

## To Investigate The Prevalance And Associative Factors Of Kidney Stone On Ultrasound

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### Abstract

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**Background:** Kidney stone disease is a common urological condition influenced by multiple metabolic and environmental factors. This study was conducted to investigate the prevalence and associated factors of renal calculi detected on ultrasound in patients presenting to hospitals and clinics in Peshawar.

**Aim:** To determine the prevalence of kidney stones and to evaluate the associated risk factors of renal calculi.

**Methods:** A descriptive cross-sectional study was conducted from March to June 2022 in selected hospitals and clinics of Peshawar, including Rehman Medical Institute. A total of 100 patients aged 15–55 years who presented to the radiology department with complaints suggestive of renal stones were included. Ultrasound examination was performed in the supine position using standard scanning techniques. Data was collected through structured proformas and analyzed to assess prevalence and associated factors.

**Results:** Among the 100 patients, 55% were male and 45% were female. The highest proportion of patients (50%) belonged to the 25–35 years age group. Kidney stones were confirmed in 50% of cases. Hydronephrosis was observed in 60% of patients, while 45% had a positive family history of renal calculi. Inadequate water intake was reported by 43% of patients, and 68% had urinary tract infections. Hematuria was present in 32% of cases.

**Conclusion:** Renal ultrasound is an effective and non-invasive modality for detecting kidney stones. The study demonstrates a slightly higher prevalence among males and highlights important associated factors, including family history, low fluid intake, and urinary tract infection. Early detection and risk factor modification are essential for prevention and management of renal calculi.

## **Introduction**

The kidneys are paired, bean-shaped retroperitoneal organs located between the T12 and L3 vertebral levels. They play a vital role in filtration, electrolyte balance, and waste excretion(1). Structurally, each kidney consists of an outer cortex, inner medulla, and renal pelvicalyceal system(2). The functional unit of the kidney is the nephron, composed of the glomerulus and renal tubules. Kidney stone formation, medically termed nephrolithiasis or urolithiasis, refers to the development of crystalline calculi within the urinary tract(3). The term originates from the Greek word “lith”, meaning stone. Nephrolithiasis is a common and increasingly prevalent urological disorder worldwide, associated with significant health and economic burden. Approximately 75–80% of kidney stones are composed of calcium salts, predominantly calcium oxalate(4). The condition is strongly associated with metabolic and environmental factors including obesity, hypertension, diabetes, dehydration, dietary habits, and genetic predisposition(5). The global prevalence of kidney stones varies geographically(6). In North America, prevalence ranges from 7–13%, while in Europe it ranges from 5–9%, and in Asia from 1–5%. Certain regions, including Pakistan, India, the Middle East, and parts of Southeast Asia, fall within the “stone belt,” where higher incidence rates are reported(7). In the United States, lifetime prevalence is approximately 10–12% in men and 7% in women, with incidence increasing over recent decades. Studies from Pakistan show variable prevalence across regions, reflecting dietary patterns, climate differences, and fluid intake habits(8). Stone formation is a complex process involving supersaturation of urine with lithogenic substances, crystal nucleation, and aggregation(9). Common metabolic abnormalities include hypercalciuria, hyperoxaluria, hyperuricosuria, hypocitraturia, low urinary volume, and persistently low urinary pH. Dehydration and hot climates further increased risk due to reduced urine output and higher solute concentration(10). Several factors contribute to nephrolithiasis, including male gender, increasing age, metabolic disorders, dietary habits (high salt and protein intake), low fluid consumption, obesity, and anatomical abnormalities(11). Primary hyperparathyroidism, for example, can lead to hypercalciuria and subsequent stone formation. Recurrence rates are high, ranging from 20–50% within five years. Ultrasound is a widely available, non-invasive, and cost-effective imaging modality commonly used for the detection of kidney stones, especially in resource-limited settings(12,13).

## **Aims and Objectives**

To determine the prevalence of kidney stones detected on ultrasound.

To identify the associated risk factors contributing to kidney stone formation.

## **MATERIAL AND METHODS**

This study was conducted using an experimental cross-sectional design to investigate the prevalence and associated factors of kidney stones detected on ultrasound. The research was carried out over a period of four months, from March to June 2022. Due to limited resources and budget constraints, a total sample size of 100 patients was included in the study. A convenient sampling technique was adopted to recruit participants. Patients aged between 15 and 55 years who were presented for ultrasound examination with complaints suggestive of renal stones were included in the study. These complaints primarily consisted of flank pain, vomiting, and hematuria. Patients with a prior history of urological interventions such as ureteroscopy, shockwave lithotripsy, percutaneous nephrolithotomy, or open renal surgery were excluded to avoid confounding factors that might influence ultrasound findings or recurrence patterns. Data were collected using a structured proforma designed to record demographic characteristics and clinical presentations. Before

