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EVALUATION OF RENAL STONES IN DIABETIC AND NON-DIABETIC PATIENTS AND THEIR DIAGNOSIS THROUGH COMPUTER TOMOGRAPHY IN THE REGION OF FAISALABAD

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Abstract

Background: Kidney stones also called urolithiasis, are among the most frequent urinary tract problems after prostate enlargement and infections. Their burden is increasing worldwide and is particularly high in Pakistan. Diabetes mellitus has been identified as a factor that increases the risk of stone formation through changes in metabolism and urine composition. There is, however, limited research in the Faisalabad region comparing diabetic and non-diabetic patients. This study was designed to assess the pattern of renal stones in both groups and to evaluate the use of computed tomography (CT) for their diagnosis. Objective: To study the occurrence, size, and location of renal stones in diabetic and non-diabetic patients and to determine the role of CT KUB as a diagnostic tool. Material and Methods: This cross-sectional study included 60 patients diagnosed with renal stones at District Headquarters Hospital, Faisalabad, between March and June 2024. Only patients above 18 years were enrolled. Information on age, gender, medical history, and other risk factors was collected through a structured questionnaire. Non-contrast CT KUB scans were carried out to confirm diagnosis, measure stone size, and identify related findings. Data were analyzed using SPSS v13 and descriptive statistics. Results: Stones were detected in both diabetic and non-diabetic patients, but their frequency was higher among diabetics. Stones were commonly seen in the left kidney and ureter, with sizes ranging from less than 3 mm to more than 20 mm. CT scans also showed complications such as hydronephrosis, staghorn stones, and ureteric dilatation. In diabetic patients, uric acid and mixed stones were more frequent due to metabolic disturbances. Incidental findings, including hepatic cysts and pleural effusion, were also noted. Conclusion: This study shows that diabetes contributes significantly to the risk of kidney stone formation in the Faisalabad population. CT KUB was found to be a dependable method for detecting stones and related complications. Early identification through imaging and timely treatment can prevent long-term kidney

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damage. Preventive strategies, including dietary advice and lifestyle changes, should be emphasized. Further large-scale studies are recommended to better understand the underlying risk factors and develop effective preventive measures.

INTRODUCTION

The Greek terms ouron (urine) and lithos (stone) are the source of the word urolithiasis. After benign prostatic hyperplasia and recurrent urinary tract infections, urolithiasis is the third most common urinary tract condition. Nephrolithiasis is more common in men (12%) than in women (6%), and it is more common in both sexes between the ages of 20 and 40, according to epidemiological research (Han et al., 2019). Genetic background, sex, age, body mass index, and ethnicity are examples of intrinsic risk factors; dietary habits, water intake, lifestyle, climate, employment, drugs, and stress are examples of extrinsic risk factors. The third most prevalent urological condition, kidney stones have a low death rate, substantial morbidity, and an impact on society and the economy. [Chartier-kastler et al.,2011].

Diabetes is the leading cause of kidney disease. Insulin resistance from diabetes (when your cells stop responding to insulin) can raise the levels of calcium in your urine. That can make kidney stones more likely. Insulin resistance plays a key role in type 2 diabetes mellitus (DM), and it has been linked to uric acid stone formation. [Keoghane, S et al.,2010]

A kidney stone Is a hard, crystalline mineral that develops in the urinary tract or kidney. Urine containing blood and acute discomfort in the belly, flank, or groin are frequently symptoms of kidney stones. Sometimes kidney stones are referred to as renal calculi. The chemical makeup of kidney stones determines their classification. Urine must be supersaturated—that is, at quantities greater than the thermodynamic solubility of the stone material—in order for crystals to form. [Ernst, E and others, 2007]

Nephrolithiasis is the term used to describe the condition of kidney stones. [N.A. Breslau et al., 1988]. Although there are many components that make up stones, the super saturation of the urine is the initial stage in the development of any stone. As a result, the ingredients crystallise and form a nucleus for future stone development and aggregation. [P.S. Chandhoke et al., 2002]. Elevated levels of obesity and hypertension, which are associated with nephrolithiasis, additionally lead to a rise in the production of stones. [Keoghane, S et al.,2010]

Kidney stone disease and Diabetes Mellitus (DM) are prevalent public health issues across the globe. [Scales Jr. and others, 2012] The quality of life is significantly impacted by kidney stones in addition to the financial load. [G. Kartha and others, 2013] N. Patil et al. (2017) Kidney stone development has been linked to diabetes mellitus (DM) in multiple studies. [Weinberg, A et al.,2014]

