



FREQUENCY OF NEGATIVE CT KUB AT A PUBLIC SECTOR TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Computed tomography of the kidneys, ureters, and bladder as non-contrast (CT KUB) is a common method of assessing the possible existence of urolithiasis. Even though it has good diagnostic precision, a significant percentage of radiographies have negative outcomes, raising concerns about unnecessary radiation exposure and resource utilization.

Objective: To determine the frequency of negative CT KUB findings and evaluate associated clinical and radiological characteristics in patients presenting with suspected urolithiasis at a public sector tertiary care hospital.

Methodology: It is a cross-sectional observational study and it was carried out at Jinnah Postgraduate Medical Centre, Karachi, between June and December 2022. The participants were 96 consecutive patients whose clinical impression of urolithiasis was present and whose age was ≥ 16 years who received non-contrast CT KUB. A structured proforma was used to record the demographic, clinical, laboratory, and radiological variables. The findings were classified as positive or negative of stones using CT. Associations between CT outcomes and specific clinical variables were measured with chi-square tests. The statistical significance was taken to be 0.05.

Results: Of the 96 patients, 65 (67.7%) had CT-confirmed urolithiasis, while 31 (32.3%) had negative CT KUB findings. Among CT-positive patients, bilateral stones were most frequent (36.9%), and the kidney was the commonest site (26.2%). The mean stone size was 7.34 ± 3.48 mm. In CT-negative cases, lumbar spondylosis (25.8%), hydronephrosis without visible calculus (22.6%), and appendicitis (19.4%) were the most frequent alternative diagnoses. No statistically significant association was observed between CT KUB result and clinical variables; fever showed a borderline association ($p = 0.097$).

Conclusion: Nearly one-third of CT KUB scans were negative, frequently revealing alternative diagnoses. These findings support the diagnostic utility of CT KUB while highlighting the need for rational imaging strategies to optimize resource use and minimize radiation exposure.

Keywords: CT KUB, urolithiasis, renal colic, negative CT, flank pain

INTRODUCTION

Urolithiasis is a frequent cause of acute flank pain and a significant percentage of emergency department visits around the world [1]. Dietary habits, climatic conditions, and metabolism predispositions have continued to increase the lifetime risk of developing urinary tract stones especially among the South Asian populations. Proper diagnosis is critical to early and accurate diagnosis to manage it properly, avoid complications, and to minimize unnecessary interventions [2, 3].

Computed tomography of the kidneys, ureters and bladder (CT KUB) has recently emerged as the imaging test of choice on patients with suspected renal colic because it has high sensitivity and specificity of identifying urinary tract calculi [4, 5]. Besides ensuring the presence of stones, CT KUB provides accurate localization, measurement of stone size, evaluation of obstruction and alternative causes of flank pain. Consequently, CT KUB is commonly used as a first-line diagnostic method both in emergency and outpatient practice [6].

Although the use of CT KUB has been advanced in the diagnosis of diseases, the common use of the diagnostic method has led to concern regarding the issue of radiation exposure, cost and excessive use especially where the diagnostic method has produced negative results [7, 8]. A large percentage of the patients with CT KUB to evaluate the suspected urolithiasis are eventually diagnosed to have no calculi, and other scans reveal other conditions, including appendicitis, pyelonephritis, musculoskeletal, or gynecological issues [9]. This points to a vital clinical and social health challenge, particularly in resource constrained state hospitals where imaging is in high demand.

Despite international literature reporting diagnostic yield of CT KUB as well as prevalence of negative findings, there are paucity of local data on public sector tertiary care settings in Pakistan. Besides, the lack of evidence that investigates the clinical features of patients with negative CT KUB and the prevalence of other diagnoses within this population remains insufficient. This gap should be bridged to educate rational imaging strategies and patient care.

Therefore, this study was undertaken to determine the frequency of negative CT KUB findings and to analyze associated demographic, clinical, and radiological features in patients presenting with suspected urolithiasis at a public sector tertiary care hospital.

METHODOLOGY

This was a cross-sectional observational study which was carried out in a Jinnah Post graduate medical center, JPMC public sector tertiary care teaching hospital, which is a referred centre, in patients presenting with acute abdominal and flank pain. The hospital serves a high number of urban and rural residents and offers a wide range of emergency, urological, and radiological services. The research was conducted during half a year, between 14th June 2022 and 14th December 2022. The enrolment was done consecutively and started during this period where all of the eligible patients with clinical suspicion of urolithiasis are referred to receive computed tomography of the kidneys, ureters, and bladder (CT KUB).