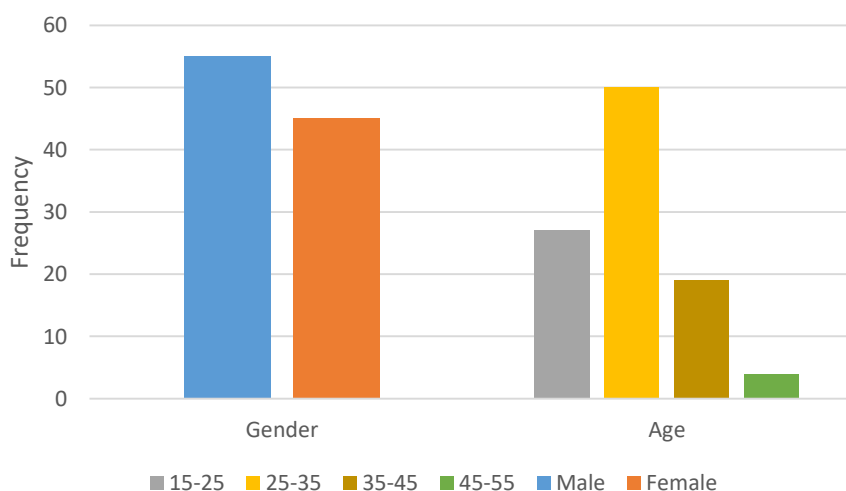
conducting the ultrasound examination, informed consent was obtained from each participant. During the procedure, patients were positioned in the supine position, and ultrasound gel was applied over the region of interest to ensure optimal acoustic coupling. Both kidneys were examined systematically using ultrasonography to identify the presence, location, and characteristics of renal calculi. All collected data were verified and entered into Statistical Package for Social Sciences (SPSS) version 27 (SPSS Inc., Chicago, IL, USA) for analysis. Descriptive statistics were used to summarize demographic and clinical variables, and graphical representations were generated to illustrate the findings.

## RESULTS

A total of 100 patients aged 15–55 years were evaluated for suspected renal calculi. Males comprised 55% and females 45% of the study population. Most patients (50%) were aged 25–35 years. The majority were married (66%) and from rural areas (57%). Ultrasound findings showed that 50% of patients had kidney stones, and 60% had hydronephrosis. Renal concretion was present in 48% of cases. A family history of kidney stones was reported by 45% of participants. Urinary tract infection was observed in 43%, and hematuria in 32%. Additionally, 22% undergone lithotripsy previously, and 68% were taking preventive medications. (Table 4.1)

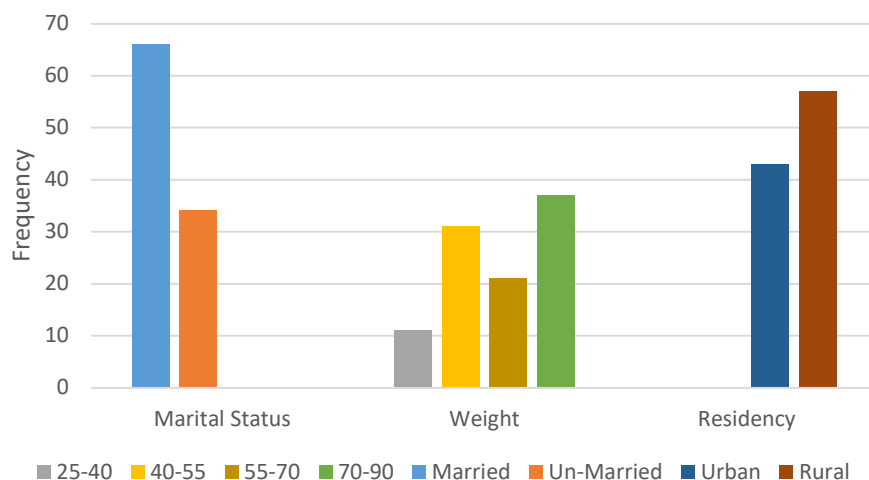
**Table 4.1: Demographic Characteristics**

Variable	Category	n (%)
<b>Gender</b>	Male	55 (55%)
	Female	45 (45%)
<b>Age (years)</b>	15–25	27 (27%)
	25–35	50 (50%)
	35–45	19 (19%)
	45–55	4 (4%)
<b>Marital Status</b>	Married	66 (66%)
	Unmarried	34 (34%)
<b>Residence</b>	Urban	43 (43%)
	Rural	57 (57%)



**Figure 4.1:** illustrates the distribution of patients according to gender and age groups (15–25, 25–35, 35–45, and 45–55 years).

Figure 4.2 shows the distribution of patients according to marital status, weight categories, and residency. Most patients were married (66%), belonged to the 70–90 kg weight group (37%), and were residents of rural areas (57%).



