Cureus
Part of SPRINGER NATURE

Open Access Original Article

Computed Tomography of the Kidneys, Ureters, and Bladder Findings in Patients Presenting With Acute Flank Pain at the Advanced Diagnostic Centre in Kassala State, Sudan: A Prospective Cross-Sectional Study

Review began 11/06/2026
Review ended 11/09/2026
Published 11/14/2026

© **Copyright** 2026
Ali et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.119649

Mohamed Ali [1], Mahil Abdalla [2], Mohamed Adam [3], Ragda Abdallah [4], Mohamed A. Abdelrahim [5], Abduraheem Farah [5], Najla Mohammed [6], Mohamed Samir Yasin Ibrahim [7], Mohamed Awad Alkareem [8], Alsawi Yusuf [9]

1. Radiology, Sudan Medical Specialization Board, Khartoum, SDN 2. General Practice, Hull University Teaching Hospitals NHS Trust, Kingston Upon Hull, GBR 3. Diagnostic Radiology, Dr. Sulaiman Al Habib Medical Group, Riyadh, SAU 4. Paediatrics, Hull University Teaching Hospitals NHS Trust, Kingston upon Hull, GBR 5. Anatomical Sciences, St. George's University School of Medicine, St. George, GRD 6. Vascular Surgery, Norfolk and Norwich University Hospital NHS Foundation Trust, Norwich, GBR 7. Pathophysiology, St. George's University School of Medicine, St. George, GRD 8. Radiology, Hull Royal Infirmary, Hull, GBR 9. Radiology, University of Kordofan, Kordofan, SDN

Corresponding author: Mahil Abdalla, dr.mahil.abdalla@gmail.com

Abstract

Background: Acute flank pain has urinary and extraurinary causes. This study assessed computed tomography of the kidneys, ureters, and bladder (CT KUB) findings in patients with acute flank pain at the Advanced Diagnostic Centre in Kassala State, Sudan, and compared them with ultrasound (US) findings.

Methods: This prospective cross-sectional study included 184 patients with acute flank pain who underwent US before CT KUB between October 2024 and January 2025. Demographic and radiological data were collected from patient records. US findings were compared with CT KUB, and positive and negative percent agreement were calculated. McNemar's test was used to compare the two modalities; Fisher's exact and chi-square tests were used for associations with gender and age group, respectively.

Results: Of 184 patients, 127 (69.0%) were male and 57 (31.0%) were female; mean age was 40.5 ± 17 years. Abnormal findings were identified in 170 patients (92.4%): 22 (12.0%) were detected only by CT KUB, 14 (7.6%) only by US and 134 (72.8%) by both modalities. Compared with CT KUB, US showed positive percent agreement of 85.9% (134/156) and negative percent agreement of 50.0% (14/28). Hydronephrosis and renal stones were the most common findings. Incidental findings were detected in 65 patients (35.3%).

Conclusion: CT KUB detected important urinary and extraurinary abnormalities in patients with acute flank pain and detected selected pathologies more often than US, while US provided complementary information, particularly on hydronephrosis. As computed tomography was the comparator rather than an independent reference standard, these results reflect agreement between modalities rather than diagnostic accuracy.

Categories: Urology, Radiology
Keywords: ct kub, flank pain, hydronephrosis (hdn), incidental imaging findings, renal and/ureteric stones, ultrasonography (usg)

Introduction

Acute flank pain is a common presenting complaint in both primary and secondary care settings. Although flank pain has a broad range of possible etiologies, urinary tract stone disease and hydronephrosis constitute a substantial clinical burden. In some patients, however, an alternative diagnosis or no definite diagnosis may also be found [1].

In addition to urolithiasis, other important urinary causes of flank pain include renal cysts, atrophic kidney, and ureteric stricture. Extraurinary conditions such as appendicitis, gallbladder disease, hepatic cysts, and ovarian cysts may also present with flank pain, making accurate imaging assessment essential for appropriate diagnosis and management [2].

