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A Prospective Observational Study On Prevalence, AKI and Other Complications, Surgical Interventions in Urolithiasis Patients with Renal Calculus Size ≥ 6mm.

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ABSTRACT:
BACKGROUND INFORMATION:
Urolithiasis refers to the accretion of hard, solid and nonmetallic minerals in the urinary tract. There are 5 types of stones they are calcium oxalate, calcium phosphate, struvite stones, uric acid stones, cysteine stones. Formation of kidney stones (calculogenesis)is a complex and multifactorial process including intrinsic (such as age, sex and heredity) and extrinsic factors such as geography, climate, dietary, mineral composition and water intake. Kidney patient with renal colic, experiencing a severe sharp pain at the flank often accompanied with nausea and emesis. The localization of stones is also important in choosing medications, surgery or lithotripsy. Ultrasonography is used frequently in determine the presence of renal stone. Complications of kidney stones are rare if kidney stones are not treated they can cause post renal AKI occurs after acute obstruction of the urinary flow which increase intra-tubular pressure and thus decrease GFR. Oral NSAIDS, antibiotics are available in managing renal calculi.
MATERIALS AND METHODS:
The prospective observational study was conducted over a period of six months in 2019 to identify the patient with Urolithiasis. Patients with plan of surgical interventions whose calculus size is ≥ 6mm. A suitable data collection form was designed to collect required information and analyze the data. The data collection form included the information related to the patient demographics such as name of the patient, age, gender, weight, vitals, etiology, lab values especially serum creatinine, imaging reports, complications, surgical intervention imaging reports such as US scan or CT-KUB complain of visiting past medical history social history and complete management plan.
RESULTS:
A total number of 250 cases were analyzed in our study population. From this data we observed that majority of the patients were male (69.6%) and in the age group of 36-45(33.6%). We observed risk factors as inadequate amount of water in 180 patients (72%), Co-morbidities as diabetes mellitus type II was seen in 78 patients (31.2%) and UTI in 62 patients (24.8%). Most common anatomical site of calculus was kidney in 108 patients (43.2%) followed by distal ureter in 64 patients (25.6%). Based on classification of AKI, 90 patients had increased serum creatinine and 120 patients had decreased urine output whereas 70 patients (28%) met both the criteria i.e., increased serum creatinine and decreased urine output, In remaining 40 patients, serum creatinine and urine output volume were found to be normal. Complications such as hydroureter seen in 122 patients (48.8%), UTI in 62 patients (24.8%) and pyelonephritis in 19 patients (7.6%). Surgical interventions such as URSL were performed in 130 patients (52%), PCNL in 61 patients (24.4%).
Key Word:**Urolithiasis,UTI, URSL, PCNL, AKI.**

I. INTRODUCTION

Urolithiasis is derived from the Greek words ouron (urine) and lithos (stone).Urolithiasis refers to the accretion of hard, solid and nonmetallic minerals in the urinary tract.(1) The formation of urinary tract stones is worldwide, sparing no geographical, cultural or racial groups. Recurrence rates are estimated at about 10% year,

totaling 50% over a 5-10 year period and 75% over 20 years. Urolithiasis is quite common in developing and under developed countries (2) where the recurrence of endemic bladder stone is quite common due to the dietary proteins being mainly derived from plant sources. Urinary stone disease continues to occupy an important place in everyday urological practice (3). The average life time risk of stone formation has been reported in the range of 5-10 %.A predominance of men over women can be observed with an incidence peak between the fourth and fifth decade of life (4). A kidney stone is a hard, crystalline mineral material formed within the kidney or urinary tract. Kidney stones are a common cause of blood in the urine and often severe pain in the abdomen, flank, or groin. Kidney stones are sometimes called renal calculi. The condition of having kidney stones is termed nephrolithiasis (5). Urolithiasis is a complex process many remedies have been employed during the ages this stones are found in all parts of the urinary tract and kidney (6).Recent studies have reported that the prevalence of urolithiasis has been increasing in the past decades in both developed and developing countries. This growing trend is believed to be associated with changes in lifestyle modifications such as lack of physical activity and dietary habits (7, 8, and 9) and global warming (10). In the United States, kidney stone affects 1 in 11 people (11), and it is estimated that 600,000 Americans suffer from urinary stones every year. In Indian population, about 12% of them are expected to have urinary stones and out of which 50% may end up with loss of kidney functions (12).There are multiple types of kidney stones; however, 80% of stones are composed of calcium oxalate or phosphate. Other stone types include uric acid (9%), struvite (10%), and cysteine (1%) stones and are significantly less common than stones composed of calcium oxalate or phosphate. The different types of stones occur due to varying risk factors such as diet, prior personal and family history of stones, environmental factors, medications, and the patient's medical history. Common risk factors for stone formation include poor oral fluid intake, high animal-derived protein intake, high oxalate intake (found in foods such as beans, beer, berries, coffee, chocolate, some nuts, some teas, soda, spinach, potatoes), and high salt intake. Crystal nucleation and growth are key factors in the production of all types of kidney stones. Nucleation is when crystals begin to compound together to initiate stone formation. Supersaturation of the urine with organic materials contributing to stone formation is a driving force of this mechanism. The presentation includes sudden to gradual onset, unilateral colicky abdominal/flank pain that often waxes/wanes, hematuria (90% microscopic on UA), nausea, vomiting, and fever. In severe cases, stones can cause urinary obstruction and/or can become a source of sepsis. In these patients, symptoms are more severe and include mild confusion to obtundation secondary to severe metabolic abnormalities. In patients that do present with severe infection or sepsis, hemodynamic instability is often present. (13)

All patients suspected of harbouring a stone in the urinary tract should undergo an imaging procedure to determine whether the new stone is located within the kidney parenchyma, renal pelvis, upper or lower ureter, or bladder, and whether there is ureteral obstruction.(14) The localization of stones is also important in choosing medications, surgery, or lithotripsy. Ultrasonography (USG) is used frequently to determine the presence of a renal stone. (15)Non-contrast computed tomography (CT) of the abdomen with 5 mm cuts is the most sensitive imaging technique for determining the number and location of stones within the renal parenchyma or along the upper or lower urinary tract. Small, radiolucent stones suggest uric acid composition. Uric acid stones appear as filling defects on i.v. pyelography.(16) There are various methods of acute urologic interventions, including extracorporeal shockwave lithotripsy (ESWL), flexible ureteroscopy (URS), and percutaneous nephrolithotomy (PCNL).(13)

If kidney stones are not treated, they can cause: hematuria, or blood in the urine, severe pain, UTIs, including kidney infections, loss of kidney function. (17)

Post-renal AKI occurs after acute obstruction of the urinary flow, which increases intra-tubular pressure and thus decreases GFR. In addition, acute urinary tract obstruction can lead to impaired renal blood flow and inflammatory processes that also contribute to diminished GFR. Post-renal AKI can develop if the obstruction is located at any level within the urinary collection system (from the renal tubule to urethra). In case the obstruction is above the bladder it must involve both kidneys (and one kidney in the case of a patient with a single functioning kidney) to produce significant renal failure. However, a patient with pre-existing renal insufficiency may develop AKI with obstruction of only one kidney. Urinary obstruction may present as anuria or intermittent urine flow (such as polyuria alternating with oliguria) but may also present as nocturia or nonoliguric AKI. Timely reversion of pre-renal or post-renal causes usually results in prompt recovery of function, but late correction can lead to kidney damage. (18)

AKI is defined as any of the following (Not Graded):

Increase in SCr by ×0.3 mg/dl (×26.5 µmol/l) within 48 hours; or

Increase in SCr to ×1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or

Urine volume < 0.5 ml/kg/h for 6 hours.