The study was ethically approved by Research Evaluation Unit, College of Physicians and Surgeons Pakistan (CPSP), Islamabad. The research was endorsed under reference number CPSP/REU/URO-2019-186-1139, dated June 14, 2022, as per the official approval letter issued by the CPSP Research Evaluation Unit. The approval pertained to the synopsis titled "*Frequency of Negative CT KUB at a Public Sector Tertiary Care Hospital.*" Informed consent was informed and taken in writing before enrollment preceded by participants or their legal guardians. Patient information was kept confidential and all procedures were performed based on the ethical principles provided in the Declaration of Helsinki.

The sample size was calculated using the World Health Organization (WHO) sample size calculator for prevalence studies. Assuming an anticipated prevalence of negative CT KUB findings of 35%, based on previously published regional data, with a confidence level of 95% and an absolute precision of 10%, the minimum required sample size was calculated to be 88 patients. To account for potential missing data and incomplete records, an additional 10% was added to the calculated sample, resulting in a final sample size of 96 patients, which were ultimately included in the study.

The study included patients of both genders who reported having flank pain, or were suspected of having urolithiasis and referred to undergo non-contrast CT KUB. Patients were not included if they had a history of recent urological procedure, had known congenital anomalies of the urinary tract, pregnant, and incomplete CT images or clinical records. Patients who had suffered a traumatic abdominal pain or undergone CT due to non-urological reasons were also locked out.

Every patient who was enrolled received non-contrast CT KUB with a standard scanning protocol. A CT scanner equipped with a multidetector with axial images reconstructed in both coronal and sagittal planes was used to carry out CT examinations. Two experienced radiologists were used to interpret images without being aware of the clinical information of the patients. Urinary tract stones were noted in terms of presence, location, in the laterality, and size. The size of the stone was measured in millimeters as the maximum diameter. Other diagnoses, including hydronephrosis without apparent calculus, appendicitis, lumbar spondylosis, ovarian cysts, pyelonephritis, or normal were documented in situations where the CT KUB was not positive.

The structured proforma collected the data by use of a specially designed proforma designed to be used in the study. The demographic factors were age, sex, and home. Clinical variables were presenting symptoms (flank pain, hematuria, dysuria, fever, nausea/vomiting), side of pain, and length of symptoms and history of urolithiasis. Where available, laboratory parameters, including urine hematuria and serum creatinine levels, were also taken. Radiological variables comprised CT KUB outcome (positive or negative), laterality of the stone, localization of the location, and stone size and alternative diagnosis (CT negative cases). The records of patients were used to establish final diagnosis and management plan.

The data were checked by two radiologists to guarantee the reliability of data and the disagreements were solved by consensus. To establish clarity and uniformity in the data collection process, the data collection proforma was piloted on a sample of 10 patients. All the measurements, more specifically, the size of stones and their location were documented by the use of standardized radiological criteria. To reduce the chances of transcription errors, two independent investigators were used to examine the data. Any discrepancies were resolved through review of the original records of patients and imaging reports.

The Statistical Package of Social Sciences (SPSS) version 25.0 was used to enter and analyze the data. The quantitative variables were age and stone size presented in mean $\pm$ standard deviation, whereas categorical variables were presented in terms of frequency and percentage. The major finding was the prevalence of negative CT KUB results. The association between CT KUB findings and the chosen clinical parameters such as gender, age group, hematuria, duration of symptoms, previous history of stones, side of pain, dysuria, and fever were assessed using chi-square tests. The Chi-square test of Pearson was used, and degrees of freedom were indicated respectively. The p-value of below 0.05 was taken to be statistically significant.

RESULTS

There were 96 patients in the study. The median age of the participants was 48.36 ± 16.99 years. Most patients were in the 41-60-year bracket (35.4%), then there were those with age above 60 (31.3), and above 21-40 years (30.2). The population of the study was 56.3 and 43.8 percent in females and males, respectively. The proportion of patients who were rural was slightly above half (51.0%).

