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PREVALENCE AND CLINICAL SIGNIFICANCE OF INCIDENTALLY DETECTED UROLITHIASIS IN PATIENTS UNDERGOING ABDOMINAL-PELVIC CT SCAN

Original Research

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ABSTRACT

Background: Urolithiasis, a globally prevalent condition, is increasingly influenced by modern dietary patterns, dehydration, and environmental changes. While symptomatic stones often lead to medical attention, asymptomatic or incidentally discovered stones are frequently overlooked despite their clinical importance. Detecting such cases is crucial for early management and prevention of future complications. This study aimed to assess the prevalence, demographic trends, and clinical significance of incidentally detected urolithiasis among patients undergoing abdominal-pelvic CT scans in Peshawar, Pakistan.

Objective: To determine the frequency, demographic distribution, and associated risk factors of incidentally detected urolithiasis in patients receiving abdominal-pelvic CT scans.

Methods: A descriptive cross-sectional study was conducted over six months in both public and private hospitals in Peshawar. A total of 163 patients aged 20–60 years who underwent abdominal-pelvic CT scans for various clinical indications were included through convenient sampling. Data on demographics, lifestyle habits, medical history, and radiological findings were collected using a structured form. CT imaging was performed using GE scanners with parameters of 120–140 kVp and 5–10 mm slice thickness. Data were analyzed using SPSS version 26. Frequencies and percentages were calculated for categorical variables, while chi-square tests determined associations between demographic factors and stone characteristics ($p < 0.05$).

Results: Among 163 patients, 67 (41.1%) had incidentally detected urolithiasis, with a slight male predominance (52.8%). The 20–35-year age group accounted for 52.1% of cases. A positive family history was observed in 62.6% of patients. Key risk factors included low water intake (55.2%), high salt consumption (56.4%), and frequent oxalate-rich food intake (58.9%). Comorbidities included hypertension (20.2%), diabetes (12.9%), and dyslipidemia (14.7%). Radiologically, 46.6% of stones were renal, 41.1% ureteral, and 12.3% vesical, with 53.4% measuring 4–10 mm.

Conclusion: The study revealed a high rate of incidental urolithiasis, emphasizing the need for early detection and preventive strategies. Encouraging adequate hydration, dietary moderation, and control of metabolic risk factors can significantly reduce recurrence and disease burden. Although CT remains the gold standard for diagnosis, its judicious use is vital in low-resource settings to balance accuracy, cost, and radiation exposure.

Keywords: Abdomen Pelvis, Computed Tomography, Hydration, Incidental Findings, Kidney Stones, Urolithiasis, Urinary Tract Diseases.

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INTRODUCTION

Urolithiasis, commonly known as kidney or urinary tract stones, represents one of the most prevalent urological disorders globally. It is characterized by the formation of hard mineral deposits within the kidneys, which may extend into the ureters, bladder, or urethra. The condition poses a major public health concern due to its rising incidence and recurrence rates, driven by lifestyle, dietary, metabolic, and environmental factors (1). The global prevalence of urolithiasis ranges from 2% to 20%, with particularly high rates observed in hot and arid regions where dehydration and concentrated urine contribute to stone formation (2). In Pakistan, urolithiasis accounts for approximately 18% of all urology outpatient cases and ranks as the sixth most frequent condition requiring surgical intervention (1,2). The condition is often compounded by comorbidities such as diabetes mellitus, dyslipidemia, chronic urinary tract infections, and repeated urinary tract surgeries, which increase susceptibility to stone development (3). The epidemiological trend of urolithiasis has changed considerably over the past few decades. In the United States, the lifetime prevalence among adults has nearly tripled—from 3.2% in 1976–1980 to 8.8% in 2007–2010—with the highest rates noted among elderly populations (4). Similar findings have been reported in South Asia, where climatic and dietary factors further exacerbate stone formation. A study in Nepal revealed that calculi most frequently affect the kidneys, followed by the ureter, vesico-ureteric junction, pelvic-ureteric junction, and bladder (5). In the U.S. alone, renal colic contributes to over one million emergency department visits annually, underscoring the considerable healthcare burden of the disease (6). Additionally, a positive family history has been identified as a major risk factor in the Pakistani population, suggesting both genetic and environmental influences (7).

