

ORIGINAL ARTICLE

TRANSABDOMINAL ULTRASONOGRAPHY IN PATIENTS WITH URETERIC COLIC

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ABSTRACT

Background: To determine the ureteric calculus in patients with renal colic using trans-abdominal ultrasound (US) and un-enhanced helical CT (UHCT). The aim of this study was to conduct an evaluation for efficacy of B-mode for diagnosing ureteric calculus in patients with renal colic by taking un-enhanced helical CT findings as gold standard.

Methods: This cross-sectional study was conducted at the department of Radiology, Dr. Ziauddin Medical University and Hospital, Clifton, Karachi from May 2013 to January 2014. Grey scale (B-mode) ultrasonography was used for the evaluation of all patients presenting with suspected renal colic followed by un-enhanced helical CT, standard, the finding of renal ultrasonography were compared.

Results: Out of total 105 patients, ultrasonography showed calculi in 21 (20%) of the patients while CT findings showed calculus in 55 (52.4%) of the patients. Out of 21 patients with calculus in ultrasound, right side was involved in 13 (61.9%) and left side in 8 (7.6%) of the patients. Mean size of calculi on ultrasound was 1.46 + 1.14. hydronephrosis was observed in 59 (56.2%) while hydroureter in 43 (41%) of the patients. Out of 55 patients with calculus in CT, right side was involved in 19 (34.5%) and left side in 36 (65.5%) of the patients. Mean size of calculi on Ct was 0.81 + 0.74. hydronephrosis was observed in 59 (93.75) while hydroureter in 43 (91.5%) of the patients.

Conclusion: For the diagnosis of small ureteral calculi B-mode ultrasonography is not a very sensitive test. However it can diagnose large ureteral calculi especially in the proximal and distal ureter.

KEYWORDS: Renal colic, ultrasonography, echogenic focus.

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INTRODUCTION

The most common problem met in the urologic practice is the renal colic and the most frequent cause of renal obstruction is the urolithiasis. In order to prevent the devastating effects of obstruction on the structure and function of kidneys prompt diagnosis is essential. Traditionally, evaluation consists of conventional radiology followed by intravenous urography and gray scale (B-mode) sonography.

Irradiation risks and reaction due to contrast media injection result in intravenous urography not a totally safe procedure. More recently CT is employed for

the detection of ureteric calculus. CT is a highly accurate and effective cross-sectional imaging technique, readily available, operator-independent, easy to perform, diagnostic sensitivity and specificity. Moreover, unlike ultrasound, obesity rarely limits study acquisition or interpretation.

The most common cause of renal colic is urolithiasis which is a very important disease. At least once during their life time approximately 10% of the general population is affected.¹⁻³ The incidence of ureterolithiasis in men and women is 3:1.⁴ In ureterolithiasis there is complete or partial obstruction of the ureter leading to its dilation with involvement of

renal pelvi-calyceal system. Therefore presence of hydronephrosis with renal colic raises the suspicion of ureterolithiasis. The presence of hydroureter and peri-renal collection are other helpful diagnostic criteria. There is limited value of US in demonstrating pathological condition of the ureter.⁶ US is appreciated to be less sensitive on visualizing ureterolithiasis although it is considered a high sensitivity imaging method in visualizing hydronephrosis.⁷ The sensitivity of US has been demonstrated to be 37-64% for calculus detection and for the detection of acute obstruction it has a sensitivity of 74-85%. For calculus and obstruction detection the specificity is 95-450% by US. The condition of the ureter are ineffectively detected by US due to towel gas obscuring the addus and the accuracy is also reduced by large patient habitus.⁷ Lack of significant hydronephrosis detectable in the examination resulted in false negative examination in the study by sommer et al. because of non-utilization of ionizing radiation, no requirement of I/V contrast media and upto 30 minutes examination time. Overlying bowel gas and unfavourable body habitus are known to limit sonographic visualization of the ureter, and many conditions that mimic renal colic are frequently stated to be more reliably detected with CT.⁸ Experience confirms that the acoustic window provided by the bladder affords consistent US visualization of the distal ureters and also corroborates previous work demonstrating that most acute calculi impact in this segment of the ureter at presentation¹¹ Although CT is generally accepted as diagnostically superior to other modalities in the setting of acute renal colic, US can frequently comprehensively assess the ureters and successfully depict many mimics of renal colic.¹² US is commonly recommended for use in the diagnosis of ureteric calculi. This study was conducted for the evaluation of efficacy of B-mode Us for diagnosing ureteric calculus in patients with renal colic by taking un-enhanced helical CT findings as gold standard. The results obtained were statistically evaluated and a comparison was made with several standard previous studies in terms of outcome and the factors contributing to it. Conclusions were derived on the basis of results about the utility of renal B-mode Ultrasonography in future in the evaluation of renal colic due to ureteral calculus.