Multidetector computed tomography of the kidneys, ureters, and bladder (CT KUB) is considered the gold standard investigation for stones in patients presenting with acute flank pain, with reported sensitivity of 90-97% and specificity of 86-100% [3,4]. Modern imaging studies have also suggested relatively low radiation doses for low-dose CT protocols [5].

How to cite this article
Ali M, Abdalla M, Adam M, et al. (November 14, 2026) Computed Tomography of the Kidneys, Ureters, and Bladder Findings in Patients Presenting With Acute Flank Pain at the Advanced Diagnostic Centre in Kassala State, Sudan: A Prospective Cross-Sectional Study. Cureus 18(11): e119649. DOI 10.7759/cureus.119649

Ultrasound (US), on the other hand, is widely available, cost-effective, radiation-free, and independent of kidney function. Its sensitivity for detecting ureteric calculi is variable, although it is particularly useful for demonstrating indirect signs of obstruction such as hydronephrosis [5,6]. However, US may be less sensitive than CT for smaller stones and for some ureteric pathologies [6,7].

In low-resource settings such as Sudan, understanding the relationship between CT KUB and US findings may help improve diagnostic pathways while balancing diagnostic accuracy, radiation exposure, and resource utilization. There is a scarcity of local data on flank pain among Sudanese patients. Therefore, the primary aim of this study was to describe the urinary and extraurinary CT KUB findings, including incidental findings, in patients presenting with acute flank pain at the Advanced Diagnostic Centre in Kassala State, Sudan. The secondary aims were to describe the demographic characteristics of these patients and to compare US findings with CT KUB findings, including patient-level agreement between US and CT KUB for detecting any abnormality, rather than urolithiasis specifically. Ureteric stone location was recorded, but evaluation of stone size and degree of obstruction was not a planned objective.

Materials And Methods

Study design and setting

This prospective cross-sectional institution-based study was conducted at the Advanced Diagnostic Centre in Kassala State, Sudan, from October 2024 to January 2025. The center is a major diagnostic facility in Kassala State and serves a large population.

Study population and eligibility criteria

The study population included patients presenting with acute flank pain during the study period.

Inclusion Criteria

Patients were included if they met all of the following criteria: presentation with acute flank pain; US performed before CT KUB; CT KUB performed as part of the diagnostic assessment; and complete patient records available for data extraction.

Exclusion Criteria

Patients were excluded if they had incomplete records, previous urological surgery, or pregnancy.

Sampling and sample size

A total-coverage sampling approach was used, including all eligible patients presenting during the study period. A total of 225 patients were initially identified, of whom 184 had complete records and were included in the final analysis; the remaining 41 were excluded because of incomplete records.

Data collection

Data were collected using a structured data collection form that included demographic data, CT KUB findings and US findings. The data collection forms were completed from patients' records. The CT scanner used in this study was the SOMATOM go.Now CT scanner by Siemens Healthineers. Non-contrast CT KUB was performed, and US was performed before CT KUB. CT acquisition parameters and US technical details were not collected. All imaging studies were reviewed descriptively by an experienced radiologist. Findings were recorded as present or absent, as stated in the radiology reports; hydronephrosis was not graded and stone size was not recorded. As US was performed before CT KUB, US findings were reported without knowledge of the CT results. The interval between the two examinations and the reason for requesting CT KUB after US were not recorded.

Study variables

The independent variables were age and gender. The dependent variables were CT KUB findings and US findings.

Statistical analysis

Descriptive data were analyzed using IBM SPSS Statistics for Windows, Version 26 (Released 2018; IBM Corp., Armonk, New York, United States). The analyzed data were presented in tables and figures. McNemar's chi-square test with continuity correction was used to compare CT KUB and US findings, as both were performed in the same patients. Fisher's exact test was used for the association between radiological findings and gender, because one expected cell count was below 5, and the chi-square test for the association with age group, with the Fisher-Freeman-Halton exact test as a check because two expected counts were below 5. CT KUB was used as the comparator for US. As CT KUB is not an independent reference standard for all abnormalities, patient-level positive percent agreement (the proportion of patients with any

