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EVALUATION OF OBSTRUCTIVE UROPATHY USING MDCT UROGRAPHY: A PROSPECTIVE STUDY

Radiology

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ABSTRACT

Background: Obstructive uropathy is a common clinical problem and results from structural impedance to urine flow anywhere along the urinary tract. It may lead to irreversible renal damage if not timely treated and so proper evaluation and accurate diagnosis is necessary for timely intervention and management

Aim/Objectives: To assess the role of Multidetector Ccomputed Tomography (MDCT) urography in patients presenting with obstructive uropathy

Material and Methods: Sixty consecutive patients with clinical and sonographic manifestations of ureteral obstruction were included in the study. Detailed history and findings of clinical examination were recorded. Non contrast, contrast enhanced and urographic phase images were obtained. Positive findings were recorded in detail and tabulated. Side, site and cause of urinary obstruction were noted based on MDCT urography findings.

Results: Unilateral urinary obstruction was seen in 53 patients (88.3%) while 7 patients (11.7%) had bilateral urinary obstruction. The commonest cause of urinary obstruction was urinary tract calculi seen in 41 patients (68.3%). Vesical masses were causes of unilateral obstruction in 7 patients and bilateral obstruction in 1 patient. Less common causes included Pelvi-Ureteric Junction (PUJ) obstruction, ureteric stricture, ureteric masses and extrinsic compression of ureter by abdominal masses/enlarged lymph nodes. Solitary case each of circumcaval ureter, vesico-vaginal fistula and bladder neck obstruction were also seen.

Conclusions: MDCT urography allows rapid detection of level and cause of urinary tract obstruction and thus significantly aids in the timely and effective management.

KEYWORDS

Computed Tomography; Uropathy; Calculi; Mass

INTRODUCTION:

Obstructive uropathy is a common clinical problem in routine practice. Obstructive uropathy is defined as obstruction to normal flow of urine and can be either due to functional or structural abnormalities of the urinary tract [1]. It results from functional or anatomic lesions located anywhere in the urinary tract from kidneys to uretheral meatus. It can be classified into congenital and acquired, intraluminal or extraluminal [2,3]. In childhood, it is mainly due to congenital anomalies of the urinary tract. Incidence of obstructive uropathy declines with age until late adulthood where the incidence again rises, predominantly in men, due to prostatic hyperplasia or cancer [1]. 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 [4].

Many imaging modalities are used to evaluate the obstructive uropathy each with its own benefits and limitations [5]. These include plain X-rays, Intravenous Urography (IVU), Ultrasonography (USG), Computed Tomography (CT), Magnetic resonance Imaging (MRI) and radionuclide studies. With technologic advances in CT and MRI, role of IVU and USG in evaluation of urinary tract has been superseded. MR urography is a highly useful imaging technique in obstructive uropathy and can be performed in patients with altered renal functions. However it is affected by motion artefacts and thus provides less diagnostic image quality. Also MR urography is time consuming and expensive. MDCT urography has become the investigation of choice in obstructive uropathy. The main advantage of MDCT urography is its ability to provide a detailed anatomic depiction of each portion of the urinary tract [6]. It also offers several advantages for imaging of the obstructive uropathy including single breath-hold coverage of the entire urinary tract and rapid imaging with optimum contrast medium opacification [7–9]. In addition, acquisition of multiple thin overlapping slices provides excellent two-dimensional and three-dimensional reformations and facilitates virtual cystoscopy [9].

MATERIAL AND METHODS:

This prospective study was performed in tertiary care centre in north India. Sixty consecutive patients with clinical and sonographic manifestations of ureteral obstruction were included in the study. Patients with history of trauma, altered renal functions, history of allergy to contrast media and pregnant and lactating patients were excluded from our study. Patients with past history of urinary tract surgery were also not included. Detailed clinical history and relevant investigations were recorded. MDCT examination was performed after at least 6 hours of fasting 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. The images were sent to on the workstation with real time Multiplanar Reconstruction and Maximum Intensity Projection capabilities. Side, site and cause of urinary obstruction were noted.

RESULTS:

Sixty patients with urinary tract obstruction were included in the study. Majority of the patients were males with male to female ratio of 1.3:1. Unilateral obstruction was seen in majority of the patients (88.3%) with bilateral obstruction in 11.7 % only. Commonest cause of urinary obstruction was urinary tract calculi which accounted for a total of 41 patients (68.3%) (Table 1). 11 patients had calculi in the renal pelvis while 30 patients had ureteric calculi. Second commonest cause of urinary tract obstruction was urinary bladder masses (Table 1) (13.3%) of which unilateral obstruction was seen in 7 (11.7) patients and bilateral in 1 patient (1.7%). Other less common causes of urinary obstruction were PUJ obstruction, ureteric stricture and extrinsic compression of ureter by enlarged lymph nodes (Table 1). Other significant findings included solitary case each of circumcaval ureter, vesico-vaginal fistula and bladder neck obstruction (Table 1).

DISCUSSION:

Obstructive uropathy is defined as a narrowing of the urinary tract necessitating elevation of the proximal pressure to enable urine flow [10]. Obstructive uropathy is a common cause of renal failure. Numerous pathological processes can lead to urinary tract obstruction and its early recognition and treatment is the key to prevent renal loss. MDCT urography is an excellent imaging modality in evaluating obstructive uropathy and allows rapid imaging and allows simultaneous assessment of obstructive causes, site of obstruction as well as enhancement and excretion status of the kidneys [4].