METHODS

Study population

This cross-sectional study was done at the radiology department

Dr. Ziauddin Medical University and Hospital, Clifton, Karachi from May 2013 to January 2014.

Sample Selection

All patients of both sexes aged 9-77 years complaining of acute unilateral flank pain radiating from loin

to groin were included whereas patients who had previous renal surgery, suffering from pre-existing renal disease other than renal obstruction with contra-indication to radiation were excluded.

Sample size

105 patients with complain of acute unilateral flank pain radiating from loin to groin. As calculated by formula expected sensitivity 1.0⁵, expected specificity 0.89⁵, expected prevalence 0.05⁴, desired precision 0.06 and confidence interval 0.95.

Ethical Consideration

After explaining purpose, procedure and risk – benefit ratio, informed consent was taken from all the patients. Approval from ethical committee was also procured.

Data Collection Procedure:

A detailed history was taken from each patient regarding the side of renal colic, duration of symptoms and any pre-existing renal disease.

The examination of all patients was done in the supine and lateral decubitus position by using a single machine Toshiba Model No.XGSSA-580A (Nemio) with a convex transducer of 3.5 Mhz frequency. By using a 3.5 MHz surface probe ultrasound K.U.B was done and reported after being reviewed by two experienced senior radiologists. The US diagnosis of ureteric calculus was established upon detection of an intrauretericechogenic focus with strong posterior acoustic shadowing. Additional ultrasound characteristics supporting positive identification of a calculus recorded and include the presence of a circumferential anechoic rim of urine (the halo-sign) and, with the application of colour Doppler imaging, the twinkle-artifact. Hydronephrosis, hydroureter, nephrogely, perinephric fluid collection, peri-nephric and peri-ureteric fat stranding which are the secondary signs of obstruction were also noted that direct visualization of calculus was considered confirmatory. True positive result for ureterolithium was considered where as calculus life feature structure with intense hyperechogenicity was detected inside the ureter. Failure of ultrasonographical assessment of UL resulted in false negative results.

The un-enhanced helical CT (UHCT) imaging performed on TOSHIBA Model CXXG-010 A (Activion 16). All patients subsequently underwent un-enhanced helical CT (UHCT) imaging which was considered positive by visualization of a highly attenuating focus with greater than 100 Hounsefield units within the lumen of ureter. Patients with full urinary bladder were placed in the supine position at the time of UHCT. Scanning was done starting from upper renal poles down to the bladder base. The exposure factors setting was KVp 200-250 and mAs 120. Helical data acquisition consisted of 5mm thick sections and a pitch of 1.5:1. The CT examination was also reviewed by two experienced radiologists.

Both sets of studies were reviewed by independent radiologists, blinded to the patients identity, noted findings such as calculus visualization, calculus size with location and signs of obstruction e.g. hydronephrosis or hydroureter. Findings which were not related to calculi were also documented consideration the UHCT results as gold standard US findings were compared with UHCT. A proforma was used to document the relevant features including the patients' age, sex, CT and US findings.

Data Analysis:

Initially the data was collected on proforma and then shifted to SPSS version 14 was used for statistical analysis, different percentages and frequencies derived after entering data in the SPSS. All the graphs and charts were obtained on SPSS.

RESULTS

Descriptive statistics

A total of 105 patients included in the study. Mean age of the patients was 45.04 + 12.20 years. Majority of the patients were males 79 (75.2%) as compared to females 26 (24.8%). Mean duration of symptoms was 23.60 + 19.66. Left side of pain was observed in majority 58 (55.2%) patients followed by right site is 31 (29.5%) while only 6 (5.7%) patients were presented with both site of pain (figure 1).

Ultrasound and CT findings

Findings of ultrasound has displayed calculus in 21 (20%) of the patients while CT findings showed calculus in 44 (52.4%) of the patients. Out of 21 patients with calculus in ultrasound right side was involved in 13 (61.9%) and left side in 8 (7.6%) of the patients. Mean size of calculi on ultrasound was 1.46+1.14. Hydronephrosis was observed in 59 (56.2%) while hydroureter in 43 (41%) of the patients. Out of 55 patients with calculus in CT, right side was involved in 19 (34.5%) and left side in 36 (65.5%) of the patients. Mean size of calculi on Ct was 0.81+0.74. hydronephrosis was observed in 59 (93.7%) while hydroureter in 43 (91.5%) of the patients. (Table 1).

