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*Original Article*

# Examination of Renal Hydronephrosis on Diagnostic Ultrasound and Their Common Causes in Adults

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## ABSTRACT

**Background:** Hydronephrosis is a clinically important manifestation of impaired urinary drainage that may progress to renal dysfunction if the underlying obstruction is not identified and managed promptly. Ultrasonography is widely used as a first-line imaging modality because it is non-invasive, accessible, radiation-free, and capable of detecting collecting-system dilatation and associated urinary tract abnormalities. **Objective:** To evaluate the sonographic findings and common causes of renal hydronephrosis among adult patients undergoing diagnostic ultrasound examination. **Methods:** This descriptive cross-sectional study was conducted in the Department of Radiology, Allied Hospital, Faisalabad, from June to September 2022. A total of 50 adult patients aged 21–60 years with sonographic evidence of hydronephrosis were included through convenience sampling. Demographic data, presenting complaints, clinical observations, ultrasonographic findings, and final diagnoses were recorded using a structured proforma. Data were analyzed using SPSS version 16, and categorical variables were summarized as frequencies and percentages. **Results:** Of 50 patients, 26 (52.0%) were male and 24 (48.0%) were female. Most patients were aged 21–40 years, accounting for 31 cases (62.0%). The most common presenting complaint was right loin pain in 10 patients (20.0%). The leading ultrasound findings were right renal mild hydronephrosis in 15 patients (30.0%), hydroureter in 10 patients (20.0%), and bilateral mild hydronephrosis in 7 patients (14.0%). Stone-related obstruction was the dominant diagnostic category, accounting for 39 patients (78.0%), with right lower ureteric stone with renal stone in 12 patients (24.0%), right lower ureteric stone alone in 11 patients (22.0%), and left lower ureteric stone in 6 patients (12.0%). **Conclusion:** Ultrasonography effectively identified hydronephrosis and its associated causes, with ureteric and renal calculi forming the principal diagnostic burden among adult patients. **Keywords:** Hydronephrosis, Ultrasonography, Ureteric Stone, Renal Stone, Hydroureter, Obstructive Uropathy.

## INTRODUCTION

Hydronephrosis is a clinically important manifestation of impaired urinary drainage, characterized by dilatation of the renal pelvis and calyceal system due to partial or complete obstruction of urine flow. In adults, this condition may remain clinically silent in slowly progressive cases or may present acutely with flank pain, loin pain, hematuria, urinary tract infection, nausea, vomiting, or features of renal dysfunction when obstruction is severe or bilateral (1). Because persistent obstruction can increase intrarenal pressure, impair renal perfusion, and eventually contribute to irreversible renal parenchymal damage, early identification of hydronephrosis and its underlying cause is essential for timely clinical management (2).

The causes of hydronephrosis in adults are diverse and may be intrinsic, extrinsic, or functional. Intrinsic obstruction commonly includes renal stones, ureteric stones, ureteric strictures, blood clots, or masses within the urinary tract, whereas extrinsic compression may result from pelvic tumors, retroperitoneal

fibrosis, pregnancy-related ureteric compression, or prostatic enlargement in older male patients (3). Functional causes, including vesicoureteral reflux and impaired bladder emptying, may also produce dilatation of the collecting system. Among adult patients, renal and ureteric calculi are frequently reported as major causes of obstructive uropathy, while benign prostatic hyperplasia is an important contributor among males, particularly with increasing age (4,5).

Ultrasonography is widely used as a first-line imaging modality for evaluating suspected hydronephrosis because it is non-invasive, readily available, repeatable, relatively inexpensive, and free from ionizing radiation (6). It allows direct visualization of renal pelvic and calyceal dilatation, assessment of laterality and severity, and identification of associated findings such as hydroureter, renal calculi, ureteric stones, vesical stones, ectopic kidney, and prostatic enlargement. Although computed tomography and magnetic resonance imaging may provide additional anatomical detail in selected cases, ultrasound remains particularly valuable in routine clinical settings where rapid screening and follow-up are required (7,8).

