

## Original Research Article

## Diagnostic Accuracy of Trans-Abdominal Ultrasound in Detection of Urinary Tract Calculi as Compared to CT KUB

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**Abstract: Background:** Urolithiasis refers to the formation of calculi as a result of a disruption in the equilibrium between salt solubility and precipitation in the urinary system. Computed tomography is considered to be extremely sensitive diagnostic test for its detection due to development in technology. The goal of this study was to find out the accuracy of ultrasound for detection of urinary tract stones as compared to CT KUB. **Objective:** The purpose of this study is to evaluate the sensitivity and specificity of ultrasound with the reference of CT KUB for the diagnosis of urinary tract stones. **Material and Method:** The cross-sectional study was conducted from January 13, 2022 to May 13, 2022 in the Department of Radiology, Gondal Medical Complex Gujranwala, in 78 patients who underwent simple CT KUB after USG with suspected urinary stones. Ultrasound and CT findings were compared based on age, gender, clinical appearance, number of stones, and location. All data was collected using a self-made questionnaire. I analyzed the data using SPSS version 26. USG specificity, sensitivity, positive predictive value, and negative predictive value were evaluated using CT as a reference standard. **Results:** Among the 78 patients, 56.4 % (n=44) were male and 43.6 % (n=34) were female. The average age of the patients was 41.5430 years. Urolithiasis was discovered in 80.76 % of the patients (n=63) who had CT KUB. Trans-abdominal ultrasound sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy in urolithiasis were calculated to be 68.3 %, 66.7 %, 89.6 %, 33.33 %, and 67.95 %, respectively. **Conclusion:** Trans-abdominal ultrasonography has a satisfactory diagnostic accuracy for urolithiasis since a range of parameters such as operator reliance, patient compliance, and stone size or location determines its sensitivity. When a CT scan is unavailable or contraindicated, it may be utilized as an alternative.

**Key words:** Trans-abdominal ultrasound, CT KUB, Sensitivity, Specificity, Urolithiasis.

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## INTRODUCTION

Urinary tract calculi are hard deposits made from minerals and salts produced in the renal tract by absorbed urinary minerals (Ahmad, *et al*, 2015). There are two sections to the urinary tract. Two kidneys and their ureters make up the upper urinary system. The kidney is a bean-shaped organ with a length of 10-12 cm, a width of 5-7 cm, and a thickness of 3-5 cm. They are located in retroperitoneal region of abdomen (El-Reshaid *et al*, 2014). The ureter is a canal that leads from the renal pelvis to the bladder and drains urine.

They are about 22-30 cm in size. (Anderson, *et al*, 2007). The bladder and urethra are part of the lower urinary system.

Renal stones can form in the kidneys, ureters, urinary bladder, or urethra, and are one of the most prevalent diseases today (Javed, 2018). Based on the location of the stone, urinary stones are categorised as renal, ureteric, urethral, and bladder stones. Urinary tract calculi (urolithiasis) is the third most prevalent urological condition after urinary tract infection (UTI)

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and prostate cancer, with a lifetime frequency of 10–15% (Johnston, *et al*, 2009).

Acute Renal colic is a painful condition caused by kidney stones. The pain is frequently episodic, with each episode lasting anywhere from 20 to 60 minutes. Renal stones can afflict anywhere from 5% to 15% of inhabitants at some point in their lives, with 50% of those experiencing severe colicky pain (Patti *et al*, 2017). When a stone moves through the urinary tract, it can cause a blockage in the flow of urine, resulting in hydronephrosis (SHAMS, RIAZ, & RAZIQ). Urolithiasis can produce symptoms such as renal colic, flank pain, painful urination, or hematuria, which is one of the most common reasons people consult a doctor (Altaf *et al*, 2019). Men are more likely to be affected than women (Rao *et al*, 2021).

The history, physical examination, presenting complaints, lab work, and imaging profile are used to diagnose renal calculi. For the identification of stones, X-ray KUB, ultrasonography, and CT scan are frequently employed imaging modalities (Leslie, *et al*, 2021). Because it is non-invasive, radiation-free, readily available, and cost-effective, ultrasonography (USG) has emerged as a major imaging technique for the diagnosis of urinary tract calculi. Sonographer variability and the difficulty in identifying ureteral stones are both disadvantages. The most sensitive test for detecting urinary stones is CT KUB (Wahab *et al*, 2019). Because of its sensitivity of 96-100 % and specificity of 96-100 %, non-enhanced CT scans are becoming the modality of choice (McLaughlin *et al*, 2014). As a result, the gold standard for detecting urolithiasis is a non-enhanced CT scan. However, frequent CT scans expose patients to ionizing radiation, which can result in high cumulative doses over time. As a result, this research compared the diagnostic accuracy of ultrasonography with CT in detecting urolithiasis, because ultrasonography has a lower radiation dose and is widely available at our facilities.