abnormality on CT KUB who also had an abnormality on US) and negative percent agreement (the proportion of patients with no abnormality on CT KUB who also had a normal US) were calculated instead of sensitivity and specificity, with exact (Clopper-Pearson) 95% confidence intervals (CIs). McNemar's tests, the exact tests, the age-group chi-square test and the CIs were calculated from the tabulated patient counts using Python, version 3.13 (Python Software Foundation), with the SciPy library, version 1.18. Patients with incomplete records were excluded, and no missing data were imputed. A p-value of <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the General Directorate of Therapeutic Medicine, Planning and Training Unit, Ministry of Health, Kassala State, Sudan (approval number: MOH/KS/GDTM/66/C).

Results

A total of 184 patients presenting with acute flank pain were included in the study. Of these, 127 (69.0%) were male and 57 (31.0%) were female. The mean age was 40.5 ± 17 years, and the largest age group was 41-60 years, comprising 73 (39.7%) patients.

Abnormal radiological findings were identified in 170 (92.4%) patients. Among these, 22 (12.0%) abnormalities were detected exclusively by CT KUB, 14 (7.6%) exclusively by US, and 134 (72.8%) by both modalities (Figure *1*).

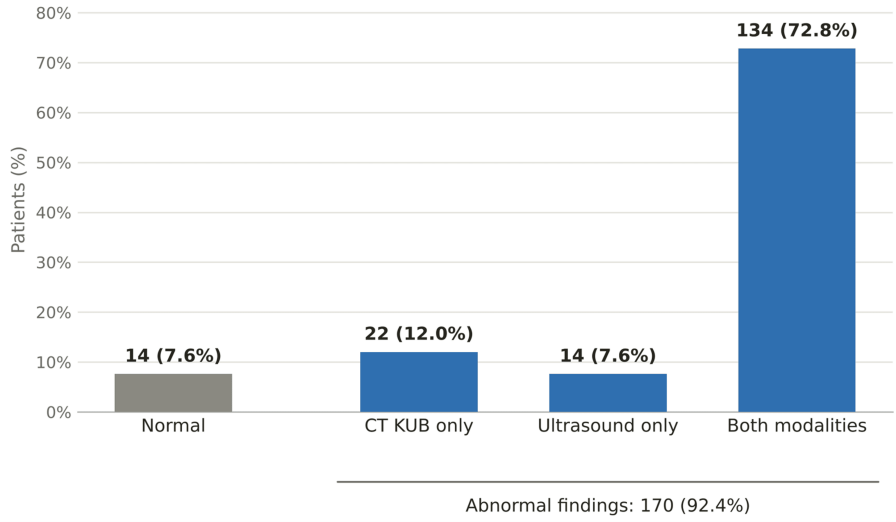


FIGURE 1: Radiological findings in patients presenting with acute flank pain (N = 184).

Abnormalities were detected by both modalities in 134 patients (72.8%), by CT KUB alone in 22 patients (12.0%), and by ultrasound alone in 14 patients (7.6%). Findings were normal in 14 patients (7.6%). Percentages are based on the total study population.

CT KUB: computed tomography of the kidneys, ureters and bladder.

Hydronephrosis was the most common abnormality, detected in 128 (69.6%) patients, followed by renal stones in 77 (41.8%) patients. Distal ureteric stones were identified in 31 (16.8%) patients, proximal ureteric stones in 25 (13.6%) patients, vesicoureteric junction stones in 18 (9.8%) patients, suspected ureteric strictures in 14 (7.6%) patients, pyelonephritis in 12 (6.5%) patients, pelviureteric junction stones in 11 (6.0%) patients, atrophic kidney in 10 (5.4%) patients, bladder outlet obstruction in six (3.3%) patients, and ureteric mass in one (0.5%) patient. CT KUB detected distal ureteric stones (McNemar's test, $\chi^2(1) = 15.04$, $P < 0.001$), proximal ureteric stones ($\chi^2(1) = 8.47$, $P = 0.004$), suspected ureteric strictures ($\chi^2(1) = 12.07$, $P < 0.001$), and pyelonephritis ($\chi^2(1) = 4.90$, $P = 0.027$) significantly more often than US (Table *1*).

