



ROLE OF CT UROGRAPHY IN EVALUATION OF PATIENTS WITH OBSTRUCTIVE UROPATHY: A PROSPECTIVE STUDY OF 50 PATIENTS IN A URBAN TERTIARY CARE HOSPITAL

Radio-Diagnosis

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ABSTRACT

Introduction: Obstructive uropathy is a relatively common clinical problem which if not treated timely can lead to irreversible renal damage. Therefore, accurate diagnosis is important for timely management. **Aim:** The purpose of present study is to assess role Multidetector Computed Tomography (MDCT) urography in evaluation of obstructive uropathy. **Materials and Methods:** This prospective study was conducted on 50 consecutive subjects presenting with evidence of unilateral or bilateral hydronephrosis and who were referred for CT urography for detection of site and cause obstruction. **Results:** Out of 50 subjects, urinary obstruction was unilateral in 45 subjects (90%) in our study. Only 5 subjects (10%) had bilateral urinary obstruction. Most common cause of urinary obstruction was urinary tract calculi which accounted for a total of 41 subjects (82%) (74 % had unilateral obstruction and 8% had bilateral urinary obstruction). Out of these, 9 subjects had calculi in the renal pelvis and 32 subjects had ureteric calculi. Second most common cause was urinary bladder masses which were causes of unilateral obstruction in 4 subjects (8%) and bilateral obstruction in 1 subject (2%). Other less common causes of urinary obstruction were PUJ obstruction in 2 subjects (4%) & ureteric stricture 2 subjects (4%) **Conclusion:** MDCT urography is very useful for complete evaluation of obstructive uropathy and allows rapid detection of level and cause of obstruction which is critical for timely and effective management.

KEYWORDS

INTRODUCTION:

Obstructive uropathy is defined as obstruction to normal flow of urine which can be either due to functional or structural abnormalities of the urinary tract [1]. Obstruction of urinary tract can occur anywhere from renal tubules to the urethral meatus like in renal pelvis, ureter, bladder and urethra. Urinary obstruction can be extra luminal or intra luminal and can be due to variety of congenital and acquired causes. Obstruction of urinary tract can occur during any phase of life, like childhood, adulthood or even during foetal development. Site of obstruction can be proximal like calyces or as distal bladder as urethral meatus. Intraluminal causes of urinary tract obstruction include scarring, stones, papillae sloughing and blood clots. Extra luminal causes include factors which place pressure over ureter and causes obstruction like cancer stricture, enlarged uterus, trauma and enlarged lymph nodes. It can cause either unilateral or bilateral obstruction depending on location [2].

Many imaging modalities are available to evaluate the patients of obstructive uropathy which include plain radiographs, Intravenous Urography (IVU), Ultrasonography (USG), CT (including CT urography), MRI (including MR urography) and radionuclide studies. USG scores over IVU in detecting the collecting system dilatation in cases of obstruction even when the renal functions are impaired but lacks specificity. However, despite the ease of demonstration of the dilated upper tract USG has limitations of its inability to reveal mid third of ureters even if they are dilated. Furthermore, USG does not provide the functional status of renal tract [3].

MR urography is a highly useful imaging technique in obstructed urinary system but it provides less diagnostic image quality relatively when compared to CT urography. Also MR urography is time consuming and expensive [4]. Technology advances in CT resulted in better imaging of urinary tract that surpasses older imaging techniques. New MDCT scanners allow rapid acquisition with increase in volume coverage, better temporal and spatial resolution and isotropic reconstructions in any plane and also virtual cystoscopy images can be obtained [5].

For many urological conditions like, urolithiasis, urinary tract infection, obstructive uropathy, renal masses and trauma, CT is now the investigation of choice. Urinary tract anatomy can be visualised accurately using CT urography [4]. It also allows excellent visualisation of any extrinsic causes of urinary obstruction.

