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NEPHROLITHIASIS AND ASSESSMENT OF COMORBIDITIES TO HYPERTENSION AND TYPE 2 DIABETES

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ABSTRACT

Nephrolithiasis is the term employed for kidney stones, also known as renal calculi, and they are crystal concretions formed typically in the kidney. Calculi typically form in the kidneys and ideally leave the body via the urethra without pain. Larger stones are painful and may need surgical intervention. This activity reviews the evaluation and treatment of nephrolithiasis and the role of the healthcare team in managing patients with this condition.

1. INTRODUCTION

Definition

a. The formation of crystal aggregates in the urinary tract results in kidney stones, the clinical condition referred to as nephrolithiasis Kidney stones may produce no symptoms or may be associated with one or several of the following flank pain, microscopic hematuria, obstruction of one or both kidneys, and urinary infections.

b. The stones are usually formed by one of four substances

(1) Calcium
(2) Uric Acid
(3) Magnisium Amonium phophates
(4) Cystine

Calcium stone disease

Calcium stone disease is the most common form of nephrolithiasis and represents about 70% of all stone-forming disease. It occurs most often in the third to fifth decade of life, more often in men than women.

Uric acid stone disease

Uric acid stone disease is found in about 5% to 10% of stone formers. It is more common in patients with chronic diarrheal disorders and in those with hyperuricemia. Most uric acid stone former do not have gout or hyperuricosuria. Uric acid stones may also be partially composed of calcium oxalate, and some patients have both uric acid and calcium oxalate stones.

Struvite stone disease

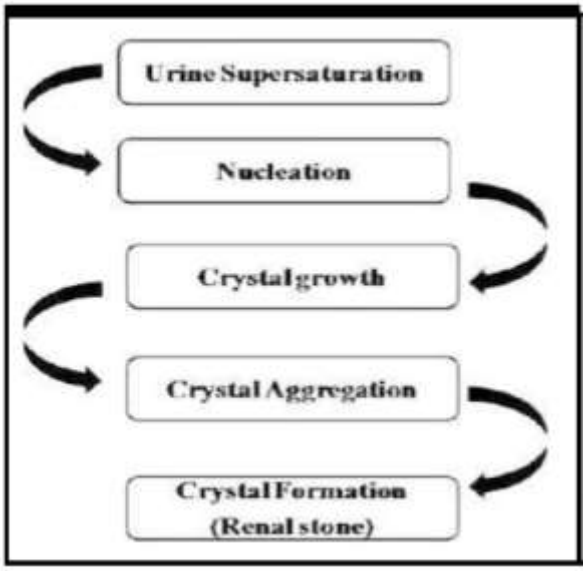
Infection stones, also known as struvite or magnesium ammonium phosphate stones, occur in about 10% to 12% of patients, more often in women. They occur more often also in patients with spinal cord injury, neurogenic bladder, vesicoureteral reflux, chronic indwelling Foley catheters, and recurrent urinary infections, and in those with chronic obstruction of the upper urinary tracts.