	Total	CT only	US only	CT+US	$\chi^2(1)$	P
Hydronephrosis	128 (69.6%)	3 (1.6%)	8 (4.3%)	117 (63.6%)	1.45	0.228
Renal stones	77 (41.8%)	13 (7.1%)	12 (6.5%)	52 (28.3%)	0	1
Distal ureteric stone	31 (16.8%)	22 (12.0%)	2 (1.1%)	7 (3.8%)	15.04	<0.001
Proximal ureteric stone	25 (13.6%)	15 (8.2%)	2 (1.1%)	8 (4.3%)	8.47	0.004
VUJ stones	18 (9.8%)	6 (3.3%)	3 (1.6%)	9 (4.9%)	0.44	0.505
Suspected ureteric stricture	14 (7.6%)	14 (7.6%)	0 (0.0%)	0 (0.0%)	12.07	<0.001
Pyelonephritis	12 (6.5%)	9 (4.9%)	1 (0.5%)	2 (1.1%)	4.9	0.027
PUJ stones	11 (6.0%)	1 (0.5%)	0 (0.0%)	10 (5.4%)	0	1
Atrophic kidney	10 (5.4%)	3 (1.6%)	0 (0.0%)	7 (3.8%)	1.33	0.248
Bladder outlet obstruction	6 (3.3%)	2 (1.1%)	0 (0.0%)	4 (2.2%)	0.5	0.48
Ureteric mass	1 (0.5%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	0	1

TABLE 1: Comparison of radiological abnormalities detected by CT KUB and ultrasound (N = 184).

Comparison of abnormalities detected by CT KUB alone, ultrasound alone, and both modalities. Data are presented as the number of patients and percentage of the total study population. P values were calculated using McNemar's chi-square test with continuity correction. Ureteric strictures were suspected on non-contrast CT KUB; confirmation by contrast imaging, retrograde pyelography or ureteroscopy was not available.

CT KUB: computed tomography of the kidneys, ureters and bladder; US: ultrasound; PUJ: pelviureteric junction; VUJ: vesicoureteric junction; χ^2: chi-square.

Compared with CT KUB, US was positive in 134 of 156 patients with abnormal CT KUB findings (positive percent agreement 85.9%; 95% CI: 79.4-90.9) and negative in 14 of 28 patients with normal CT KUB findings (negative percent agreement 50.0%; 95% CI: 30.6-69.4).

Incidental findings were noted in 65 (35.3%) patients, including 32 urinary and 33 extraurinary findings. Among urinary incidental findings, renal cysts were the most common, found in 22 (12.0%) patients, followed by enlarged prostate in nine (4.9%) patients and crossed fused renal ectopia in one (0.5%) patients. Among extraurinary incidental findings, appendicitis was the most frequent, detected in 10 (5.4%) patients, followed by gallbladder stones in seven (3.8%) patients, mesenteric lymphadenopathy in four (2.2%) patients, splenomegaly in four (2.2%) patients, fatty liver in three (1.6%) patients, bony changes of hyperparathyroidism in three (1.6%) patients, splenic cyst in one (0.5%) patient, and paraumbilical hernia in one (0.5%) patient. Enlarged prostate was detected significantly more often by CT KUB than by US (McNemar's test, $\chi^2(1) = 4.17$, P = 0.041). Gallbladder stones were detected by US alone in five patients and by CT KUB alone in none, but this difference was not statistically significant ($\chi^2(1) = 3.20$, P = 0.074) (Table *2*).