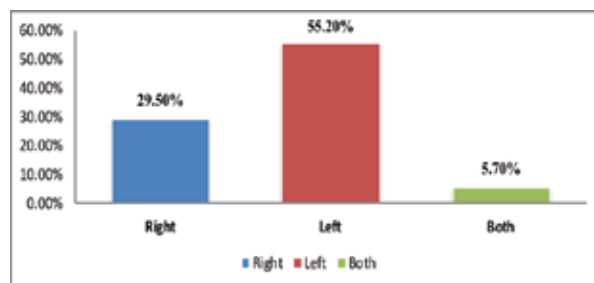


Figure 1: Descriptive statistics of patients; Left site of pain was observed in majority 58 (55.2%) patients followed by right site is 31 (29.5%) while only 6 (5.7%) patients were presented with both site of pain

	Ultrasound Findings		CT Findings	
	n	%	n	%
Calculus	21	20	55	52.4
Side				
Right	13	61.9	19	34.5
Left	8	7.6	36	65.5
Site				
Middle	5	23.8	5	9.1
Upper	0	0	16	29.1
Distal Ureter	16	76.2	34	61.8
Size	1.46 ± 1.14*		0.81 ± 0.74*	
Number calculi				
Single	13	61.9	55	100
Double	8	38.1	0	0
Hydronephrosis	59	56.2	59	93.7
Mild	51	86.4	59	100
Moderate	0	0	0	0
Severe	8	13.6	0	0
Hydroureter	43	41	43	91.5

n: number, *mean ± standard deviation (SD)

DISCUSSION

The sensitivity of US is high for urolithiasis & hydronephrosis but low for ureteric calculi. UHCT demonstrate urolithiasis and hydronephrosis in patients presenting with flank pain⁽¹⁻³⁾ it has been noted by sommer et.al 4 that UHCT reformatted images are very much superior to US. Additional non-urinary tract pathologies can also be suggested by UHCT in 12% of patients⁽¹¹⁾. We used some protocols for US in the present study, included patients of all age group who presented in ER with clinical signs and symptoms of acute renal colic and were referred to our department by the emergency physicians or surgeons. Trans abdominal sonography was done. CT scan studies were later performed with a single breath-hold technique using 5mm collimation and 1.5 pitch. No oral, rectal or intravenous contrast was administered. The subsequent axial images with reconstructed coronal and sagittal images were evaluated with special attention to determine the presence or absence of ureteric calculus. The US findings were compared with CT.

In this study, primary US criteria for ureteric calculus was an echogenic focus with strong posterior acoustic shadowing. The associated HDN and HDU were also noted prospectively. We also compared results of this study with other studies done so far on related topics. In this study, US scan was able to detect ureteric calculus in 8.27% (28/58). We also observed that HDN was the most frequently visualized associated sign and was detected in 91.6% out

of 28 true-positive cases. In this study 30 false-negative interpretations that occurred were obese, young patients with excessive bowel gases. In these 30 patients resulted in obstruction of calculus in the ureter. Most common reason for a false-negative US scan in a patient with ureteric colic is an excess of intra-abdominal gas which serves as a barrier to the transmission of US waves. Our study showed that there were two patients diagnosed as false positive, one patient had phlebolith and another patient had appendicolith. My study showed that 68.57 patients suffering from ureterolithiasis were males. International studies also favour that there is a slight male predilection for urolithiasis. Our research achieved a sensitivity of 48.27%, specificity of 60%, and an accuracy of 69.52% and an alternative diagnosis was established in 13 patients with US scan. Disease entities in these patients included appendicitis in 3(23%), gynaecologic pathologies in 4 (30.7%), bowel pathology in 3(23%), mesenteric adenitis in 2 (15.3%) and acute cholecystitis in 1(8%) patient. The possible limitations of our study were the non-fasting status of patients with excessive bowel gases obstructing the transmission of US wave for adequate ureteric visualization, and unfavourable body habitus.

CONCLUSION

The study revealed that transabdominal ultrasonography is not a very sensitive examination for the evaluation of ureteric calculus. We believe that transabdominal ultrasonography should be used with CT as an adjunct in patients who present with acute level colic. Hence on the basis of results we conclude that Transabdominal Ultrasonography should be employed in patients contraindicated to CT e.g pregnant patients and those who are at risk of irradiation. However US cannot replace CT as a standard diagnostic examination.

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