STAGE	SERUM CREATININE	URINE OUTPUT
1	Increase by 1.5 – 1.9 times baseline within 7 days OR Increase by ≥ 0.3 mg/dL (26.5 µmol/L) within 48 hours	Less than 0.5 mL/kg/h for 6 – 12 hours
2	Increase by 2 – 2.9 times baseline	Less than 0.5 ml/kg/h for ≥ 12 hours
3	Increase by ≥3 times baseline OR Increase to ≥4 mg/Dl (353.6 µmol/L) OR Renal replacement therapy initiation OR In patients younger than 18 years, decrease in estimated GFR to <35 mL/min/1.73 m^2	Less than 0.3 mL/Kg/h for ≥24 hours OR Anuria for ≥ 12 hours

Table showing KDIGO staging of AKI

II. MATERIAL AND METHODS

Study site:
The study was conducted in Lalitha Kidney Centre, Karimnagar
Study design:
The study was Prospective observational study
Study duration:
The study was done in a six months period.
Sample size:
250 urolithiasis patients
Study criteria:
1. Inclusion criteria

- Patients of any age
- Both male and female patients
- Also patients with other co-morbidities
- Patients with the plan of surgical interventions whose calculus size is ≥6mm

2. Exclusion criteria

- Patients with renal calculus size ≤ 6mm
- Patients with other urological abnormalities
- Pregnant women with urolithiasis
- Patients with cancer
- Patients with solitary kidney

Source of data:

- Review of patients records
- Investigation reports
- Direct communication with patient and patient relatives
  Parameters to be considered are:
- Patient Demographics
- Co-morbidities of patient
- Lab values especially Serum creatinine value
- Imaging reports such as US scan or CT-KUB
- Secondary data through internet, magazines, journals, text books, articles and etc.

Data collection and assessment of the study results/observations:
A suitable data collection form was designed to collect required information and analyze the data. The data collection form included the information related to patient demographics such as name of the patient, age, gender, weight, vitals, etiology, lab values especially serum creatinine, imaging reports, complications, surgical intervention.

- **Digitalization of data collection and assessment**
- All the data collected and analyzed was entered into Microsoft excel for the easy accessibility, retrieval and for plotting of charts and graphs.

Procedure of the study:

The study team had approached the head of the hospital and submitted study protocol, data collection form, a written/oral consent was obtained from the head of the hospital. All the case sheets were thoroughly reviewed about the patient's Demographics details such as name of the patient, age, gender, weight, vitals, etiology, lab values especially serum creatinine, imaging reports, complications, surgical intervention. The patients as well as care takers were counselled about urolithiasis and precautions to be taken. All the collected data was subjected to suitable statistical test and analyzed for the results.

III. RESULTS

The study "A Prospective observational study on prevalence, AKI and other complications, surgical interventions in urolithiasis patients of calculus size ≥ 6mm was conducted in Sri Lalitha kidney centre. A total number of 250 patients were admitted in the hospital participated in the study.

DISTRIBUTION OF PATIENTS ACCORDING TO GENDER:

GENDER	NO. OF PATIENTS	PERCENTAGE (%)
MALE	174	69.6
FEMALE	76	30.4
TOTAL	250	100%

Table 1: Showing the Gender wise distribution of patients

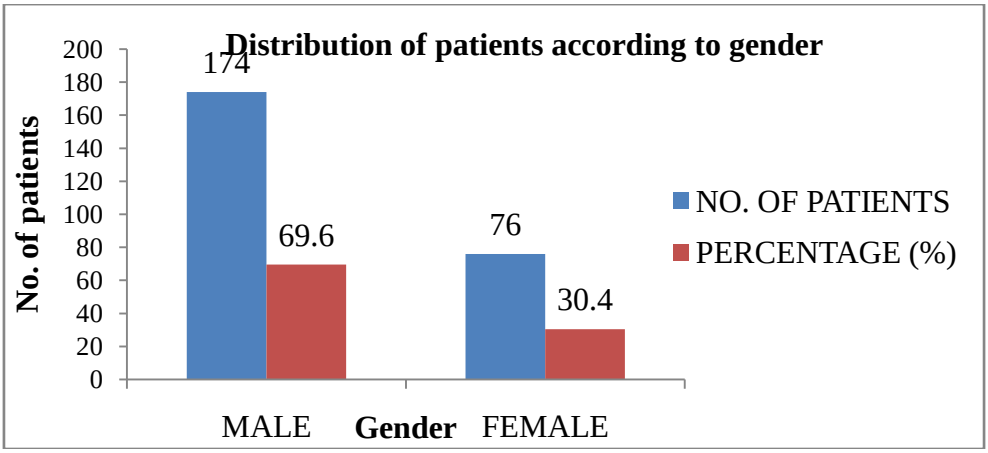

Figure 1: Graph showing the Gender wise distribution of patients.

Out of the 250 patients, 174 were male and remaining 76 were female patients. Male patients (69.6%) suffering from urolithiasis were almost twice in number as the female patients (30.4%). This states that urolithiasis is more in male patients than the female patients in our study population.

DISTRIBUTION OF PATIENTS ACCORDING TO AGE CRITERIA:

AGE	NO.OF PATIENTS	PERCENTAGE (%)
15 – 25	26	10.4
26 – 35	56	22.4
36 – 45	84	33.6
46 – 55	34	13.6
56 – 65	32	12.8
66 – 75	14	5.6
76 – 85	4	1.6

TABLE 2: Showing the distribution of patients according to age

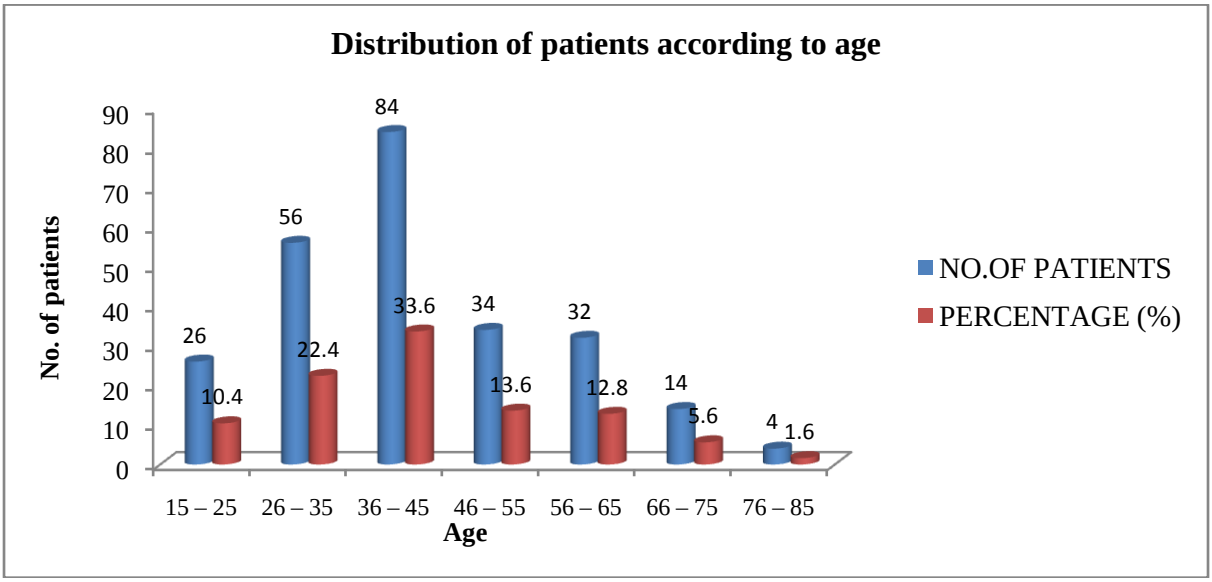

Figure 2: Graph showing distribution of urolithiasis patients according to Age

In the study population it was observed that both male and female patients were maximum effected between the age group of 36 – 45 years (33.6%) followed by 26 – 35 years (22.4%), 46 – 55 years (13.6%), 56 – 65 years (12.8%), 15 – 25 years (10.4%), 66 -75 years (5.6%) and 76 - 85 years (1.6%) shows the cases of urolithiasis.