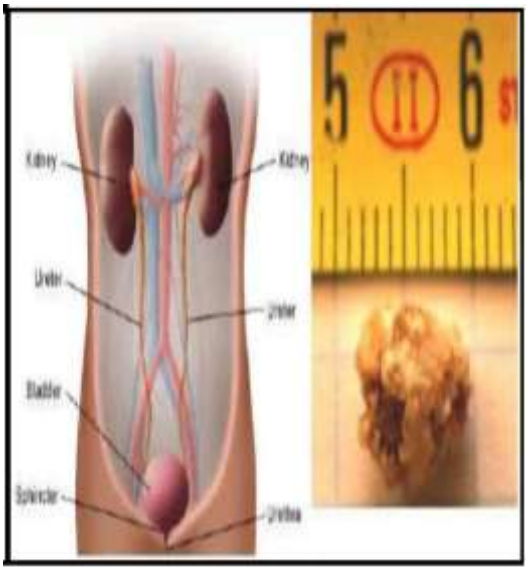
Cystine stone disease

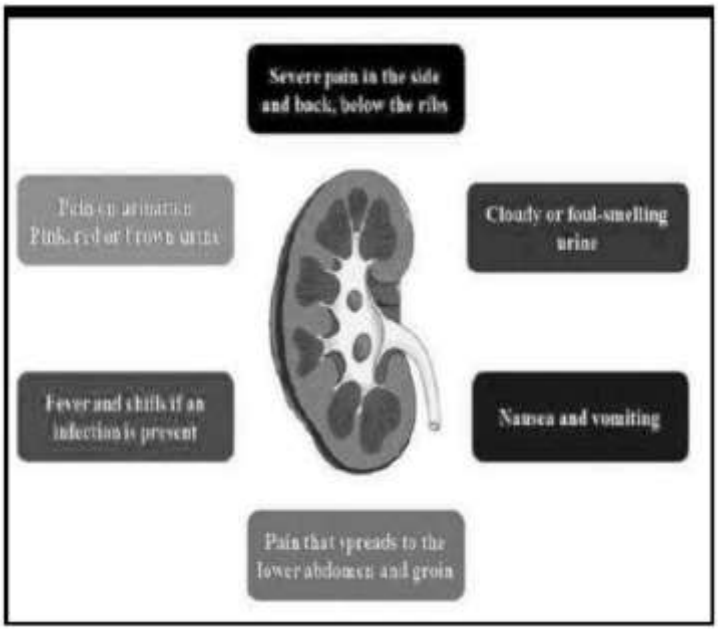
Cystine stone disease occurs in less than 1% of all adult stone formers and in about 6% to 8% of children with nephrolithiasis.

Pathophysiology

Due to Supersaturation of urine contains excessive ions and calcium and other micro nutrients which makes nephrons to filter blood difficult and then these excessive ions filtered out and stay in the nucleus of the kidney leading to nucleation with creates crystal growth in the nucleus of the kidney which then aggregate to form Calcium crystallized stones leading to Nephrolithias or renal stones.







AIMS

a) The main Aim is to present the study.
b) To analyse about Nephrolithiasis
c) And Assessment of comorbidities
d) With respect to Hypertension and Type II Diabetes Mellitus
e) To study the nature of nephrolithiasis and its distribution
f) To identify the predominance in renal system
g) To identify obstructive complication in symptomatic nephrolithiasis
h) To plan based on renal function

OBJECTIVES

a) To Evaluate the Risk factors that favour kidney stones formation
b) List the types of kidney stones, their chemical constituents and characteristics
c) To Identify the etiological causes of each type of kidney stone
d) To Discuss the diagnosis, treatment and prevention of kidney stones.
e) To access the comorbidities to Hypertension and type II DM.
f) To mention the Inhibitors of Spontaneous Crystallization in urine.

LITERATURE REVIEW

D S Goldfarb et al. Am Fam Physician. 1999. Conducted a study on Prevention of recurrent nephrolithiasis A 24-hour urine collection with measurement of the important analytes is usually reserved for use in patients with recurrent stone formation. In these patients, the major urinary risk factors include hypercalciuria, hyperoxaluria, hypocitraturia and hyperuricosuria. Concluded with Effective preventive and treatment measures include thiazide therapy to lower the urinary calcium level, citrate supplementation to increase the urinary citrate level and, sometimes, allopurinol therapy to lower uric acid excretion. Uric acid stones are most often treated with citrate supplementation. Data now support the cost-effectiveness of evaluation and treatment of patients with recurrent stones.

Yasmin Abu-Ghanem et al. Isr Med Assoc J. 2021 Jan. Conducted a survey on Dietary modifications and patient-tailored medical management are significant in controlling renal stone disease. Prospective registry database of patients treated for nephrolithiasis. Data included age, sex, and stone burden before treatment. Under individual treatment, patients were followed at 6-8 month intervals with repeat radiographic images. under appropriate diet and medical treatment revealed a progressive increase in citrate levels compared to baseline and significantly decreased calcium levels ($P = 0.001$ and 0.03, respectively). A significant decrease was observed in stone burden ($P = 0.001$) and overall nephrolithiasis-related events. Finally concluded that Dietary modifications and medical management significantly aid in correcting urinary metabolic abnormalities. Consequently, reduced nehprolithiasis-related events and better stone burden control is expected.