Table 1: Demographic Characteristics of Patients (n = 96)

Variable	n (%)
Age (years)	48.36 ± 16.99

Age Group (years)	
<20	3 (3.1)
21–40	29 (30.2)
41–60	34 (35.4)
>60	30 (31.3)
Gender	
Female	54 (56.3)
Male	42 (43.8)
Residence	
Rural	49 (51.0)
Urban	47 (49.0)

All patients (100.0%) had flank pain, and most often (54.2% and 51.0% respectively) were accompanied by fever and hematuria, then nausea/vomiting and dysuria. The most frequent laterality was right-sided pain (41.7%) and the majority of the patients arrived within 24 hours (36.5%), 1-3 days (32.3) of symptoms onset, and one-third of the patients had a history of urolithiasis (45.8%).

Table 2: Clinical Presentation of Patients (n = 96)

Variable	n (%)
Symptoms	
Flank pain	96 (100.0)
Hematuria	49 (51.0)
Dysuria	40 (41.7)
Fever	52 (54.2)
Nausea/Vomiting	42 (43.8)
Side of pain	
Right	40 (41.7)
Left	26 (27.1)
Bilateral	30 (31.3)
Duration of symptoms	
<24 hours	35 (36.5)
1–3 days	31 (32.3)
>3 days	30 (31.3)
Past history of stones	
Yes	44 (45.8)
No	52 (54.2)

CT KUB validated urolithiasis in 65/102 patients (67.7/32.3), thus, showing that one-third of the patients that were assessed due to suspected renal colic did not have any radiological evidence of stones.

Table 3: CT KUB Findings (n = 96)

CT KUB Result	n (%)
Positive for stone	65 (67.7)
Negative for stone	31 (32.3)

Bilateral stones were found in 36.9 percent cases of 65 patients with CT-confirmed urolithiasis with right and left stones being found in 32.3 percent and 30.8 percent cases respectively. Kidney (26.2) was the most common site of stone, then the ureterovesical junction (20.0), mid ureter (18.5) and distal

ureter (18.5), and proximal ureter (16.9). The average size of the stone was 7.34 ± 3.48 mm and a range of 3.0-14.0mm.

Table 4: Stone Characteristics in CT-Positive Patients (n = 65)

Variable	n (%)
Stone laterality	
Right	21 (32.3)
Left	20 (30.8)
Bilateral	24 (36.9)
Stone location	
Kidney	17 (26.2)
Proximal ureter	11 (16.9)
Mid ureter	12 (18.5)
Distal ureter	12 (18.5)
UVJ	13 (20.0)
Stone size (mm)	7.34 ± 3.48
Minimum–Maximum	3.0–14.0

The most common alternative diagnosis was lumbar spondylosis (25.8%), hydronephrosis without apparent calculus (22.6%), appendicitis (19.4%), and normal scan findings (19.4) among the 31 patients presenting with negative CT KUB. It was found that 9.7% of cases were a result of pyelonephritis and that 3.2% of patients had ovarian cysts.

Table 5: Findings in Patients with Negative CT KUB (n = 31)

Alternative Diagnosis	n (%)
Lumbar spondylosis	8 (25.8)
Hydronephrosis without stone	7 (22.6)
Appendicitis	6 (19.4)
Normal scan	6 (19.4)
Pyelonephritis	3 (9.7)
Ovarian cyst	1 (3.2)

The CT KUB result did not demonstrate any statistically significant correlation with the clinical variables under study. There was a borderline interest in fever and CT positivity ($\chi^2 = 2.759$, df = 1, p = 0.097).

Table 6: Association of CT KUB Result with Selected Variables (n = 96)

Variable	CT KUB Positive n (%)	CT KUB Negative n (%)	χ^2 (df)	p-value
Gender			0.400 (1)	0.527
Female (n = 54)	38 (70.4)	16 (29.6)		
Male (n = 42)	27 (64.3)	15 (35.7)		
Age group (years)			6.193 (3)	0.103
<20 (n = 3)	1 (33.3)	2 (66.7)		
21–40 (n = 29)	18 (62.1)	11 (37.9)		
41–60 (n = 34)	28 (82.4)	6 (17.6)		
>60 (n = 30)	18 (60.0)	12 (40.0)		
Hematuria			1.519 (1)	0.218
Present (n = 49)	36 (73.5)	13 (26.5)		
Absent (n = 47)	29 (61.7)	18 (38.3)		