DISTRIBUTION OF PATIENTS ACCORDING TO THEIR RISK FACTORS:

RISK FACTORS	NO. OF PATIENTS	PERCENTAGE (%)
Already stones in their lifetime	78	31.2
Family history of stones	46	18.4
Inadequate intake of water	180	72
Excessive sweating	80	32
BPH	38	15.2
Pure Veg intake	18	7.2
Frequent intake of non-veg	40	16
Habit of smoking	90	36
Alcohol consumption	103	41.2
HTN	46	18.4
DM (Type-II)	78	31.2
UTI	62	24.8

Table 3: showing the distribution of patients according to their risk factors.

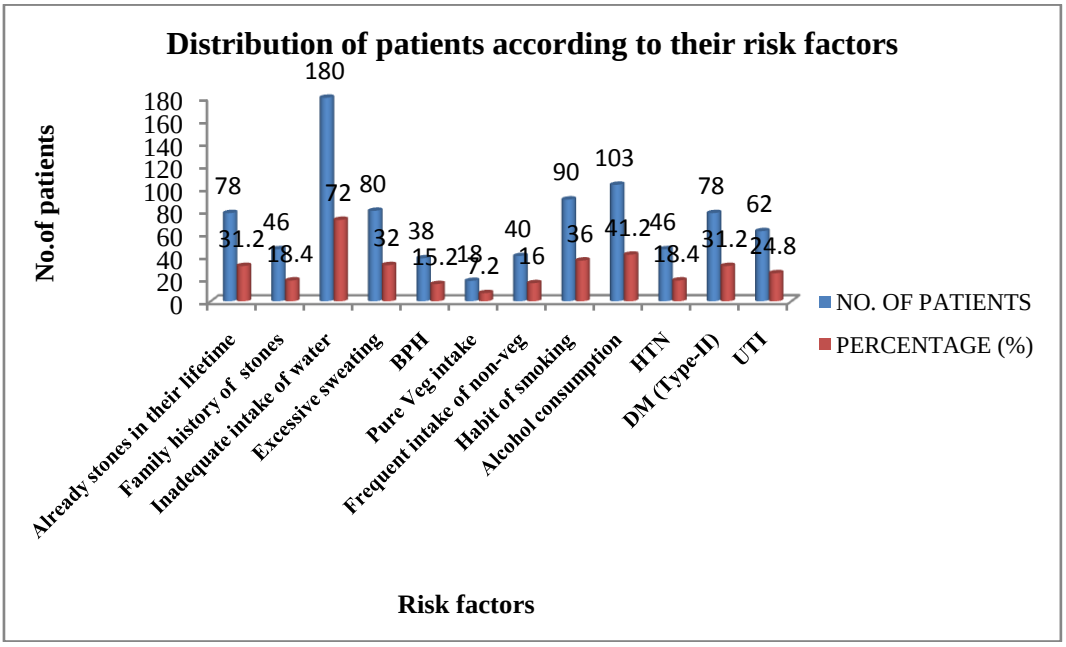

Figure 3: Graphshowing distribution of patients according to their risk factors

Out of 250 study population, we observed risk factors in patients as follows – Already stones in their lifetime in 78 patients (31.2%), Family history of stones in 46 patients (18.4%),Inadequate intake of water in 180 patients (72%), Excessive sweating in 80 patients (32%), BPH in 38 patients (15.2%), Pure veg intake in 18 patients (7.2%), Frequent intake of non-veg in 40 patients (16%), Habit of smoking in 90 patients (36%), Alcohol consumption in 103 patients (41.2%), HTN in 46 patients (18.4%), DM (Type-II) in 78 patients, UTI in 62 patients (24.8%).

DISTRIBUTION OF PATIENTS ACCORDING TO THEIR CO-MORBIDITIES:

CO - MORBIDITIES	NO.OF PATIENTS	PERCENTAGE (%)
DIABETES MELLITUS (TYPE - II)	78	31.2
HYPERTENSION	46	18.4
HYPOTHYROIDISM	10	4
BPH	38	15.2
UTI	62	24.8
NONE	88	35.2

Table 4: showing distribution of patients according to their co-morbidities

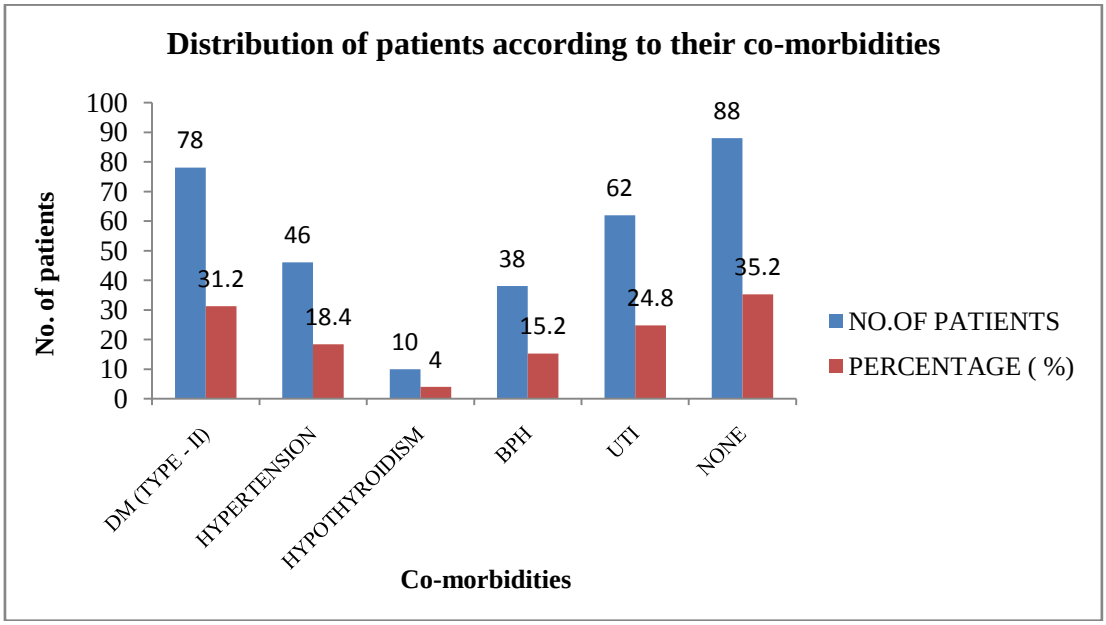

Figure 4: Graph showing distribution of patients according to their co-morbidities

In our study population, we observed that Diabetes mellitus (type- II), was the most common co-morbidity seen in 78 patients (31.2%), followed by hypertension in 46 patients (18.4%), BPH in 38 patients (15.2%), UTI in 62 patients (24.8%) and hypothyroidism in 10 patients (4%).