Giuseppe Vezzoli et al. Urolithiasis. 2019 Feb. Conducted a study on Calcium-sensing receptor: evidence and hypothesis for its role in nephrolithiasis. Calcium-sensing receptor (CaSR) is a plasma-membrane G protein-coupled receptor activated by extracellular calcium and expressed in kidney tubular cells. It inhibits calcium reabsorption in the ascending limb

and distal convoluted tubule when stimulated by the increase of serum calcium levels; therefore, these tubular segments are enabled by CaSR to play a substantial role in the regulation of serum calcium levels. In addition, CaSR increases water and proton excretion in the collecting duct and promotes phosphate reabsorption and citrate excretion in the proximal tubule. Concluded that These CaSR activities form a network in which they are integrated to protect the kidney against the negative effects of high calcium concentrations and calcium precipitates in urine. Therefore, the CaSR gene has been considered as a candidate to explain calcium nephrolithiasis.

Lars Rejnmark et al. J Clin Endocrinol Metab. 2011 Aug. Reviewed published evidence on the occurrence, pathophysiology, and consequences of renal complications is well-known risks in primary hyperparathyroidism (PHPT) In asymptomatic PHPT, renal stones are present in approximately 7% of the patients, which is a significantly higher prevalence than among patients without PHPT (1.6%). Also, before diagnosis of PHPT, risk of hospital admissions due to renal stones is increased compared with the background population, and the risk remains increased for at least 10 yrs after surgical cure from PHPT. However, shortly after parathyroidectomy, risk of recurrent stone episodes is reduced to the recurrence rate among patients with idiopathic renal stone disease and concluded with All patients with a diagnosis of PHPT should initially be evaluated for renal calcifications by unenhanced helical computed tomography. If calcifications are present, parathyroidectomy is recommended.

METHODOLOGY

Study design

A Prospective cross-sectional study

a) Study site

Urology Department at Aditya Multi Speciality Hospital in Guntur.

b) Sample size

150 Subjects were included in this study

c) Study period

October 2023 to December 2023(3 months)

Methodology

a) 150 Cases are collected from both inpatient and outpatient among them 122 are from inpatient and next 28 cases are from outpatient.

b) Among this 150 cases male patients are 87 and female patients are 63

c) Age group from 40 to 60 yrs
d) In 87 male patients 52 are from 40 to 50 age group
e) Remaining 35 patients are between 50 to 60 age group
f) Total number of urinary calculi was 150 in which 87 were found in male patients and 63 were found in female patients.
g) Of total 150 calculi, 72 were renal stones,
h) 37 were ureteric stones,
i) 12 of the stones were found in pelviureteric junction (PUJ),
j) 23 of stones were found in vesicoureteric junction (VUJ),
k) and 6 were in bladder.
l) According to the previous mentioned patients outcome data patients underwent different types of surgical procedures such as:
m) Ureteroscopic lithotripsy or URSL – 52
n) Percutaneous nephrolithotomy or PCNL – 70

CASE STUDY

Study procedure

A Prospective Observational study was conducted over a three-month period at the Aditya Multi Speciality hospital in Guntur. We approached the urology department and informed about the study to get participants consent. The data was collected to gather Information from patient and medical records, a legitimate and trustworthy patient-specific data collected. The collected data is helpful to perform the descriptive analysis to draw the results.

Eligibility criteria

a) Inclusion criteria

Inclusion Criteria is defined as the key features of the target population that the investigators will use to answer their research question typical inclusion criteria include demographic, clinical and geographic characteristics.

b) Inclusion criteria for nephrolithiasis

This including age greater than 18 years and presence of a single symptomatic and trackable kidney stone located in the ureter, renal pelvis, or renal calyx.

Inclusion criteria

1) A significant renal stone in a solitary kidney

2) Severe kidney injury
3) An infected renal stone
4) Intractable pain or nausea
5) Urinary extravasation
6) Hypercalcemic crisis
7) All Mens and Women Were Included
8) Both Gender Diagnosed with Nephrolithiasis
9) Inpatients and Outpatients Were Included

Exclusion criteria

Exclusion criteria comprises characteristics used to identify potential research participants who should not be included in a study.

