ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasound in Detection of Ureteric Calculi Taking CT KUB as Gold Standard

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ABSTRACT

Objective: To assess the diagnostic accuracy of ultrasound in detection of ureteric calculi taking CT KUB as gold standard.

Material and Method:

Study design: Cross-sectional study.

Setting: The study was conducted at Advance diagnostic Centre, Bilawal Medical College LUMHS Jamshoro

Duration of study: Study duration was six months from April 2020 to September 2020.

Methods: All the patients who were referred for CT KUB to diagnose the ureteric calculus, age more than 12 years and either of gender were included in this study. All the patients referred to CT KUB, underwent fresh trans-abdominal ultrasound after taking informed consent. All the data was recorded via self-made proforma. Data was analyzed by using SPSS version 20. 2X2 table was used to calculate the Sensitivity (SE), specificity (SP) "positive predictive value (PPV), negative predictive value (NPV) and accuracy of "trans abdominal ultrasound" by taking CT KUB as gold standard.

Results: Mean age of total 60 cases was 36.6 ± 8.49 years and mean duration of symptoms was 7.3±10.45 days. There were 51.7% males and 48.3% females. Ureteric calculi were detected among 68.3% of the cases on trans-abdominal ultrasound and 76.7% via CT KUB. Trans-abdominal ultrasound showed sensitivity 92% and specificity 44%, followed by positive predictive value (PPV) 90% and negative predictive value (NPP) 50% in the diagnosis of ureteric calculus by taking CT KUB as gold standard.

Conclusion: Trans-abdominal ultrasonography was observed to be a safe, reliable, non-invasive, feasible and quick diagnostic tool to detect the ureteric calculus and severity of the obstruction.

Keywords: Ureteric calculi, Ultrasound, sensitivity, specificity

INTRODUCTION

Ureteric stones are usually small in size and symptomatic.[1] Significant advancements occurred in the treatment of ureteral calculi in the last ten years. [2] Most significantly, therapeutical medical approach to aid in the ureteral stones removal has gained popularity, and ureteroscopic technological advances have progressed dramatically.[2] The majority of ureteral calculi dissolve on their own and need no treatment. The shape, size, and position of the stone, as well as any related ureteral oedema, all influence spontaneous passage.[3,4] Ureteral calculi smaller than 6mm have just a 40–50% probability of passing spontaneously. However, calculi greater than 6mm have a less than 5% chance of spontaneous passage.[3,4]

Previous research based on the effects of stone location and size on the history of naturally passage of ureteric stone, but with so many conflicting variables, such as hydronephrosis, stone impaction, and peri-ureteric oedema, a reliable estimation of the calculi fate is challenging to come by.[5] With the details in the NECT, the ureteral stone's natural passage of may be accurately estimated.[3] CT has a lots of benefits over IVU, including a shortened period of examination, the elimination of IV contrast mediums, improved sensitivity towards stone detection, as well as enhanced detection of anomalies not attributable towards ureteral stones.[6] Though, radiation dose remains high,[6] and procedure is invasive. This study intended to evaluate the ultrasound's diagnostic accuracy in ureteric calculi detection by taking CT KUB as a gold standard.

MATERIAL AND METHODS

This cross-sectional study has been conducted at Advance diagnostic Centre, Bilawal Medical College LUMHS Jamshoro. Study was conducted during six months from April 2020 to September 2020. All the clinically suspected patients and those referred for CT KUB to be diagnosed with ureteric calculus, age more than 12 years and either of gender were included in this study. Patients who were under lithotripsy treatment, having been referred only for ultrasound and those who were not agreeing to participate in the study were excluded. All those patients who were referred for CT KUB, underwent fresh trans-abdominal ultrasound after taking informed consent. All the data was recorded via self-made proforma. Data was analyzed by using SPSS version 20. Frequency and percentage were computed for categorical variables. Mean and standard deviation were computed for numerical data. 2X2 table was used to calculate the Sensitivity (SE), specificity (SP) "positive predictive value (PPV), negative predictive value (NPV) and accuracy of "trans abdominal ultrasound" by taking CT KUB as gold standard.

RESULTS

Total 60 individuals were studied. Mean age of the cases was 36.6±8.49 years and mean duration of symptoms was 7.3+10.45 days. Out of all 31(51.7%) were males and 29(48.3%) were females. Right side ureteric calculus was found in 30.0% cases, 38.8% cases had left ureteric calculus and 8.3% had bilateral ureteric calculus. Table .1

Ureteric calculi were detected among 68.3% of the cases on trans-abdominal ultrasound, while on CT KUB, ureteric calculi were found among 76.7% of the cases. Table 2.

Trans-abdominal ultrasound showed sensitivity 92% and specificity 50%, followed by positive predictive value (PPV) 90% and negative predictive value (NPP) 50% in the diagnosis of ureteric calculus by taking CT KUB as gold standard. Table 3.