DISTRIBUTION OF PATIENTS ACCORDING TO THEIR CHIEF COMPLAINTS:

CHEIF COMPLAINTS	NO. OF PATIENTS	PERCENTAGE
LOIN PAIN	198	79.2
NAUSEA / VOMITING	190	76
FEVER	84	33.6
BURNING MICTURITION	184	73.6
HEMATURIA	16	6.4

Table 5: showing distribution of patients according to their chief complaints

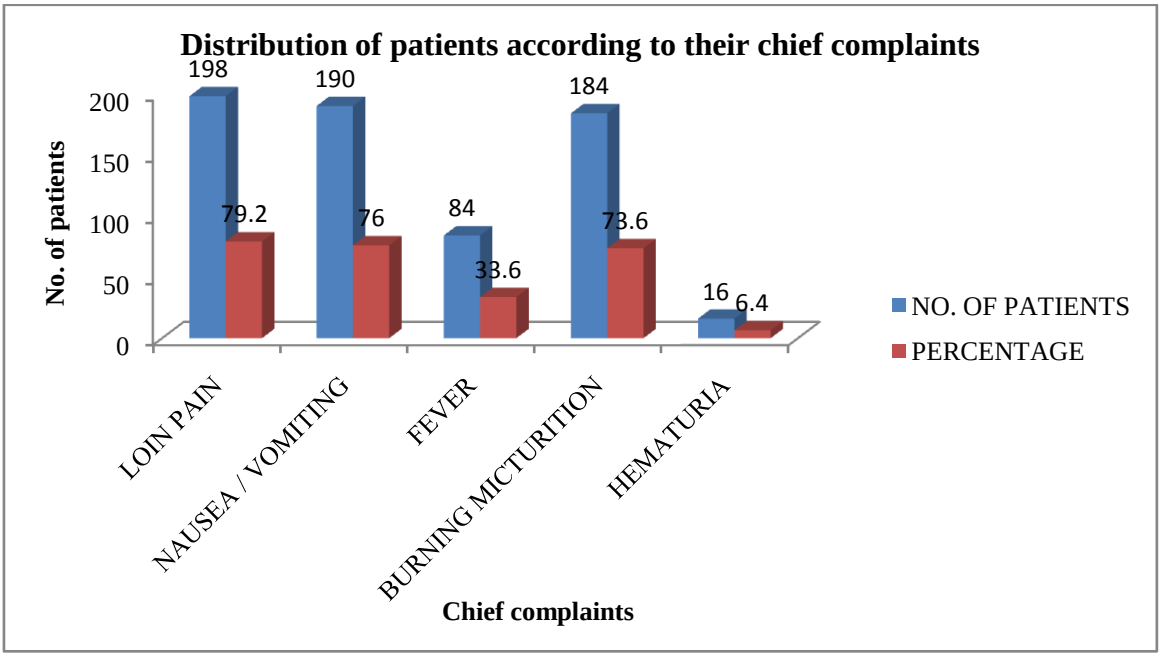

Figure 5: Graph showing distribution of patients according to chief complaints.

In our study population, loin pain was the major complaint seen in 198 patients (79.2%), followed by nausea/vomiting in 190 patients (76%), burning micturition in 184 patients (73.6%), fever in 84 patients (33.6%) and hematuria in 16 patients (6.4%).

DISTRIBUTION OF PATIENTS ACCORDING TO ANATOMICAL SITE OF STONE:

ANATOMICAL SITE OF STONE	NO. OF PATIENTS	PERCENTAGE (%)
KIDNEY	108	43.2
PROXIMAL/UPPER URETER	48	19.2
MIDDLE URETER	24	9.6
DISTAL/ LOWER URETER	64	25.6
BLADDER	6	2.4

Table 6: Distribution of patients according to anatomical site of stone

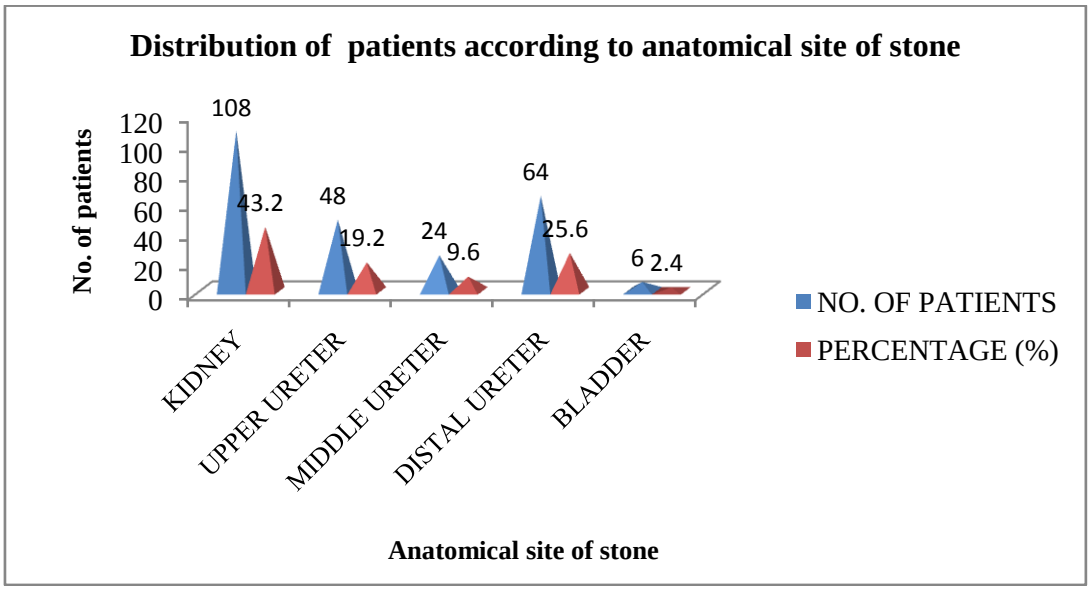

Figure 6: Graph showing distribution of patients according to anatomical site of stone.

Out of 250 patients, we observed that the most common site of calculus was kidney in 108 patients (43.2%), followed by distal ureter in 64 patients (25.6%), proximal ureter in 48 patients (19.2%), middle ureter in 24 patients (9.6%), bladder in 6 patients (2.4%).

DISTRIBUTION OF PATIENTS ACCORDING TO INCREASED SERUM CREATININELEVELS:

SERUM CREATININE LEVELS	NO.OF PATIENTS	PERCENTAGE (%)
1.5 – 1.9 times baseline (STAGE – I)	41	16.4
2 – 2.9 times baseline (STAGE – II)	28	11.2
≥3 times baseline (STAGE – III)	21	8.4

Table 7: Showing distribution of patients according to increased serum creatinine levels.

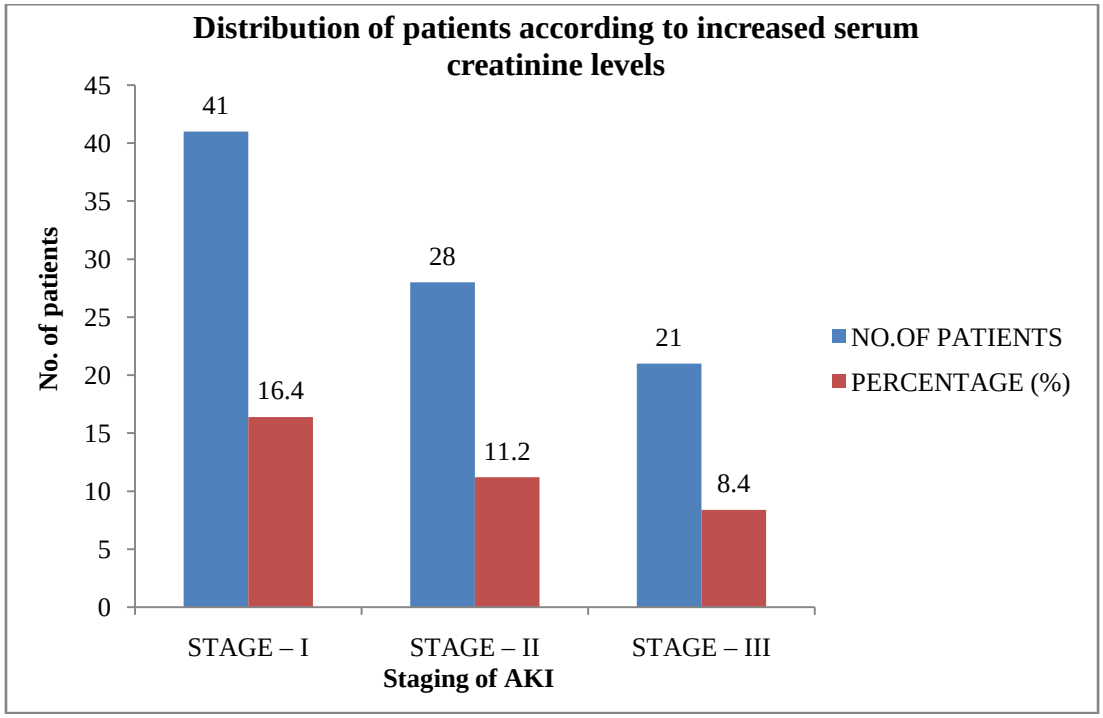

Figure 7: Graph showing distribution of patients according to increased serum creatinine levels.