Nephrolithiasis and Diabetes Mellitus are two prominent causes of morbidity, and both appear to be on the rise.[S. Wild and others, 2004] One of the main causes of the metabolic syndrome and a major contributor to several of these urine abnormalities is diabetes mellitus (DM).[E, N, Taylor, et al., 2009] The underlying metabolic disease that underlies the metabolic syndrome and type 2 diabetes is insulin resistance. Insulin resistance6, a metabolic disturbance that may raise the risk of kidney stones, is a hallmark of type 2 diabetes mellitus. [Beck-Nielsen, H et al.,1994]

Compared to stone formers without diabetes, stone formers with diabetes may have more acidic urine.[C.Y. Pack et al., 2003]Nephrolithiasis is considerably more common in persons with diabetes mellitus, according to population-based cohort studies.[E. Tyler and others, 2008] Insulin resistance and obesity are linked, and an increasing amount of research indicates that insulin resistance may contribute to the development of kidney stones.[Ando, R et al.,2011]

Understanding the epidemiology of kidney stones is critical for establishing effective prevention and treatment methods. While studies have established the global burden of urolithiasis, data relevant to the demographics, presentation, and associated conditions of kidney stones in Faisalabad, Pakistan, remains sparse. By examining CT KUB (Kidneys, Ureters, and Bladder) results from a group of patients in Faisalabad, this study seeks to close this knowledge gap. Renal and ureteric stone prevalence,

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distribution in size, location, and related conditions will all be examined in this study, which will shed important light on the disease burden in the area.

Objective

The purpose of this study will reveal the prevalence of Renal Stones in Faisalabad Pakistan and calculate whether the infection is significantly associated with different demographic factors, such as age groups, gender, socioeconomic status, and other diseases. CT imaging is highly effective in detecting renal stones, regardless of whether the patient is diabetic or not. It provides detailed images of the kidneys and urinary tract, allowing radiologists to identify the presence, location, size, and number of stones.

Hypothesis

Since the previous ten years, Renal Stones have become more common in Faisalabad, Pakistan. Renal stones are most likely caused by a few risk factors, according to our hypothesis. Renal stone incidence may be influenced by alterations in lifestyle, unsanitary circumstances, and additional demographic factors. Our goal is to determine which risk factors lead to an elevated risk of renal stones.

MATERIAL & METHODOLOGY

All samples will be collected in strict accordance with ethical guidelines after obtaining patients' consent. This study will involve approximately 60 renal stone patients, selected from the District Headquarters Hospital in Faisalabad. Patients diagnosed with renal stones through CT scan and aged above 18 years will be included, while individuals younger than 18 years will be excluded, irrespective of gender. Data collection will be carried out through face-to-face interviews using a structured consent form in Urdu, the national language, ensuring clarity for participants. A specially designed questionnaire will be used to record information such as age, sex, ethnicity, area of residence, hygienic status, history of other diseases, medication use, smoking, diabetes, transfusions, surgeries, and dental history, focusing on the risk factors of renal stones. Data will be gathered over a three-month period (March 2024 to June 2024) at the District Headquarters Hospital, Faisalabad. The collected data will be entered into an Excel sheet, coded into digital form (0 and 1), and analyzed using SPSS version 13. Descriptive statistics will be applied, and demographic data as well as prevalence rates will be illustrated graphically using GraphPad software.

RESULTS

Quantitative data on stone size, location, and associated conditions were tabulated and analyzed using descriptive statistics.

Stone Count	Largest Stone Size (mm)	Stone Density (HU)	Associated Features
2	1.7 (861 HU), 5.6	861, 487	Moderate hydronephrosis, emphysematous pyelitis, wall thickening, fat stranding
Multiple	13 (1260 HU), 11 (1208 HU), others	1260, 1208	Moderate hydronephrosis, hepatic cystic lesions

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1	9.5x5.5 (1200 HU)	1200	Proximal hydronephroureter, perinephroureteric fat stranding, prostate enlargement with calcifications
2	16 (355 HU), 4 (311 HU)	355, 311	Mild to moderate hydroureteronephrosi s, staghorn calculus,
			hepatic cystic lesions
1	7 (650 HU)	650	Moderate left hydronephrosis, suspected narrowing at pelviureteric junction, renal cortical scarring
1	11x3 (369 HU)	369	Lower pole calculus, lobulated kidney contour, minimal pelvicalyceal system fullness

