

Detection of Renal Malignancy on Multi-detector Computed Tomography in Patients Presented with Hematuria

ZAHID NAZIR¹, ATIF MAQSOOD², MUHAMMAD AHMAD ASGHER³

¹Assistant Professor of Radiology, Government Kot Khawaja Saeed Teaching Hospital Lahore, King Edward Medical University Lahore

²Assistant Professor of Medicine, Aziz Fatimah Hospital Faisalabad.

³Assistant Professor of Medicine, Amna Inayat Medical College, Sheikhpura

Correspondence to: Dr. Zahid Nazir Email: drzahidradiologist@gmail.com

ABSTRACT

Aim: To determine the diagnostic accuracy of MDCT in detection of renal carcinoma taking histopathology as gold standard.

Study Design: Cross sectional study

Place and Duration of Study: Department of Radiology, Government Kot Khawaja Saeed Teaching Hospital, Lahore from 1st June 2018 to 31st December 2018.

Methods: One hundred patients who fulfilling criteria were included. Then MDCT was applied to detect the cause of hematuria and then was underwent renal biopsy for confirmation of renal disease causing hematuria. Findings were noted and accuracy of MDCT was noted.

Results: The mean age of patient was 53.74±11.39 years. The mean duration of symptoms was 5.42±1.56 days. There were 77 males and 23 females. In the sample 12(12%) had family history of renal calculi. In the sample 7(7%) had family history of renal carcinoma. The MDCT had sensitivity: 70.2%, specificity: 81.4%, PPV: 83.3%, NPV: 67.3%, accuracy: 75% for detection of renal carcinoma.

Conclusion: Multi-detector computed tomography is accurate enough that it can replace interventional methods to diagnose renal carcinoma including renal biopsy.

Keywords: Hematuria, Renal calculi, Renal carcinoma, Malignancy, Multi-detector computed tomography

INTRODUCTION

Haematuria is existence of blood in the urine sample, which can be present as macroscopic or microscopic. Main reasons for haematuria are abnormalities of blood, urinary tract infections/neoplasms, stones, injuries, billharziasis, benign prostatic hyperplasia, glomerulonephritis, etc¹. Other less common causes are urinary tract allergies, renal vein hypertension, thrombosis in inferior vena cava, bladder wall varices and endometriosis^{1,2}.

Haematuria can be indicative of serious illnesses like bladder or renal cell carcinoma, urothelial cell carcinoma or calculi in upper urinary tract.^{3,4} Different radiological methods are available which can help to investigate presence of haematuria including intravenous urography, retrograde ureterography and pyelography, ultrasonography, CT, cystoscopy and ureteroscopy⁵. Multi-detector CT (MDCT) acquires thin collimated data of urinary tract and provides higher spatial resolution than conventional CT. Its capability to offer reconstructions in coronal, sagittal and oblique planes, makes it exact in stone position and several urinary tract diseases. It offers exact anatomical features of vital organs, providing important information to plantreatment protocols⁶.

Multi-detector computed tomography urography is replacing conventional urography extensively as first-line diagnostic tool for assessment of renal tract.^{7,8} Multi-detector computed tomography urography is applied in many clinical setting to detect the upper renal system for and and metachronous urothelial tumors and primarily for detection of haematuria^{9,10}.

So we planned to conduct this study as there is not much literature available in this regard. As if MDCT showed more accuracy for detection of renal carcinoma, then in future we can implement the MDCT as first line detection tool to detect renal carcinoma in patients with renal colic pain and other symptoms.