**Figure 4.2: Distribution of patients according to marital status, weight categories,**

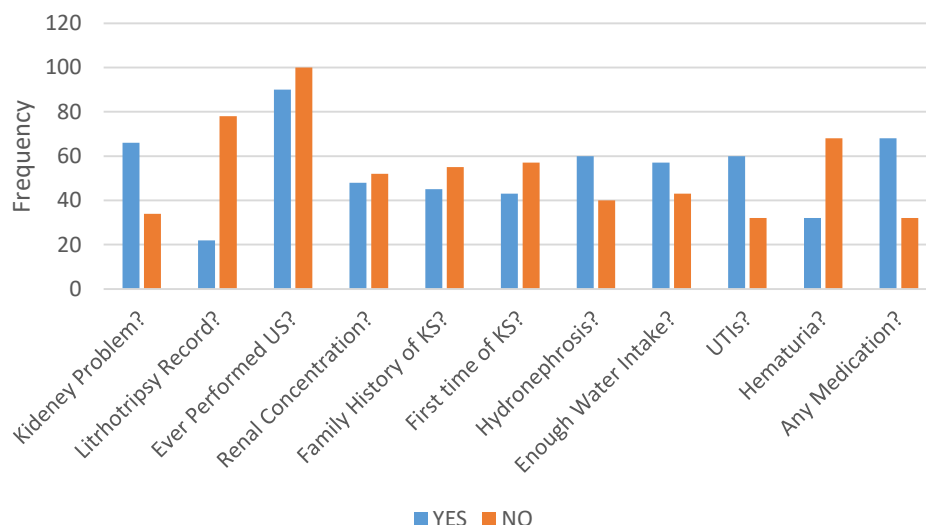
The table presents patients' responses regarding the prevalence and associated factors of kidney stones. Among the participants, 66% reported having kidney problems, and 50% confirmed having kidney stones. A family history of kidney stones was present in 45% of patients, while 43% experienced kidney stones for the first time. Hydronephrosis was reported in 60% of patients. Regarding lifestyle factors, 57% stated that they drank adequate water daily. Urinary tract infection (UTI) was reported by 68% of patients, and 32% experienced hematuria (blood in urine). Additionally, 22% had previously undergone lithotripsy or surgery, and 68% were taking medications to prevent kidney stones. Overall, the findings highlight several clinical and lifestyle factors associated with kidney stone occurrence. (Table 4.2)

**Table 4.2: Patients' Responses Regarding Prevalence and Associated Factors of Kidney Stones**

S. No	Question	Yes n (%)	No n (%)
1	History of kidney problem	66 (66%)	34 (34%)
2	Previous lithotripsy or surgery	22 (22%)	78 (78%)
3	Previous ultrasound performed	90 (90%)	10 (10%)
4	History of renal concretion	48 (48%)	52 (52%)
5	Presence of kidney stone	50 (50%)	50 (50%)
6	Family history of kidney stone	45 (45%)	55 (55%)
7	First episode of kidney stone	43 (43%)	57 (57%)
8	Presence of hydronephrosis	60 (60%)	40 (40%)
9	Adequate daily water intake	57 (57%)	43 (43%)
10	History of urinary tract infection (UTI)	68 (68%)	32 (32%)
11	Hematuria (blood in urine)	32 (32%)	68 (68%)
12	Use of medication for stone prevention	68 (68%)	32 (32%)

The graphical representation demonstrates patients' responses (Yes/No) to various questions related to the prevalence and associated factors of kidney stones. A considerable proportion of patients reported kidney problems, hydronephrosis, urinary tract infections, and the use of preventive medications. Half of the participants confirmed the presence of kidney stones, and nearly half had a positive family history.

The majority had previously undergone ultrasound examination, while a smaller percentage reported a history of lithotripsy or surgical intervention.



**Figure 4.3: Distribution of Patients' Responses Regarding Prevalence and Associated Factors of Kidney Stones**

## DISCUSSION

This study was conducted in various hospitals and clinics of Peshawar to determine the prevalence and associated factors of kidney stones detected on ultrasound. A total of 100 patients aged 15–55 years were included.

In our study, males (55%) were slightly more affected than females (45%), which aligns with previous studies reporting male predominance in nephrolithiasis. However, recent literature suggests that the gender gap is gradually decreasing. The majority of patients (50%) belonged to the 25–35 years age group, indicating that kidney stones are more common in young and middle-aged adults. Similar findings have been reported in other regional and international studies, where age has been identified as a strong predictor of stone risk.

Ultrasound findings confirmed kidney stones in 50% of patients, and 60% had hydronephrosis, indicating obstructive complications. Family history was present in 45% of patients, supporting the role of genetic predisposition in stone formation. Comparable studies have reported positive family history in approximately 30–45% of cases.

Inadequate water intake was observed in 43% of patients, highlighting poor hydration as a significant risk factor. Previous studies have similarly emphasized low fluid intake as a major contributor to stone formation due to increased urinary concentration. Urinary tract infection (68%) and hematuria (32%) were also common in our patients, consistent with literature identifying UTI as an important associated factor.

## CONCLUSION

Renal ultrasound is a safe and effective tool for detecting kidney stones. In this study, kidney stones were slightly more common in males than females. The condition is influenced by multiple metabolic and lifestyle factors, including low water intake and urinary abnormalities. Early diagnosis and identification of risk factors are important for proper management and prevention of renal calculi.

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