Out of 250 study population, 160 patients (64%) has normal Sr.creatinine levels i.e. 0.6 -1.2 mg/ dL, remaining 90 patients has increased Sr.cr levels. They were classified into stages of AKI as follows: stage I – 41 patients (16.4%), stage II – 28 patients (11.2%) and stage III – 21 patients (8.4%).

DISTRIBUTION OF PATIENTS ACCORDING TO STAGE OF AKI BASED ON DECREASED URINE OUTPUT:

URINE OUTPUT	NO. OF PATIENTS	PERCENTAGE (%)
< 0.5 ml/kg/hr for 6 hours (stage - I)	71	31.2
< 0.5 ml/kg/hr for 12 hours (stage – II)	28	11.2
< 0.3 ml/kg/hr for 24 hours (stage – III)	21	8.4

Table 8: Showing distribution of patients according to stage of AKI based on decreased urine output.

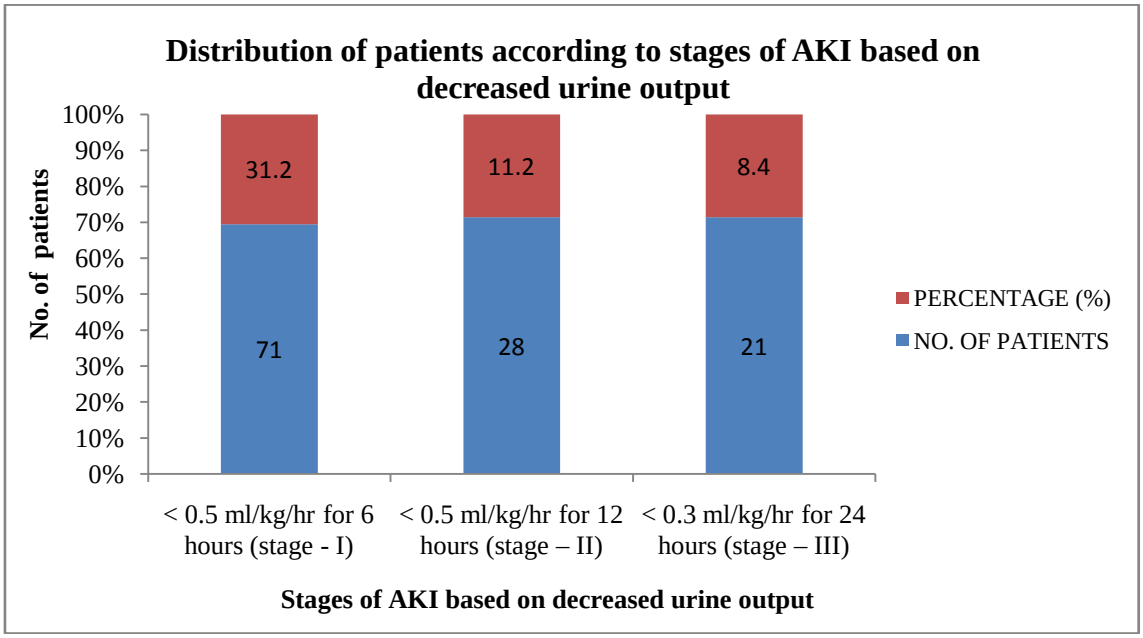

Figure 8: Graph showing distribution of patients according to stage of AKI based on decreased urine output.

Out of 250 study population, 130 patients (52%) has normal volume of urine output i.e. > 0.5ml/kg /hr, remaining 120 patients has decreased urine output. They were classified into stages of AKI as follows: Stage I – 71 patients (31.2%), Stage II – 28 patients (11.2%) and stage III – 21 patients (8.4%).

DISTRIBUTION OF PATIENTS ACCORDING TO STAGES OF AKI BASED ON BOTH INCREASED SERUM CREATININE AND DECREASED URINE OUTPUT:

INCREASED SR. CR & DECREASED URINE OUTPUT	NO. OF PATIENTS	PERCENTAGE (%)
STAGE – I	32	12.8
STAGE – II	20	8
STAGE – III	18	7.2

Table 9: Showing distribution of patients according to stages of AKI based on both increased serum creatinine and decreased urine output.

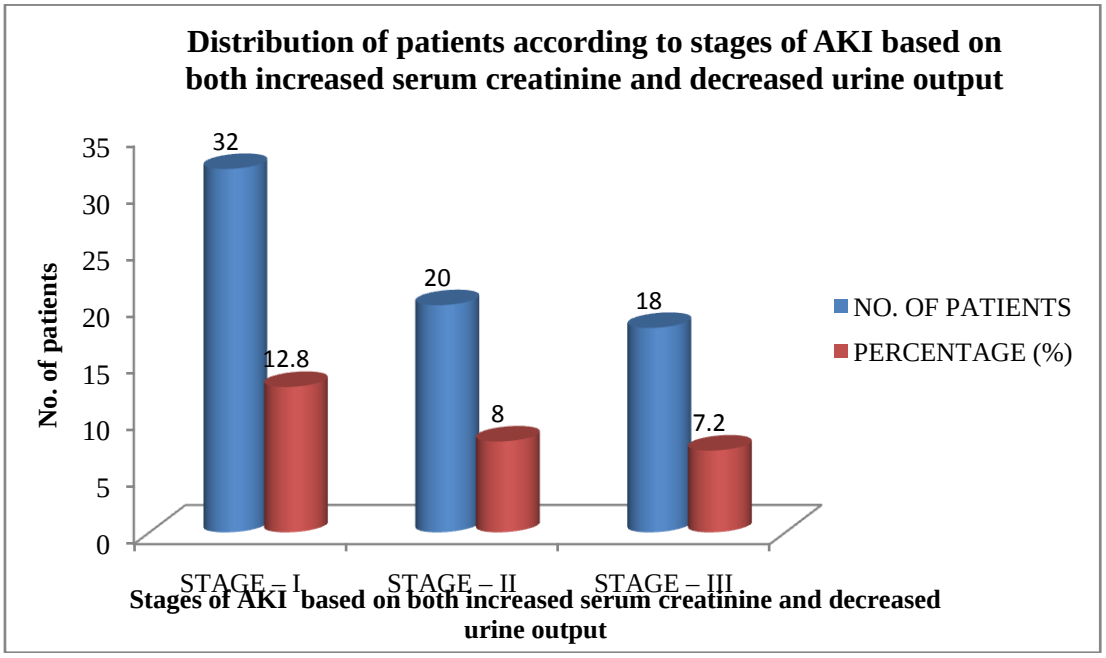

Figure 9: Graph showing distribution of patients according to stages of AKI based on both increased serum creatinine and decreased urine output.