	Total	CT	US	CT+US	$\chi^2(1)$	P
Urinary						
Renal cyst	22 (12.0%)	4 (2.2%)	0 (0.0%)	18 (9.8%)	2.25	0.134
Enlarged prostate	9 (4.9%)	6 (3.3%)	0 (0.0%)	3 (1.6%)	4.17	0.041
Crossed fused renal ectopia	1 (0.5%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	Not calculable	Not calculable
Extraurinary						
Appendicitis	10 (5.4%)	1 (0.5%)	5 (2.7%)	4 (2.2%)	1.5	0.221
Gallbladder stones	7 (3.8%)	0 (0.0%)	5 (2.7%)	2 (1.1%)	3.2	0.074
Mesenteric lymphadenopathy	4 (2.2%)	4 (2.2%)	0 (0.0%)	0 (0.0%)	2.25	0.134
Splenomegaly	4 (2.2%)	4 (2.2%)	0 (0.0%)	0 (0.0%)	2.25	0.134
Fatty liver	3 (1.6%)	0 (0.0%)	3 (1.6%)	0 (0.0%)	1.33	0.248
Bony changes of hyperparathyroidism	3 (1.6%)	3 (1.6%)	0 (0.0%)	0 (0.0%)	1.33	0.248
Splenic cyst	1 (0.5%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	0	1
Paraumbilical hernia	1 (0.5%)	1 (0.5%)	0 (0.0%)	0 (0.0%)	0	1

TABLE 2: Incidental urinary and extraurinary findings detected by CT KUB and ultrasound (N = 184).

Distribution of incidental urinary and extraurinary findings detected by CT KUB alone, ultrasound alone, and both modalities. Data are presented as the number of patients and percentage of the total study population. P-values were calculated using McNemar's chi-square test with continuity correction. The test was not calculable for crossed fused renal ectopia because the finding was detected by both modalities.

CT KUB: computed tomography of the kidneys, ureters and bladder; US: ultrasound; χ^2: chi-square.

No statistically significant association was found between radiological findings and gender (Fisher's exact test, two-sided P = 1.000) or age group (chi-square test, $\chi^2(3) = 2.33$, P = 0.506); Fisher-Freeman-Halton exact test, P = 0.524).

Discussion

A total of 184 patients were included, of whom 127 (69.0%) were male, and 57 (31.0%) were female, with a mean age of 40.5 ± 17 years. The largest age group was 41-60 years. Similar demographic patterns have been reported previously, with acute flank pain occurring more commonly in middle-aged male patients, often in relation to urinary calculi [6,8-10].

Abnormal radiological findings were identified in 170 patients (92.4%), indicating a high diagnostic yield. CT KUB detected abnormalities exclusively in 22 patients (12.0%), while US alone identified abnormalities in 14 patients (7.6%); both modalities detected abnormalities in 134 patients (72.8%). Compared with CT KUB, US showed positive percent agreement of 85.9% (134/156) and negative percent agreement of 50.0% (14/28). The low negative agreement reflects the 14 patients with abnormalities seen only on US. These should not automatically be regarded as US errors, as some findings seen only on US, such as gallbladder stones, are generally better assessed by US than by non-contrast CT; these results therefore describe agreement between the two modalities rather than diagnostic accuracy. US is non-invasive and free of ionizing radiation, but its findings should be interpreted in the clinical context when it is used as the initial imaging tool in acute flank pain. Jaiswal et al. reported an accuracy of 85.03% (267/314), sensitivity of 94.09% (255/271), and specificity of 27.9% (12/43) for US when CT KUB was used as the gold standard [2].

Hydronephrosis was the most common abnormality in this study, followed by renal stones. This is consistent with previous studies in which urolithiasis was a frequent cause of acute flank pain [1,2]. Jaiswal et al. reported stones and/or secondary signs of obstruction in 340 of 414 CT KUB reports (82.1%), with stones present in 313 of these 340 (92.1%) [2]. The most common ureteric stone locations in the current study were the distal ureter and proximal ureter, similar to the distribution reported by Khatiwada et al. [6].