Imaging plays an indispensable role in the diagnosis, monitoring, and management of urinary calculi (8). Since the advent of unenhanced computed tomography (CT) in 1995, non-contrast computed tomography (NCCT) has emerged as the gold standard imaging modality for urolithiasis, offering unparalleled accuracy in identifying stone size, density, and location (9,10). Moreover, urinary tract infections (UTIs), including pyelonephritis and cystitis, frequently coexist with urolithiasis and can significantly complicate clinical outcomes, particularly among women due to their shorter urethral anatomy (11). Although rarely life-threatening, the recurrent and painful nature of urolithiasis substantially impairs quality of life and imposes a significant economic burden on healthcare systems (12). The recurrence rate may reach up to 50%, with varying incidence across different ethnic and geographical populations—ranging from 7.4% among Saudi Arabians to 29.5% among Egyptians (13,14). Multiple sociodemographic factors, including age, gender, dietary patterns, occupation, and socioeconomic status, influence the risk and recurrence of urolithiasis (15,16). The rising healthcare costs associated with this condition are alarming; in the United States, the projected annual economic burden is expected to exceed $4.57 billion by 2030 (17). Pakistan, located within the so-called “stone-forming belt,” continues to experience a prevalence of urolithiasis comparable to global figures (18). Despite its high burden, there remains limited regional data on incidentally detected urinary stones in patients undergoing abdominal and pelvic imaging, highlighting a critical gap in epidemiological surveillance and preventive strategies. Therefore, this study aims to determine the prevalence, demographic distribution, and clinical relevance of incidentally detected urolithiasis among patients undergoing abdominopelvic CT scans in Peshawar, Pakistan, thereby providing essential insights to inform early detection and management strategies for this increasingly common urological condition.

METHODS

This study employed a descriptive cross-sectional research design to determine the prevalence and clinical significance of incidentally detected urolithiasis among patients undergoing abdominal and pelvic CT scans in Peshawar, Pakistan. The study was conducted over a six-month period in both public and private hospitals of Peshawar. Ethical approval was obtained from the institutional review board prior to the commencement of data collection, and informed written consent was obtained from all participants in accordance with the Declaration of Helsinki. A total of 163 patients who met the inclusion criteria were enrolled through a convenient sampling technique. The sample size was calculated using the World Health Organization (WHO) sample size calculator, based on an anticipated frequency of 12% (7), a confidence level of 95%, and a 5% margin of error. Eligible participants included adults aged 20 to 60 years who had undergone CT scans of the abdomen and pelvis for any clinical indication and who were willing to provide informed consent. Excluded from the study were individuals with a previously established diagnosis of urolithiasis, incomplete medical records, or insufficient clinical data. Patients with severe abdominal trauma or other emergency conditions that could compromise imaging accuracy, as well as

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those who refused or later withdrew consent, were also excluded. Data collection was carried out in the CT scan units using GE CT scanners with configurations ranging from 2 to 128 slices, depending on the facility's equipment capacity. Each participant was recruited upon arrival at the CT suite, and informed consent was obtained before the procedure. Relevant biodata, clinical details, and physical activity information were recorded using a structured, de-identified data collection form to ensure confidentiality and data integrity. The standardized abdominal-pelvic CT protocol included patient preparation, supine positioning (head-first), and scanning with or without intravenous contrast, depending on the referring physician's request. The scan coverage extended from the diaphragm to the pubic symphysis, encompassing the kidneys, ureters, and urinary bladder.

During image acquisition, patients were instructed to remain still while the CT scanner's X-ray tube rotated around the abdominal region. The scanning parameters were adjusted according to patient body habitus and diagnostic requirements, with tube potential set between 120–140 kVp and tube current (mA) modulated automatically to optimize image quality while minimizing radiation exposure. Slice thickness ranged from 5 to 10 mm, depending on the specific scanning protocol. These standardized parameters ensured adequate visualization of renal and urinary tract structures for stone detection. All data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Quantitative variables such as age were summarized as mean ± standard deviation, while categorical variables—including gender distribution, anatomical site of stones, and incidental findings—were presented as frequencies and percentages. The chi-square test was applied to assess associations between categorical variables, with a p-value of less than 0.05 considered statistically significant. Results were presented in the form of tables and graphs to enhance clarity and comprehension.