Despite the established diagnostic value of ultrasonography, local data on the sonographic patterns and common causes of adult hydronephrosis remain limited in many hospital-based populations. Variation in patient age, sex distribution, referral patterns, stone burden, infection rates, and access to imaging may influence the observed frequency of different etiologies. Therefore, documenting local patterns is clinically useful for improving diagnostic suspicion, prioritizing ultrasound evaluation, and guiding early referral for urological management. Previous adult studies have emphasized that hydronephrosis is not a diagnosis in isolation but a radiological sign requiring systematic evaluation of the underlying cause, severity, and associated urinary tract abnormalities (9,10).

In this context, the present study was designed using a PICO-oriented framework in which the population comprised adult patients presenting for abdominal and kidney-ureter-bladder ultrasonography with suspected or diagnosed hydronephrosis; the index assessment was diagnostic ultrasonography; the comparison of interest involved variation across sex and age groups; and the outcomes were sonographic findings and final identified causes of hydronephrosis. Therefore, the objective of this study was to evaluate the sonographic findings and common causes of renal hydronephrosis among adult patients examined at the Department of Radiology, Allied Hospital, Faisalabad, and to describe their distribution according to age and sex.

## MATERIALS AND METHODS

A descriptive cross-sectional observational study was conducted in the Department of Radiology, Allied Hospital, Faisalabad, Pakistan, over a four-month period from June 2022 to September 2022. The study was designed to evaluate the sonographic findings and common causes of renal hydronephrosis among adult patients undergoing abdominal and kidney-ureter-bladder ultrasonography. A cross-sectional design was appropriate because all clinical and sonographic variables were assessed at a single point of diagnostic evaluation, allowing estimation of the frequency and distribution of hydronephrosis-related findings within the study population.

The study population consisted of adult male and female patients aged 21 to 60 years who presented to the radiology department for abdominal and KUB ultrasound examination and were identified as having hydronephrosis on ultrasonography. Participants were selected using a non-probability convenience sampling technique. Patients were included if they were older than 20 years, presented with symptoms or clinical suspicion suggestive of renal or urinary tract pathology, and showed sonographic evidence of hydronephrosis during the examination (11). Patients outside the defined adult age range, patients without sonographic evidence of hydronephrosis, and patients whose clinical or ultrasound information was incomplete for the study variables were not included. A total of 50 patients fulfilled the eligibility criteria and were enrolled during the study period.

Before data collection, informed consent was obtained from each participant or guardian where applicable. Patient confidentiality was maintained throughout the study by recording data on a structured proforma without using information unnecessary for analysis. The proforma captured demographic characteristics, including age and sex, along with presenting complaints and relevant clinical observations. Clinical variables included back pain, flank pain, urinary frequency, hematuria, lower abdominal pain, urinary tract infection, nocturia, dysuria, loin pain, suprapubic pain, urine retention, iliac fossa pain, swelling, fever, nausea, vomiting, hypertension, diabetes, kidney stones, and ureteric or bladder stones.

All ultrasound examinations were performed using a 3–5 MHz curvilinear transducer. The examination was conducted with the patient initially in the supine position, and both sagittal and transverse planes were used to assess the kidneys and urinary tract. The right and left kidneys were examined for renal pelvic and calyceal dilatation, renal stones, renal pelvic stones, ectopic kidney, hydroureter, and severity of hydronephrosis. The urinary bladder, ureters where visualized, and prostate in male patients were also assessed to identify associated obstructive causes such as ureteric stone, vesical stone, benign prostatic hyperplasia, ureteric mass, or other pelvic abnormalities. Sonographic findings were categorized as bilateral hydronephrosis, bilateral mild hydronephrosis, bilateral moderate hydronephrosis, renal pelvic stone, upper ureteric stone, ectopic kidney, hydroureter, severe hydronephrosis with hydroureter, right renal hydronephrosis, renal stone with mild hydronephrosis, and right renal mild hydronephrosis.

