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# ACUTE URETERIC COLIC: ULTRASOUND AS THE INITIAL DIAGNOSTIC TOOL

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**ABSTRACT**

Computed tomography is considered as an imaging modality of choice in acute ureteric colic. However due to concerns regarding radiation exposure, sonograms are re-emerging as imaging methods in such situations. Patients presenting to the Urology OPD or Emergency department at our hospital, who clinically have acute colicky flank pain, routinely undergo USG abdomen evaluation, among them suspected cases of ureterolithiasis were selected for initial evaluation by USG KUB evaluation and plain KUB radiograph, NCCT KUB done depending on clinical scenario. The 145 patients with urolithiasis identified on sonography included 130 patients with ureterolithiasis,8 patients with calculus in the urinary bladder, and 1 patient with uretherolithiasis. Sonogram can be used in all cases of acute ureteric colic.

## INTRODUCTION

Patients with various pathologies present with acute flank pain to Emergency Department. Ureterolithiasis is the most common cause of acute flank pain, and patients usually present with radiating colicky pain with or without hematuria. However, the clinical findings are nonspecific, with potential mimics of this Condition includes appendicitis, pelvic inflammatory disease, tubo-ovarian abscess, inflammatory bowel disease, and pyelonephritis. Imaging helps in arriving at a specific diagnosis and planning of management [1,2]. In addition, in cases of urolithiasis, imaging allows treatment planning (e.g., surgical retrieval of large [>5-mm] calculi vs. use of analgesics and hydration for smaller calculi). Acute flank pain caused by ureterolithiasis is common condition presenting to emergency department or urological outpatient department. The prevalence of urinary stones has progressively increased in the industrialized nations, and a similar trend is being observed in developing countries due to changing social and economic conditions.

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Concomitant with the increasing prevalence of urolithiasis is the growing utilization of imaging for diagnosis, treatment planning, and post treatment follow-up. Imaging in urolithiasis has evolved over the years due to technologic advances and a better understanding of the disease process. Radiologic studies including plain radiography, intravenous urography (IVU), computed tomography (CT), and ultrasonography (USG) have always had important roles in the workup of these patients. Kidney-ureter-bladder (KUB) radiograph is the initial, readily available method with a less sensitivity (63%) and specificity for diagnosing urinary stones, and does not rule out other potential causes [3].

Intravenous urography (IVU) is reserved to the places where USG or Non- Contrast Computed Tomography (NCCT) are unavailable, however it is costly and requires contrast media and has lengthy cumbersome protocol [4-6]. USG is a low-risk; low-cost imaging modality with reasonable sensitivity and Specificity for the depiction of calculi and acute obstruction and ruling out other pathologies. In addition, in cases of ureterolithiasis, USG evaluation allows treatment planning [e.g., Surgical retrieval of large (>5-mm) calculi verses use of Analgesics and Flush therapy for smaller calculi]. Even though, use of US in the Emergency department may be controversial, US are widely accepted as the screening

modality for ureterolithiasis due to its low cost and ready availability [7]. NCCT is the gold standard for the evaluation of urinary stone disease, as it not only provides information regarding stone burden, composition, and fragility, which helps in the selection of treatment strategies and predicting success, but also rules out other potential mimics [6].

In our study we are using USG as the initial screening modality in the suspected cases of ureterolithiasis and its impact on management of the disease, because of its low cost, easy availability, no radiation dose to patient.

## METHODOLOGY

The present study was conducted in:

Department of Radio diagnosis and Imaging, Manipal Hospital, Rustom Bagh Road, Bangalore-560017. Patients presenting to the Urology OPD or Emergency department at our hospital, who clinically have acute colicky flank pain, routinely undergo USG abdomen evaluation, among them suspected cases of ureterolithiasis were selected for initial evaluation by USG KUB evaluation and plain KUB radiograph, NCCT KUB done depending on clinical scenario.

**Study procedure:**

1. Study sample size consists of 160 patients.
2. The study period was of 18 months (From May 2010 - October 2011).
3. Patients are enrolled into the study based on:

**Inclusion Criteria**:

Patients with Acute flank pain,suspected to have ureteric calculus.
Patients with Ureteric colic with or without hematuria.
Pregnant patients with suspected ureterolithiasis.

**Exclusion Criteria:**

Patients who are acutely ill,unco-operative not willing to undergo USG KUB as initial assessment.

4. Informed consent was taken from all the patients included in the study.
5. All the enrolled patients had detailed history, clinical examination and weight recorded.
6. Urinary Bladder of most patients was adequately distended before imaging except in few severely ill/non co-operative patients.
7. Patients are evaluated with US, NCCT of KUB and Plain KUB radiograph region.
8. Clinical, surgical, and/or imaging follow-up data were obtained in all patients.
9. All the data collected were analyzed by appropriate statistical test and differences in sensitivity and specificity between each modality (US and NCCT) and were compared.

**History and clinical evaluation**

All patients presented with acute, severe, colicky, unilateral or bilateral flank pain, radiating from the front of the abdomen to the groin or to the testicles ipsilaterally, with or without hematuria.