RESULTS

A total of 163 individuals who underwent abdominal-pelvic CT scans were included in the study. The findings focused on demographic patterns, clinical characteristics, and radiological features associated with the incidental detection of urolithiasis. The majority of patients were aged between 20 and 35 years (52.1%), followed by 25.2% aged 46–60 years, and 22.7% aged 36–45 years, indicating a predominance of younger adults among the participants. Males constituted 52.8% of the sample, while females made up 47.2%, showing a slightly higher male representation. A positive family history of urinary stones was reported by 62.6% of the participants, whereas 37.4% had no such history. Urinary symptoms were experienced by 91.4% of patients, while 8.6% were asymptomatic. In terms of lifestyle factors, 44.8% reported a history of smoking, and 14.1% reported alcohol consumption, while the majority (85.9%) denied alcohol use. Regarding comorbidities, 38.0% of patients had no known health condition, 20.2% had hypertension, 12.9% had diabetes, and 14.7% reported hypercholesterolemia. Repeated urinary tract infections were observed in 4.3% of patients, whereas 7.4% had both diabetes and high cholesterol. Only 2.5% presented with a combination of diabetes, hypertension, and repeated urinary tract infections. Concerning physical activity, 28.8% were active, 38.0% were moderately active, and 33.1% were sedentary. A high dietary salt intake was reported by 56.4% of participants, 38.0% consumed a moderate amount, and only 5.5% reported low salt intake. In terms of hydration habits, 44.8% of patients consumed at least two liters of water daily, while 55.2% drank less. Stones were discovered incidentally in 41.1% of cases, whereas 58.9% of stones were detected in patients who were symptomatic or investigated for related complaints.

High-oxalate food consumption was common, with 58.9% reporting frequent intake, 37.4% reporting occasional consumption, and only 3.7% rarely consuming oxalate-rich foods. The primary reason for undergoing CT scanning was abdominal pain in 66.3% of patients, followed by evaluation for hematuria (13.5%), both abdominal pain and hematuria (12.9%), and routine check-ups (7.4%). Radiological assessment revealed that stones were most frequently located in the kidneys (46.6%), followed by the ureter (41.1%) and bladder (12.3%). The most common stone size was between 4 and 10 mm (53.4%), followed by stones smaller than 4 mm (30.1%) and those larger than 10 mm (16.6%). Statistical analysis demonstrated several significant associations. A strong relationship ($p = 0.02$) was observed between patient age and daily salt intake, with younger individuals more likely to report higher salt consumption. Another significant association ($p = 0.05$) existed between age and stone size, where smaller stones (<4 mm) were more frequent among younger participants, and medium-sized stones (4–10 mm) were predominant across all age groups. Larger stones (>10 mm) were relatively uncommon but were still more prevalent in younger patients than older ones. Gender differences in urinary symptoms were statistically significant ($p = 0.05$), with a slightly higher prevalence among males. Similarly, significant gender-based differences were found in health conditions ($p = 0.01$), with males more frequently exhibiting diabetes and hypercholesterolemia, whereas females had higher rates of repeated urinary tract infections and mixed metabolic disorders. Smoking history was entirely confined to males ($p = 0.00$). The association between gender and the reason for undergoing CT scanning was also statistically significant ($p = 0.007$). Males most commonly presented with abdominal pain, while females were more often evaluated for hematuria or during routine check-ups.

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Moreover, a strong correlation was observed between family history of urinary stones and stone size ($p = 0.008$), with patients having a positive family history being more likely to develop larger stones (>10 mm) compared to those without such a history.

Table 1: Distribution of Demographic and Lifestyle Characteristics Among Patients

Age Group	Frequency	Percent
20-35 years	85	52.1
36-45 years	37	22.7
46-60 years	41	25.2
Gender		
Male	86	52.8
Female	77	47.2
Family History of stone		
Yes	102	62.6
No	61	37.4
Urinary symptoms		
Yes	149	91.4
No	14	8.6
Smoking History		
Yes	73	44.8
No	90	55.2
Alcohol Consumption		
Yes	23	14.1
No	140	85.9
Total	163	100.0

Table 2: Distribution of Health Conditions, Lifestyle Factors, and Incidental Detection of Urolithiasis Among Patients

Health Condition	Frequency	Percent
Diabetes	21	12.9
Hypertension	33	20.2
High cholesterol	24	14.7
Repeated urinary tract infection	7	4.3
None	62	38.0
Both diabetes and high cholesterol	12	7.4

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Health Condition	Frequency	Percent
Diabetes, hypertension and repeated urinary tract infection	4	2.5
Physical Activity Level		
Active	47	28.8
Moderately active	62	38.0
Inactive/sedentary	54	33.1
Daily Salt Intake		
Low	9	5.5
Moderate	62	38.0
High	92	56.4
Daily Water Intake		
Yes	73	44.8
No	90	55.2
Incidental detection of Stone		
Yes	67	41.1
No	96	58.9
Total	163	100.0

