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FREQUENCY OF RISK FACTORS ASSOCIATED WITH KIDNEY NEPHROLITHIASIS IN KPK – A CROSS-SECTIONAL STUDY

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Abstract

Background: Kidney nephrolithiasis are mineral deposits in the crusts of the kidneys and pelvis that are released or stuck to the kidney papillae. Contains transparent and normal parts and boxes where urine is supersaturated with respect to a minerals.

Aims and objectives: To record the frequency of various intrinsic and extrinsic risk factors of kidney nephrolithiasis in KPK, to aid in the prevention and management of the frequent risk factors to reduce the burden of nephrolithiasis.

Material and Methods: This descriptive cross sectional study using non-probability convenient sampling technique consisting of 150 participants with kidney nephrolithiasis after applying selection criteria. Approval was taken from the Institutional Review and Ethical Committee (IR&EC) of Iqra National University and from the department of urology of Institute of Kidney Diseases (IKD) Peshawar. Close ended questionnaire was used to collect data and for data analysis using SSPS Version-22.

Results: In our study 150 cases of kidney nephrolithiasis with mean age 35 year, 54% with kidney stone, 60% hypertensive, 81% diabetes millets, 71% have the history of chronic kidney diseases, 86% cardiovascular disease, 67% family history of kidney stones, and 63% have the history of Recurrent UTI.

Conclusion: Obesity, hypertension, diabetes mellitus, chronic kidney disease, cardiovascular disease, positive family history of nephrolithiasis, male sex, smoking, recurrent urinary tract infections, weekly consumption of red meat, and inadequate water

intake (less than eight glasses per day) were identified as major risk factors for kidney stone formation. In contrast, the consumption of beverages such as tea and carbonated drinks showed no significant association with the development of kidney stones.

INTRODUCTION

Kidney nephrolithiasis are mineral deposits in the crusts of the kidneys and pelvis that are released or stuck to the kidney papillae. Contains transparent and normal parts and boxes where urine is supersaturated with respect to a minerals (1)

Nephrolithiasis includes several types of kidney stones with distinct chemical compositions. Calcium-containing stones are the most common, accounting for approximately 70–80% of cases, with calcium oxalate being the predominant form, followed by calcium phosphate. Struvite stones, composed of magnesium ammonium phosphate, represent about 5–15% of cases and are typically associated with urinary tract infections caused by urease-producing bacteria. Uric acid stones account for approximately 5–10%, while cysteine stones are rare, occurring in less than 1% of patients and are linked to inherited metabolic disorders. Among all types, calcium oxalate stones are the most prevalent and commonly develop on Randall's plaques located on the papillary surfaces of the kidney (2).

The development of nephrolithiasis is influenced by genetic, metabolic, and disease-related factors. Inherited and metabolic disorders associated with kidney stone formation include idiopathic hyper-calciuria, hyper-oxaluria, cystinuria (including Dent disease), medullary sponge kidney, autosomal dominant polycystic kidney disease, primary hyperparathyroidism, inflammatory bowel disease (IBD), renal tubular acidosis, and sarcoidosis. A positive family history significantly increases the risk of nephrolithiasis, with

individuals having affected first-degree relatives showing a two- to threefold higher likelihood of stone formation. Additional risk factors include obesity, diabetes mellitus, hypertension, and metabolic syndrome, all of which are associated with an increased risk of chronic kidney disease and end-stage renal disease (3).

Non-obstructive kidney stones may be asymptomatic or present only with microscopic or gross hematuria, whereas obstructive nephrolithiasis typically causes acute renal colic characterized by severe flank pain radiating to the abdomen or groin and is often accompanied by nausea, vomiting, dysuria, and hematuria. The pattern of pain depends on stone location: upper ureteral stones cause flank pain radiating to the upper abdomen, lower ureteral stones may radiate to the ipsilateral testis in males or labia in females, and stones lodged at the uretero-vesical junction commonly result in urinary urgency, frequency, and dysuria. Symptoms generally resolve after stone passage, but severe cases frequently require emergency medical attention (4-6).

Diagnosis relies on a combination of laboratory evaluation and imaging studies, with non-contrast helical computed tomography considered the gold standard for accurately determining stone size, location, and degree of obstruction. A kidney ureter bladder (KUB) radiograph can identify radiopaque stones, including calcium-containing, struvite, and cysteine stones, but cannot detect uric acid stones, which are radiolucent. Ultrasonography is often used in selected populations, such as pregnant women and children, to avoid radiation exposure (7-9).