The main outcome variable was the final sonographic diagnosis responsible for hydronephrosis. Final diagnostic categories included benign prostatic hyperplasia, bilateral renal stones, cystitis, left renal pelvic stone with upper-third ureteric stone, left lower ureteric stone, right renal stone, left ovarian cyst, left renal stone, psoas muscle abscess, right lumbar mass, right ectopic kidney, right lower ureteric stone, ureteric mass, vesical stone, and right lower ureteric stone with renal stone. Hydronephrosis was operationally defined as sonographic dilatation of the renal pelvis with or without calyceal dilatation, and hydroureter was defined as sonographic dilatation of the ureter associated with urinary tract obstruction. Age was grouped into four categories: 21–30 years, 31–40 years, 41–50 years, and 51–60 years. Sex was recorded as male or female. Presenting complaints, clinical observations, ultrasound findings, and final diagnoses were recorded as categorical variables.

To reduce information bias, data were collected using a structured and pretested proforma containing predefined clinical and ultrasound variables. Each participant underwent a standardized abdominal and KUB ultrasound assessment using the same general scanning approach. Demographic, clinical, and imaging data were recorded immediately after assessment to minimize transcription error. Confounding was addressed descriptively by stratifying findings according to age group and sex, allowing comparison of diagnostic patterns across clinically relevant patient subgroups. Because the study was descriptive and based on convenience sampling, inferential interpretation was limited to observed associations within the enrolled study population.

The sample size consisted of 50 adult patients examined during the defined four-month study period who met the eligibility criteria. Data were entered and analyzed using Statistical Package for the Social Sciences version 16. Categorical variables were summarized as frequencies and percentages. Gender distribution, age-group distribution, presenting complaints, associated clinical observations, ultrasound findings, and final diagnoses were tabulated. Associations between sex and final diagnosis and between age group and final diagnosis were assessed using chi-square testing, with statistical significance considered at $p < 0.05$. Missing or incomplete entries for key variables were excluded from the corresponding analysis. No imputation was applied because all reported analyses were based on observed categorical data.

Ethical principles were followed during patient recruitment, consent, ultrasound examination, and data handling. Participation was voluntary, informed consent was obtained before enrollment, and patient information was kept confidential. The ultrasound examination was non-invasive and formed part of the

diagnostic assessment of patients presenting with suspected renal or urinary tract pathology. Data integrity was maintained through use of a single structured data collection sheet, consistent variable definitions, direct recording of ultrasound findings, and statistical analysis using predefined categorical groupings.

## RESULTS

A total of 50 adult patients with sonographic evidence of hydronephrosis were included. Males represented a slightly larger proportion of the sample than females, with 26 male patients (52.0%) and 24 female patients (48.0%). The largest age subgroup was 31–40 years, comprising 16 patients (32.0%), followed by 21–30 years with 15 patients (30.0%). Together, patients aged 21–40 years accounted for 31 of 50 cases (62.0%), indicating that most cases in this sample occurred in younger and middle adult age groups.

*Table 1. Demographic Characteristics of Patients with Hydronephrosis*

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Sex** | Male | 26 | 52.0 |
| | Female | 24 | 48.0 |
| **Age group** | 21–30 years | 15 | 30.0 |
| | 31–40 years | 16 | 32.0 |
| | 41–50 years | 12 | 24.0 |
| | 51–60 years | 7 | 14.0 |
| **Total** | | 50 | 100.0 |

The most frequent presenting complaint was right loin pain, reported by 10 patients (20.0%). Urinary tract infection and left loin pain were reported by 6 patients (12.0%). Hematuria, urinary frequency, and right loin pain with urinary tract infection were each observed in 4 patients (8.0%). Less frequent symptoms included back pain, flank pain, lower abdominal pain, nocturia/dysuria, lower back pain, suprapubic pain, urinary retention, and iliac fossa pain, each reported by 2 patients (4.0%). Among associated clinical observations, ureteric and bladder stones were the most frequent, present in 20 patients (40.0%), followed by kidney stones in 10 patients (20.0%). Hypertension and diabetes were each present in 5 patients (10.0%).