Table 3: Distribution of Stone Location and Size Among Patients

Variable	Category	Frequency (n)	Percentage (%)
Location of Stone	Kidney	76	46.6
	Ureter	67	41.1
	Bladder	20	12.3
Stone Size Category	Less than 4 mm	49	30.1
	4–10 mm	87	53.4
	More than 10 mm	27	16.6
Total		163	100.0

Table 4: Cross-Tabulation of Patient Age Groups with Daily Salt Intake

Variable	Age Group (Years)	20–35	36–45	46–60	p-value
Daily Salt Intake	Low	3	0	6	0.02
	Moderate	29	18	15	
	High	53	19	20	

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Table 5: Association Between Patient Gender and Primary Reason for Undergoing CT scan

Variable	Gender of the Patient	Male (n)	Female (n)	p-value
Reason for CT scan	Abdominal pain	64	44	0.007
	Evaluation of hematuria	6	16	
	Routine check-ups	3	9	
	Both abdominal pain and evaluation of hematuria	13	8	

Table 6: Association Between Family History of Stones and Stone Size Category in Patients

Variable	Family History of Stones	Yes (n)	No (n)	p-value
Stone Size Category	Less than 4 mm	29	20	0.008
	4–10 mm	49	38	
	More than 10 mm	24	3	

Table 7: Stratification of Incidental versus Symptomatic Urolithiasis by Demographic and Clinical Factors

Variable	Category	Incidental (%)	Symptomatic (%)	p-value
Gender	Male	38 (56.7)	48 (50.0)	0.11
	Female	29 (43.3)	48 (50.0)	
Age Group (years)	20–35	36 (53.7)	49 (51.0)	0.09
	36–45	18 (27.0)	19 (19.8)	
	46–60	13 (19.3)	28 (29.2)	
Family History of Stones	Yes	43 (64.2)	59 (61.5)	0.04*
	No	24 (35.8)	37 (38.5)	
Daily Water Intake (<2L)	Yes	41 (61.2)	49 (51.0)	0.06
	No	26 (38.8)	47 (49.0)	
High Salt Intake	Yes	40 (59.7)	52 (54.2)	0.07
	Moderate/Low	27 (40.3)	44 (45.8)	
Physical Activity	Active	19 (28.4)	28 (29.2)	0.08
	Moderately Active	25 (37.3)	37 (38.5)	
	Sedentary	23 (34.3)	31 (32.3)	
Comorbidities (Any)	Present	41 (61.2)	59 (61.5)	0.10
	None	26 (38.8)	37 (38.5)	

*Significant association ($p < 0.05$)

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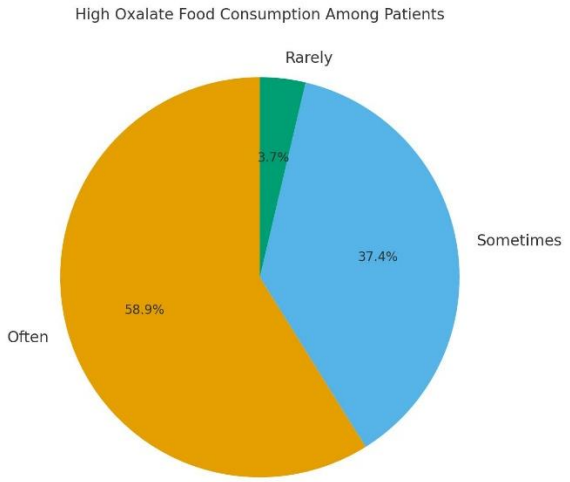