Exclusion criteria for nephrolithiasis

This included presence of more than one stone, urinary tract infection, and renal colic lasting more than a day.

Exclusion criteria

1) History of renal failure
2) Taking drugs that affect electrolyte handling
3) Having anatomic disorders
4) Having metabolic disorders
5) Having gastrointestinal disorders
6) Having other renal disorders
7) Having abnormal serum creatinine (>5 mg/dl)
8) Having recurrent urinary infections
9) Pediatrics Were Excluded

Study design flow

A Research study was conducted over a 3-month period among Nephrolithiasis patient at the Aditya Multi Speciality hospital in Guntur. (October 2023- December 2023)

↓

In this study, we include Nephrolithiasis patients with adrs and written consent was taken from patient who are willing to participate in the study.

↓

The patient's data and the demographic details were collected.

↓

Taking into considerations for certain adrs that have objective evidence and their associated drugs, the patient's response was noted.

↓

The drugs related adrs were recorded

↓

The acquired data was collected, where the descriptive analysis was carried out.

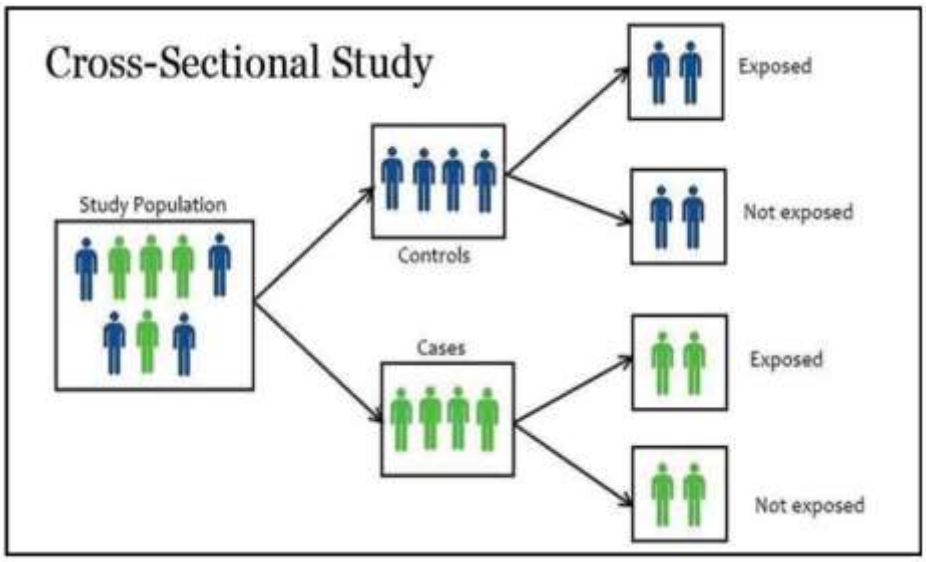
↓

Results were drawn and the study conclusion was framed

Cross sectional studies

A cross sectional study is a type of research design in which you collected data from many different individuals at a single point of time.

In cross sectional study you observe variables without influencing them.



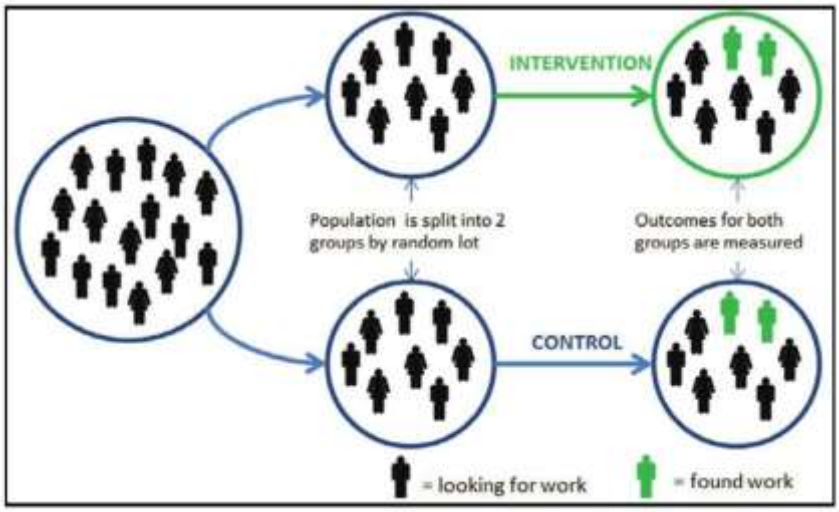
The cross-sectional study was performed to access the clinical profile of patients Nephrolithiasis, the demographics details of the patients were taken, comorbidities were noticed, and laboratory test were done.