*Table 2. Presenting Complaints and Associated Clinical Observations*

| Variable Group | Finding | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Presenting complaints** | Back pain | 2 | 4.0 |
| | Flank pain | 2 | 4.0 |
| | Urinary frequency | 4 | 8.0 |
| | Hematuria | 4 | 8.0 |
| | Lower abdominal pain | 2 | 4.0 |
| | Urinary tract infection | 6 | 12.0 |
| | Nocturia/dysuria | 2 | 4.0 |
| | Left loin pain | 6 | 12.0 |
| | Right loin pain | 10 | 20.0 |
| | Right loin pain + urinary tract infection | 4 | 8.0 |
| | Lower back pain | 2 | 4.0 |
| | Suprapubic pain | 2 | 4.0 |
| | Urinary retention | 2 | 4.0 |
| | Iliac fossa pain | 2 | 4.0 |
| **Associated observations** | Swelling | 2 | 4.0 |
| | Fever | 2 | 4.0 |
| | Nausea and vomiting | 2 | 4.0 |
| | Hypertension | 5 | 10.0 |
| | Diabetes | 5 | 10.0 |
| | Kidney stones | 10 | 20.0 |
| | Ureteric and bladder stones | 20 | 40.0 |
| | Pain | 4 | 8.0 |

On ultrasonography, right renal mild hydronephrosis was the most common finding, documented in 15 patients (30.0%). Hydroureter was identified in 10 patients (20.0%), while bilateral mild hydronephrosis was observed in 7 patients (14.0%). Renal stone with right mild hydronephrosis was present in 5 patients (10.0%), and right renal hydronephrosis was observed in 3 patients (6.0%). Less frequent findings

included bilateral hydronephrosis, bilateral moderate hydronephrosis, upper ureteric stone, and severe left hydronephrosis with hydroureter, each present in 2 patients (4.0%). Renal pelvic stone and ectopic kidney were each identified in 1 patient (2.0%).

*Table 3. Ultrasonographic Findings Among Patients With Hydronephrosis*

| Ultrasonographic Finding | Frequency (n) | Percentage (%) |
|---|---|---|
| **Bilateral hydronephrosis** | 2 | 4.0 |
| **Bilateral mild hydronephrosis** | 7 | 14.0 |
| **Bilateral moderate hydronephrosis** | 2 | 4.0 |
| **Renal pelvic stone** | 1 | 2.0 |
| **Upper ureteric stone** | 2 | 4.0 |
| **Ectopic kidney** | 1 | 2.0 |
| **Hydroureter** | 10 | 20.0 |
| **Severe left hydronephrosis + hydroureter** | 2 | 4.0 |
| **Right renal hydronephrosis** | 3 | 6.0 |
| **Renal stone + right mild hydronephrosis** | 5 | 10.0 |
| **Right renal mild hydronephrosis** | 15 | 30.0 |
| **Total** | 50 | 100.0 |

The most frequent final diagnosis was right lower ureteric stone with renal stone, observed in 12 patients (24.0%). Right lower ureteric stone alone was the second most frequent diagnosis, identified in 11 patients (22.0%), followed by left lower ureteric stone in 6 patients (12.0%) and benign prostatic hyperplasia in 4 patients (8.0%). Bilateral renal stones, cystitis, left renal pelvic stone with upper-third ureteric stone, right renal stone, left renal stone, and vesical stone were each reported in 2 patients (4.0%). Single-case diagnoses included left ovarian cyst, psoas muscle abscess, right lumbar mass, right ectopic kidney, and ureteric mass, each accounting for 2.0% of the sample.

*Table 4. Final Sonographic Diagnoses*

| Final Diagnosis | Frequency (n) | Percentage (%) |
|---|---|---|
| **Benign prostatic hyperplasia** | 4 | 8.0 |
| **Bilateral renal stones** | 2 | 4.0 |
| **Cystitis** | 2 | 4.0 |
| **Left renal pelvic stone + upper-third ureteric stone** | 2 | 4.0 |
| **Left lower ureteric stone** | 6 | 12.0 |
| **Right renal stone** | 2 | 4.0 |
| **Left ovarian cyst** | 1 | 2.0 |
| **Left renal stone** | 2 | 4.0 |
| **Psoas muscle abscess** | 1 | 2.0 |
| **Right lumbar mass** | 1 | 2.0 |
| **Right ectopic kidney** | 1 | 2.0 |
| **Right lower ureteric stone** | 11 | 22.0 |
| **Ureteric mass** | 1 | 2.0 |
| **Vesical stone** | 2 | 4.0 |
| **Right lower ureteric stone + renal stone** | 12 | 24.0 |
| **Total** | 50 | 100.0 |