Figure 1 High Oxalate Food Consumption Among Patients

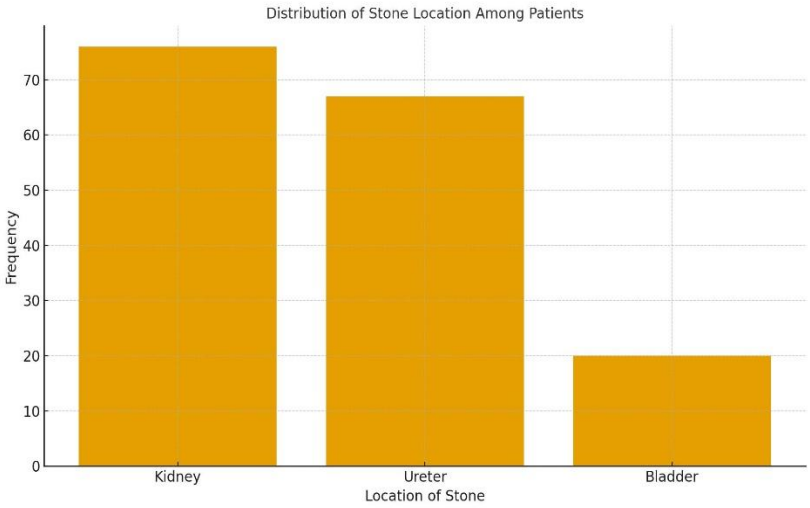


Figure 1 Distribution of Stone Location Among Patients

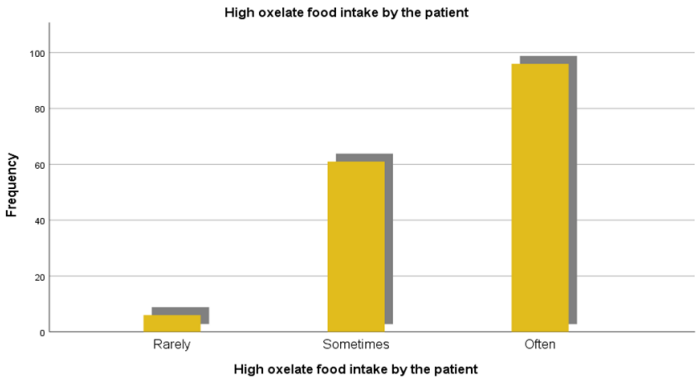


Figure 3 High Oxalate Food Intake by the Patients

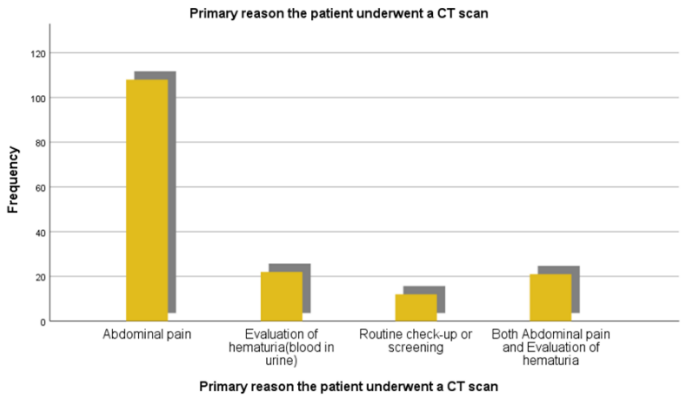


Figure 2 Primary Reason the Patients Underwent a CT scan

DISCUSSION

This study examined the prevalence and clinical characteristics of incidentally detected urolithiasis in patients undergoing abdominal-pelvic CT scans in Peshawar. The findings revealed that 41.1% of urinary stones were discovered incidentally, indicating a substantial proportion of asymptomatic individuals harboring silent stones that would have otherwise remained undiagnosed. This figure was considerably higher than the 2.8% incidental detection rate previously reported in Lahore (10,11), suggesting regional variability and potentially greater use of CT imaging for abdominal evaluation in Peshawar. Such a high prevalence underscores the importance of routine imaging in identifying subclinical disease, thereby allowing early management before complications arise. The study demonstrated a slight male predominance (52.8% males versus 47.2% females), consistent with global evidence indicating that men have approximately double the lifetime risk of developing kidney stones compared to women (12). Similar gender trends have been documented across Pakistan, including in Karachi and Lahore, where male prevalence ranged between 54% and 62% (13). The predominance among men may be attributed to greater occupational exposure to heat, dehydration, and differences in dietary protein and sodium intake. However, the narrowing gender gap observed in recent years reflects changing lifestyle patterns among women, including dietary shifts and reduced physical activity, contributing to a rising incidence of urolithiasis in both sexes. The age distribution showed that more than half of the affected patients were young adults between 20 and 35 years, suggesting that urolithiasis is increasingly affecting productive age groups. This contrasts with data from Western populations, where the peak incidence typically occurs between

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40 and 59 years (14). In Pakistan, earlier onset may be linked to poor hydration, high consumption of oxalate-rich foods, and the widespread adoption of sedentary lifestyles. Younger individuals are also more exposed to processed food and fast-food diets, which are known to contribute to hyperoxaluria and hypercalciuria, major risk factors for stone formation. These findings emphasize the need for early preventive strategies targeting dietary and behavioral factors in young adults.