Out of 250 study population, 70 patients (28%) meet both criteria of increased serum creatinine and decreased volume of urine output whereas remaining 180 patients (72%) were not included in the above case.

DISTRIBUTION OF PATIENTS ACCORDING TO SIZE OF THE STONE:

SIZE OF THE STONE (mm)	NO. OF PATIENTS	PERCENTAGE (%)
6 – 10	122	48.8
11 – 15	64	25.6
16 – 20	46	18.4
21 – 25	18	7.2

Table 10: Showing distribution of patients according to size of the stone.

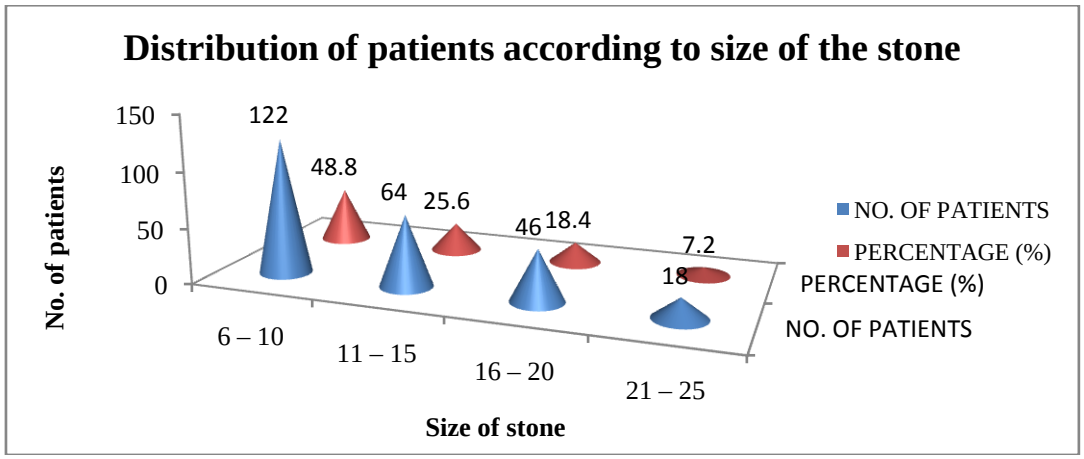

Figure 10: Graph showing distribution of patients according to size of the stone.

In our study, maximum i.e. 122 (48.8%) patients has stone size between 6-10 mm, followed by 11-15 mm in 64 (25.6%) patients, 16-20 mm in 46 (18.4%) patients and 21-25 mm in 18 (7.2%) patients.

DISTRIBUTION OF PATIENTS ACCORDING TO THEIR COMPLICATIONS:

Complications	No. of patients	Percentage
Pyelonephritis	19	7.6
Cystitis	18	7.2
UTI	62	24.8
Hematuria	16	6.4
Mild to moderate Hydroureter	122	48.8
Mild to moderate Hydronephrosis	98	39.2
Grade I Parenchymal changes	20	8
Grade II Parenchymal changes	11	4.4
AKI (based on Sr.creatinine)	90	3.6
CKD	4	1.6
Nephrectomy	8	3.2

Table 11: Showing distribution of patients according to their complications.

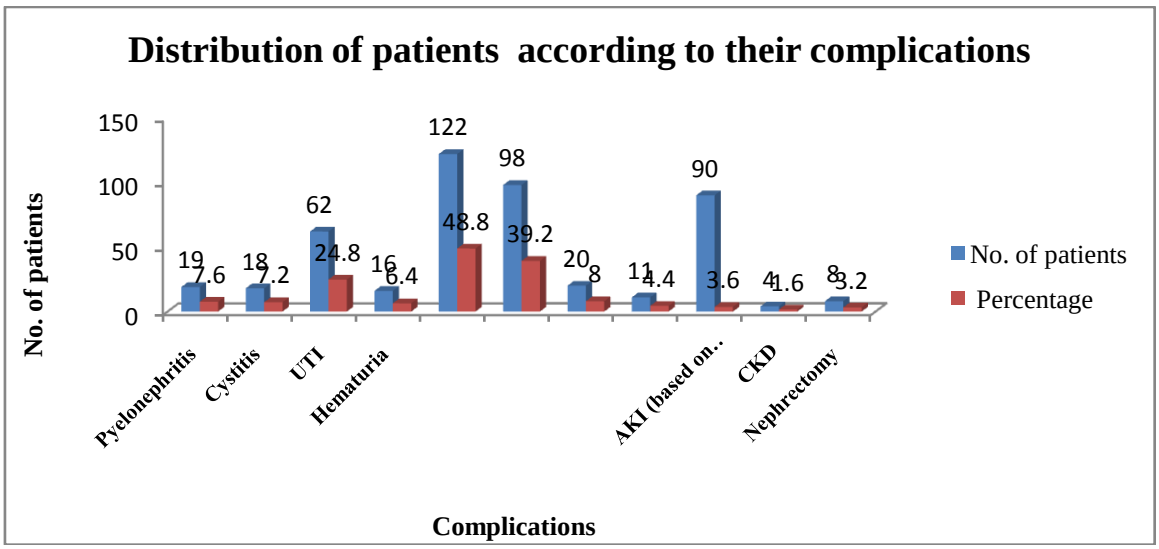

Figure 11: Graph showing distribution of patients according to their complications

Out of 250 study population, Hydroureter is seen in 122 patients (48.8%), hydronephrosis is seen in 98 patients (39.2%), AKI is seen in 90 patients (3.6%), UTI is seen in 62 patients (24.8%), Grade I Parenchymal changes in 20 patients (8%), Pyelonephritis in 19 patients (7.6%), Cystitis in 18 patients (7.2%), Hematuria in 16 patients (6.4%), Grade II Parenchymal changes in 11 patients (4.4%), Nephrectomy in 8 patients (3.2%) and CKD in 4 patients (3.2%).

DISTRIBUTION OF PATIENTS ACCORDING TO THEIR HEAMOGLOBIN LEVELS:

HEAMOGLOBIN (mg/dl)	No. of patients	Percentage (%)
8.6 – 10.5		
• MALE	64	36.7
• FEMALE	36	47.3
10.6 – 12.5		
• MALE	54	31
• FEMALE	32	42.1
12.6 – 14.5		
• MALE	42	24.1
• FEMALE	08	10.5
14.6 – 16.5		
• MALE	14	8.0
• FEMALE	0	0

Table 12: Showing distribution of patients according to their haemoglobin levels.

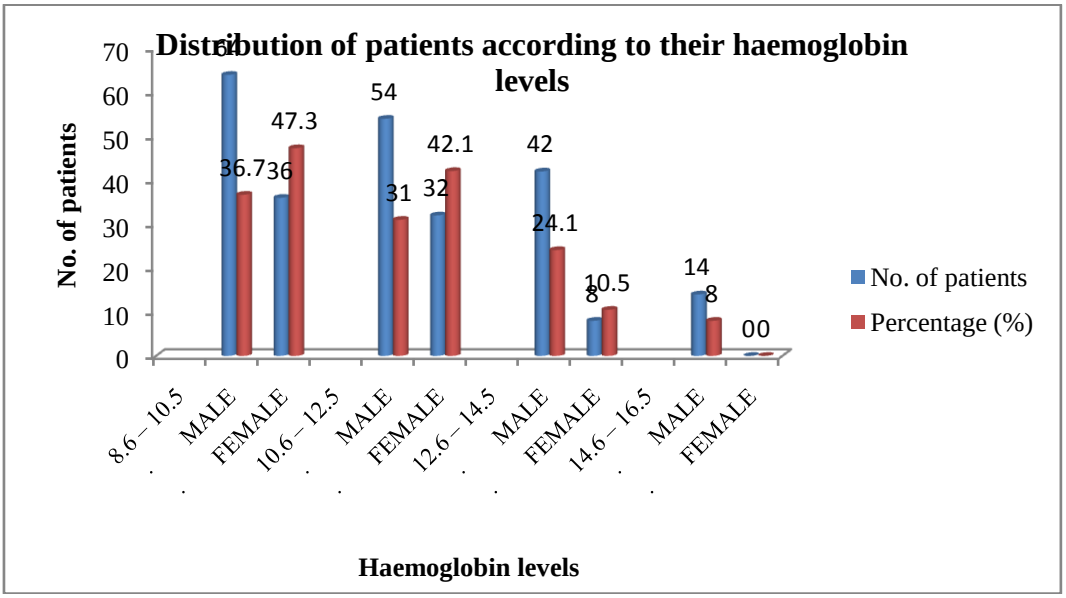

FIGURE 12: Graph showing distribution of patients according to their haemoglobin levels.

