III. Aim And Objectives**

-To study the incidence of urinary tract stones in patients attending outpatient department/ward of department of Surgery regarding age, sex, medical conditions and dietary habits.

-To study the composition and clinical presentation of stone disease.

-To access the management of urinary tract stones- medical/surgical.

### **Inclusion criteria-**

- Patient's irrespective of age and sex, presenting with renal colic (prediagnosed as patient of renal stones)
- Patients providing written informed consent
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**Exclusion criteria-** A diagnosis of urinary tract stones was reached after exclusion of the following:

- Pain due to cholecystitis or appendicitis
- Pain abdomen due to infections
- Pregnant women
- Patients who fail to give written informed consent
- Nonspecific pain resembling renal colic but on investigation no renal stone found

## **IV. Observations**

The present study was a prospective observational study consisted of 100 clinically and radiologically evaluated cases of urinary stone. The patients were selected from the OPD of Department of Surgery, Government Medical College, Amritsar from Jan 2017 to July 2018 for the period of one and half year. In this study an attempt has been made for the evaluation of clinical trends.

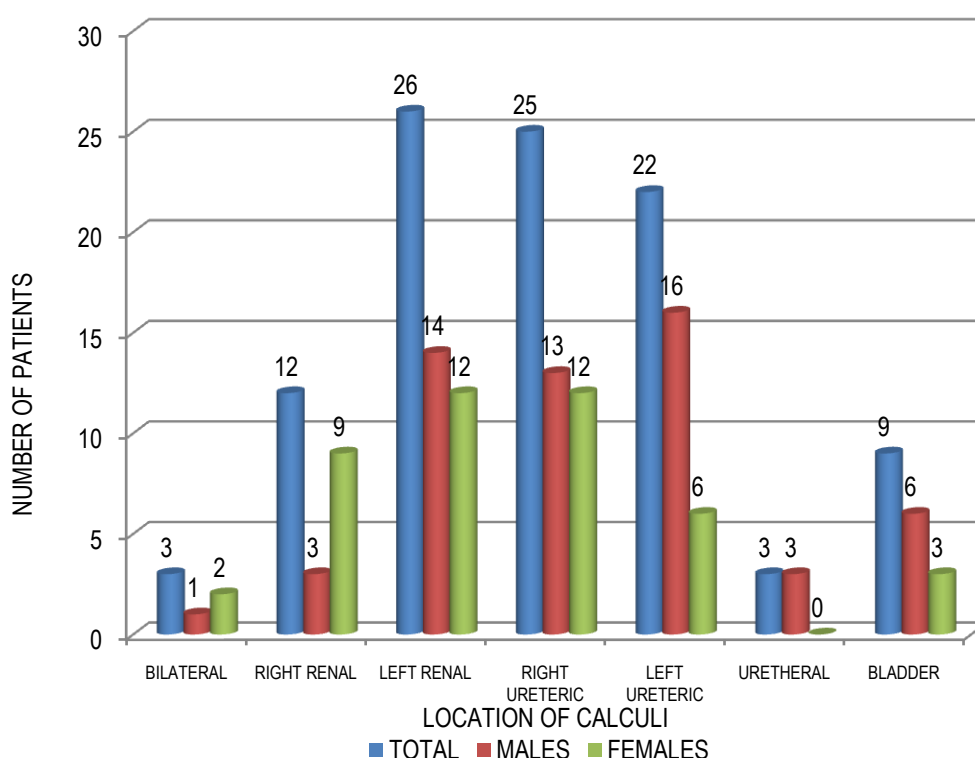
56 males and 44 females have presented with urinary tract stones. Maximum number of patients were between the age group of 40-49 years and there were 20 males and 6 females in this age group. Only 7 patients in age group 10-19 years and 9 patients in age group of 60-69 years reported with urinary tract stones. Amongst the vegetarians 31 were females and 27 were males whereas 29 males and 13 females were non vegetarian. There was a statistically significant difference in both the groups (  $p < 0.05$  ) Maximum number of patients (33) presented with history of symptoms of urinary tract stones since 1-2 months whereas only 5 patients reported immediately within 1 week. 27 patients had symptoms from less than 1 month and 12 patients gave a prolonged

history of symptoms from more than 3 months. 23 patients were in the study group from 2-3 months. 59 had single stone, 9 had staghorn and 32 were diagnosed with single stone.