Duration of symptoms			3.196 (2)	0.202
<24 hours (n = 35)	20 (57.1)	15 (42.9)		
1–3 days (n = 31)	24 (77.4)	7 (22.6)		
>3 days (n = 30)	21 (70.0)	9 (30.0)		
Past history of stones			0.120 (1)	0.729
Yes (n = 44)	29 (65.9)	15 (34.1)		
No (n = 52)	36 (69.2)	16 (30.8)		
Side of pain			0.386 (2)	0.824
Right (n = 40)	28 (70.0)	12 (30.0)		
Left (n = 26)	18 (69.2)	8 (30.8)		
Bilateral (n = 30)	19 (63.3)	11 (36.7)		
Dysuria			0.165 (1)	0.685
Present (n = 40)	28 (70.0)	12 (30.0)		
Absent (n = 56)	37 (66.1)	19 (33.9)		
Fever			2.759 (1)	0.097
Present (n = 52)	39 (75.0)	13 (25.0)		
Absent (n = 44)	26 (59.1)	18 (40.9)		

χ^2 = Pearson Chi-square; df = degrees of freedom. $p < 0.05$ considered statistically significant

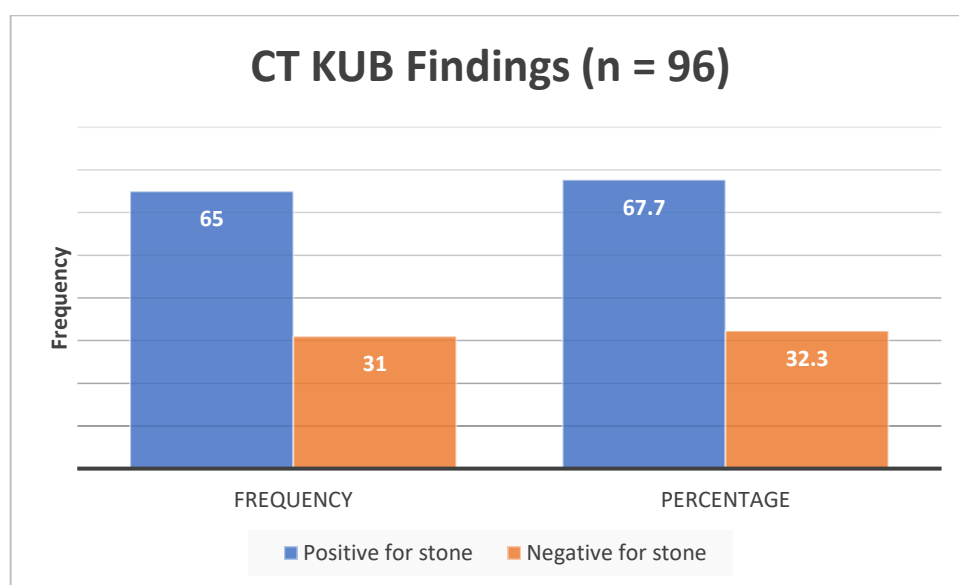


Figure 1: Frequency of CT KUB findings among patients undergoing evaluation for suspected urolithiasis (n = 96).

DISCUSSION

This study assessed the frequency of negative CT KUB in patients who have presented with suspected urolithiasis in a tertiary care unit in the public sector. About a third of scans had a negative result (32.3%), and two-thirds had stones (67.7). Such a diagnostic performance is in line with the previous experience of the region that sets a high percentage of CT KUB tests proving urolithiasis, as well as emphasizes the fact that a significant number of patients pass through CT without identifying a stone presence [10] The ACR observes that non-contrast CT is the technique of choice in acute flank pain because it helps to identify stones, establish the size/location, evaluate complications, and detect other causes of pain which will be an important consideration because the diagnosis is overlapping in acute manifestations [11].

Bilateral stones prevailed in CT-positive patients (36.9), and the most common site was the kidney (26.2), after which were UVJ and ureteric segments. The average size of the stones was 7.34 ± 3.48

mm which is clinically relevant as the size of the stones will determine the probability of spontaneous passage and the choice of conservative management or intervention. Global urolithiasis advice and recommendations endorse the use of CT characterization to aid decision-making, particularly when the symptoms are prominent or in cases of uncertainty in diagnosis [12, 13]. Local research has also characterized CT KUB as a strong modality to detect and characterize stone, and local results also indicate high diagnosis and applicability to standard practice [14, 15].