In our study population of 150 patients, we observed that 64 male and 36 female patients had hemoglobin levels in the range of 8.6 – 10.5 mg/dl, 54 male and 32 female patients are in the range of 10.6 – 12.5 mg/dl, 42 male
and 8 female patients are in the range of 12.6 – 14.5 mg/dl and 14 male patients are in the range of 14.6 – 16.5 mg/dl.

DISTRIBUTION OF PATIENTS ACCORDING TO SURGICAL INTERVENTIONS:

SURGERIES	NO.OF PATIENTS	PERCENTAGE
URSL	130	52
PCNL	61	24.4
RIRS	49	19.6
AN	4	1.6
CLT	6	2.4

Table 13: Showing distribution of patients according to surgical interventions.

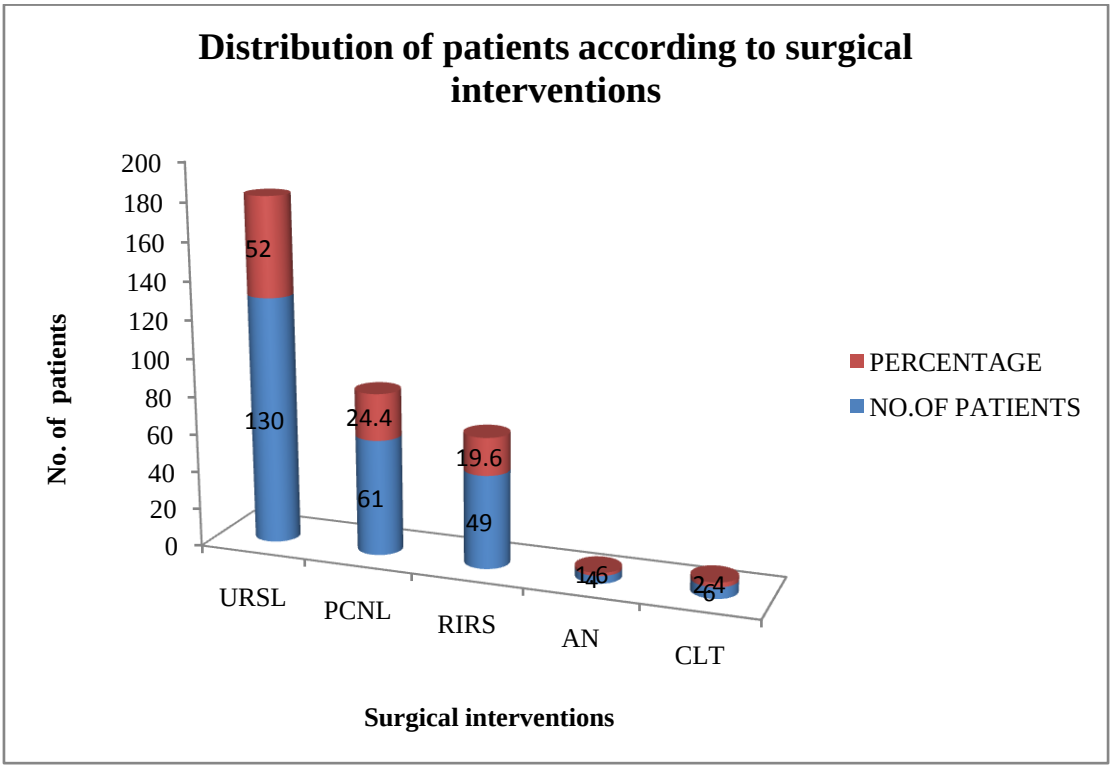

Figure 28: Graph showing distribution of patients according to surgical interventions

Out of 250 patients, URSL was performed in 130 patients (52%) followed by PCNL in 61 patients (24.4%), RIRS in 49 patients (19.6%), Anatrophic nephrolithotomy in 4 patients (1.6%) and CLT in 6 patients (2.4%).

IV. Discussion

The study provides the insights of prevalence, AKI and other complications, surgical interventions in urolithiasis patients with calculus size ≥ 6mm

In the present study conducted in a six months period, 250 cases of Urolithiasis fulfilling the study parameters were admitted and subsequently operated in Lalitha Kidney Centre, Karimnagar.

About 30-40 years ago, the male: female ratio was approximately 6:1- 8:1. But over a period of time this ratio has decreased to 2:1 worldwide. This is even lower in western countries. It has been theorized that the relative increase in number of females inflicted with urolithiasis in western countries is due to modern day dietary habits and lifestyle. (20)

In addition, Welshman and McGeowan demonstrated increased citrate concentrations in the urine of women (21). It has been postulated that this may aid in protecting females from calcium urolithiasis since citrate inhibits nucleation of calcium oxalate crystals (22)

In this study 69.6% were male, 30.4% were female and male to female ratio was 2.2:1

Morse and Resnick (1991), in a series of 378 cases of urolithiasis, reported 87% patients had loin pain, 17% patients had vomiting and 3% presented with fever.(23)

In this study, loin pain was the most common symptom, presenting in 198 (79.2%) patients. This was followed by vomiting/ nausea in 190 (76%), burning micturation in 184 (73.6%), fever in 84 (33.6%) and haematuria in 16 (6.4%) patients.

Several authors have demonstrated that urolithiasis usually occurs between the third and fourth decades of an individual's life, and that the prevalence rate varies considerably according to age, while the peak incidence of urinary calculi is from the twenties to the forties. (24)

The present study showed similar results with maximum prevalence 84 (33.6%) in the age group of 36 to 45 years followed by 56 (22.4%) in the age group of 26 to 35 years. In the study conducted by Nalini H.Sofia et.al on prevalence and risk factors of urolithiasis with 666 sample size, recurrence was seen in 288 (43.24%), family history of stones in 154(23%),etc

In this study recurrence of stones, family history of stones, Inadequate intake of water, Excessive sweating, BPH, Pure vegetarians, Frequent intake of non-veg, Habit of smoking, Alcohol consumption, Hypertension, Diabetes, UTI were found to be the risk factors and their prevalence rate as follows- 78(31.2%),

46(18.4%), 180(72%), 80(32%), 38(15.2%), 18(7.2%), 40(16%), 90(36%), 103(41.2%), 46 (18.4%), 78(31.2%), 36(14.4%) respectively.

Urinary stone affect 10-12% of the population in industrialized countries. The average lifetime risk of stone formation has been reported in the range of 5-10%. Recurrent stone formation is a common part of the medical care of patients with all types of stone disease. The incidence of Urinary stones has been increasing recently. With a prevalence of >10% and an expected recurrence rate of nearly 50%, stone disease has an important effect on the health care system.