MATERIALS AND METHODS

This study was conducted in Radiodiagnosis Department of BJ Government medical college & Sassoon hospital Pune, Maharashtra in month of November 2023 on 50 subjects who first undergone abdominal ultrasonography presenting with evidence of unilateral or bilateral hydronephrosis and who were referred for CT urography for detection of site and cause obstruction. Informed consent was obtained

from all the subjects/guardians. Subjects with deranged renal function tests, pregnant subjects and those with history of allergy to iodinated contrast media were excluded from the study. Patients with any past history of urinary tract surgery were also excluded from the study.

CT-scan was performed with CT scanner (128 slice siemens MDCT). Neural or positive contrast was used depending upon clinical situation. First phase was initial non contrast phase. Second phase was nephrographic/venous phase obtained following a delay of 90-100 seconds after injecting 80-120 mL of intravenous non-ionic iodinated contrast to study the renal parenchyma. Second phase was followed by a delayed phase (after 8-10 mins) from injecting of the contrast to evaluate the excretory function of the kidneys and for the visualisation of the ureters. Additional more delayed scans were done wherever required. Images were reconstructed at a slice thickness of 0.625 mm. The images were viewed on the workstation with real time MPR and MIP capabilities. After identification of kidneys and urinary tract structures, urinary obstruction was assessed to either unilateral or bilateral. Then site and cause of obstruction was identified using real-time multiplanar images. Any associated findings likely lymph nodes, metastasis, ureterocoloceles and any other significant findings were also noted.

RESULTS

Out of the total 50 subjects in the study, 28 were male and 22 were female. Mean age of the patients was 33.5 ± 14.3 years (range 18-60 years). Urinary obstruction was unilateral in most of the subjects (90%) in our study. Only 10% of subjects had bilateral urinary obstruction. Most common cause of urinary obstruction was urinary tract calculi which accounted for a total of 41 subjects (82%) (74 % had unilateral obstruction and 8% had bilateral urinary obstruction). Out of these, 9 subjects had calculi in the renal pelvis and 32 subjects had ureteric calculi. Second most common cause was urinary bladder masses which were causes of unilateral obstruction in 4 subjects (8%) and bilateral obstruction in 1 subject (2%). Other less common causes of urinary obstruction were PUJ obstruction in 2 subjects (4%) & ureteric stricture 2 subjects (4%)

Showing site and distribution of urinary calculi detected on MDCT urography.

Urinary calculi	Number (%)
Total	41 (82%)
Renal pelvis	9 (18%)
Ureter	32 (64%)

Showing various causes of urinary obstruction detected on MDCT urography.

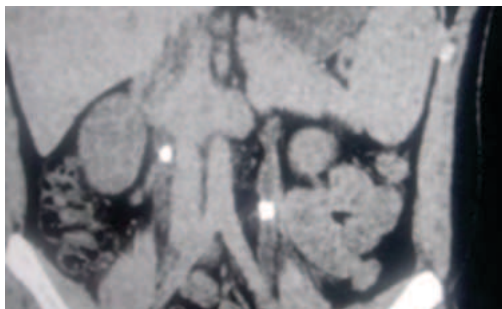
	Cause	Number (%)
Unilateral urinary obstruction (45)	Urinary calculi	37 (74%)
	Urinary bladder mass	4 (8%)
	PUJ obstruction	2 (4%)
	Ureteric stricture	2 (4%)

Bilateral urinary obstruction (5)	Urinary calculi Urinary bladder mass(es)	4(8%) 1 (2%)
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DISCUSSION:

In present study, urinary obstruction was mostly unilateral 45 subjects (90%) with only 5 subjects (10%) presenting with bilateral obstruction. Although, unilateral obstruction is much more common than bilateral obstruction, this difference is exaggerated in our study because many of the subjects with bilateral urinary obstruction have deranged renal function tests and therefore were excluded in our study. The most common cause of obstructive uropathy in our study was urinary calculi.

MDCT urography is an excellent imaging modality in obstructive uropathy and allows rapid imaging and allows simultaneous assessment of intraluminal and extra-luminal obstructive causes, site of obstruction as well as enhancement and excretion status of the kidneys [6].



