Original Article

Comparative Study of Non-Contrast-Enhanced Spiral CT Scan to Ultrasonography in the Diagnosis of Acute Renal Colic

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ABSTRACT

Objective: To evaluate the sensitivity and specificity of noncontrast spiral CT scan in ureteric colic with comparative evaluation of ultrasonography.

Study Design: Prospective comparative study.

Place and Duration of Study: This study was conducted at the Dept. of Radiology, Nishtar Medical College and Hospital, Multan from June, 2010 to June, 2011.

Materials and Methods: 62 patients with flank pain were examined with both ultrasonography and non contrast enhanced 16 slice spiral CT scan over a period of one year. Both techniques were used to determine the presence, size, and location of ureteric stone, and the presence or absence of secondary signs like ureteral and calyceal dilatation, stranding of perinephric, periureteric fat and soft tissue rim sign

Results: 43 of the 62 patients were confirmed as having ureteric calculi based on stone recovery or urological intervention. Ultrasound showed 93% sensitivity and 95% specificity in the diagnosis of ureterolithiasis. CT scan showed 91% sensitivity and 95% specificity respectively. Hydronephrosis was seen in all patients that were positive for ureteric calculi. Most common site of calculus was distal ureter. Perinephric fluid was demonstrated in three patients. Perinephric stranding was seen in 26 cases, and periureteric stranding in three patients on CT scan. Pathology unrelated to urinary stone disease was demonstrated in six patients

Conclusion: Although both modalities were excellent for detecting ureteric stones, consideration of cost and radiation lead us to suggest that ultrasound be employed first and CT scan be reserved for when ultrasound is unavailable or non-diagnostic

Key Words: Renal colic, Ultrasonography, Multidetector CT scan

INTRODUCTION

In the fields of emergency medicine and urology, acute flank pain is a common clinical problem. Urolithiasis is reported to affect up to 12% of the population during their life time[1]. Traditionally, excretory urography has been the gold standard method of diagnosing this condition, but it takes long time. In addition, the intravenous injection of contrast material is required and this carries the risk of life threatening side effect[2]

For patients with suspected acute ureteric colic, ultrasonography and unenhanced spiral CT are attractive alternatives

The advantages of spiral CT over IVU are well documented and include shorter examination time, avoidance of intravenous contrast, greater sensitivity for stone detection and increased detection of abnormalities unrelated to ureteric stones. However radiation dose is high [3,4]

Tran abdominal ultrasound has the advantage of being universally available, does not expose the patient to radiation, requires no intravenous contrast material and is independent of kidney function. Ultrasound is therefore attractive modality for the initial evaluation of urinary symptoms[5]

This prospective study compared the accuracy of spiral CT with ultrasonography in the evaluation of patients with acute flank pain

MATERIALS AND METHODS

Study was conducted between June, 2010 to June, 2011 to compare the accuracy of ultrasonography and multislice spiral CT scan in the diagnosis of ureteric calculi.

Total of 62 patients presenting in emergency department with clinical suspicion of renal colic were included. Initially transabdominal ultrasound was performed by emergency Radiologist for detection, location and size of ureteric calculi along with associated findings like hydronephrosis, hydroureter and perinephric collection

Multislice spiral CT without oral and intravenous contrast was performed on Toshiba Aquilion 16 slice MDCT machine. Source images were transferred to work station for reformation. The presence of ureteric calculus, its location, size and density were noted by consultant radiologist. Associated findings i.e. hydronephrosis, hydroureter, stranding of perinephric and periureteric fat and soft tissue rim sign were also noted.

RESULTS

43 of the 62 patients were confirmed to have ureteric calculi based on stone recovery and urological interventions. The US and CT findings are summarized in Table I.

Table No. I: Results of imaging with ultrasound and CT for detection of ureteric calculi

	Ureteric calculi Present	Ureteric calculi absent	Total No. of cases
Ultrasound			
Positive for calculi	40	1	41
Negative for calculi	3	18	21
Total	43	19	62
CT Scan			
Positive for calculi	39	1	40
Negative for calculi	4	18	22
Total	43	19	62