Stone Characteristics

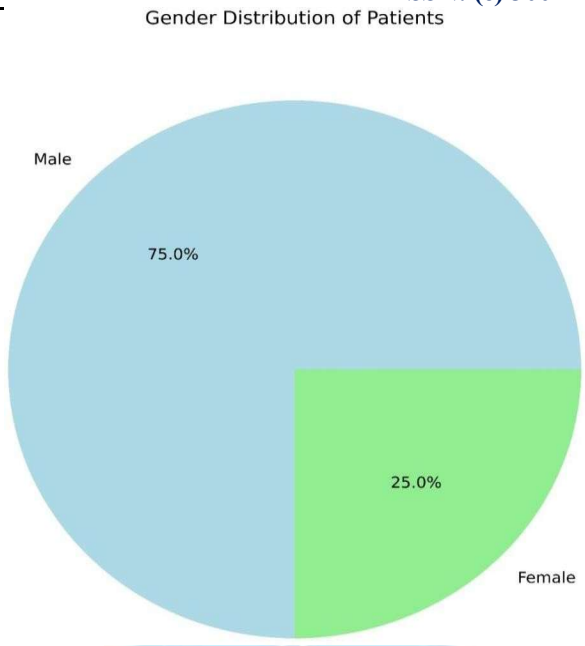
Age Range	Gender	Number of Patients
18-17	Male	7
28-37	Male	12
28-37	Female	6
38-47	Male	17
38-47	Female	8
48-57	Male	9
48-57	Female	6

Patient Demographics

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Gender Distribution of Patients

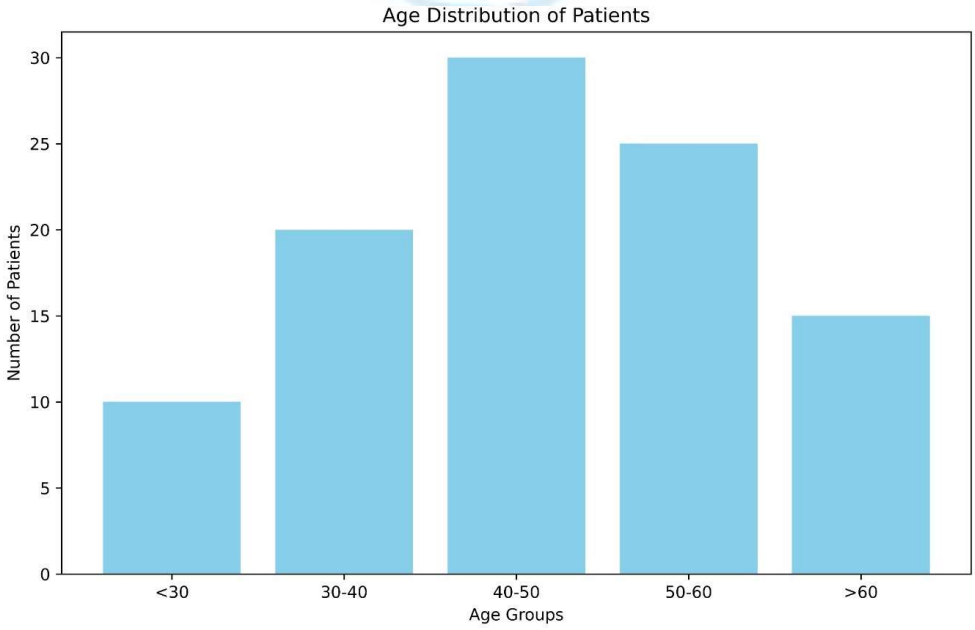
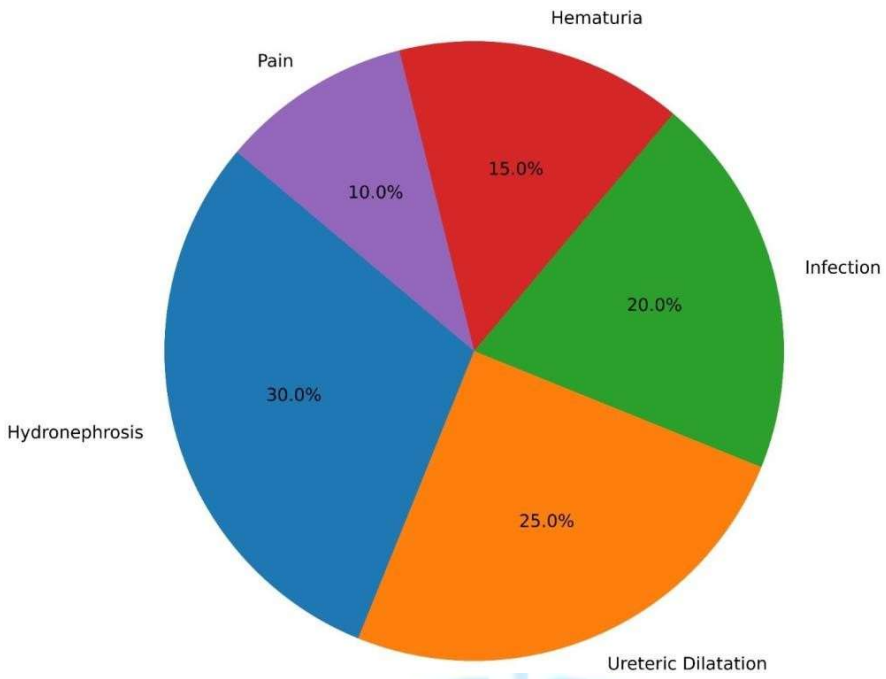


