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Original Research Paper

Radio Diagnosis

NON-CONTRAST COMPUTED TOMOGRAPHY VERSUS INTRAVENOUS PYELOGRAPHY IN THE DIAGNOSIS OF UROLITHIASIS AND URINARY TRACT OBSTRUCTION: A PROSPECTIVE STUDY

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ABSTRACT

Objectives:
To evaluate the diagnostic accuracy of non contrast computed tomography (NCCT) and intravenous pyelography (IVP) in the diagnosis of urolithiasis and urinary tract obstruction in the same patient.

Material and Methods:
300 USG diagnosed or suspected patients with urolithiasis and/or ureteral obstruction were included. NCCT was performed followed by IVP. Presence of calculi, hydronephrosis and hydroureter, cysts and ureteric wall thickening were evaluated. Perinephric fat stranding in NCCT and delayed excretion of contrast in IVP were also evaluated.

Results:
Majority of patients were males with M:F ratio of 1.6:1. On NCCT stones were detected in 190 patients while in IVP, stones were detected in 154 patients. The findings of hydronephrosis, hydroureter and renal cortical cysts were more common on NCCT than IVP examination. Additional incidental findings were more common on NCCT (24/300, 8.0%) than IVP (2/300, 0.7%).

Conclusions:
NCCT compared to IVP had a higher detection rate for urolithiasis and ureterolithiasis. Detection of significant additional findings was additional benefit of NCCT over IVP.

KEYWORDS : Urolithiasis; Ureterolithiasis; Computed Tomography; Hydroureter

INTRODUCTION:

Urinary tract is one of the most common systems to be affected by calculi. Urolithiasis and renal colic are common conditions affecting up to 15% of the population during their lifetime [1]. In the last two decades, imaging modalities in the evaluation of urolithiasis and ureteric obstruction has seen a marked shift. Plain radiography, IVP, ultrasonography (USG) and Computed Tomography are the most common radiographic modalities in diagnosing urolithiasis and urinary tract obstruction. The sensitivity of plain radiography for diagnosing renal calculi ranges from 45% to 60% and so has a limited value in the diagnosis [2]. IVP has been commonly used for nephrolithiasis and/or ureteric obstruction but it requires the use of intravenous contrast agent with inherent potential toxicity [3]. Also presence of bowel gases and inadequate patient preparation significantly affect the sensitivity of IVP. USG has demonstrated promising sensitivity but is less useful in obese patients and in those with mid-ureteral calculi [4].

Non Contrast Computed Tomography (NCCT) especially multi-slice computed tomography has a high sensitivity and specificity for diagnosing patients with renal colic. The excellent spatial resolution provided by multislice NCCT has made it the imaging modality of choice for the diagnosis and follow-up of urolithiasis [5]. Additional advantage of NCCT over IVP is its ability to diagnose other causes of flank pain and additional pathologies [6] which cannot be visualised on IVP or radiography.

Ureteric colic accounts for approximately 1% of all hospital admissions and IVP has been the standard imaging modality for suspected urolithiasis for many years. However, recently it has been superseded by NCCT [6]. Though IVP is specific for the collecting system, NCCT gives a more global picture of the whole abdomen [6]. Smith et al. [5] found that NCCT is more effective than IVU in identifying ureteric stones and equally effective in the determination of ureteric obstruction.

Major drawback of Computed Tomography is the radiation dose. Some studies [7] have noted that almost 20% of patients received potentially significant radiation doses during short-term follow-up of an acute stone event. So the purpose of the study was to determine the better imaging modality among NCCT or IVP in patients with suspected urolithiasis.

Material and Methods:

This prospective study was carried out in tertiary care centre in north India over a period of 6 months (June to November 2018). 300 patients with suspected and/or diagnosed urolithiasis, and/or ureteric calculi were included. Detailed clinical history and relevant investigations were recorded. NCCT examination was performed with Siemens 64 slice-MDCT scanner from the level of the kidneys to the pubic symphysis in breath-hold status. No Intravenous or oral contrast agents were used. IVP was then performed by taking a plain abdominal film prior to administration of 50ml of non-ionic iodinated contrast. Anteroposterior view of KUB regions were obtained at 5 min and 15 min with prone view at 30 minutes. Full bladder and post-void views were also obtained in all patients. Further delayed images were taken if necessary. Presence of renal and ureteric calculi, presence of hydronephrosis and hydroureter, cysts and ureteric wall thickening were evaluated in both NCCT and IVP. Also Perinephric stranding in NCCT and delayed excretion in IVP were also evaluated. The findings were recorded in detail and tabulated.