NCCT coronal images showing hyperdense calculus in bilateral proximal ureter

The calculi can be in the renal pelvis or more commonly in the ureter involving vesico-ureteric junction. This is consistent with many previous studies. Non-contrast CT (NCCT) is the best imaging modality for detection of urinary calculi and can accurately depict site and size of calculus and associate back pressure changes. With MDCT urography, the functional status of the kidneys can be evaluated simultaneously [7].



Volume rendered image showing bilateral proximal ureter calculus with right renal calculi in upper & middle calyx.

Second most common cause of urinary obstruction was due to urinary bladder masses which can cause urinary obstruction due to involvement of vesico-ureteric junction (VUJ) which can be unilateral or bilateral. In our study, six subjects had unilateral VUJ involvement and two subjects had bilateral VUJ involvement. It is similar to the study by Moawad MM. Urinary bladder masses are most commonly transitional cell carcinomas which can be multifocal. MDCT urography allows rapid detection of site and number of lesions. It can also detect transmural tumour extension and allows simultaneous detection of abdominal and pelvic lymphadenopathy and any associated hepatic or bony metastasis [6-9].

Other less common causes of obstructive uropathy were PUJ obstruction, ureteric stricture.

In addition to evaluation of obstructive uropathy, MDCT can detect many significant associated findings which can have significant bearing on patient management. In our study, in patients with urinary bladder masses.

Comparison of our study with previous similar studies in literature. The most common cause of urinary obstruction in various studies across literature is urinary calculi and in many such cases, patients present with acute obstructive features and in these cases, rapid and

accurate diagnosis is important for short term as well as long term outcome. MDCT is the most important diagnostic modality in evaluation of urinary tract calculi and has completely replaced excretory urography for this purpose. The reasons for this are manifold. While excretory urography may require bowel preparation and suffers from artefacts due to overlapping structures, on the other hand MDCT allows acquisition of true isotropic 3-dimensional images. Unlike radiographs, there are no problems due to overlapping of structures and even small calculi can be confidently visualised and characterised [10-11]. The most important factor for deciding management of ureteric calculi is the size of the stone which can be most accurately measured using CT scan. Moreover, MDCT allows direct multiplanar reconstructions and therefore 3-dimensional depiction of stone and even more accurate measurements.

MDCT also accurately depicts stone burden, stone-skin distance and allows some assessment of stone composition by Hounsfield density measurement. These factors are helpful in predicting success of Shock Wave Lithotripsy (SWL) with more dense stones typically being less responsive to SWL treatment and may require percutaneous nephrolithotomy or ureteroscopy.

The results of present study indicate the robust role of MDCT urography as single most useful investigation of obstructive uropathy. MDCT urography with high spatial resolution and real time isotropic multiplanar capability is able to depict [9-11].

MDCT urography also has proven efficacy in the evaluation of both upper and lower urinary tract transitional carcinomas and provides good adjuvant to cystoscopy and also allows simultaneous assessment of multiple lesions and associated enlarged lymph nodes. Few recent studies have shown that contrast-enhanced high-resolution MR urography on 3 Tesla scanners can provide high-resolution images of upper urinary tract equivalent to MDCT urography and can also avoid potential radiation exposure with MDCT urography but these findings need to be reproduced in larger studies. Moreover, MR urography suffers from many disadvantages like longer acquisition times, artefacts and requirement of patient co-operation which may be feasible in acute settings. Till then, MDCT urography remains the proven gold standard [12-13].

CONCLUSION:

In conclusion, MDCT urography is one stop shop investigation for evaluation of site and cause of obstructive uropathy. It can be performed rapidly even in unstable patients and provides high spatial and contrast resolution with multiplanar imaging capability. High-resolution imaging allows evaluation of any associated complications and metastatic abdominal pathologies and also other significant findings. It can be easily incorporated into CT abdomen protocols by adding excretory phase images in obstructive uropathy patients to get additional functional information.

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