Genetic predisposition emerged as a significant risk factor, with 62.6% of patients reporting a family history of urolithiasis. This aligns with global and regional findings showing that individuals with a positive family history have a markedly increased risk of stone formation (15). The inheritance of metabolic abnormalities such as hypercalciuria and hypocitraturia likely contributes to this familial pattern. Furthermore, the present study identified several modifiable lifestyle factors. High salt intake was observed in 56.4% of participants and frequent consumption of oxalate-rich foods in 58.9%, both of which are recognized dietary contributors to nephrolithiasis (16). Additionally, 55.2% of participants consumed less than two liters of water daily, which increases urinary supersaturation and predisposes to crystallization. These findings reinforce the importance of public health education aimed at promoting adequate hydration and reducing dietary sodium and oxalate intake to prevent recurrence. The study also demonstrated that comorbid conditions such as hypertension (20.2%), diabetes mellitus (12.9%), and dyslipidemia (14.7%) were common among patients with urolithiasis. These metabolic disorders are well-established risk factors, as they alter urinary composition by increasing calcium, uric acid, and oxalate excretion (17,18). This suggests that urolithiasis shares a strong metabolic component with non-communicable diseases and should be addressed as part of broader chronic disease prevention programs. Radiologically, most stones were located in the kidneys (46.6%) and ureters (41.1%), with a smaller proportion found in the bladder (12.3%), consistent with previous reports indicating a predominance of upper urinary tract calculi (19,20). The majority of detected stones were moderate in size (4–10 mm), with 30.1% measuring less than 4 mm. The widespread use of advanced CT imaging has improved the ability to detect smaller and asymptomatic stones that may not have been visualized using traditional modalities such as ultrasound or intravenous urography. Non-contrast CT remains the gold standard for stone detection because of its high diagnostic sensitivity and specificity (21,22). However, its high cost and radiation exposure present significant challenges in resource-limited settings like Pakistan, where ultrasound—although less sensitive—remains a safer and more accessible diagnostic tool.

This study holds several strengths. It provided a comprehensive overview by including both symptomatic and incidentally detected patients, enhancing the understanding of disease burden across clinical presentations. The use of CT scans ensured diagnostic accuracy and minimized false-negative results. Furthermore, the findings have practical implications for public health planning by highlighting key risk factors such as poor hydration, high salt and oxalate intake, and metabolic comorbidities. The results support the introduction of community-level preventive strategies focusing on hydration awareness, dietary modification, and routine metabolic screening for high-risk groups. Nevertheless, some limitations must be acknowledged. The study was conducted in a single city using hospital-based data, which limits its generalizability to the wider population. The use of a convenience sampling technique introduced potential selection bias, as only patients who underwent CT imaging were included, possibly overestimating prevalence among the general population. Furthermore, the study did not include stone composition analysis, which is crucial for determining the biochemical etiology and guiding individualized preventive therapy. Future studies should incorporate multi-center designs with random sampling and biochemical profiling to obtain a more representative understanding of urolithiasis in Pakistan (23). Overall, the findings highlight the growing burden of urolithiasis in Pakistan, particularly among young adults, and underscore the need for national prevention programs focused on lifestyle modification, hydration promotion, and early screening of at-risk populations. Development of standardized clinical guidelines for managing incidentally detected stones is also warranted to optimize treatment decisions and minimize unnecessary interventions. Interdisciplinary collaboration among radiologists, nephrologists, and public health practitioners can further enhance early detection, prevention, and management strategies. Broader awareness campaigns led by health authorities and educational institutions could significantly reduce disease incidence, economic costs, and patient suffering associated with urolithiasis in the Pakistani population and similar developing regions.

CONCLUSION

The findings of this study highlight that urolithiasis, often detected incidentally during abdominal-pelvic imaging, represents a growing yet largely silent health concern in Pakistan. The results reinforce the importance of proactive screening for high-risk groups and underscore that preventive measures—such as maintaining adequate hydration, adopting balanced dietary habits, and managing metabolic disorders—are essential in reducing disease burden. While computed tomography remains the gold standard for accurate detection, its use must be judiciously balanced against cost and radiation exposure, particularly in low-resource settings. Overall, the

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study emphasizes the urgent need for public health initiatives, clinical awareness, and preventive education to curb the rising prevalence of urolithiasis and promote early, cost-effective management strategies.

AUTHOR CONTRIBUTION

Author	Contribution
Afsha Shoukat	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Satia Gul	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Isfahan Tariq	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Abdul Salam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ayesha Malik	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abdul Wadood*	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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