**Table 1: SIZE WISE DISTRIBUTION OF URINARY STONE**

Sizes	Total	Males	Females
<b>Multiple Stones</b>			
< 1 cm	22	16	6
> 1 cm	10	5	5
<b>Single Stones</b>			
< 1 cm	16	13	3
> 1 cm	43	22	21
Total	91	56	35

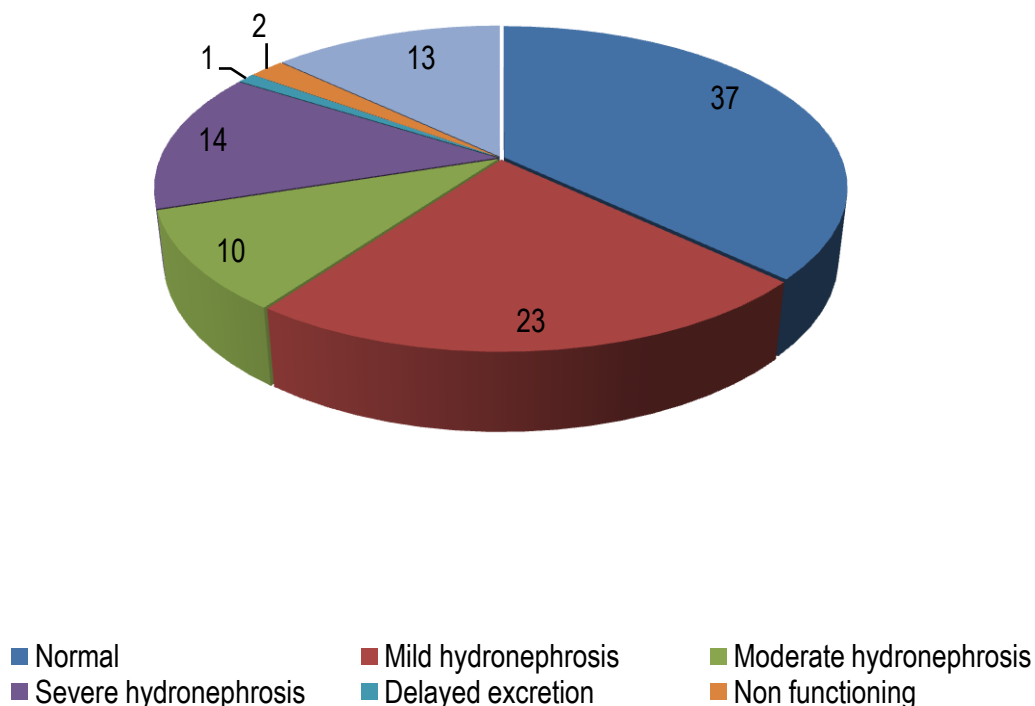
**GRAPH 2: LOCATION WITH RESPECT TO SIDE AND SITE OF STONE**



**TABLE 2: CLINICAL PRESENTATION OF THE PATIENTS OF URINARY STONE**

Symptoms	Male		Female		Total	
	No. of Pts.	%age	No. of Pts.	%age	No. of Pts.	%age
Paininlumarregion	13	23.21	11	25.00	24	24.00
Feverwithrigors&chills	2	3.57	1	2.28	3	3.00
Burningmicturation	14	25.00	9	20.45	23	23.00
Pain iliac fossa	8	14.29	4	9.09	12	12.00
Dysurea	5	8.93	7	15.91	12	12.00
Mixedsymptoms	11	19.64	8	18.18	19	19.00
Haematuria	3	5.36	4	9.09	7	7.00
Total	56	100	44	100.00	100	100