Management of nephrolithiasis has evolved substantially over recent years and is guided by stone size, location, composition, and clinical presentation. Treatment ranges from conservative measures, including adequate hydration, analgesia, and medical expulsive therapy, to minimally invasive interventions such as extracorporeal shock wave lithotripsy,

ureteroscopy, and percutaneous nephrolithotomy. Long-term prevention focuses on dietary modification, increased fluid intake, and correction of underlying metabolic abnormalities to reduce recurrence (10).

Nephrolithiasis is a common and increasingly prevalent global health problem, affecting approximately 10–12% of the population worldwide during their lifetime. Recent epidemiological studies demonstrate a higher prevalence among males, with a rising incidence linked to obesity, diabetes, and modern lifestyle factors (11). Pakistan lies within the Afro-Asian stone belt, a region with a high prevalence of nephrolithiasis estimated at 10–16%, where environmental factors such as hot climate, chronic dehydration, low fluid intake, and dietary habits substantially contribute to the disease burden (12).

Material and methods

In this descriptive cross sectional study 150 participants with kidney nephrolithiasis included after applying the selection criteria (diagnosed with kidney nephrolithiasis were included and the suspected cases were excluded) and using non-probability convenient sampling technique. Approved was taken from the Institutional Review and Ethical Committee (IR&EC) of Iqra National University and the department of urology, Institute of Kidney Diseases (IKD) Peshawar. Introduced the close-ended questionnaire to the participants for data collection after the written inform consent sign from participants. The questions included were name, age, gender, Education, uses of beverages, Body mass index, history of cardiovascular disease, diabetes mellitus, family history of kidney nephrolithiasis, recurrent UTI, history of chronic kidney disease, daily intake of water, frequency of daily urine passing, smoking, consumption of red meat. The study duration of 4 months and using the Cochran formula for sampling size (Cochran 1987):

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n=(p)(1−p)(Z/E)2*n*=(*p*)(1−*p*)(*Z*/*E*)2 (n*n* = sample size, p*p* = prevalence of latest article, Z*Z* = confidence interval at 95% is 1.96, E*E* = standard error). Statistical analysis for data done through the SPSS version-22.

Results

Table 1. Demographics

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	35.3	—
	Minimum–Maximum	18–79	—
Gender	Male	87	58
	Female	63	42
Body Mass Index (BMI)	Normal	26	17
	Pre-obese	44	29
	Obese	80	54
Educational Status	Illiterate	44	29
	Primary	44	29
	Higher secondary	47	31
	Degree holder	15	11

The mean age of patients was 35 years with range from 18 to 79 years. Out of 150 male were 87 (58%) and female 63 (42 %). Participants with normal BMI were 26(17%), Pre-Obese 44(29%) and obese 80(54%). According to educational status 44(29%) illiterate, 44(29%) Primary schooling, 47(31%) higher secondary and 15(11%) have graduation.

Table 2: Risk Factors Associated with Kidney Nephrolithiasis

Risk Factor	Category	Frequency (n)	Percentage (%)
Chronic Kidney Disease	Yes	107	71
	No	43	29
Cardiovascular Disease	Yes	129	86
	No	21	14
Diabetes Mellitus	Yes	122	81
	No	28	19
Hypertension	Yes	90	60
	No	60	40
Family History of Kidney Stones	Yes	101	67
	No	49	33
Smoking Status	Smoker	89	59
	Non-smoker	61	41
Recurrent Urinary Tract Infection	Yes	95	63
	No	55	37
Daily Water Intake	< 8 glasses/day	80	53
	≥ 8 glasses/day	70	47
Daily Urine Frequency	≤ 5 times/day	33	22
	> 5 times/day	117	78
Use of Beverages (Tea/Coke)	≤ 3 times/day	107	71
	> 3 times/day	43	29
Red Meat Consumption	Once a week	122	81

Once a month	26	17
Never	2	2

Summarized results of table-2 shows the distribution of risk factors associated with kidney nephrolithiasis among the 150 study participants. A history of chronic kidney disease was present in 107(71%) of patients, while 129 (86%) reported cardiovascular disease. Diabetes mellitus and hypertension were observed in 122 (81%) and 90 (60%) of cases, respectively. A positive family history of kidney stones was reported by 101 (67%) of patients. Lifestyle-related risk factors were also common; 89 (59%) of participants were smokers, and 95(63%) had a history of recurrent urinary tract infections. More than half of the patients 80(53%) reported a daily water intake of less than eight glasses, whereas 117(78%) had a urine output frequency of more than five times per day. With regard to dietary habits, 107(71%) of patients consumed tea or carbonated beverages three times per day or less, and a large majority 122(81%) reported consuming red meat once per week. These findings highlight the high prevalence of metabolic, clinical, and lifestyle-related risk factors among patients with kidney nephrolithiasis.