MATERIALS AND METHODS

This cross sectional study was done at Department of Radiology, Government Kot Khawaja Saeed Teaching Hospital, Lahore from 1st June 2018 to 31st December 2018. One hundred patients of renal malignancy with hematuria were included. The patients were recruited through the emergency with complaint of renal colic pain, voiding problem, creatinine > 1.2mg/dl, with or without renal calculi (on x-ray KUB) and hematuria (on urine analysis). Patients with previous treatment of renal calculi or malignant or benign disease, were excluded. Informed consent was obtained and patient were assured about confidentiality of their data used for this research. Demographic details were obtained. Then patients were underwent X-ray KUB for detection of renal calculi. Then MDCT was done with 4-, 16-, or 64-MDCT scanner (Volume Zoom, Sensation 16 & 64, Siemens Healthcare). All the patients were advised to drink 1L oral water and void just before examination. Patients underwent scanning in supine position. This protocol include unenhanced scanning (collimation, 0.6-2.5mm; 120kVp; pitch, 0.875-1.25; 155-280mA) of abdominal & pelvic region, nephron-graphic phase imaging of kidneys (collimation, 0.6-2.5mm; 120kVp, pitch, 0.875-1.25; 155-280mA) 100seconds after administration of 100mL iopromide intravenously at the speed of 3mL/s, and excretory phase imaging of abdominal & pelvic region (collimation, 0.6–1.0mm; 120 kVp; pitch,

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0.65–1.00; 160–280mA) 15min after infusion of contrast medium. Excretory phase images were also recreated in 3mm to 5mm thick sections of axial planes & 3mm thick sections of coronal planes. Then these findings were categorized as: large mass (>5mm), small mass (≤5mm) or urothelial thickening. Patients were labeled positive or negative. Then patient will undergo renal biopsy for confirmation of renal carcinoma. Data was entered & analyzed in SPSS version 21. 2x2 table was used to calculate sensitivity, specificity, PPV, NPV and accuracy of MDCT.

RESULTS

The mean age of patient was 53.74±11.39 years. There were 77(77%) males and 23 (23%) females. The mean duration of symptoms was 5.42±1.56 days. There were 54 (54%) patients belonged to low socioeconomic status, 38 (38%) belonged to middle class while 8(8%) belonged to high class. In the sample 12(12%) had family history of renal calculi. In the sample 7(7%) had family history of renal carcinoma. Renal stone was detected in 62(62%) cases (Table 1). The MDCT had Sensitivity: 70.2%, specificity: 81.4%, PPV: 83.3%, NPV: 67.3%, accuracy: 75% for detection of renal carcinoma (Table 2).

Table 1: Demographic details of patient (n=100)

Age (years)	53.74±11.39
Gender (M / F)	77 / 23
Duration of symptoms (days)	5.42±1.56
Socioeconomic status	
Low	54
Middle	38
High	8
Family history of renal calculi	12
Family history of renal carcinoma	7
Renal stone detected	62

Table 2: Accuracy of MDCT

MDCT	Renal biopsy		Total
	Positive	Negative	
Positive	40	8	48
Negative	17	35	52
Total	57	43	100

Sensitivity: 70.2%, specificity: 81.4%, PPV: 83.3%, NPV: 67.3%, accuracy: 75%

DISCUSSION

In a previous research, the incidence of hematuria was 14%, which was detected on MDCT urography.¹¹ Song et al¹² found the prevalence of hematuria i.e. 6.8% which is highly significant extra-urinary findings of MDCT. Multi-detector computed tomography can also aid to identify active haemorrhage and leakage of urine. It is very accurate in evaluation of high-grade trauma and also helps in guiding Transcatheter embolization and defining pre-existing diseases. Multi-detector computed tomography displays well-established several traumatic renal lacerations with appropriate diagnosis and staging of trauma in renal organ and also helped in planning proper management.

In our study, the MDCT had sensitivity: 70.2%, specificity: 81.4%, PPV: 83.3%, NPV: 67.3%, accuracy: 75% for detection of renal carcinoma. Yousef & Seifelnasr¹³ found that in detecting the etiology of haematuria, the

sensitivity of MDCT was 82%. For detection of recurrence in the bladder, whole diagnostic accuracy of MDCT was reported to be significantly higher for nephrographic phase than for pyelographic phases [91.7% versus 83.2%, p<0.05]. For detection of recurrence in the upper urinary tract, the overall diagnostic accuracy of MDCT was also significantly higher for nephrographic phase than for pyelographic phase [86.7% versus 80%, p<0.05]¹⁴

Cha et al¹⁵ conducted a trial to build-up a system, which would be computerized, for segmentation of bladder in the CT urography as the critical constituent for computer assisted recognition of carcinoma of the bladder. Researchers found that deep learning library-convolutional neural network can overwhelm solid margins in two regions, which have huge dissimilarity in grey levels. This also offers smooth mask to monitor level set amplification which was the problem for several gradient based dissection procedures.