## MATERIAL AND METHOD

A cross-sectional study was undertaken utilizing a non-probability convenient sampling strategy in the Department of Radiology at Gondal Medical Complex Gujranwala. After an institutional review board approved the synopsis, 78 patients were included. The study lasted four months, from January 18th to May 18th, 2022. All patients who reported to the hospital during the study's period and met the inclusion criteria were included in the study. The ethics committee of the institute authorized the research proposal.

Patients of either gender and all ages were included in the study, who were referred to the radiology department after undergoing an ultrasound with the suspicion of urinary tract calculi and symptoms such as flank discomfort or hematuria. Patients who had previously undergone surgery, those with obstruction caused by any other pathology, pregnant women, those who refused to give consent, and those who were recalcitrant were all excluded from the research. All participants were informed about the study's purpose, and formal informed consent was acquired. A self-made proforma was used to obtain demographic data.

Ultrasonography was performed utilizing a Toshiba Ultrasound scanner with a 3.5 MHz frequency transducer for all individuals with a full urine bladder via the Trans abdominal route. Both longitudinal and transverse views of the kidneys were taken. The ureters will be followed all the way to the urinary bladder.

The patients' CT scans were done on an Acquilion 64 slice CT scanner. The patient was supine on the CT examination table with a full urinary bladder, and the scan range was from the upper abdomen region to the symphysis pubis. For a thorough KUB view, a non-enhanced CT scan was performed from the abdomen to the pelvis, with images reconstructed at 1mm for reporting and 5mm for filming.

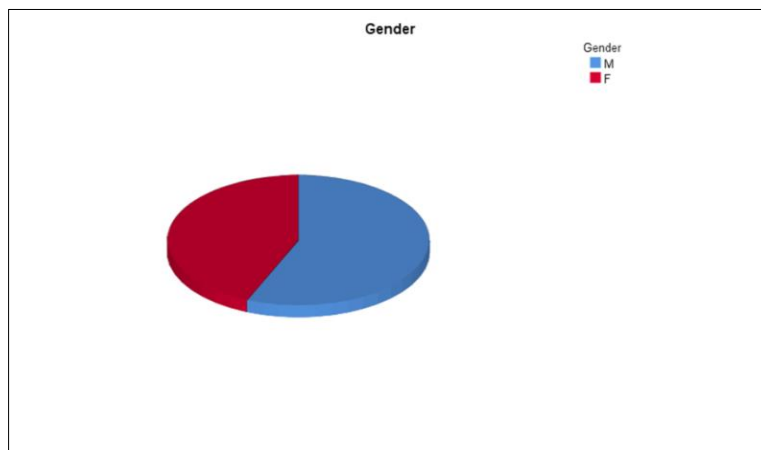
SPSS version 26 was used to analyze the data. The accuracy, sensitivity, specificity, PPV, and NPV were then assessed.

## RESULTS

There were 56.4% (n=44) males and 43.6% (n=34) females among the 78 patients (Table 1). Mean age of patients was 41.54±30 years. Large number of patients was in age group 26-50 as shown in (Table 2). Most common complaint of the patient was flank pain which was found in 72 patients followed by burning micturition, hematuria, vomiting and fever having % age of 38.5%, 25.6%, 12.8% and 15.4% respectively (Table 4). Urolithiasis was found in 80.76% of patients (n=63) undergone CT KUB. On the CT scan, 95 calculi were detected in 78 patients. Kidney was the most common site of urinary calculi with 44 (46.31%) calculi located in kidneys. Distal ureter was the second commonest site with 14 (14.7%) calculi. Bladder and urethra were the sites with 1(1.1%) calculus. Trans-abdominal ultrasound's sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy in urolithiasis were calculated to be 68.3 %, 66.7 %, 89.6 %, 33.33 %, and 67.95 %, respectively.