Discussion

In this study of 150 patients with kidney nephrolithiasis, the mean age was 35 years, with a male majority (58%) and female representation (42%). A similar pattern was observed in the population-based cross-sectional study by Alshubaili et al., where out of 1,043 participants surveyed in Riyadh province, 51.1% were males and 48.9% were females, and a higher prevalence of nephrolithiasis was reported among those with hypertension and positive family history emphasizing the male predominance in stone disease (13).

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Regarding body mass index (BMI), 26 (17%) of our patients were normal weight, 44 (29%) pre-obese, and 80 (54%) obese. In contrast, the BMC Nephrology study by Guo et al. (2024) among medical staff in Qingdao, China, while not providing exact BMI categories, highlighted obesity and metabolic risk factors as important predictors of nephrolithiasis (14). This aligns with our observation that higher BMI is common in stone formers, suggesting a metabolic contribution to stone risk.

Cardiovascular disease (CVD) was present in 129 (86%) of our patients, notably higher than figures from population studies where hypertension, gout, and family history were the main significant comorbidity correlates of stone prevalence. For example, Alshubaili et al. reported hypertension as a significant correlate (20.6% stone prevalence among hypertensives vs. 8.2% in non-hypertensives) (13). We found 122 (81%) of patients had diabetes mellitus and 90 (60%) had hypertension. By contrast, in the Riyadh population, diabetes was present in 84 participants (8.1%) and hypertension in 97 (9.3%) among 1,043 surveyed, reflecting much lower community-level proportions but similar directional associations between metabolic disease and stone prevalence.

A positive family history of nephrolithiasis was reported by 101 (67%) of our participants, whereas Alshubaili et al. found 36.4% of their Riyadh cohort reported family history of kidney stones (13). This suggests stronger clustering of genetic or familial risk in our clinical sample compared to community settings.

Lifestyle risk factors were also prominent: 89 (59%) were smokers, and 95 (63%) had recurrent urinary tract infections (UTIs). In the Jazan region study by Alqahtani et al., smoking was significantly associated with stone prevalence , supporting the role of smoking as a modifiable risk factor (15). Recurrent UTIs, while variably reported in general

population studies, are a known risk for certain stone types (e.g., infection stones), and our findings indicate that infectious contributors remain significant in clinical practice.

Hydration and diet patterns in our cohort showed that 80 (53%) patients reported daily water intake <8 glasses, and 117 (78%) had frequent urine output. The Urological Science study found that 88% of stone patients consumed <2 L/day of water, directly mirroring our finding that low fluid intake is a key risk factor (16).

Concerning dietary habits, 107 (71%) consumed tea/carbonated beverages ≤3 times per day and 122 (81%) ate red meat weekly. While many observational studies do not report beverage or red meat intake in detail, the Riyadh province data indicated that overall dietary patterns including high sodium and animal protein intake are recognized risk contributors to stone formation, reinforcing that dietary habits are relevant even if the prevalence figures differ by region (13).

Several studies have identified additional risk factors for kidney stone formation, including body mass index (BMI), gender, and age etc. Future research should further investigate these remaining risk factors to better understand their contribution to kidney stone disease. Moreover, community-based awareness and educational interventions are strongly recommended to reduce the high incidence of kidney stones through lifestyle modifications such as dietary changes, smoking cessation, and increased water intake. Regular screening and routine follow-up of individuals with diabetes mellitus, hypertension, cardiovascular disease, and chronic kidney disease may facilitate early diagnosis and timely management of kidney stones, thereby preventing progression to renal failure. This is particularly important given that Pakistan ranks among the countries with a high burden of kidney stone disease, highlighting the urgent need for preventive strategies and public health interventions.

Conclusion

Obesity, hypertension, diabetes mellitus, chronic kidney disease, cardiovascular disease, positive family history of nephrolithiasis, male sex, smoking, recurrent urinary tract infections, weekly consumption of red meat, and inadequate water intake (less than eight glasses per day) were identified as major risk factors for kidney stone formation. In contrast, the consumption of beverages such as tea and carbonated drinks showed no significant association with the development of kidney stones.

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