In our study, majority of the cases were unilateral and seen in 88.3%

cases. Bilateral obstruction was seen in 11.7% cases only. The results were similar to study by Mittal P et al who also observed unilateral obstruction in 90% cases. The commonest cause of urinary tract obstruction was urinary tract calculi seen in 41 patients (68.3%), similar to previous studies [4,11-13]. The calculi may be in the renal pelvis or the ureters including PUJ and vesio-ureteric junction (VUJ). Cronin CG et al [14] stated that the unenhanced portion of their CT examination provides optimal evaluation of all urinary calculi as well as the evaluation of the level of obstruction and demonstrates reliable secondary signs of obstructing calculi. With MDCT urography, the functional status of the kidneys can also be evaluated simultaneously [12]. MDCT has complete replaced IVU in evaluation of urinary tract calculi. IVU requires bowel preparation and suffers from artefacts due to overlapping structures. In MDCT, unlike X-rays, there are no problems due to overlapping of structures and even small calculi can be confidently visualised and characterised [5,15]. Deciding factor in the management of ureteric/renal calculi is the stone size which can be most accurately measures on MDCT especially with use of multiplanar reconstructions Vesical masses were the second commonest cause of urinary tract obstruction, similar to results of previous studies [4,12]. Unilateral obstruction due to vesical masses was seen in 7 patients (11.6%) while bilateral obstruction was seen in 1 patient (1.6%). Involvement of VUJ was the cause of obstruction due to vesical masses. MDCT urography allows rapid detection of site, size and number of lesions [4]. It can also detect transmural tumour extension and allows simultaneous detection of abdominal and pelvic lymphadenopathy and any associated hepatic or bony metastasis [4]. MDCT urography 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 [16,17].

Third commonest cause in our study was PUJ obstruction seen in % cases. Of these partial PUJ obstruction was seen in three cases while complete obstruction was seen in one case. All the patients were children aged less than 16 years and presenting with abdominal pain and/or lump. MDCT urography was able to differentiate partial from complete obstruction by delineating the ureters in partial PUJ obstruction. It was also helpful to assess the structural and functional status of the kidneys to guide the surgeon regarding appropriate management.

Less common causes of obstructive uropathy in our study were ureteric stricture, ureteric masses and extrinsic compression of ureter by abdominal masses/enlarged lymph nodes. Solitary case each of circumcaval ureter, vesico-vaginal fistula and bladder neck obstruction were also seen.

Results of our study further consolidate the role of MDCT urography as single most useful investigation in evaluation of obstructive uropathy. Because of high spatial resolution and MPR capabilities, it can accurately depict the site and cause of obstruction in majority of the cases. It also provides functional information regarding the kidney status which important for clinical decision making. In case of malignant lesions, it provides simultaneous assessment of abdominal metastatic lesions which have prognostic implications.

CONCLUSIONS:

MDCT urography is the primary imaging modality for evaluation of site and etiology of obstructive uropathy. It provides high spatial and contrast resolution with multiplanar imaging capability in evaluating patients with obstructive uropahy. Further MDCT urography can guide the clinician regarding appropriate treatment strategy and thus aid in prognostic evaluation. Only limitation is the radiation exposure associated with MDCT and thus judicious use is advocated.

Conflicts of Interest: Nil
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Table 1: Causes of Obstructive Uropathy on MDCT

Cause	No of Patients	Percentage
Calculi	41	68.3
Vesical Mass	8	13.3
PUJ Obstruction	4	6.7
Stricture Ureter	2	3.3
Ureteric Compression by abdominal mass/lymph nodes	2	3.3
Circumcaval Ureter	1	1.7
Uretero-Vaginal Fistula	1	1.7
Bladder Neck Obstruction	1	1.7
Total	60	100

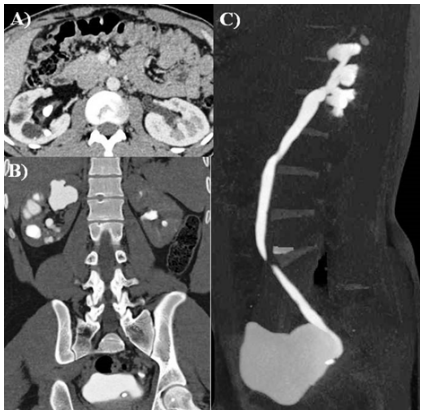

Figure 1: Bilateral Obstruction
Axial CECT (A) and Coronal excretory phase (B) images reveal moderate right hydronephrosis due to hyperdense calculus in right renal pelvis and mild left hydroureteronephrosis due to left VUJ calculus. Sagittal urographic phase MIP images (C) reveal mild left ureterohydronephrosis with left VUJ calculus clearly seen

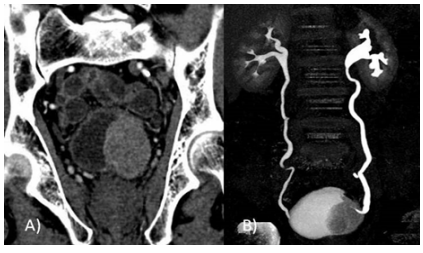

Figure 2: Unilateral Obstruction
Coronal CECT (A) and Excretory Phase MIP (B) images reveal large vesical mass along left postero-lateral UB wall with mild left ureterohydronephrosis.

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