Table 1: Descriptive statistics of age and gender n=60

Variables		Statistics
Age (Mean ± SD)		36.6 ± 8.49 years
Duration of symptoms (Mean ± SD)		7.3+10.45 days
Gender	Females (frequency (%)	29(48.3%)
	Males (frequency (%)	31(51.7%)
Site of calculus On CT KUB	Right ureter	18(30.0%)
	Left ureter	23(38.8%)
	Bilateral	05(8.3%)
	No calculus detected	14(23.4%)

Table 2: Frequency of ureteric calculus according to trans-abdominal ultrasound and CT KUB, n=60

Variables	Frequency	Percentage
Trans-abdominal ultrasound findings		
Yes	41	68.3%
No	19	31.7%
CT KUB findings		
Yes	46	76.7%
No	14	23.3%

Table: 3: Diagnostic accuracy of trans-abdominal ultrasound by taking CT KUB as gold standard n=60

Trans-abdominal ultrasound findings	CT KUB findings		Total
	Positive	Negative	
Positive	47	5	52
Negative	4	4	8
Total	51	9	60

Sensitivity: 92%, Specificity: 44%, PPV: 90%, NPV: 50%

DISCUSSION

Ureteric colic is a type of pain caused by a stone blocked within the ureter. It can be extremely painful and requires immediate treatment.[7] The diagnosis of this is necessary for the early diagnosis of the location and presence of ureteric stones.[8] However, ultrasonography is frequently used as the primary modality for imaging in patients with severe flank pain, because ultrasonography is a reliable, fast, low-cost, and replicable technique for detecting stones.[7] As in in this study trans-abdominal ultrasound showed sensitivity 92% and specificity 44%, followed by positive predictive value (PPV) 90% and negative predictive value (NPP) 50% in the diagnosis of ureteric calculus by taking CT KUB as benchmark. Similarly in the study of Wahab M et al[8] reported that the trans-abdominal ultrasound showed sensitivity of 69.64%, specificity of 66.6%, PPV of 82.92%, NPV of 48.48% and accuracy of 68.75% for detecting the ureteric stone. In another study of

Faiq SM et al[7] reported that CT has 100% sensitivity, US has 52.6% sensitivity and KUB X-ray has 89.5% sensitivity in the detection of ureteric calculus. On other hand Javed M et al[9] reported that Transabdominal ultrasonography's sensitivity, diagnostic accuracy, and specificity for urolithiasis were estimated to be 65.27 %, 67.83 %, and 72.09 %, respectively and they further stated that the trans-abdominal sonography can possibly be utilized effectively in detecting calculi in proximal ureter, kidneys, urinary bladder or vesicoureteric junction.[9] It also provides details on the severity and extent of obstruction that has resulted. The mid-ureter is generally obscured from the shadows of bowel gas, making visualization difficult.[9] Ahmed F et al[11] documented that ultrasonography has a sensitivity of 75.4% (CI: 0.7–0.8), and specificity of 16.7% (CI: 0.03–0.56); with 97.18% positive predictive value and 1.69% negative predictive value. Xia J et al[12] stated that the patients with positive "ultrasonic ureteral crossing sign", were found to have a sensitivity of 91%, specificity 97%, PPV 98%, NPV 87%, and AUC of 0.94 for distal ureteral calculi.

In this study right side ureteric calculus was in 30.0% cases, 38.8% cases had left ureteric calculus and 8.3% had bilateral ureteric calculus. Although in the study of Ahmed F et al[11] left- and right-side stones were detected in 47.2% and 52.8% cases respectively. In this study mean age of the cases was 36.6±8.49 years and these findings were analogous to the findings of Wahab M et al[8] as mean of the study subjects was 36.47±8.243 years. On other hand Javed M et al[9] also found similar average age of the cases as 35.69±5.91 years. However in an Iranian study of Ahmed F et al[11] found mean age of study subjects 47.7±15.9 years. As per gender distribution in this study males were 31(51.7%) and 29(48.3%) were females. Though Altaf N et al[10] et al found males (64.4%) and females (35.6%). Inconsistently Wahab M et al[8] found female 53.8% and males 46.3%. This gender difference may due small sample of studies including this study. However further large sample size and multicenter studies should be done on this subject. It is a limited imaging technique for the detection of urinary system stones, particularly when performed by an unskilled radiologist and if the stone's weight is increased, size is smaller, and hyderonephrosis levels are low.[11] The biggest issue with using ultrasound to diagnose ureteral calculi is that it relies on the radiologist's expertise and technique.[12] To find ureteral calculi through imaging, sonologists must inspect the ureter from start to end, which may take longer and necessitates continuous hand pressure to avoid the interference of intestinal gas.[12]

CONCLUSION

Trans-abdominal ultrasonography observed to be a safe, reliable, non-invasive, feasible and quick diagnostic tool to detect the ureteric calculus and severity of the obstruction. There are some factor affecting the diagnosis like non hyderoureter and experience of ultrasonography. However, ultrasonography still contributes significantly in the primary diagnosis of urinary tract stone suspected patients, an also during follow-up. This was a small sample size study, therefore further large sample size studies are recommended.

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