For inferential analysis, final diagnosis was compared across sex and age group. The association between sex and final diagnosis showed a Pearson chi-square value of 46.280 with 15 degrees of freedom and $p < 0.001$. The likelihood ratio was 62.030 with 15 degrees of freedom and $p < 0.001$. The association between age group and final diagnosis showed a Pearson chi-square value of 109.722 with 45 degrees of freedom and $p < 0.001$, while the likelihood ratio was 103.801 with 45 degrees of freedom and $p < 0.001$. Sparse category distribution was present in both analyses, with expected cell counts below 5 in 93.8% of cells for the sex-based comparison and 100.0% of cells for the age-group comparison.

*Table 5. Association of Sex and Age Group With Final Diagnosis*

| Association Tested | Statistical Test | Test Statistic | df | p-value |
|---|---|---|---|---|
| **Sex × final diagnosis** | Pearson chi-square | 46.280 | 15 | <0.001 |
| **Sex × final diagnosis** | Likelihood ratio | 62.030 | 15 | <0.001 |
| **Age group × final diagnosis** | Pearson chi-square | 109.722 | 45 | <0.001 |
| **Age group × final diagnosis** | Likelihood ratio | 103.801 | 45 | <0.001 |

Overall, the results show that stone-related obstruction dominated the diagnostic profile. When right lower ureteric stone with renal stone (24.0%), right lower ureteric stone alone (22.0%), left lower ureteric stone (12.0%), bilateral renal stones (4.0%), right renal stone (4.0%), left renal stone (4.0%), left renal

pelvic stone with upper-third ureteric stone (4.0%), and vesical stone (4.0%) were considered together, stone-related diagnoses accounted for 39 of 50 patients (78.0%). Benign prostatic hyperplasia accounted for 8.0%, while inflammatory, anatomical, mass-related, and other less frequent diagnoses collectively represented the remaining cases. These findings indicate that ureteric and renal calculi were the leading sonographic causes associated with hydronephrosis in this patient group.

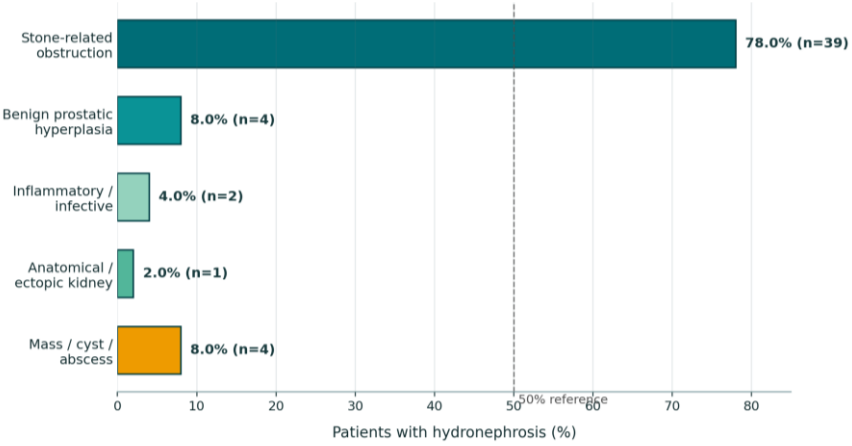


*Figure 1. Etiological Gradient of Sonographic Hydronephrosis Diagnoses*

Stone-related obstruction showed a dominant etiological burden, accounting for 39 of 50 patients (78.0%), markedly exceeding all other diagnostic groups. Benign prostatic hyperplasia and mass/cyst/abscess-related causes each accounted for 4 patients (8.0%), while inflammatory/infective causes represented 2 patients (4.0%) and anatomical/ectopic kidney-related causes represented 1 patient (2.0%). This distribution demonstrates that calculous obstruction was the principal sonographic diagnostic pattern associated with hydronephrosis in the study population, with non-stone causes forming a comparatively small but clinically relevant minority.

