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Original Research Article

Role of Multi-detector Computed Tomography in Evaluation of Hematuria in Young Adults: A Prospective Study

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ABSTRACT

Aim/Objectives: To determine the cause of hematuria in young adults using Multi-Dectector Computed Tomography (MDCT) and to correlate the MDCT findings with cystoscopic and histopathological correlation wherever indicated.
Materials and Methods: Hundred young adults (40 years or less in age) who presented with macroscopic or microscopic hematuria were included in the study. Detailed history and findings of clinical examination were recorded. Non contrast and contrast enhanced scans were performed and MDCT findings recorded in detail. Histopathological and Cystoscopic Findings were also recorded and correlated with the MDCT findings wherever indicated.
Results: Mean age of patients in the study was 26 years; 66% were males. Of all the examined cases, cause of hematuria was seen in 76 patients (76.0%). The most common clinically significant findings were renal or ureteric calculi seen in 64 out of 76 patients (84.2%). Five cases of urinary bladder (UB) mass & 3 cases of renal mass were seen. Three cases of Pyelonephritis and/or renal abscess and a solitary case of renal papillary necrosis were also seen. Diagnostic accuracy of MDCT in evaluating renal and vesical masses was 100 %.
Conclusions: Renal and Ureteric Calculi are the commonest cause of hematuria in young adults. UB and renal malignancy account for a small percentage of cases only. Also MDCT is highly accurate modality for diagnosing and characterising renal and ureteric calculi, UB and renal malignancy and helps in surgical planning and prognostic evaluation.

Key words: Computed Tomography; Hematuria; Calculi; Mass; Abscess

INTRODUCTION

Hematuria is common urological condition in young adults. [1–3] It may originate in any site in the urinary tract and is a very common sign of urinary tract pathology. Hematuria may be gross or microscopic. Gross hematuria is alarming and has a high predictive value for malignancy while definition of microscopic hematuria is quite controversial and several factors contribute to its definition including the urine collection method, hematuria detection method, number of positive results, and patient characteristics. [4] UB and renal masses account for the commonest cause of painless hematuria in young adults as well as elderly individuals.

Evaluation of a patient with hematuria includes proper history and physical examination. Complete evaluation

includes cytology, cystoscopy, and upper tract imaging. Many imaging modalities are available with ultrasonography (USG) and Computed Tomography (CT) being the commonest ones. USG is safe and reasonably accurate non-invasive modality for the evaluation of the kidneys and UB. However it has poor ability to detect calculi and small renal and UB masses. CT provides single comprehensive non invasive evaluation of the urinary tract, including UB and is the modality of choice for evaluation of gross or microscopic hematuria. Further MDCT urography allows delineation of tiny renal and UB masses which may be inconspicuous on USG.

So the current study was performed to determine the cause of hematuria in young adults using MDCT and to correlate the findings with cystoscopy and histopathological evaluation wherever indicated.

MATERIALS AND METHODS

This prospective study was performed in tertiary care centre in north India. Ethical and institutional clearance was obtained before initiation of the study. Hundred young adults (40 years or younger) who presented with gross or microscopic hematuria and were advised MDCT of abdomen and pelvis were included in the study. A total of 100 MDCT examinations were performed with 64 slice-MDCT scanner (Somatom Definition AS+ scanner from Siemens Healthcare). Patients were scanned in the supine position using a three-scan CT protocol, including an unenhanced scan, a nephrographic phase scan and excretory phase scan of the abdomen and pelvis after contrast injection. Additional delayed scans were also obtained in some patients depending upon findings observed during nephrographic and excretory phase. Images were reviewed by three radiologists with significant experience. Findings of the examinations were recorded and clinically significant source of hematuria was determined. In patients with UB and renal mass, histopathological evaluation was performed. Histopathological findings were correlated with MDCT findings.

RESULTS

Majority of the patients were seen in 3rd decade of life (Table 1). Most of the patients were males with male to female ratio of 1.9 (Table 1).

Table 1: Age & Sex Distribution (n=100)

Age Group	Number of Patients	Number of Males	Number of Females
0-10	3	3	0
11-20	23	16	7
21-30	44	30	14
31-40	30	17	13
Total	100	66	34

Out of 100 patients who underwent MDCT scans, clinically significant cause of hematuria was seen in 76% cases. Majority of them included renal and/or ureteric calculi, seen in 64% cases (Table 2). No clinically significant cause of hematuria was seen in 24 % cases.

Table 2: Sources of Hematuria Identified on MDCT (n=76)

Category	No. of Patients
Life Threatening	
A) Renal Mass	3
B) Vesical Mass	5
Significant and Requiring Treatment	
A) Renal and/or ureteral calculus	64
B) Pyelonephritis and/or Renal Abscess	3
C) Renal Papillary Necrosis	1
Total	76

Five cases of UB mass, 3 cases of renal mass and 3 cases of pyelonephritis and or renal abscess were seen (Table 2). In four cases, solitary UB mass (Fig. 1) was seen while multiple polypoidal UB masses were seen in one case (Fig. 2). All patients with UB mass were subjected to cystoscopy followed by biopsy and histopathological evaluation. All patients with UB mass presented with multiple episodes of gross hematuria.

Fig. 1: Solitary UB mass

Axial Non Contrast and Contrast Enhanced MDCT images reveal a small enhancing mass lesion along right posterolateral UB wall (white arrows).