Kidney stones develop more frequently in individuals with a family history of kidney stones than in those without a family history. In others study the family history is significant association (p=0.009) between kidney stone. Studies had proved that a family history of stones has been reported in 16% to 37% of patients who have formed a kidney stone, compared with 4% to 22% in healthy control subjects. A family history of kidney stones substantially increases the risk of stone formation. The relative risk increased in patients with family history for calculosis, with the tendency to eat protein-rich food and with overweight and body mass index (BMI)>32kg/m2. A patient with stones is twice as likely as a stone-free cohort to have at least one first degree relative with renal stones (30%vs50%). Those with a family history of stones have an increased incidence of multiple and early recurrences.

Diet plays an important role in the development of kidney stones, especially in patients who are predisposed to this condition. Vegetarians have a decreased risk of developing stones. Studies have shown that even among meat eaters those who ate higher amounts of fresh fruits and vegetables had a lower incidence of stones (25)

Eric N Taylor et.al, in their study reported that a history of diabetes mellitus was independently associated with a history of nephrolithiasis. People with Type 2 diabetes mellitus have highly acidic urine that can lead to kidney stones, particularly uric acid stones. Cappuccio et.al reported that hypertensive men had a greater risk of developing kidney stones than normotensive ones.

Traditionally, UTI with urease-producing bacteria, in most cases belonging to Proteus spp., can split urinary urea and increase urinary pH, thus, promoting the precipitation and aggregation of struvite crystals to form infective urolithiasis. However, UTIs are frequently associated with kidney stones of different chemical compositions other than struvite.

Mohammad Reza Tamadon et.al, in their study the proportion of smokers among patients with nephrolithiasis was significantly higher than in the control subjects. Cigarette smoking was 2.06 times more common in stone formers than in the control group. Hence, smoking may be an independent risk factor for nephrolithiasis. One of the possible factors which may explain the effect of smoking on stone formation is a high body cadmium and lead level in smokers. Cigarette smoking may induce urolithiasis by decreasing urinary flow and increasing serum cadmium in healthy subjects. Also, Scott et al in their study proposed that increased serum cadmium levels associated with cigarette smoking may be a risk factor for urinary tract stone formation.

Fluids intake and urinary output may have an effect of urinary stone disease. The average daily urinary output in stone formers is 1.6 L/d. A low fluid intake, with a subsequent low volume of urine production, produces high concentrations of stone forming solutes in the urine. High fluid intake may be beneficial not only to prevent CaOx overgrowth, but also to reduce plaque formation itself. One of the goals of kidney stone treatment is to keep your urine as dilute as possible. This helps to keep the substances that could potentially form a kidney stone, such as calcium and oxalate moving quickly through the urinary tract. (25)

Reid Morse et al reported incidence of 17% in the upper 1/3rd of the ureter, 11% in the middle 1/3rd of the ureter and 72% in the lower 1/3rd of the ureter. (26)

David J et al in his series of 292 patients reported an incidence of 45% renal calculi and 55% ureteric calculi. Among the ureteric calculi, 27% of calculi were seen in the upper 1/3rd of the ureter, 12% in the middle 1/3rd of the ureter and 61% in the lower 1/3rd of the ureter. (27)

Rizvi et al 2002 reported incidence of 33% of renal calculi and 66% of ureteric calculi. Among the ureteric calculi 31% in the upper 1/3rd of the ureter, 14.9% in the middle 1/3rd of the ureter and 53.7% in the lower ureter.(28)

The present study revealed that kidney was the most common site of calculus affecting 108(43.2%) patients followed by lower ureter 64(25.6%) ,upper ureter 48(19.2%) ,middle ureter 24(9.6%) and bladder 6(2.4%). Our observation in the study matched the worldwide trends.

AKI is defined as any of the following (Not Graded):

Increase in SCr by ×0.3 mg/dl (×26.5 micromol/l) within 48 hours; or

Increase in SCr to ×1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or

Urine volume o0.5 ml/kg/h for 6 hours.

STAGE	SERUM CREATININE	URINE OUTPUT
1	Increase by 1.5 – 1.9 times baseline within 7 days OR Increase by ≥ 0.3 mg/dL (26.5 µmol/L) within 48 hours	Less than 0.5 mL/kg/h for 6 – 12 hours
2	Increase by 2 – 2.9 times baseline	Less than 0.5 ml/kg/h for ≥ 12 hours
3	Increase by ≥3 times baseline OR Increase to ≥4 mg/Dl (353.6 µmol/L) OR Renal replacement therapy initiation OR In patients younger than 18 years, decrease in estimated GFR to <35 mL/min/1.73 m^2	Less than 0.3 mL/Kg/h for ≥24 hours OR Anuria for ≥ 12 hours

In patients with bilateral ureteral obstruction or bladder neck occlusion, the serum creatinine levels are often elevated, sometimes causing postrenal acute kidney injury (AKI).(30) However, in patients with unilateral ureteral obstruction, the serum creatinine levels are usually normal, as long as their contralateral kidneys are preserved intact and have sufficient clearance capacity to excrete the nitrogenous wastes generated daily.(31) In addition to postrenal causes, there are "prerenal" and "renal" causes of serum creatinine elevation, which account for the majority of causes leading to AKI.(32) These include hypoperfusion in the renal vasculature and direct damage to the renal tubules or parenchyma, which are commonly triggered by dehydration, sepsis, or drugs. In previous studies, unilateral ureteral obstruction stimulated the renin secretion from the obstructed kidneys, and thus activated the renin-angiotensin system. (29) This finding strongly suggested that mechanical obstruction of the ureter, which humorally influences the renal hemodynamics, could affect the renal function possibly by prerenal causes. Here, some authors report a case of unilateral urolithiasis complicated by a postrenal increase in the serum creatinine level. Unilateral ureteral obstruction by calculus, which caused reflex vascular constriction and ureteral spasm in the contralateral kidney, was likely responsible for the deteriorating renal function. (33)

In this study out of 250 patients, 90 subjects were categorized as AKI patients based on increased serum creatinine levels. Based on decreased volume of urine output 120 patients fall under AKI. There were 70 patients who meet both criteria i.e. increased serum creatinine and decreased urine output.(70 out of 90 serum creatinine increased patients also has decreased urine output, whereas 70 out of 120 urine output decreased patients also has increased serum creatinine). In remaining 40 patients, serum creatinine levels and urine output volume were found to be normal. Serum creatinine levels and volume of urine output in AKI patients had normalized slowly after removal of the stone, except in 4 patients who reached to CKD.

In a study conducted by Dr. Ankur Goel on urolithiasis with sample size 136, concluded that URSL was performed in 71 patients, PCNL in 43 patients, ESWL in 15 patients and CLT in 5 patients and he also reported about the size of stone, majority of patients i.e. 78 members has stone size between 6-8mm.

Similar results were found in our study, out of 250 patients, URSL was performed in 130 patients, followed by PCNL in 61 patients, RIRS in 49 patients, AN in 4 patients and CLT in 5 patients and maximum i.e. 122 (48.8%) patients has stone size between 6-10 mm.

V. CONCLUSION

The present study concluded that urolithiasis was more prominent in males than in females in their third and fourth decades mostly. Untreated urolithiasis for a long time can lead to complications like AKI, UTI, parenchymal changes, rarely also CKD. We observed AKI patients with urolithiasis some are with increased Sr.Cr levels, some with decreased urine output and some met both the criteria and we classified them into stages of AKI according to KDIGO criteria. Serum creatinine levels and volume of urine output in AKI patients had normalized slowly after removal of the stone, except in few patients who reached to CKD. Urolithiasis patients underwent different types of surgeries such as URSL, PCNL, RIRS, AN, CLT etc. Observed URSL as mostly performed surgery as there are many patients with ureteral calculi then followed by PCNL, RIRS, AN and CLT.

Being clinical pharmacists, monitoring of patient condition is done by evaluating their day to day biochemical parameters and also counseled the patients about the preventive measures to be taken to avoid further recurrences of stones.

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