Sochiodemographic risk factors.		Renal calculi	Vuj calculi	Puj calculi	Ureteric calculi	Urinary bladder
Sex	Male Female	46 26	13 10	7 5	12 25	4 2
Age	>50yrs	52	19	8	17	3

	<50yrs	20	4	4	20	3
Alcohol		23	-	12	7	2
Smoking		5	3	1	-	1

Randomized controlled trail

Randomised control trail is a form of scientific experiment used to control factors not under direct experimental control. Examples of RTCS are clinical trails that compare the effects of drugs, surgical techniques, medical devices, diagnostics procedures, or other medical treatments.



Rct on nephrolithiasis

1) Intervention subjects

Randomly assigned 99 persons who had calcium oxalate stones for the first time to a low animal protein, high fiber diet that contained approximately 56-64 g daily of protein, 75 mg daily of purine (primarily from animal protein and legumes), one-fourth cup of wheat bran supplement, and fruits and vegetables. They were also instructed to drink six to eight glasses of liquid daily and to maintain adequate calcium intake from dairy products or calcium supplements.

2) Control subjects

They were instructed only on fluid intake and adequate calcium intake. Both groups were followed regularly for up to 4.5 years with food frequency questionnaires, serum and urine chemistry analysis, and abdominal radiography; and they were urged to comply with dietary instructions.

Trials conclusion

a) In the intervention group of 50 subjects, stones recurred in 12 compared with 2 in the control group. After adjustment for possible confounding effects of age, sex, education, and baseline protein and fluid intake, the relative risk of a recurrent stone in the intervention group was compared with the control group.

b) To conclude that advice to follow a low animal protein, high fiber, high fluid diet has no advantage over advice to increase fluid intake alone.

Demographics

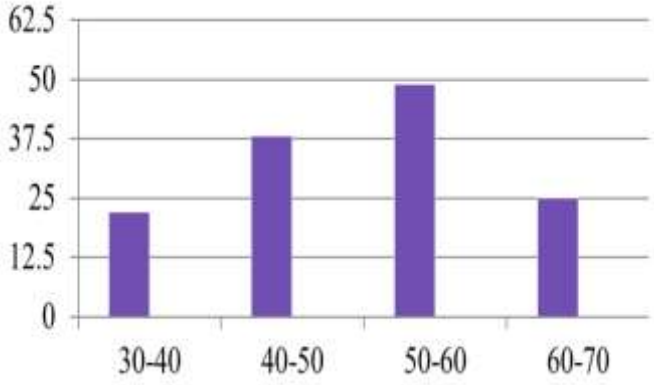
Demographics are the statistics that describes population and their characteristics.

Demographics of the Nephrolithiasis involves are: -

1. Age
2. Gender
3. Hypertension
4. Diabetes
5. Family history.
6. Lifestyle factors.
7. Smoking and alcoholic.

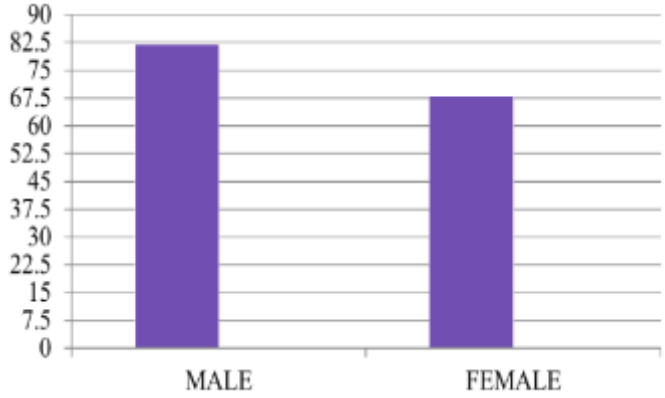
Demographics

Age group distribution



In my study the age groups from 30-40 years old are 22 members, 40-50 years old are 38 members, 50-60 years old are 49 members, 60-70 yrs old 25 members.

