EFFICACY OF URINALYSIS IN SCREENING PATIENTS UNDERGOING CT KUB FOR SUSPECTED UROLITHIASIS

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ABSTRACT

Objective: To determine the role of urinalysis in patients undergoing CT KUB (kidney, ureter, bladder) for acute renal pain.

Study Design: Descriptive cross sectional validation study.

Place and Duration of Study: Study was conducted at PAF hospital Islamabad, from Aug 2014 to Sep 2015.

Material and Methods: A total of 93 patients coming to the radiology department of Pakistan Air Force (PAF) hospital for assessment of acute flank pain underwent CT KUB (Kidneys, ureter and bladder) and urine routine examination (RE). Urinalysis was considered abnormal if it contained pus cells greater than five per high field or red blood cells, or both. Result of CT KUB was compared with urinalysis to find out if the latter could be used to predict presence or absence of urolithiasis. Frequency of abnormal urinalysis was calculated for site and size of calculus detected on CT KUB for selection for CT while those with normal urinalysis could be evaluated by ultrasound only.

Results: Urinalysis was identified as an invalid indicator for renal tract calculi in patients with acute flank pain. Abnormal Urine RE was mostly associated with lower tract urinary calculi and with smaller calculi than larger ones.

Conclusion: Urinalysis was identified as an invalid indicator for urolithiaisis in patients having acute renal pain. In patient with urolithiasis, abnormal urinalysis was more frequently seen when the calculus was smaller and moreover was impacted in the lower urinary tract.

Keywords: CT KUB, Urinalysis, Urolithiasis.

INTRODUCTION

Urolithiasisis one of the commonest causes of acute abdominal pain. Incidence of renal tract calculi in Asia is 1-5%[1]. A study in Pakistan has revealed almost similar statistics of urolithiasis (5%), with the addition that 3% of renal calculi are silent[2]. In Europe the incidence of urolithiasis is upto 8%[3]. Gold standard for detecting urolithiasis is non-enhanced computed tomography of kidneys, ureters and bladder (CT KUB) in emergency setting[4]. It is also recommended as a first line imaging method by the American college of radiologists appropriateness criteria for patients with acute lumbar pain[5]. Despite it being a first line investigation in the acute renal pain setting, CT still remains potential source of radiation and hence needs to be used appropriately[6]. Radiation dose of CT is significantly higher than plain radiography therefore a careful selection of patients is required, particularly in children.

Most of the patients worked up for urolithiasis routinely undergo additional evaluation such as urinalysis prior to CT scanning. Urinalysis forms an integral part in the clinical evaluation of patients having renal pain, hence it has been recommended as basic laboratory test in emergency urolithiasis by the European Association of Urology[7]. In patients presenting with acute renal pain, urine analysis report showing haematuria and/or pus cells logically warrants a CT KUB. On the other hand, our aim was to assess the reliability of normal urinalysis in predicting the absence of urolithiasis

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in acute renal pain to limit the number of patients undergoing high radiation CT KUB. Hence we determined the frequencies of normal and abnormal urinalysis to calculate the negative and positive predictive values of urine analysis in the diagnosis of urolithiasis, using CT KUB as the gold standard.

MATERIAL AND METHODS

This was a cross sectional descriptive validation study with consecutive non-probability sampling, duly approved by the ethics review committee of PAF hospital Islamabad. It included patients with acute renal pain, who were referred to the radiology department, for CT KUB over a period of 13 months from Aug 2014 to Sep 2015. Patients who were referred for CT KUB for reasons other than acute flank pain were excluded from the study.

CT KUB was preceded in all the patients by urinalysis for presence of pus cells and/or red blood cells. Urine RE was considered abnormal if it contained more than 5 pus cells and /or more than 2 red blood cells per high power field on routine microscopy. Multi-detector CT scan machine (BR-6 Philips) was used for performing CT KUB. Imaging was carried out on full bladder without any contrast administration from top of kidneys to the level of symphysis pubis. Presence or absence of calculus on CT KUB was identified. If a calculus was present, then its location within the renal tract and its size were recorded.

Data was stratified according to the size of calculus and the site of calculus for better appreciation of results. Findings were documented using statistical package for social sciences (SPSS-17). Frequency and percentage were calculated for qualitative variables and chi-square calculator was used to assess the difference in variable; *p*-value less than 0.05 was considered as significant. Mean with standard deviation (SD) were computed for quantitative variables. Taking CT KUB as a gold standard, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic

Table-I: Gender comparison in patients showing urolithiasis on CT KUB.

Gender Distribution	Proportion of patients with calculi	Proportion of patients without calculi
Female n=26 (28%)	18/26 (19.01) (0.05)	8/26 (6.99) (0.15)
Malen=67 (72%)	50/67 (48.99) (0.02)	17/67(18.01) (0.06))
Total n=93		

Chi-square statistic is 0.2775. The *p*-value is 0.5. The result is not significant as *p*-value is >0.05.

Table-II: Frequency and percentages of various calculi depending upon the size and location in urinary tract and positivity rate of urine analysis in each category.

Patients with calculi detected on CT KUB (n=68)		
(a) Size of the calculi	**Frequency and percentage (n=93)**	**Proportion and percentage of patients with urinalysis positivity (n=40)**
<3 mm	14 (20.6%)	10/14 (71.4%)
3-5 mm	30 (44.1%)	16/30 (53.3%)
>5 mm	24 (35.3%)	14/24 (58.3)
(b) Site of the calculi		
Renal	18 (26.5 %)	8/18 (44.4%)
Ureteric	30 (44.1%)	17/30 (56.6%)
Vesicoureteric junction	20 (20.4%)	15/20 (75.0%)
Patients without detection of calculi on CT KUB (n=25)		
Number of patients	25 (26.8%)	8/25 (32.0%)

accuracy of urine analysis for diagnosing renal tract calculi were calculated using the standard formulae.