## DISCUSSION

The present study demonstrates that hydronephrosis in this adult hospital-based sample was predominantly associated with obstructive stone disease. Among 50 patients evaluated by ultrasonography, stone-related diagnoses accounted for 39 cases, representing 78.0% of the total diagnostic profile. The largest single diagnostic category was right lower ureteric stone with renal stone, observed in 24.0% of patients, followed by right lower ureteric stone alone in 22.0% and left lower ureteric stone in 12.0%. This pattern indicates that ureteric calculi, particularly lower ureteric stones, were the leading identifiable causes of hydronephrosis in the study population. This finding is clinically plausible because ureteric obstruction directly increases upstream urinary pressure, resulting in dilatation of the ureter, renal pelvis, and calyceal system. The high proportion of stone-related obstruction also supports the role of ultrasound as an accessible first-line investigation for detecting hydronephrosis and identifying associated calculi, hydroureter, and renal pelvic dilatation in symptomatic adults (12,13).

The age distribution showed that most patients were within the 21–40-year age range, with 30.0% in the 21–30-year group and 32.0% in the 31–40-year group. Together, these two age groups represented 62.0% of all cases. This concentration of cases among younger and middle-aged adults may reflect the strong contribution of urinary stone disease in this sample, as stone formation is frequently encountered in economically and socially active adult age groups (14). However, because the study used a descriptive cross-sectional design and convenience sampling, these findings should be interpreted as the distribution of diagnosed cases within the enrolled sample rather than as population-level incidence or risk. The slightly higher proportion of males, 52.0% compared with 48.0% females, also suggests a modest male

predominance, but the difference was small and should not be overinterpreted as evidence of a strong sex-based risk difference.

The symptom profile was consistent with obstructive urinary tract pathology. Right loin pain was the most common presenting complaint, affecting 20.0% of patients, while left loin pain and urinary tract infection were each documented in 12.0%. Hematuria and urinary frequency were each present in 8.0% of cases. These symptoms are clinically relevant because loin or flank pain often reflects acute ureteric obstruction, while hematuria may accompany calculous disease due to mucosal irritation. Urinary tract infection may either coexist with obstruction or occur secondary to urinary stasis, making its recognition important in patients with hydronephrosis (15). The associated observation profile further reinforces this interpretation, as ureteric and bladder stones were recorded in 40.0% of patients and kidney stones in 20.0%, making calculous disease the dominant clinical association in the cohort.

Ultrasonographic findings further clarified the pattern of disease. Right renal mild hydronephrosis was the most frequent ultrasound finding, present in 30.0% of patients, followed by hydroureter in 20.0% and bilateral mild hydronephrosis in 14.0%. The predominance of mild hydronephrosis may indicate that many cases were detected before progression to severe collecting-system dilatation, supporting the practical value of early ultrasound assessment. Hydroureter in one-fifth of patients is particularly important because ureteric dilatation often helps localize obstruction below the renal pelvis, especially in patients with lower ureteric stones (16). Severe left hydronephrosis with hydroureter was less common, observed in 4.0%, suggesting that advanced obstructive dilatation was present only in a minority of cases.

Benign prostatic hyperplasia accounted for 8.0% of final diagnoses. Although this proportion was smaller than stone-related obstruction, it remains clinically meaningful because bladder outlet obstruction in adult males can produce bilateral upper tract dilatation, urinary retention, recurrent infection, and renal impairment if untreated. In the current sample, the relatively low proportion of BPH may be partly explained by the age structure, as only 14.0% of patients were aged 51–60 years, while most participants were younger adults. This age distribution likely favored stone-related etiologies over prostatic obstruction. Non-stone diagnoses, including cystitis, ureteric mass, vesical stone, ectopic kidney, ovarian cyst, psoas abscess, and lumbar mass, were less frequent individually but highlight the importance of systematic evaluation beyond the kidney alone when hydronephrosis is identified.