Sadow et al¹⁶ reported that CT urography for upper tract urothelial carcinoma has 53% predictive value, 83% for large masses, 0% for small masses and 46% for urothelial thickening.

CONCLUSION

Multi-detector computed tomography is accurate enough that it can replace interventional methods to diagnose renal carcinoma including renal biopsy. Now in future, we can recommend the use of MDCT for detection of renal carcinoma in patients with hematuria with or without renal calculi as first line diagnostic modality in order to avoid interventional methods.

REFERENCES

- Grossfeld GD, Wolf Jr JS, Litwin MS, Hricak H, Shuler CL, Agerter DC, et al. Asymptomatic microscopic hematuria in adults: summary of the AUA best practice policy recommendations. *Am Fam Phys* 2001;63(6).
- Koshy CG, Govil S, Shyamkumar N, Devasia A. Bladder varices—rare cause of painless hematuria and idiopathic retroperitoneal fibrosis. *Urology* 2009;73(1):58-9.
- C Cowan N. CT urography for hematuria. 2012.
- Song JH, Beland MD, Mayo-Smith WW. Hematuria evaluation with MDCT urography: is a contrast-enhanced phase needed when calculi are detected in the unenhanced phase? *American Journal of Roentgenology* 2011;197(1):W84-9.
- Joffe SA, Servaes S, Okon S, Horowitz M. Multi-detector row CT urography in the evaluation of hematuria. *Radiographics* 2003;23(6):1441-55.
- Eshed I, Witzling M. The role of unenhanced helical CT in the evaluation of suspected renal colic and atypical abdominal pain in children. *Pediatr Radiol* 2002;32(3):205-8.
- Silverman SG, Leyendecker JR, Amis ES. What is the current role of CT urography and MR urography in the evaluation of the urinary tract? *Radiology* 2009;250:309.
- Amis ES. Epitaph for the urogram. *Radiology* 1999;213:639-40.
- Sudakoff GS, Dunn DP, Guralnick ML, Hellman RS, Eastwood D, See WA. Multi-detector computerized tomography urography as the primary imaging modality for detecting urinary tract neoplasms in patients with asymptomatic hematuria. *J Urol* 2008;179:862-7.

10. Albani JM, Ciaschini MW, Stroom SB, Herts BR, Angermeier KW. The role of computerized tomographic urography in the initial evaluation of hematuria. *J Urol* 2007;177:644.
11. Kumar R, Kumar Airon R, Mittal A, Singal R, Sharma K, Singal S. Evaluation of Multidetector Computed Tomography in Haematuria. *Maedica* 2017;12(2):87-94.
12. Song JH, Beland MD, Mayo-Smith WW. Hematuria evaluation with MDCT urography: is a contrast-enhanced phase needed when calculi are detected in the unenhanced phase? *AJR* 2011;197(1):W84-9.
13. Yousef A, Seifelnasr M. The value of unenhanced multi-detector computed tomography versus three-dimensional ultrasound in evaluating patients with impaired renal function and hematuria. *Afr J Urol* 2012; 18(4):149-54.
14. Kim JY, Kim SH, Lee HJ, Kim MJ, Kim YH, Cho SH. MDCT urography for detecting recurrence after transurethral resection of bladder cancer: comparison of nephrographic phase with pyelographic phase. *AJR* 2014;203(5):1021-7.
15. Cha KH, Hadjiiski L, Samala RK, Chan HP, Caoili EM, Cohan RH. Urinary bladder segmentation in CT urography using deep-learning convolutional neural network and level sets. *Medical physics* 2016 Apr;43(4):1882.
16. Sadow CA, Wheeler SC, Kim J, Ohno-Machado L, Silverman SG. Positive Predictive Value of CT Urography in the Evaluation of Upper Tract Urothelial Cancer. *Am J Roentgenol* 2010;195(5):W337-43.