RESULTS

A total of 93 patients with acute flank pain undergoing CT KUB were included in the study. patients' age ranged from 12-70 years with a mean age of 38.8 ± 13.3 years. There were 26 (28%) females and 67 (72%) males (ratio: 1:2.3). Calculi were detected in 68 (73.12%) of 93 patients by means of CT KUB. Yield of CT KUB in terms of presence and absence of urolithiasis and correlating the results with gender is shown in table-I. Urinalysis was abnormal (showed red blood cells, or pus cells greater than five per high field, or both) in 48 (51.6%) of 93 patients, which included 40 (58.82%) of 68 patients with calculi detected on CT KUB. Urinalysis was abnormal (that is showed more than five pus cells, and/or red blood cells) more commonly if the stone was less than 3 mm or if the calculus was in the ureter; in 71.42% and 75% patients in each category respectively (table-II). The specificity, sensitivity, positive and negative predictive values and reliability of abnormal urinalysis to detect urinary tract calculi are shown in table-III. Receiver operating curve (ROC) depicting the diagnostic accuracy of urinalysis in predicting urolithiasis is shown as figure.

Table-III: Sensitivity, specificity, positive predictive value, negative predictive value of urinalysis in detection of urolithiasis keeping CT KUB as gold standard.

	CT KUB- Urolithiasis detected	CT KUB: Urolithiasis not detected
Urinalysis: Positive for pus cells/ RBCs	40	8
Urinalysis: Negative for pus cells/ RBCs	28	17

Sensitivity = True positives/True positives + False negatives= 58.82%, Specificity = True negatives/False positives + True negatives= 68%, Positive predictive value = True positives/True positives + False positives= 83.3%, Negative predictive value = True negatives/False negatives + True negatives = 37.7%, Reliability = (TP+TN) 100/Total No of tests = 61.29%.

DISCUSSION

CT KUB has a high sensitivity and specificity in detection of renal tract abnormality in patients of acute renal pain with 98% sensitivity and 97% specificity[8]. Despite it being an emergency imaging in patients of renal colic, its role in immediate management has come under scrutiny due to high radiation dose. Radiation dose for CT KUB is significant for human body with potential radiation hazards and has been reported at between 2.8 to 9.2 mSv[9]. Although CT KUB is an emergency examination however a research hasrevealed that no significant management alterationoccursif imaging is delayed in a patient of acute renal pain[10].

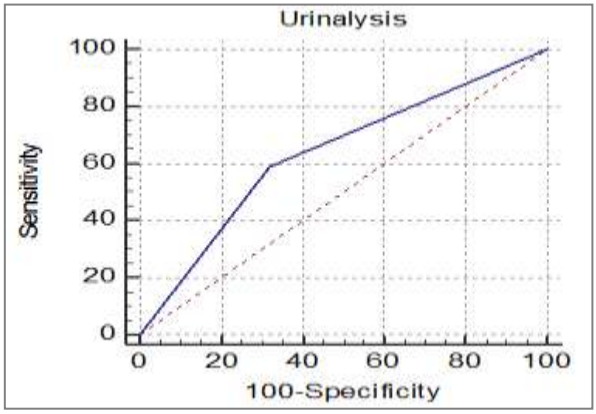

Figure-I: Receiver operating characteristic (ROC) curve depicting the diagnostic accuracy of urinalysis in predicting urolithiasis. Area under ROC curve = 0.634. (Diagnostic accuracy on the basis of area under ROC curve: 0.9-1 = excellent, 0.8-0.9 = good, 0.7-0.8= fair, 0.6-0.7 = poor, 0.5-0.6 = fail).

Urinalysis is suggested as a first line laboratory investigation in all patients suspected of having renal tract calculi[11]. Our study showed that urine examination positive for increased pus cells and/or red blood cells has only a moderate degree of sensitivity and specificity in detecting

the urolithiasis in patients presenting with acute pain in the abdominal flank. Although this corresponds with a moderately high positive predictive value of 83.3%, the negative predictive value is poor. With an overall reliability of 61.29% in our study, abnormal urine analysis does not qualify as an indicator for urolithiasis in patients of acute renal pain.Urinalysis needed to have a very high negative predictive value in order to qualify as a test which could be used to screen out the patient who did not require the exposure to radiation dose of CT KUB. In that case a urine negative for increased pus cells and/or RBCs would have obviated the need for CTKUB in patients presenting with renal colic. Moloney et al found in their research that imaging in patients with haematuria is primarily to detect malignancy rather than acute problems such as ureteric colic[12].

Calculi in the urinary tract may cause haematuria and increased pus cells by mucosal erosion or inflammation. A study found that 67% of patients having ureterolithiasis had microscopic haematuria[13]. Our study included patients having calculi in the whole of urinary tract including renal calculi had a lower percentage of abnormal urinalysis at 51.6% (n=48). In our patients, lower ureteric calculi had a greater frequency at 62.5% (n=30/48) of abnormal urinalysis in terms of presence of significant number of pus cells and/or RBCs (red blood cells) when compared to pelvi-ureteric junction or renal calculi. This correlates well with an international research carried out in United Arab Emirates which showed that microscopic haematuria was commoner with lower ureteric calculi (at 69.6%) than with high ureteric or renal calculi[14].

CONCLUSION

Urinalysis was identified as an invalid indicator for urolithiaisis in patients having acute renal pain. In patient with urolithiasis, abnormal urinalysis was more frequently seen when the calculus was smaller and moreover was impacted in the lower urinary tract.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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