**GRAPH 3: SHOWING IVP FINDINGS IN PATIENTS OF URINARY STONE**

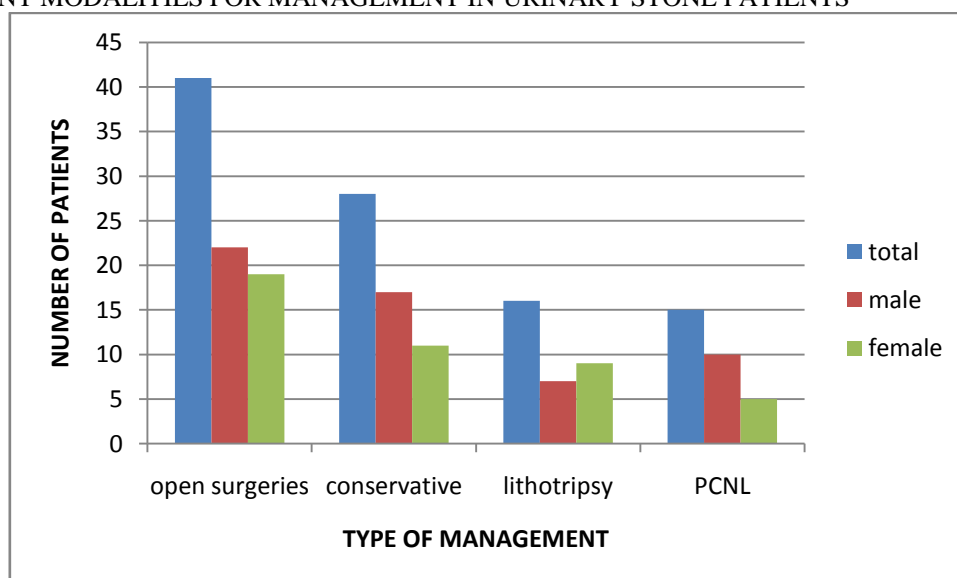


**Table 3: RELATION OF SYMPTOM DURATION WITH RENAL STATUS ON IVP**

Duration	Normal	Hydronephrosis
1 Week - 1 Month	13	6
1-2 Months	14	16
2-3 Months	5	18
> 3 Months	5	7

'p' value is 0.02515 (Significant; p<0.05)

**DIFFERENT MODALITIES FOR MANAGEMENT IN URINARY STONE PATIENTS**



Majority of patients were managed by open surgical procedure (41%) whereas Per Cutaneous Nephrolithotomy was done in 15% of the cases. 28% were medically managed and 16% were managed using Extracorporeal shock wave lithotripsy. Amongst the various open surgical procedures pyelolithotomy was done in 19 cases, ureterolithotomy in 17 cases and 5 cases were managed by cystolithotomy.

**Table 4: TYPES OF STONES ON ANALYSIS**

Types of Stones	Number of Patients	Percentage of Patients
Pure	18	31
Mixed	41	69

**Table 5: CHEMICAL COMPOSITION OF STONES ON CHEMICAL ANALYSIS IN MALES VS FEMALES**

Chemical Composition	Males	Females	Total
Ca Ox	4	8	12
Uric Acid	3	0	3
Struvite	2	2	4
Cystine	0	3	3
Ca Ox and Uric Acid	7	5	12
Ca Ox and PO4	7	5	12
Ca Ox and Ammonia	1	1	2
Ca Ox , Uric Acid And PO4	3	1	4
Ca and Mg	2	0	2
PO4 and Uric Acid	1	1	2
Ca and Struvite	1	0	1
Mg and PO4	2	0	2
Not Done	23	18	41