In this cohort, CT KUB detected distal ureteric stones, proximal ureteric stones, suspected ureteric strictures, and pyelonephritis significantly more often than US. These findings support the role of CT KUB in

evaluating acute flank pain, particularly for ureteric pathologies that may be missed on US [6,7]. Of the findings seen on CT KUB, US also detected most cases of hydronephrosis (117/120, 97.5%), renal stones (52/65, 80.0%) and pelviureteric junction stones (10/11, 90.9%), but fewer vesicoureteric junction (9/15, 60.0%), proximal (8/23, 34.8%) and distal ureteric stones (7/29, 24.1%), and none of the suspected strictures (0/14). Khatiwada et al. also reported lower US sensitivity for proximal (66.67%) and distal ureteric calculi (56.52%) than for pelviureteric junction calculi (95.00%) [6]. Mid-ureteric stones were not recorded as a separate category in this study.

Incidental findings were identified in 65 patients (35.3%), including 32 urinary and 33 extraurinary findings. Renal cysts were the major urinary incidental findings, while appendicitis was the major extraurinary incidental finding. However, appendicitis is likely to represent an alternative cause of acute flank pain in these patients rather than a truly incidental finding. Gallbladder stones were detected by US alone in five patients and by CT KUB alone in none, although this difference was not statistically significant (McNemar's test, $\chi^2(1) = 3.20$, $P = 0.074$). This may suggest complementary roles of the two imaging modalities in evaluating both urinary and extraurinary causes of flank pain. Salam et al. reported an incidental finding rate of 15% (48 of 320 patients), with renal cysts as the most frequent genitourinary finding and appendicitis as the most common non-genitourinary finding [11]. Keoghane et al. reported incidental findings in 389 of 1,442 patients (27%) [1].

No significant association was found between radiological findings and patient gender or age.

CT also demonstrated a possible additional role in suggesting underlying causes of stone formation, as bony changes of hyperparathyroidism were observed in some patients with multiple renal stones. In contrast, US demonstrated hydronephrosis more frequently than CT in this study, despite the generally higher sensitivity of CT for urinary tract pathology [6,7], although this difference was not statistically significant (McNemar's test, $\chi^2(1) = 1.45$, $P = 0.228$). This discrepancy may reflect operator dependence, technique variability, physiological distension, overdiagnosis on US, timing differences between examinations, or technical limitations related to patient factors. These findings underline the importance of correlating imaging findings with the clinical context and support the use of CT KUB for confirmation in equivocal cases.

In this study, 44 ureteric stone findings were detected by CT KUB but not by US: 22 distal, 15 proximal, six vesicoureteric junction, and one pelviureteric junction stone. Pyelonephritis was also detected by CT KUB alone in nine patients. In low-resource settings such as Kassala State, such missed findings could delay the recognition of ureteric obstruction or infection. However, because clinical outcomes were not collected, we could not determine how many of these patients would have developed obstructive nephropathy or urosepsis had CT not been available. International guidelines support US as the initial investigation in selected patients. The European Association of Urology (EAU) guidelines state that US should be the primary diagnostic imaging tool and recommend non-contrast CT to confirm the diagnosis in acute flank pain following initial US assessment. They also recommend US as the first-line modality in pregnant women and children, with low-dose CT as a last-line option in pregnancy or when US does not provide the required information in children [12]. The American Urological Association (AUA) recommends non-contrast CT as the initial study for most patients, using a low-dose protocol when body habitus allows, US as the initial modality for pregnant and paediatric patients, and ultrasonography with plain radiography as an option for known stone formers [3]. In keeping with the as low as reasonably achievable (ALARA) principle, low-dose CT has shown a pooled sensitivity of 93.1% and specificity of 96.6% for urolithiasis [4]. In a randomized trial, initial ultrasonography was associated with lower cumulative radiation exposure than initial CT, without significant differences in high-risk diagnoses with complications or serious adverse events [13]. A US-first pathway may therefore be reasonable for pregnant women, children, and known stone formers, with CT KUB using a low-dose protocol where body habitus allows, reserved for cases in which US is inconclusive [3,12].

