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EVALUATION OF DIAGNOSTIC ACCURACY OF ULTRASONOGRAPHY VERSUS COMPUTED TOMOGRAPHY IN PATIENTS OF ACUTE RENAL COLIC

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Abstract:
CT scan is considered as gold standard imaging modality for diagnosis of nephrolithiasis but its utility is limited due to harmful radiation especially in children and pregnant females. The objective of the study was to evaluate the diagnostic accuracy of ultrasonography for detection of calculi in acute renal colic patients taking computed tomography as gold standard.
Material and Methods: *This was a cross-sectional study conducted at Services Hospital, Lahore. 102 patients of nephrolethiasis were selected using non-probability convenient sampling. Adult male and female patients of all ages fulfilling the inclusion criteria were included in the study. Ultrasonography and computed tomography of all patients were done and findings were noted. The data was entered and analyzed using SPSS version 24.*
Results: *Taking CT scan as gold standard, the sensitivity, specificity, positive predictive & negative predictive values and diagnostic accuracy of ultrasonography in detecting renal calculi was 74.47%, 96.36%, 94.59%, 81.54% and 86.27% respectively.*
Conclusion: *Sensitivity and specificity of ultrasonography for detection of renal and ureteric calculi and hydronephrosis is variable and is influenced by stone size, type and location of the stone in urinary tract.*

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INTRODUCTION:

Acute renal colic is extremely painful condition and is the typical presentation of renal stones. The colicky pain is often episodic in nature with each episode lasting from 20 to 60 minutes. Urinary stones may affect from 5% to 15% of the population at some point and 50% of those may report recurrent episodes of colicky pain. Whenever the stone moves down the urinary tract, there are chances of blockage in urinary flow and hydronephrosis [1]. Prevalence of nephrolithiasis is on rise across the globe and highest increase in incidence is observed in 15 – 19 years age group in the last decade [2]. Regional and geographical variability has been reported in stone prevalence. The prevalence of nephrolithiasis is highly variable among various regions of Pakistan with highest reported prevalence of 12% from Dera Ghazi Khan [3].

The diagnosis of renal calculi is made on the basis of history, physical examination, presenting complaints, blood biochemistry and imaging profile. X-ray KUB, Ultrasonography and CT scan are commonly used imaging modalities for detection of stones [4]. There is no consensus on use of optimal initial imaging modality in suspected nephrolithiasis patients between European Association of Urology [EAU], American College of Radiology [ACR] and American Urological Association [AUA] [5]. Although CT scan is considered as the gold standard in diagnosing nephrolithiasis [6] but due its unavailability at primary healthcare centers, ionizing radiations, contradiction in pregnant females and children and high operative and maintenance cost makes it less suitable to be used as initial diagnostic imaging modality [7].

Ultrasonography is very accurate for detection of hydro-nephrosis in stone patients. Renal stones exhibiting posterior acoustic shadowing and stones of size >5mm can be detected on USG reliably [8]. Ultrasonography has also advantages of lower cumulative radiation exposure, easy to use, cost effectiveness, non-invasive and availability at lower-level healthcare facilities.

The objective of the study was to determine diagnostic accuracy of ultrasonography for detection of stones in patients with acute renal colic taking computed tomography as gold standard.

MATERIALS AND METHODS:

The proposed study was undertaken at radiology department. All the adult male and females presenting to emergency department with symptoms of acute renal colic were included in the study. Patients not willing to participate, non-cooperative patients, pregnant females and patients with renal failure were excluded from the study.

Ultrasound of the patients presenting with symptoms of acute renal colic was performed by consultant radiologist using Ecoste mylab 7 color doppler machine equipped with 3.5, 5 and 7.5 MHz probes. Facility of Doppler was used for evaluation of kidneys, ureter and urinary bladder in multiple anatomic planes to visualize stone and to measure the size of the stone.

CT scan of the patients was performed by using Siemens CT Somatom Sensation 64 observing following protocol. Patient with full urinary bladder was positioned supine on CT examination table and scan was performed from the upper abdomen to the symphysis pubis with images constructed at 5 mm intervals. No oral or intravenous contrast was given. Any hyper dense focus in the kidney, ureter and / or bladder was taken as calculus.

Data was noted on a proforma and entered and analyzed using SPSS version 24. Sensitivity, specificity, positive predictive and negative predictive values and diagnostic accuracy were calculated for ultrasonography keeping CT scan as gold standard.

RESULTS:

Mean age of the subjects in the present study was 36.43 $\pm$ 10.34 years. Most of the patients [39; 38.24] were younger than 30 years of age. 34 [33.33%] were between 31-40 years of age, followed by 18 [17.65%] in 41 – 50 years and 10.78% in 51-60 years of age [Fig. 1]. 49% of the patients belonged to lower-middle class, followed by 33.3% and 17.6% in middle and lower socio-economic strata [Table 1].

Ultrasonography helped detection of 35 renal calculi in 35 out of 102 patients indicating a sensitivity and specificity of 74.47%, 96.36% respectively. The diagnostic accuracy was 86.27% while negative and positive predictive values were 81.54% and 94.59% respectively [Table 2].

Sensitivity and specificity of ultrasonography for detection of ureteric calculi was 12.0%, 92.59% respectively. The negative and positive predictive values using CT scan as gold standard were 27.47% and 81.82% while the diagnostic accuracy was only 33.33% [Table 3].

DISCUSSION:

Renal colic is the clinical presentation of flank pain radiating towards groin. Its prevalence is highly variable across various geographical regions and between races and is influenced by socio-economic and environmental factors. CT scan is the gold standard for diagnosis of urolithiasis but its use is limited due to ionizing radiation and unavailability at low level health care facilities in resource limited countries like Pakistan. On the other hand, ultrasonography is easily accessible, cost effective and easy to operate imaging modality for identification of renal stones.

A study from US indicated 66.7% sensitivity and 97.4% specificity for detecting renal stones in pediatric population while PPV and NPV were 95.2% and 79.2% respectively [9]. Another study from USA reported a sensitivity and specificity of 54% and 91% respectively for detection of renal calculi on ultrasonography [10]. The sensitivity and specificity of USG from Jordan was reported to be 58% and 91% respectively for diagnosing renal stone disease [11]. Results from a study from Nawaz Sharif Social Security Hospital, Lahore reported 91% specificity of ultrasonography for diagnosing urolithiasis. While sensitivity and specificity of CT scan was 91% and 95% respectively in the same study [12].

Another study from Iran reported an overall sensitivity and specificity of 75.4% and 16.75 for detecting urinary calculi on ultrasonography [13].. Various factors affect sensitivity, specificity and diagnostic accuracy of the ultrasonography. Review of literature shows that diagnostic accuracy of ultrasonography in urolithiasis is directly associated with degree of hydronephrosis [15]. Moreover, increasing stone size also increases detection rate of renal stone. [16].

CONCLUSION:

The high diagnostic accuracy of ultrasonography for renal stones makes it suitable as a first line diagnostic approach in emergency settings. Contrary to this, lower diagnostic accuracy for ureteric stones makes it less suitable. However, due to easy accessibility, less side effects, no contraindications and cost effectiveness supports this as an initial diagnostic modality. CT scan should be used only when ultrasonography is in-conclusive.

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