## V. Discussion

Urolithiasis is the aggregation of crystals in the urine. Events that lead to disruption of equilibrium between promoters and inhibitors of crystallization in the urinary system are liable for stone formation.(7) The disease is ubiquitous with an increasing incidence and prevalence worldwide that appears more pronounced in industrialized countries and younger population of productive age group.It is a multifactorial disease where stone are formed at any location within the urinary tract and are responsible for renal colic, which is the most common symptomatic presentation.Most stone originate within the kidney and proceed distally, creating various degrees of urinary obstruction as they become lodged in narrow areas, including the ureteropelvic junction, pelvic brim, and ureterovesical junction. Location and quality of pain are related to position of the stone within the urinary tract.

It carries significant morbidity and imposes tremendous financial burden on healthcare system. Prevalence has shown a rise over decades due to changing lifestyles and climate as 37% rise has been reported in USA from 1976 to 1994. Life-time risk of urolithiasis varies from 1-5% in Asia, 5-9% Europe, 10-15% USA and 20-25% middle-east; lowest prevalence is reported from Greenland and Japan. Stress should be laid on the preventing aspect of urolithiasis as the situation in various geographical regions worldwide is going to be almost similar.

Majority of the urinary stone (78%) contain calcium in combination with either oxalate or phosphate, whereas 4.2% contain uric acid. Infection-induced stone consist of ammonium magnesium phosphate and carbonate phosphate in approximately 10.6% of patients. (8)

Treatment modalities of urolithiasis vary widely. Some patients require emergent surgical intervention while there is spontaneous expulsion in others.About 15-20% of patients require invasive intervention due to stone size, continued obstruction, infection, or intractable pain. Surgical advancement has mainly focused on removal of stones and usually small stones are left as such.This study was conducted to evaluate the clinical trends, presentation, management and composition of urinary tract stone.

In our study 56 males and 44 females have presented with urinary tract stones. Maximum patients were between the age group of 40-49 years and there were 20 females and 6 males in this age group. Similar results were observed in the study conducted at Krishna Hospital and Research centre Karad a South-West region of Maharashtra (India), during a period of 2006-2008 where high percentage of urolithiasis was reported in males than females of age group between 31-60 years.(9).

In our study there is slight preponderance of males over females which could be due to greater reporting to hospital by males as compared to females. The rate of occurrence is three times higher in men than women, because of larger body size and enhancing capacity of testosterone and inhibiting capacity of oestrogen in stone formation. (10)(11)Only 7 patients in age group 10-19 years and 9 patients in age group of 60-69 years reported with urinary tract stones.Out of total 9 patients in age group of 60-69 there were 6 females and 3 males andthis could be due to significant fall of estrogen in this period as it corresponds to the onset of menopause.

Out of 100 patients in our study 58% were vegetarian and 42% were non vegetarian (p < .05) showing significant preponderance of vegetarian over non vegetarians. Results were different in similar study on association of diet with urolithiasis which concluded that the risk of developing kidney stones was significantly associated with diet group; compared to high meat-eaters (>100g/day), the incidence rate ratios for moderate meat-eaters (50–99g/day), low meat-eaters (<50g/day), fish eaters and vegetarians were 0.71 (95% CI 0.49–

1.04), 0.52 (0.32–0.82), 0.52 (0.31–0.88) and 0.53 (0.34–0.78), respectively. A high intake of fresh fruit was associated with a reduction in urolithiasis risk, although there was no association with vegetable consumption.(12)

There were 47 patients out of 100 cases of urolithiasis who had hydronephrosis of different grades, 37 had normal functioning kidney, one patient showed delayed excretion on IVP and 2 had non-functioning kidney. Duration of symptoms had shown its effect on development of hydronephrosis. In our study 18 patients were having symptoms for more than 2 months, 16 had symptoms from 1-2months and those with history less than one month were only 6 in number. It has been observed that patients with history of longer duration suffered more changes in the renal functioning and presented with different grades of hydronephrosis.