Limitations

This study had several limitations. It was a single-center study of 184 patients, and 41 of the 225 patients initially identified were excluded because of incomplete records, which may limit generalizability; the study period may also not have captured seasonal variation in urolithiasis. Only patients who underwent both US and CT KUB were included, so patients whose US did not lead to CT were not captured. This introduces verification and spectrum bias, as the study population probably had a higher pre-test probability of significant pathology, and may have affected the agreement estimates.

CT KUB was used as the comparator rather than an independent reference standard, and without clinical follow-up or surgical or ureteroscopic confirmation, the results reflect agreement between the two modalities rather than definitive diagnostic accuracy. Non-contrast CT KUB cannot reliably distinguish an intrinsic ureteric stricture from a collapsed or underfilled ureteric segment distal to a calculus or from localized spasm in the acute phase, and it is limited in confirming uncomplicated pyelonephritis. As confirmation by contrast-enhanced CT, CT urography, retrograde pyelography, or ureteroscopy was not available, strictures should be regarded as suspected and pyelonephritis findings interpreted with caution. Findings were taken from routine reports without grading: stone size, stone attenuation, and hydronephrosis severity were not recorded, and the interval between US and CT KUB was not documented, so changes between the two examinations, such as stone passage, cannot be excluded.

US technical details, such as probe frequency, bladder filling, and the use of Doppler ureteric jets or the twinkling artifact, and CT acquisition parameters, including dose protocol, slice thickness, reconstruction interval, and patient position, were not collected, and US findings may have varied with operator expertise. Clinical outcomes, such as obstructive nephropathy or urosepsis, were not collected, so the consequences of findings missed on US could not be assessed. Finally, multiple comparisons were made without adjustment, so P-values close to 0.05 should be interpreted with caution.

Conclusions

In this study population, CT KUB demonstrated a high frequency of urinary and extraurinary abnormalities among patients presenting with acute flank pain, with hydronephrosis and renal stones being the most common findings. CT KUB detected several abnormalities, including distal and proximal ureteric stones, suspected ureteric strictures, and pyelonephritis, more often than ultrasound, while ultrasound detected most cases of hydronephrosis and renal stones and provided complementary information. Incidental findings were identified in more than one-third of patients, with renal cysts representing the major urinary incidental finding and appendicitis the major extraurinary incidental finding. Because CT KUB was used as the comparator rather than an independent reference standard, these findings should be interpreted as a comparison of imaging findings rather than a definitive assessment of diagnostic accuracy. The choice of imaging should depend on the clinical question, patient factors such as pregnancy or young age, and radiation exposure, and further multicenter studies with clinical follow-up or an independent reference standard are warranted.

Appendices

Data collection form

Demographics
Age ..... years: <18 ( ) 18-40 ( ) 41-60 ( ) >60 ( )
Sex: Male ( ) Female ( )

Findings	CT KUB	US
Normal		
Urinary		
Renal stone		
PUJ stone		
Proximal ureteric stone		
Distal ureteric stone		
VUJ stone		
Hydronephrosis		
Ureteric stricture		
Pyelonephritis		
Atrophic kidney		
Ureteric mass		
Bladder outlet obstruction (BOO)		
Others (specify)		
Extraurinary		
Appendicitis		
Gallbladder disease		
Mesenteric lymphadenopathy		
Others (specify)		

TABLE 3: Data collection form.

CT KUB: computed tomography of the kidneys, ureters, and bladder; US: ultrasound; PUJ: pelviureteric junction; VUJ: vesicoureteric junction.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mahil Abdalla, Mohamed Ali, Mohamed Adam, Mohamed A. Abdelrahim, Najla Mohammed, Alsawi Yusuf

Acquisition, analysis, or interpretation of data: Mahil Abdalla, Ragda Abdallah, Mohamed Ali, Mohamed Adam, Abduraheem Farah, Mohamed Samir Yasin Ibrahim, Mohamed Awad Alkareem, Alsawi Yusuf

Drafting of the manuscript: Mahil Abdalla, Ragda Abdallah, Mohamed Ali, Mohamed Adam, Mohamed A. Abdelrahim, Abduraheem Farah, Mohamed Awad Alkareem, Alsawi Yusuf

Critical review of the manuscript for important intellectual content: Mahil Abdalla, Ragda Abdallah, Mohamed Ali, Mohamed Adam, Mohamed A. Abdelrahim, Najla Mohammed, Mohamed Samir Yasin Ibrahim, Alsawi Yusuf

Supervision: Alsawi Yusuf

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all

participants in this study. General Directorate of Therapeutic Medicine, Planning and Training Unit issued approval MOH/KS/GDTM/66/C. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

Mohamed Ali and Mahil Abdalla are to be considered co-first authors.