**Clinical Evaluation Scoring**

| | |
|---|---|
| Unilateral ureteric colic | 1 |
| Bilateral ureteric colic | 2 |
| Haematuria absent | 0 |
| Haematuria present | 1 |

**Protocols**

Of 160 patients,all of them underwent USG KUB as the initial diagnostic imaging modality, depending on the clinical scenario they were subjected to Plain KUB radiograph and or NCCT KUB. Of 160 patients,15 patients underwent KUB radiograph and NCCT KUB, 3 patients underwent IVU as additional imaging tool.

## RESULTS

The study comprising 160 patients with 115 male and 45 female patients of 16 years to 69years. Urolithiasis was confirmed in 145 of 160 patients. It was seen on sonography in 139 cases but was missed in 6 cases, however the ureterolithiasis was identified in these cases after non contrast enhanced CT KUB(n=6).The 145 patients with urolithiasis identified on sonography included 130 patients with ureterolithiasis,8 patients with calculus in the urinary bladder and 1 patient with uretherolithiasis. In the USG missed 6 cases, the clinical symptoms and signs were typical and swelling of the ureter was often present, then NCCT –KUB performed. We detected 139 calculi in 145 patients with sonography 130 patients had ureterolithiasis, 8 calculi identified in the urinary bladder, 1 calculus in the urethera. Twenty one patients without evidence of ureterolithiasis on sonography underwent non-contrast-enhanced CT (n=6), pre and post contrast CT (n=15), IVU (n=3) and radiographic work up Xray KUB (n=15). In the cases of non-visualization of ureteric calculi by sonograpghy, urolithiasis was confirmed on NCCT KUB (n=6). Computed tomography showed the absence of ureterolithiasis in 15 cases. Three cases were diagnosed with adnexal pathology, one case of ectopic pregnancy on right side, two cases of acute appendicitis, one case of gallbladder calculi; rest 8 cases no pathology could be detected for acute pain abdomen. One case of Pelvi Ureteric junction Obstruction confirmed on IVU.

**Locations of Calculi**

The 139 calculi identified in 145 patients on sonography included 02 in the renal,07 in the UPJ,37 in the proximal ureter,64 in the distal ureter,22 in the UVJ,08 in the urinary bladder,01 in the urethra.

**Dimension of Calculi:** The diameter of the ureteral calculi ranged from 2mm to 25 mm. The details of diameter as provided in the graph.

**Figure 1. Acute Flank Pain causes**

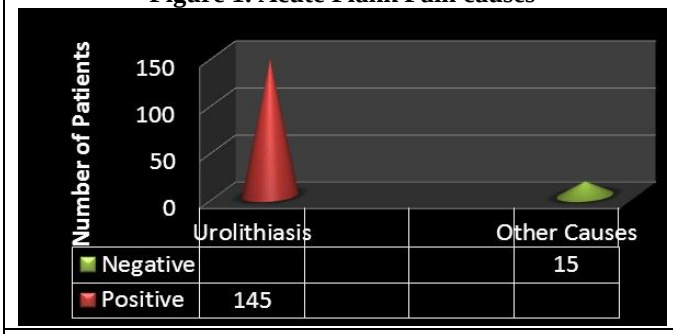



**Figure 2. USG Positive Calculus identification**

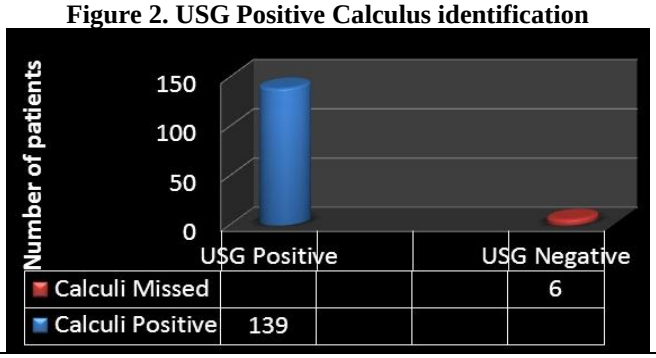



**Figure 3. USG Negative - CT KUB Positive**

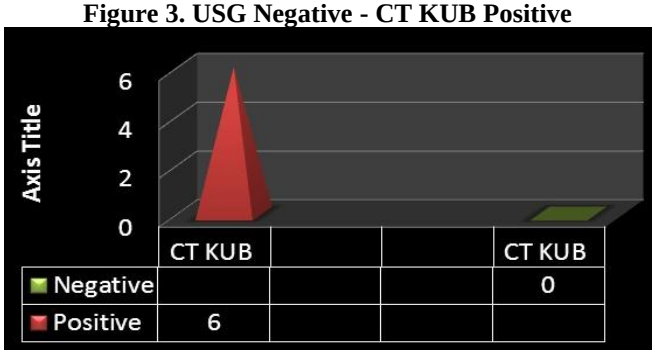
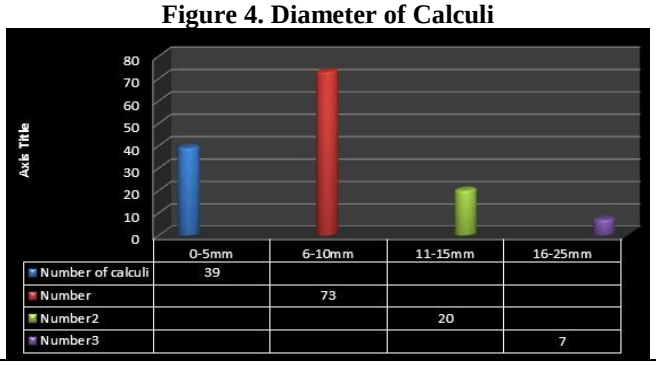