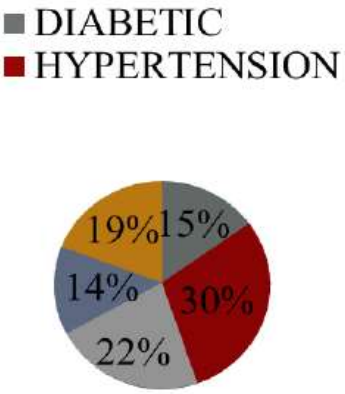
Gender group of distribution

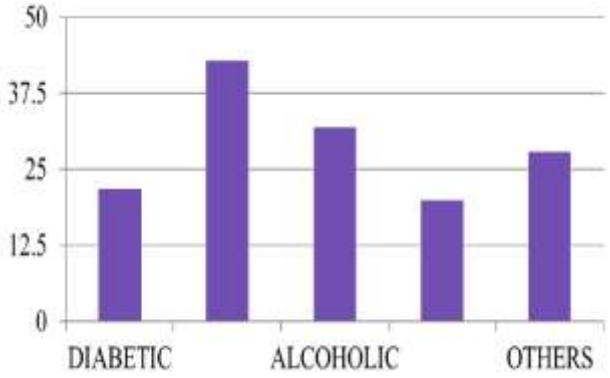


In my study gender group distribution has been done from males are 82 and females are 68.

Risk factors

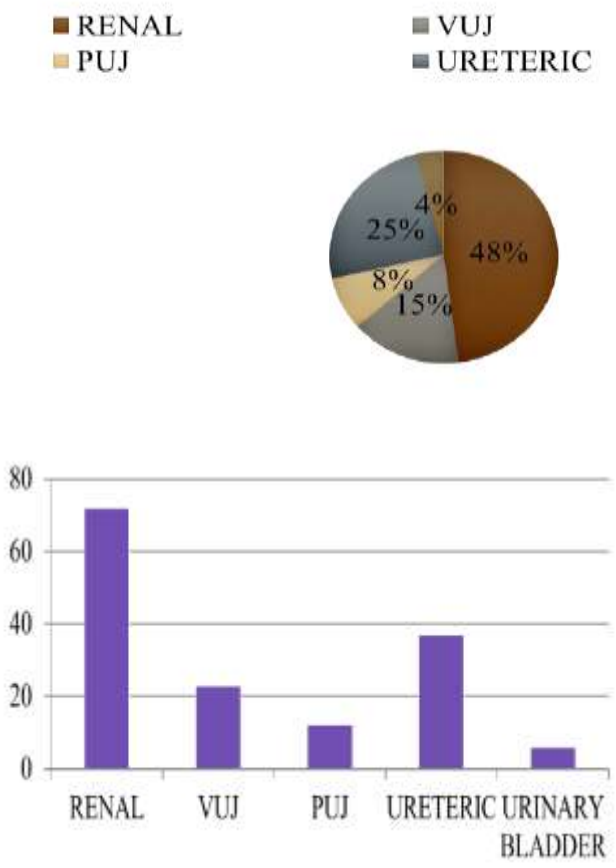
The disease-causing risk factors were categorised in among the population of categories as they are, Diabetic patients are 22 members and Hypertension patients are 43 members, Alcoholic patients are 32 members, Smoking patients are 20 members and other patients are 28 members.