These findings were consistent in a similar study conducted on 83 patients presenting to the emergency department with flank colic pain where hydronephrosis has been reported in 57.8% cases.(13) Several studies found that ultrasound-detected hydronephrosis was present in approximately 90% of patients with urinary stones and colic pain. In study of 136 patients with a diagnosis of symptomatic hydronephrosis various causes and degrees were studied. The hydronephrosis grade varied from the stage I up to IV. It was concluded that the main causes of hydronephrosis are kidney stone, followed by ureteral stones, in which larger percentage appeared with II degree of hydronephrosis.(14) Temporary occlusion of the ureter can result in moderate hydronephrosis.(15)

In this study of 100 patients 24 presented with the pain in the lumbar region and 23 patients had difficulty of burning during micturition. There were very few patients of fever with rigors and chills and of haematuria. These results were consistent with the prospective randomized study conducted on clinically and radiologically suspected patients of urolithiasis of rural area.(16)

In our study single stone was seen in 59% and multiple site stone including stag horn were present in 41% patients. This observation is in consistence with the prospective open multicentre study of 311 cases of urinary tract stone where 56% patients had single and 43% had multiple stones.(17).

In this study 50% of the stones were located in the ureter at different sites and 37% were in the kidney. Only 10% were in the bladder and 3% were in the urethra. The results are in consonance with the cross-sectional study conducted in Tiwan that included 40,027 patients in which ureteral stones were the most common (76.4%), followed by kidney stones (15.8%), bladder stones (7.5%), and urethral stones (0.4%).(18)

In this study 41% of patients were managed by open surgical procedure whereas Percutaneous Nephrolithotomy was done in 15% of the cases. 28% were medically managed and 16% were managed using Extracorporeal shock wave lithotripsy. 28% patients with <10 mm urinary tract stone were offered an appropriate medical therapy to facilitate stone passage. 15% of patients with stone of > 2cm underwent PCNL and 16% of cases with stone size more than 8 mm and not responding to medical treatment were managed using shock wave lithotripsy. Results of management of patients with open surgery are not in accordance to the retrospective study of 10 years period conducted by Honeck P in which the indications for open stone removal were complex stone mass with complete or partial staghorn stones.(19). Minimally invasive options shock wave lithotripsy, percutaneous nephrostolithotomy techniques and intracorporeal lithotripsy have made open stone surgery nearly obsolete. (20)

In our study 69% of the stones were of mixed type, 31 % were pure and analysis was not done in 41 patients who were either managed conservatively or by lithotripsy. Maximum number of females had pure type calcium oxalate stones whereas males had calcium oxalate, phosphate and uric acid mixed type. Uric acid stones were seen more in males in comparison to females whereas cysteine stones were more in females. Calcium component was present in 76% and oxalate in 71% of urinary tract stone. Most of the calcium stones were composed of mixture of calcium oxalate, calcium phosphate and calcium ammonium phosphate. Similar findings are seen in a study conducted by Zhang (21). But these are not in accordance to the study conducted on 273 patients by Takasaki where maximum number of stones contained magnesium ammonium phosphate.(22)

In our study according to the chemical composition of the urinary stones, most of the stones examined were of calcium oxalate + uric acid 20%, calcium oxalate 20%, calcium oxalate + calcium phosphate 20%, pure uric acid 5% and calcium oxalate + calcium phosphate + uric acid 6%. Similar observations have been observed in the study which was carried out to investigate chemical composition of urinary stones in patients of different age groups of human population in Multan, Pakistan.(23)

## **VI. Conclusion**

In light of aforesaid observations, it can be concluded that the incidence of urinary tract stone is more in males than females. Most frequent type of stone both in female and male subjects is of calcium type and there is significant correlation between duration of symptoms and presence of hydronephrosis.

### **Limitations:**

The present study was carried out in the Department of Surgery for shorter duration and on a small sample size which was the main limitation. Therefore, to arrive at definite conclusion, studies with large sample size and longer duration are required.

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