**Figure 4. Diameter of Calculi**




## DISCUSSION

Many studies have compared the efficacy of different radiologic modalities for evaluating acute flank pain. Since the mid-1990s, non–contrast enhanced CT has been considered the most precise imaging technique, and the reference standard for diagnosis of urolithiasis. Its advantages include the freedom from intravenous contrast agents, simplicity of performance, and ability to be used on a patient immediately. Non–contrast-enhanced CT can detect extra urologic diseases and is fast and relatively easy to learn. Nevertheless, CT has limitations: it is not available outside hospital facilities and is costly [8]. The amount of radiation in non-contrast enhanced helical CT is approximately 10 times that of plain radiography of the abdomen and pelvis [9] .Moreover, many patients may receive an additional radiation dose with follow-up studies (if a calculus is not expelled) or with new episodes of colic (75% of patients) [10]. Sonography is a radiation-free diagnostic tool that can be very accurate. In our study, the overall diagnostic sensitivity, specificity, and accuracy of sonography were 95.86%, 85.7%, and 95.4%, respectively. Previous articles reported sensitivity rates of sonography for detecting lithiasis of 12% to 93%, [11-13]. and a recently published article reported that the sensitivity and specificity of sonography for lithiasis were 78.6% and 100%, which were better than in previous reports, and those for obstruction were both 100% [14] .Several studies have been performed with low-dose CT protocols to detect ureteral stones using a tube charge current of 20 to 50 mA; the sensitivity was reported to be 89.5% to 97%, and the specificity was found to be 94.7% to 100%. Consequently, the diagnostic efficacy of sonography in our study is comparable with that of low dose CT but did not reach the sensitivity of normal-dose CT. Although low-dose CT has many advantages, including simple preparation, objective information, and easy application. Sonography also has great advantages; it is radiation free, universally available, easily applicable, and inexpensive compared with CT, and it allows for repeated follow-up examinations. The higher sensitivity and accuracy of sonography for detecting lithiasis might have been due to the development of new sonographic equipment, appropriate preparation for tracing the entire ureter, and the relatively thinner body habitus of Asian patients [15].

We applied strict preparation protocol for the adequate natural filling of urinary bladder, and also avoiding over distension which hinders the visualization of the distal ureter and UVJ.

Appropriate bladder filling helps show not only the distal ureter, including the UVJ, but also the ureter proximal to crossing the iliac vessels because high pressure in the bladder during filling permits exacerbation of hydronephrosis. We attempted to directly visualize the urolithiasis. Usually, transabdominal sonography can easily identify the renal pelvis, proximal ureter, distal ureter, and bladder and can be used to determine the level of obstruction, but its ability to show pathologic conditions in the mid ureter is limited. We divided the ureter into proximal and distal portions from the UPJ to the UVJ based on the level of crossing the iliac vessels because no appreciable difference exists in the sensitivity, specificity, and diagnostic accuracy of sonography for detecting urolithiasis based on location .The locations of the 139 calculi in the 145 patients with a sonographic

diagnosis consisted of the Renal in 2 cases, UPJ in 7 cases, proximal half of the ureter in 37 cases, distal half of the ureter in 64 cases, UVJ in 22 cases, urinary bladder in 8 cases, and urethra in 1 case. Compression can remove bowel gas anterior to the ureter and help with tracing the ureter between the level of the iliac wing and the dome of the urinary bladder.

Although the distal ureter can be readily identified with trans abdominal sonography because the urinary bladder provides a good sonic window an over distended bladder may interfere with identification of a small stone in the distal ureter [15]. Detecting secondary signs of a ureteral stone, including hydronephrosis, a perirenal fluid collection, and a change in the resistive index of an interlobar artery, is important. In one study, the authors achieved 95% sensitivity and 67% specificity when they included definite ureteral stones and hydronephrosis[1] and in another report, the sensitivity jumped from 12% to 81% when secondary signs of ureteral obstruction were included in the diagnosis of urolithiasis [1]. Direct visualization of urolithiasis is very important.

## CONCLUSION

In summary, sonography is an excellent modality with many advantages for detecting ureteral stones; it is radiation free, relatively inexpensive, universally available, and easily applicable, and it has high diagnostic efficacy. Adequately filled patients urinary bladder before scanning, new sonographic equipment, compression techniques, can enhance the diagnostic accuracy and confidence for detecting ureteral calculi on sonography.

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**CONFLICT OF INTEREST**:
The authors declare that they have no conflict of interest.

## STATEMENT OF HUMAN AND ANIMAL RIGHTS

All procedures performed in human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

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