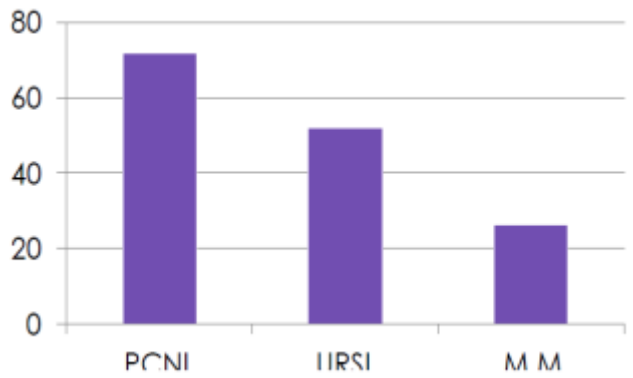
Based on site of calculus

a) In the case study among 150 patients, they are categorising as 5 types based on the location of calculus present.
b) Renal calculi are 72 members.
c) VUJ calculi are 23 members.
d) PUJ calculi are 12 members.
e) URETERIC calculi are 37 members.
f) URINARY BLADDER calculi are 6 members.



Based on underwent surgical procedure

1. In the case study among 150 patients they are categorise as 3 types based on underwent surgical procedures are:-
2. PCNL (Percutaneous Nephrolithotomy) are 72 members.
3. URSL (Ureteroscopic Lithotripsy) are 52 members.
4. MM (Medical Management) are 26 members



DISCUSSION

1. Our prospective observational study was carried out among 150 patients in Nephrology inpatient department shows that majority of the nephrolithiasis patients.
2. Nephrolithiasis is a frequent disorder affecting the population with a high risk of recurrence.
3. Treatment and prevention have to be tailored to the individual causes of disease and require an assessment of underlying predispositions and interacting modifiable environmental factors.
4. The primary risk factors for nephrolithiasis were age, acidic urine and the hardness of drinking water, which is consistent with the data of other authors.
5. Difficulties in measuring, grading and controlling subjective risk factors for nephrolithiasis (fluid intake, diet, heredity, and past diseases) make it difficult to analyze them in cross-sectional studies and prevent direct comparison with other studies
6. This study of a large cohort of SB patients with long-term follow-up highlights that the risk of nephrolithiasis is cumulative and related to bladder stone formation, age at augmentation and time since augmentation.
7. An association with bladder stones suggests potential shared metabolic causes.
8. The study's retrospective design likely led to underestimating the risk of nephrolithiasis by not capturing spontaneously passed stones.

CONCLUSION

Nephrolithiasis, commonly known as kidney stones, is a prevalent condition characterized by the formation of crystal aggregates in the urinary tract. These stones can cause various symptoms, including flank pain, hematuria, and urinary infections. Calcium stone disease is the most common type, followed by uric acid, struvite, and cystine stones. The

pathophysiology involves the supersaturation of urine with ions and calcium, leading to crystal growth and stone formation in the kidneys.

The aim of this study is to analyse nephrolithiasis and its association with comorbidities such as hypertension and type 2 diabetes mellitus. The objectives include evaluating risk factors for kidney stone formation, identifying different types of stones and their causes, discussing diagnosis and treatment options, and assessing inhibitors of spontaneous crystallization in urine.

Literature review highlights various studies focusing on prevention, dietary modifications, calcium-sensing receptor's role, and renal complications in primary hyperparathyroidism. These studies provide insights into preventive measures, dietary management, and potential therapeutic targets for nephrolithiasis.

The methodology involves a prospective cross-sectional study conducted at a urology department, with a sample size of 150 subjects. Data collection includes demographic analysis, assessment of comorbidities, and examination of urinary calculi. Various surgical procedures, such as ureteroscopic lithotripsy and percutaneous nephrolithotomy, are performed based on patient outcomes.

The discussion emphasizes the significance of tailored treatment and prevention strategies for nephrolithiasis, considering individual causes and environmental factors. The study identifies age, acidic urine, and water hardness as primary risk factors for kidney stones. It also highlights the cumulative risk associated with bladder stone formation and underscores the need for further research on the pathophysiological link between nephrolithiasis and systemic disorders.

In conclusion, nephrolithiasis poses a significant health and economic burden globally, particularly among hypertensive and diabetic individuals. Understanding the underlying mechanisms and risk factors is crucial for developing effective preventive and therapeutic interventions. Future research should focus on elucidating the interplay between nephrolithiasis and systemic diseases to improve patient outcomes.

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