**Table 1: Frequency of Gender Distribution**

Valid	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
	M	44	56.4	56.4	56.4
	F	34	43.6	43.6	100.0
	<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>100.0</b>	



**Figure 1: Gender distribution in sample population graphically illustrated**

**Table 2: Patients age distribution (n=78)**

		Frequency (years)	Percent	Valid Percent	Cumulative Percent
Valid	1-25	14	17.9	17.9	17.9
	26-50	42	53.8	53.8	71.8
	51-70	19	24.4	24.4	96.2
	70-85	3	3.8	3.8	100.0
	<b>Total</b>	<b>78</b>	<b>100.0</b>	<b>100.0</b>	

**Table 3: Cross tabulation of results of CT KUB and Trans abdominal ultrasonography in survey respondents**

		Ultrasound		Total
		Present	Absent	
Ct scan	Present	43	20	63
	Absent	5	10	15
<b>Total</b>		<b>48</b>	<b>30</b>	<b>78</b>

**Table 4: Frequency of complaints in patients**

Complaints	Frequency	Percentage
Flank pain	72	92.3%
Hematuria	20	25.6%
Burning micturition	30	38.5%
Vomiting	10	12.8%
Fever	12	15.4%

## DISCUSSION

Renal colic is pain that occurs when a stone blocks urinary tract. It has the potential to be quite painful and it necessarily requires quick medical attention. Diagnosis of this condition is necessary for early diagnosis of the site and size of stone. Though ultrasound is considered as the primary modality for evaluation of urinary tract stones because it is cheap, readily available, non-invasive and radiations free (Sasui et al, 2021).

Trans-abdominal ultrasound's sensitivity, specificity, and diagnostic accuracy in cases of urinary tract calculi were evaluated to be 68.3 %, 66.7 %, and 67.95 %, respectively, in our study. In our study urolithiasis was found in men more than women as shown in (Table 3). Our findings are consistent with the findings of the majority of studies conducted in this area. Maryam Javed, et al. in 2018 conducted a study (Javed, 2018) Transabdominal ultrasonography's sensitivity, specificity, and diagnostic accuracy for detecting urolithiasis were calculated to be 65.27 %, 72.09 %, and 67.83 %, respectively. Ultrasonography

was found to be an adequate method for detecting urolithiasis in the study.

Hasan Shams, *et al.* published a study in 2019 comparing the diagnosis accuracy of USG and CT in patients with Acute Renal Colic (SHAMS *et al.*). It concludes that ultrasound can be utilised as the primary evaluation method for patients with acute renal colic, despite its poor efficacy in diagnosing urinary stones. Ultrasonography's sensitivity and specificity for detecting kidney and ureteral stones, as well as hydronephrosis, vary depending on the size, kind, and site of the stone in the urinary tract.

Toru, *et al.* (Kanno *et al.*, 2014) conducted same study on 856 people, and the results showed that ultrasound sensitivity was 78.9% and specificity was 83.7 %. Ultrasound is effective for detecting kidney stones, according to study. As a result, ultrasonography should be taken into account for both acute and follow-up renal stone examinations.

Calculi in the kidneys, proximal ureter, vesicoureteric junction, and urinary bladder can be seen with ultrasound. It also indicates the magnitude and severity of the related obstruction. Transabdominal ultrasonography provides significant advantages as a diagnostic technique for urolithiasis, especially in pregnant women and children, in our opinion.

## CONCLUSION

The value of USG in detecting the presence of urinary tract stones is limited. All individuals with renal colic should get a plain CT KUB scan because the use of ultrasonography is entirely dependent on the operator and requires several variables such as patient cooperation, patient preparation and obesity, which limits the ultrasound evaluation of urolithiasis. CT was found in this study to be more sensitive in detecting urolithiasis wherever they occur (in any portion of the urinary tract), as well as to provide more information about the surrounding anatomy to the location of stone. Ultrasound, on the other hand, continues to play a significant role in the initial diagnosis of patients suspected of having a stone, as well as in cases where CT is contraindicated, such as in pregnant patients and during follow-up.

## CONFLICT OF INTERESTS

The authors of this research report state that the current study has no conflicts of interest.

## ACKNOWLEDGMENTS

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## CONTRIBUTION STATEMENT

MR, MAN, and AA, collectively contributed to the present study. During the data collection, literature and document examination, analysis, and discussion processes, all writers work closely together. The paper was finalized, reviewed and approved for submission by all authors.

## ETHICAL APPROVAL

The Hospital Ethical Committee granted ethical approval. The study's subject was protected from harm during the data collection and procedure.

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