An important observation of this study is that negative CT KUB frequently provided different diagnoses. Cases of lumbar spondylosis, hydronephrosis with no calculus observed, appendicitis and pyelonephritis were some of the reported diagnosis in our CT negative group. This supports clinical utility of CT KUB in addition to the detection of stones, since other outcomes can divert the treatment plan (e.g. surgical investigation to appendicitis, antimicrobial treatment to pyelonephritis, and conservative musculoskeletal treatments to treat spine-related pain). Experience in other environments reveals also that a significant number of patients researched about renal colic are found to have other diagnoses identified on CT [16].

Clinically plausible trends were observed but no statistically significant relationships were presented between CT outcome (positive/negative) and the clinical variables studied (gender, hematuria, dysuria, duration, history of previous stones, pain side and fever). Fever demonstrated a marginal relationship ($p = 0.097$) as more febrile patients were positive on CT. Although fever might indicate both infection and complicated obstruction, in practice in the real emergency room where urinary tract infection, obstruction, and inflammatory conditions may coexist, this pattern might be indicative of mixed presentation. Guideline papers stress that urgent imaging is especially so in case of diagnostic uncertainty, fever or risk factors, despite the lack of strongly discriminatory clinical features [17].

Resource and safety In terms of resource and safety, the use of CT KUB ought to result in a balance of diagnostic yield against radiation exposure particularly in recurrent stone formers and in hectic public-sector emergency departments. Modern evidence has endorsed dose- optimised CT KUB protocols that preserve diagnostic quality whilst minimizing the radiation dose, and pragmatic interventions such as scan length optimisation and the use of low dose techniques can be easily adopted without loss in clinical confidence in most patients [2, 18, 19]. These considerations are especially applicable in the environment where the CT demand is large and repetitive imaging is a frequent occurrence.

On the whole, our results not only justify CT KUB as a high-yield test in the suspected urolithiasis but also indicate that a substantial proportion of scans turn out negative and can show other diagnoses. The lack of good clinical predictors in this group of patients indicates that symptom-based triage might not be reliable to differentiate stone and non-stone etiologies. Further practice in this direction might test the use of structured clinical scoring, or staged imaging, (e.g. ultrasound-first with selective CT) to minimise unnecessary radiation with diagnostic safety maintained [20].

CONCLUSION

In this public sector tertiary care cohort, CT KUB confirmed urolithiasis in two-thirds of patients, while nearly one-third had negative scans. Among CT-negative cases, clinically meaningful alternative diagnoses were frequently identified, emphasizing the broader diagnostic contribution of CT in acute flank pain. No significant associations were observed between CT outcome and the evaluated demographic or clinical variables, although fever showed a borderline trend with CT positivity. These findings support CT KUB as an effective diagnostic tool in suspected urolithiasis, while underscoring the need for rational imaging pathways and dose-optimised protocols to balance diagnostic benefit with radiation exposure.

REFERENCES

1. Anderson, T., et al., *Assessment of clinically significant urolithiasis positivity rate using CT KUB for suspected renal colic*. Irish Journal of Medical Science (1971 -), 2024. **193**(2): p. 1009-1013 DOI: 10.1007/s11845-023-03477-5.