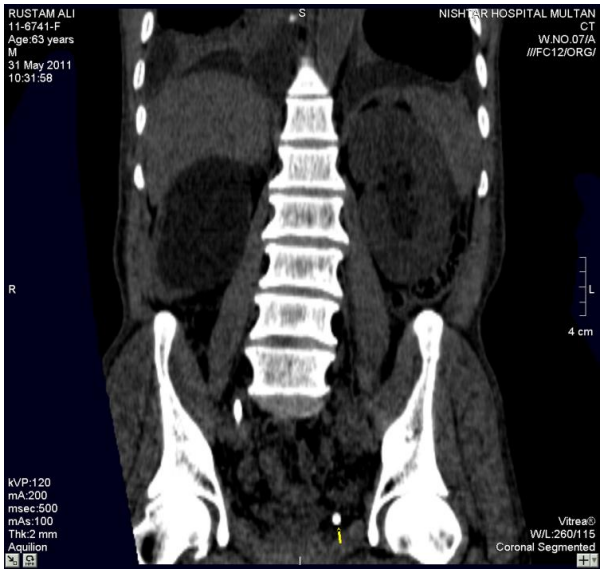

Figure No.1: CT scan –Bilateral ureteric calculi with hydronephrosis

US demonstrated ureterolithiasis in 40 of the 43 patients confirmed to have ureteral calculi (Sensitivity 93%, specificity 95%, positive predictive value 98%,negative predictive value 86%).Four calculi were located in the upper third of the ureter, four in the middle third and 32 in distal ureter

Hydronephrosis was noted in 43 cases. The degree of hydronephrosis demonstrated by US examination was graded as minimal in 22 patients, mild in 11 patients and moderate in 11 patients. Perinephric fluid was demonstrated in three patients

Of the 43 patients with calculi, CT detected 39(sensitivity 91%, specificity 95%, positive predictive value 98%,negative predictive value 82%).5 calculi were demonstrated in the proximal ureter,4 in the mid ureter and 30 in the distal ureter.

Perinephric stranding was seen in 26 cases, and periureteric stranding in 5 cases

Pathology unrelated to urinary stones was demonstrated in six patients and included appendicitis, cholelithiasis, cholecystitis and adnexal lesions in three patients

DISCUSSION

Recent studies have shown that non-contrast spiral CT is an excellent method for demonstrating ureteral calculi in patients with suspected renal colic[7].Smith et al[8] showed to be more effective than IVU in identifying ureteric stones. In another comparative study, Sommer et al[3] noted that reformatted, non contrast spiral CT images were superior to a combination of US and plain abdominal radiography for imaging ureteric calculi. In the current study, a comparison was made between US and spiral CT in 62 patients with comparable results for the two modalities in the demonstration of ureteric calculi. In some cases, it was difficult to ascertain on CT scan whether calcification was within the urinary tract or elsewhere, e.g. calcified phleboliths or a calcified seminal vesicle.

In one case, CT interpretation was false positive for a ureteric calculus, and retrospectively the calcification was shown to be a pelvic phleboliths. Four patients passed stones (2-5mm in size), none of which had been seen on CT scan. Non visualization of stones may be explained by volume averaging, small stone size and or low attenuation value of the stones US, which is universally available, non-invasive, inexpensive and radiation free, is preferred by some radiologist as the initial method for evaluation of the kidneys and bladder. However, US is considered to be of limited value in demonstrating pathological conditions of the ureter.

All patients with ureterolithiasis described herein had some degree of ureterohydronephrosis, hence US was able to follow the ureter to the level of stone demonstrate the exact nature of the obstructing lesion. An intraluminal echogenic focus with acoustic shadowing was clearly seen in all cases. Technical problems might occur in assessing the ureter when the stone is in the middle third, an area often obscured by bowel gas; we overcome this problem by compressing the area to be examined and changing the patient's position

Dalla Palma(6) evaluated 120 patients with renal colic using US and plain radiographs, and achieved 95% sensitivity but only 67% specificity.US was classified as positive for ureteric colic in the study when calculi or hydronephrosis were present. In the current study, only cases with definite demonstration of ureteric calculi were classified as positive and our results show a high specificity of 95%

In our study, CT and US were equally sensitive in detecting ureteric calculi; 91% and 93% respectively. In the study by Sommer et al, there were false negative US examination owing to a lack of significant hydronephrosis detectable on the examination (3).In our patients, US was also accurate in depicting stones in cases of minimal hydronephrosis

Extraurinary causes mimicking renal colic were demonstrated by both modalities except in one case of appendicitis that was diagnosed by CT only. However, the small number of cases with extra-urinary causes precluded statistical analysis.

CONCLUSION

In summary, both spiral CT and US were found to be excellent modalities for depicting ureteric stones, but because of high cost, radiation dose and high workload of CT, we suggest that US should be performed first in all cases and CT Scan should be reserved for cases where US is unavailable or fail to provide diagnostic information

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