References

1. Keoghane S, Austin T, Coode-Bate J, Deverill S, Drake T, Sanpera-Iglesias J, Johnston T: The diagnostic yield of computed tomography in the management of acute flank pain and the emergency intervention rate for a proven acute ureteric stone. Ann R Coll Surg Engl. 2018, 100:1-8. 10.1308/rcsann.2018.0172
2. Jaiswal P, Shrestha S, Dwa Y, Maharjan D, Sherpa NT: CT KUB evaluation of suspected urolithiasis. J Patan Acad Health Sci. 2022, 9:58-64. 10.3126/jpahs.v9i1.43895
3. Fulgham PF, Assimos DG, Pearle MS, Preminger GM: Clinical effectiveness protocols for imaging in the management of ureteral calculous disease: AUA technology assessment. J Urol. 2013, 189:1203-13. 10.1016/j.juro.2012.10.031
4. Xiang H, Chan M, Brown V, Huo YR, Chan L, Ridley L: Systematic review and meta-analysis of the diagnostic accuracy of low-dose computed tomography of the kidneys, ureters and bladder for urolithiasis. J Med Imaging Radiat Oncol. 2017, 61:582-90. 10.1111/1754-9485.12587
5. Brisbane W, Bailey MR, Sorensen MD: An overview of kidney stone imaging techniques . Nat Rev Urol. 2016, 13:654-62. 10.1038/nrurol.2016.154
6. Khatiwada B, Mahat A, Yadav GK, et al.: A comparative study of ultrasonography (USG) and computed tomography for detecting ureteric calculi in patients with acute flank pain, and analysis of factors influencing ultrasound detection rates. Int J Surg Glob Health. 2024, 7:0464. 10.1097/GH9.0000000000000464
7. Moore CL, Scoutt L: Sonography first for acute flank pain? . J Ultrasound Med. 2012, 31:1703-11. 10.7863/jum.2012.31.11.1703
8. Asif M, Haroon N, Ahmad B, Burki S, Ikramullah S: Optimal use of computed tomography kidney, ureter, and bladder: review of patients presenting with acute flank pain. J Postgrad Med Inst. 2022, 36:25-7. 10.54079/jpmi.36.1.2931
9. Saleem N, Balooch S, Qayyum A, Afzal T, Niazi NUSK, Adil R: Evaluating unenhanced multidetector computed tomography of kidneys, ureters and bladder (CT KUB) as the initial imaging service in suspected acute renal colic patients. Pak Armed Forces Med J. 2023, 73:207-10.
10. Serinken M, Karcioglu O, Turkcuer I, Ozkan HI, Keysan MK, Bukiran A: Analysis of clinical and demographic characteristics of patients presenting with renal colic in the emergency department. BMC Res Notes. 2008, 1:79. 10.1186/1756-0500-1-79
11. Salam A, Bogale GA, Yousaf Q, et al.: Role of unenhanced computed tomography kidney, ureter, bladder (CT KUB) in the diagnosis of incidental findings. J Popul Ther Clin Pharmacol. 2023, 30:769-76.
12. EAU Guidelines on Urolithiasis. (2026). Accessed: November 9, 2026: https://uroweb.org/guidelines/urolithiasis.
13. Smith-Bindman R, Aubin C, Bailitz J, et al.: Ultrasonography versus computed tomography for suspected nephrolithiasis. N Engl J Med. 2014, 371:1100-10. 10.1056/NEJMoa1404446