Table 4 : Age Distribution

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Associated Conditions Frequency

Location	Number of Stones
Right Kidney	25
Left Kidney	35
Left Ureter	22
Right Ureter	12
Bladder	5

Associated Condition

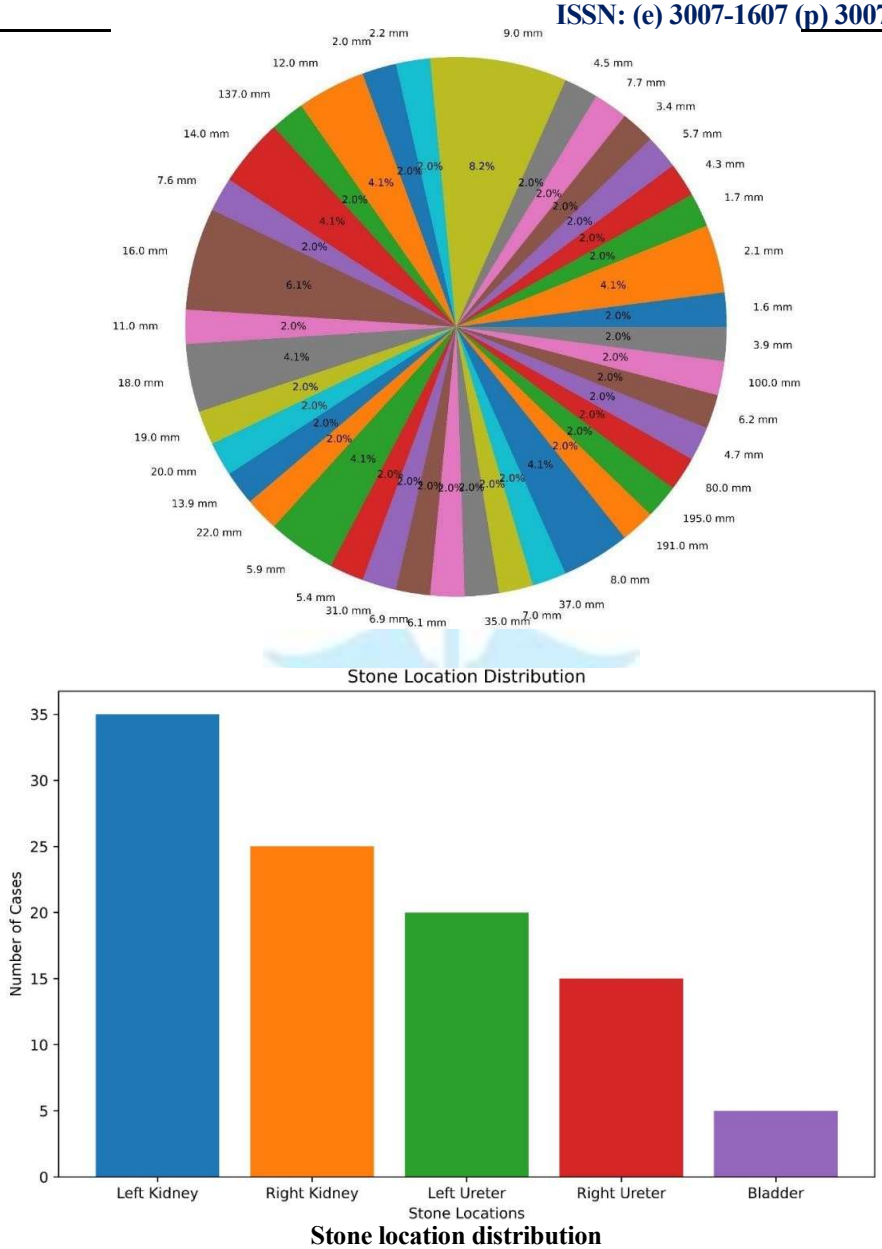
Size Range (mm)	Number of Stones
<3	35
5-10	25
10-15	10
15-20	10
>20	5