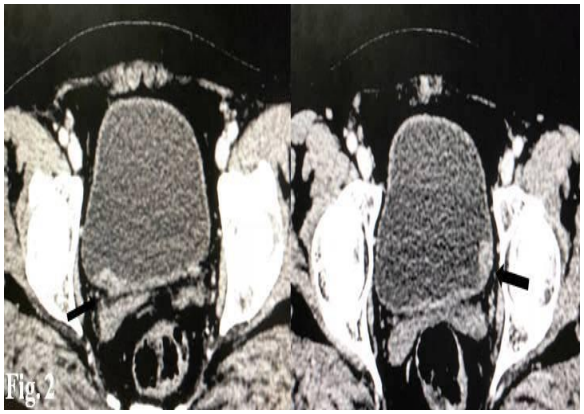

Fig. 2: Multiple UB masses

Axial Contrast Enhanced MDCT images reveal small enhancing mass lesions along both posterolateral UB walls (black arrows).

Three cases of renal mass were also seen in our study and were diagnosed correctly on MDCT images (Fig 3). All the patients underwent partial or total nephrectomy followed by histopathological correlation. Malignant changes were seen in all the three cases.

Fig. 3: Renal Mass

Axial and Coronal Contrast Enhanced MDCT images reveal small heterogeneously enhancing mass lesion involving the mid pole of right kidney (white arrows).

Three cases of pyelonephritis and/or renal abscess were seen and were reliably diagnosed on MDCT scans. On MDCT, renal abscess was seen as ill defined hypodense area in renal parenchyma with thick peripheral rim enhancement (Fig 4). Extension into perinephric space may also be seen.

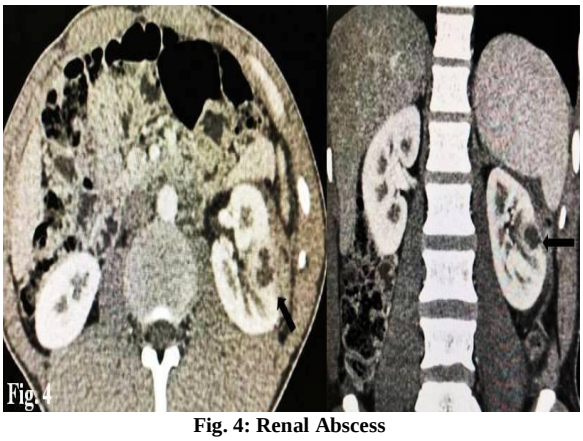

Fig. 4: Renal Abscess

Axial and Coronal Contrast Enhanced MDCT images reveal small ill defined thick walled peripherally enhancing hypodense lesion (black arrow), extending into left perinephric space.

One case of renal papillary necrosis was also seen in our study. On urographic images, non enhancing debris was seen in the renal collecting system representing shredded renal papilla (Fig 5).

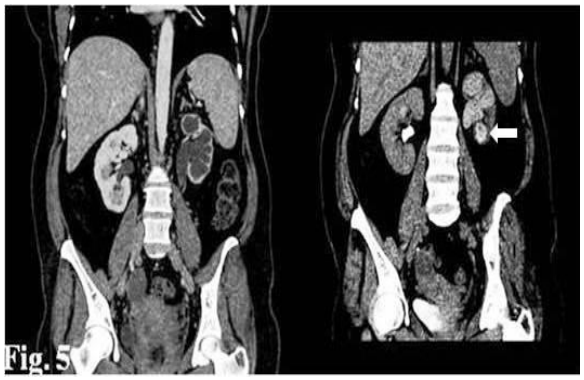

Fig. 5: Renal Papillary Necrosis

Coronal Contrast enhanced and Delayed MDCT images reveal dilated left Pelvicalyceal system with presence of small non enhancing filling defect in inferior pole calyx (white arrow) seen on delayed images representing shredded papilla.

DISCUSSION

American Urologic Association for the evaluation of adults with hematuria published the practice guidelines in 2001 and recommends the initial upper urinary tract imaging with either excretory urography or CT urography, in addition to cystoscopy of the UB and urine cytology. [5,6] MDCT has better diagnostic accuracy for diagnosing urinary calculi, renal and UB masses, renal and perirenal infections, and unsuspected extra-urinary diseases as compared to excretory urography. [7–10] Also CT urography has been recommended over excretory urography by the American College of Radiology in the evaluation of hematuria. [10]

In our study, clinically significant source of hematuria was seen in 76 % cases. The maximum numbers of cases in this group (62 %) were renal or ureteral calculi. Five cases of UB mass, 3 cases of renal mass and 3 cases of pyelonephritis and or renal abscess were also seen in our study. Majority of clinically significant findings in our study included urinary tract calculi and renal and vesical masses and upper urinary tract infections, thus justifying the superiority of CT over other modalities. [11]

In our study, MDCT was able to diagnose all cases of vesical and renal masses and findings were correlated with pathological evaluation. So, diagnostic accuracy of MDCT in evaluating renal and vesical masses was 100 % in our study. Many studies have discovered life threatening conditions on urinary tract imaging and thus have advocated the evaluation of microscopic hematuria with upper urinary tract imaging in young adults. [12-15] One of limitations in our study was small sample size as only 100 patients were included in the study.

One of the major concerns regarding the use of MDCT is the radiation exposure. The mean effective dose of CT urography is 14.8 mSv which is to approximately 1.5 times the radiation risk from IVU. [16] In young adults, this radiation exposure is significantly higher and thus judicious and cautious use of MDCT is required in evaluation of hematuria in young adults in line with as low as reasonably achievable (ALARA) principles.

CONCLUSIONS

MDCT is a highly accurate and effective modality in diagnosing the cause of hematuria in young adults, especially in vesical and renal masses. Also MDCT can guide the clinician regarding appropriate treatment strategy and aid in prognostic evaluation. However due to concerns regarding radiation exposure, it must be used a problem solving modality with judicious use according to ALARA principles.

Conflicts of Interest: Nil
Source of Funding: Nil

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