Results:

300 patients were included in our study. Majority of the patients were seen in 3th decade of life with male to female ratio of 1.6:1. On NCCT, stones were seen in 63.3% cases while IVP demonstrated stones in 51.3% cases (Table 1). NCCT identified more renal and ureteric stones than IVP (Table 1), especially in the middle and lower ureters.

In addition, presence of other findings in urinary tract like hydroureter, cysts, perinephric stranding and ureteric wall thickening were seen in more cases on NCCT than on IVP (Table 1). Besides, additional incidental findings like renal and/vesical mass, cholelithiasis, adrenal adenoma, liver cirrhosis, pancreatitis and acute appendicitis were seen only on NCCT images. Only in presence of delayed contrast excretion, IVP had an advantage over

NCCT (Table 1).

DISCUSSION:

Imaging of the urinary tract plays a significant role in patients with urolithiasis. Use of NCCT for the evaluation of acute flank pain allows a rapid and accurate evaluation of the urinary tract calculi and obstruction. Imaging of the urinary tract is pivotal in the diagnosis, management and follow-up of patients with calculi [6]. Previously IVP was considered the gold standard for diagnosing renal calculi, but now the modality has been replaced by NCCT due to high sensitivity and specificity and ease of procedure [6].

In our study, majority of cases were seen in 3rd decade of life with male preponderance. In the study, NCCT as compared to IVP had a higher detection rate for renal calculi and ureterolithiasis. Some of these stones may not require active intervention at the time of diagnosis, but require active surveillance [6]. Further NCCT was also able to evaluate the severity of the ureteric obstruction in nearly same number of cases as with IVP in our study. Increased detection of incidental findings was also seen on NCCT as compared to IVP, thus making CT more useful. This could provide significant contribution to the treating surgeon regarding the associated co-morbidites and help decide further course of action. Only major advantage of IVP was the evaluation of renal function and delayed excretion, which could not be evaluated by NCCT.

NCCT is a extremely useful modality and compared with IVP, NCCT has simple accessibility, rapid image acquisition time, advanced image quality, and no requirement for contrast material [8]. Also NCCT is preferable to IVP in patients with acute flank pain associated with pre-existing renal insufficiency [8]. Further additional findings non related to urinary tract can be easily picked up on NCCT as compared to IVP.

Though the accuracy of IVP is presumed to be high in diagnosing ureteral obstruction, the exact accuracy is not exactly known. Smith et al [5] reported that urinary calculi causing obstruction may not be diagnosed with IVP in up to 58% of patients owing to small stone size, lack of ureteral opacification, or stone radiolucency. Though IVP provides information regarding the the degree of obstruction and functioning of kidneys, it could give false-positive results due to phleboliths adjacent to the ureter. Also, extraurinary tract causes of acute flank pain usually could not be diagnosed with IVP. As Compared to IVP, the sensitivity of NCCT in patients with suspected renal calculi was 95% and its specificity was 97% [9,10]. In our study, NCCT showed higher accuracy IVP because all urinary tract calculi could be identified by NCCT [10]. Similar results were also reported in previous studies [6,11].

The potential disadvantage regarding the use of NCCT is the radiation exposure and concern of increased cancer risk resulting from the radiation exposure. Patients with urinary calculi are at increased risk for excessive radiation exposure owing to the recurrent nature of the disease and the resultant repetition of radiographic examinations [12,13]. As a result, low-dose CT protocols, which decrease the radiation exposure of the patients, have been developed.

Conclusions:

NCCT compared with IVP had a significantly higher detection rate for the calculi and associated urinary tract obstruction. Detection of significant additional findings and evaluation of perinephric stranding was an added advantage of NCCT over IVP. Significant advantage of IVP is the evaluation of renal function and excretion, which cannot be evaluated by NCCT.

Conflicts of Interest: Nil
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Tables:

Table 1: Findings on NCCT and IVP

Findings	NCCT	Percentage	IVP	Percentage
Stones (no of patients)	190	63.3	154	51.3
Number of Stones	216	-	168	-
Renal calculi/PUJ calculi	162	54.0	130	43.3
Ureteric Calculi	52	17.3	37	12.3
Vesical Calculi	2	0.7	1	0.3
Hydronephrosis and/or hydroureter	74	24.7	72	24
Ureteric Wall Thickening	4	1.3	1	0.3
Perinephric Stranding	12	4.0	-	-
Cortical Cysts	10	3.3	2	0.7
Delayed Excretion	-	-	14	4.7
Incidental Findings (renal/vesical mass, Cholelithiasis, appendicitis, pancreatitis, adrenal adenoma, liver cirrhosis, ovarian cysts)	24	8.0	2	0.7

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