2. Gul, P., *COMPARATIVE DIAGNOSTIC ACCURACY OF LOW-DOSE CT KUB AND CONVENTIONAL CT IN DETECTING RENAL AND URETERIC CALCULI*. Pakistan Journal of Radiology, 2025. **35**(2).
3. Lee, L., et al., *Applying Deep-Learning Algorithm Interpreting Kidney, Ureter, and Bladder (KUB) X-Rays to Detect Colon Cancer*. Journal of Imaging Informatics in Medicine, 2025. **38**(3): p. 1606-1616 DOI: 10.1007/s10278-024-01309-1.
4. *Utility of Unenhanced CT KUB: Beyond Urolithiasis*. ANNALS OF ABBASI SHAHEED HOSPITAL AND KARACHI MEDICAL & DENTAL COLLEGE, 2023. **28**(1): p. 45-52.
5. Khalid, S., et al., *Ureteric colic diagnosis by plain radiography and ultrasound by taking CT-KUB as Gold Standard*. The Professional Medical Journal, 2025. **32**(03): p. 272-277 DOI: <https://doi.org/10.29309/TPMJ/2025.32.03.8826>.
6. Yenikekaluva, A., et al., *UrologiQ: AI-based accurate detection, measurement and reporting of stones in CT-KUB scans*. Urolithiasis, 2024. **52**(1): p. 170 DOI: 10.1007/s00240-024-01671-3.
7. Ullah, K., et al., *Diagnostic Role of X-ray Imaging in Renal and Ureteric Calculi Keeping Computed Tomography as Gold Standard: Diagnostic Role of X-ray Imaging in Renal and Ureteric Calculi*. Pakistan BioMedical Journal, 2025. **8**(1): p. 18-22 DOI: 10.54393/pbmj.v8i1.1205.
8. Rasul, T., et al., *Diagnostic Accuracy of Twinkling Artefact on Color Doppler Ultrasound to Diagnose Urinary Tract Stones taking Unenhanced CT-KUB as Gold Standard*. Indus Journal of Bioscience Research, 2025. **3**(4): p. 858-861 DOI: 10.70749/ijbr.v3i4.1972.
9. Khatiwada, B., 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*. IJS Global Health, 2024. **7**(4).
10. Farhan, M., et al., *Utilization of Non-contrast Enhanced CT KUB in Patients with Suspected Renal Colic*. J Med Heal Sci, 2021. **15**(12): p. 3737-40 DOI: 10.53350/pjmhs2115123737.
11. Gupta, R.T., et al., *ACR Appropriateness Criteria® Acute Onset Flank Pain-Suspicion of Stone Disease (Urolithiasis)*. J Am Coll Radiol, 2023. **20**(11s): p. S315-s328 DOI: 10.1016/j.jacr.2023.08.020.
12. Geraghty, R.M., et al., *Best Practice in Interventional Management of Urolithiasis: An Update from the European Association of Urology Guidelines Panel for Urolithiasis 2022*. European Urology Focus, 2023. **9**(1): p. 199-208 DOI: <https://doi.org/10.1016/j.euf.2022.06.014>.
13. Farzaneh, S.B., et al., *"CRP-first" algorithm to guide imaging in suspected renal colic: a retrospective UK cohort study*. Emerg Radiol, 2025. **32**(6): p. 939-945 DOI: 10.1007/s10140-025-02411-9.
14. Bano, S., et al., *Diagnosis of Urinary Tract Urolithiasis using Computed Tomography: Urinary Tract Urolithiasis using Computed Tomography*. Pakistan Journal of Health Sciences, 2022. **3**(01): p. 03-06 DOI: 10.54393/pjhs.v3i01.46.
15. Munawar, A., et al., *Computed Tomography Findings in the Evaluation of Urolithiasis*. Journal of Health and Rehabilitation Research, 2024. **4**(2): p. 164-170 DOI: 10.61919/jhrr.v4i2.767.
16. O'Mahony, A.T., et al. *Performance of Computed Tomography of the Kidneys, Ureter and Bladder in Non-Calculus Diagnoses: A Comparative Review of Non-Enhanced with Intravenous Contrast-Enhanced Imaging*. Diagnostics, 2025. **15**, 1731 DOI: 10.3390/diagnostics15141731.
17. Skolarikos, A., et al., *European Association of Urology Guidelines on the Diagnosis and Treatment of Urolithiasis*. European Urology, 2025. **88**(1): p. 64-75 DOI: <https://doi.org/10.1016/j.eururo.2025.03.011>.
18. Ghoshal, N. and G. Gaikstas, *CT KUB scans for renal colic: Optimisation of scan range to reduce patient radiation burden*. Radiography, 2021. **27**(3): p. 784-788 DOI: <https://doi.org/10.1016/j.radi.2020.12.006>.
19. Haji, O., et al., *The Diagnostic Accuracy of Reduced-Dose CT of the Kidneys, Ureters, and Bladder in the Evaluation of Renal Colic*. Cureus, 2025. **17**(11): p. e96882 DOI: 10.7759/cureus.96882.
20. Raza, M.A., et al., *Diagnostic Accuracy of Non-Contrast Computed Tomography in Identification of Renal Calculi in Suspected Patients with Negative Intravenous Pyelogram*.

Journal of Health and Rehabilitation Research, 2024. 4(2): p. 1078-1082 DOI: 10.61919/jhrr.v4i2.882.