Stone Distribution by location

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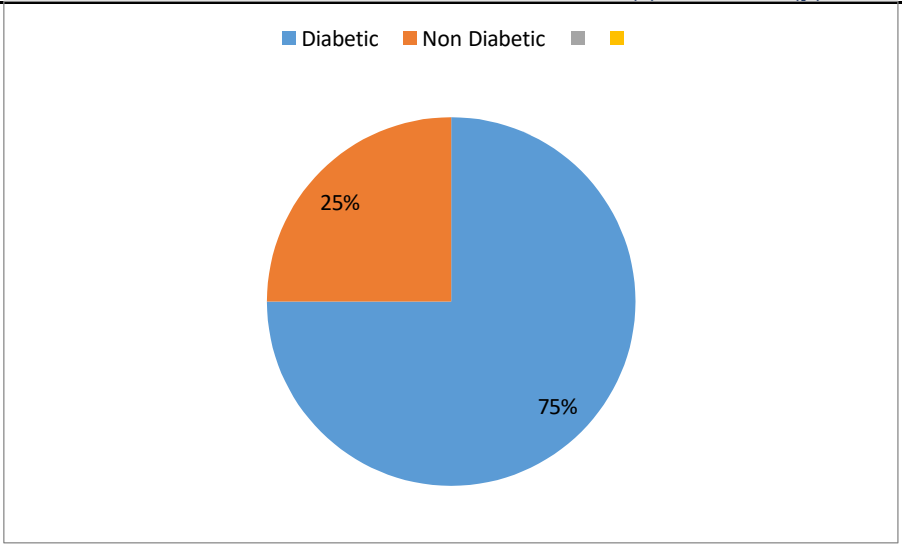


Stone location distribution

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Percentage of renal stones in Diabetic or Non Diabetic Patients

DISCUSSION

Key Findings and Interpretation:

Prevalence: Analyze whether the observed prevalence of renal and ureteric stones deviates from current global trends and highlights potential regional risk factors. The observed prevalence of these stones in this study population serves as a baseline for comparison with future research and national statistics.

Size Distribution: The severity of presentations can be determined by analyzing the distribution of stone sizes. Talk about whether most of the stones were small enough to pass on their own or whether a sizable number needed to be treated medically.

Location: More research is necessary in light of the discovery that stones are more common in the left kidney and ureter. Talk about possible anatomical causes or referral patterns that could affect laterality.

HU Values: Examine the HU value range and how it relates to the composition of the stone. Based on HU values, were there any predominant stone kinds, and if so, how does this relate to dietary or metabolic risk factors that the study population had identified?

Associated Conditions: Possible problems resulting from stone blockage are indicated by the existence of concomitant symptoms such as hydronephrosis and ureteric dilatation. Talk about how frequently these results occur and how they affect patient care.

Incidental Findings: The discovery of incidental abnormalities (pleural effusions, cysts, and hepatomegaly) emphasizes how crucial a thorough assessment is when doing CT KUB scans. Examine the frequency of these results and, if necessary, stress the need for additional investigation.

Limitations and Future Directions:

Recognize the study's shortcomings, including its retrospective nature and possible bias in selection. Talk about the possible effects these restrictions may have had on the findings' generalizability. Outline potential avenues for future study to overcome these constraints and increase knowledge about urolithiasis in Faisalabad. The following are some possible directions for further research:

- To get a more complete view of patient demographics, risk factors, and clinical manifestations, conduct a prospective study.
- Incorporate laboratory studies to examine metabolic profiles and pinpoint possible underlying reasons for the development of stones.
- Examine the research population's eating and drinking habits in order to pinpoint modifiable risk variables.
- Examine long-term results to learn about kidney stone recurrence rates and any consequences.

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CONCLUSION

In a cohort of patients from Faisalabad, Pakistan, this study offers important new information about the prevalence, size distribution, location, and related circumstances of renal and ureteric stones related to diabetic and non-diabetic patients. Diabetic patients often exhibit metabolic disturbances such as hypercalciuria and hyperuricosuria, further predisposing them to nephrolithiasis. Clinically, this translates into a higher incidence of renal stones among diabetics compared to non-diabetics. The results emphasize how crucial it is to treat kidney stones as soon as possible in order to avoid problems. To investigate the underlying causes of urolithiasis and create tailored prevention measures for the people of Faisalabad, more research is required. Healthcare providers can improve kidney stone care and lessen the incidence of kidney stones in this area by putting these suggestions into practice