The inferential analysis showed statistically significant associations between final diagnosis and both sex and age group, with p-values reported as less than 0.001. However, these findings must be interpreted carefully because the diagnostic categories were numerous relative to the sample size. The expected cell count criteria for chi-square testing were not met, with 93.8% of cells below 5 in the sex-by-diagnosis analysis and 100.0% of cells below 5 in the age-group-by-diagnosis analysis. This sparse distribution limits the reliability of conventional chi-square interpretation. From a clinical and analytical perspective, the descriptive pattern is more informative than the nominal significance level: stone-related causes dominated across the sample, whereas BPH and other non-stone causes formed smaller diagnostic subgroups.

The findings are consistent with the broader clinical understanding that adult hydronephrosis is most often a radiological sign of underlying obstruction rather than a final diagnosis by itself (17). In adult populations, renal and ureteric stones are frequently recognized causes, while prostatic enlargement, tumors, strictures, inflammatory conditions, and congenital or anatomical abnormalities may also contribute depending on patient age and clinical context (18,19). The present results align particularly well with literature emphasizing calculous obstruction as a major contributor to adult hydronephrosis and reinforce the importance of identifying the level and cause of obstruction during ultrasound examination. Because ultrasound can detect collecting-system dilatation, renal stones, bladder distension, prostatic enlargement, and associated hydroureter without radiation exposure, it remains especially useful as an initial investigation in patients presenting with loin pain, urinary symptoms, hematuria, or suspected obstructive uropathy (20,21).

This study has several strengths. It focuses on a clinically relevant and commonly encountered radiological problem, includes both male and female adult patients, and reports symptoms, associated observations, ultrasound findings, and final diagnoses in a structured manner. The use of abdominal and KUB ultrasonography reflects real-world diagnostic practice in a hospital radiology department. The dataset also provides useful local evidence showing that stone-related obstruction was the dominant sonographic cause of hydronephrosis in the evaluated adult population.

The study also has limitations that influence interpretation. The sample size was small, and the use of convenience sampling limits generalizability beyond the study setting. The cross-sectional design allows description of sonographic patterns but does not establish incidence, causality, treatment outcomes, recurrence, or long-term renal function changes. The large number of final diagnostic categories created sparse cells for association testing, reducing the reliability of chi-square-based inference. Severity grading of hydronephrosis was reported in ultrasound findings but was not consistently linked with each final diagnosis, symptom group, or laterality pattern. Important clinical variables such as serum creatinine, estimated glomerular filtration rate, urine analysis, stone size, exact obstruction level, symptom duration, treatment received, and follow-up outcome were not integrated into the analysis. These factors would have strengthened clinical interpretation by showing whether specific ultrasound findings were associated with functional impairment or more severe obstruction.

Overall, the study indicates that ultrasound identified a predominantly calculous pattern of hydronephrosis among adult patients, with ureteric and renal stones forming the major diagnostic burden. The clinical presentation was mainly pain- and urinary-symptom based, and the most common imaging findings were right renal mild hydronephrosis and hydroureter. The results support the practical value of ultrasound as an initial imaging modality for adult patients with suspected obstructive urinary tract disease, particularly in settings where rapid, non-invasive, and radiation-free assessment is needed. Future analyses using larger samples, grouped diagnostic categories, standardized hydronephrosis grading, renal function correlation, and follow-up outcomes would provide stronger evidence regarding severity, prognosis, and management pathways.

## CONCLUSION

Ultrasonography was an effective first-line imaging modality for identifying hydronephrosis and its associated causes among adult patients in this cross-sectional study. Among the 50 evaluated patients, stone-related obstruction was the predominant diagnostic pattern, accounting for 39 cases (78.0%), with right lower ureteric stone with renal stone (24.0%), right lower ureteric stone alone (22.0%), and left lower ureteric stone (12.0%) forming the leading causes. Most patients were aged 21–40 years (62.0%), and males represented a slightly higher proportion of cases than females (52.0% versus 48.0%). The most frequent sonographic findings were right renal mild hydronephrosis (30.0%), hydroureter (20.0%), and bilateral mild hydronephrosis (14.0%), while right loin pain was the most common presenting complaint (20.0%). These findings indicate that ureteric and renal calculi were the major contributors to adult hydronephrosis in this study population, while benign prostatic hyperplasia, inflammatory causes, anatomical abnormalities, and mass-related conditions formed smaller but clinically important diagnostic groups.

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