Research Article

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The efficacy of unenhanced MDCT in the evaluation of nephroureterolithiasis

Rahul Kumar Reddy G.1*, Swetha Reddy A.2

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*Correspondence:

Dr. Rahul Kumar Reddy G., E-mail: grkr77@gmail.com

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ABSTRACT

Background: Increasing availability of MDCT with higher number of detectors has made it an initial modality of choice with higher degree of sensitivity and specificity, over and above the other modalities. The objective was to study the efficacy of unenhanced MDCT in the evaluation of nephroureterolithiasis.

Methods: This is a prospective study done over a period of one year. It includes all patients with loin pain, who are clinically suspected for urinary stone disease. The study is performed on Philips Brilliance 64 slice MDCT.

Results: It was found that maximum patients belonged to the age group of 41-50 years followed by 31-40 years. Males were more than females. The male to female ratio was 1.8:1. Maximum patients presented with ureteric calculi i.e. 40% followed by renal calculi (18.8%). A total of 23 patients were found to have ureteric calculi. Out of them majority presented with distal ureteric calculi (34.8%) followed by calculi at proximal ureter. Maximum i.e. 66.6% developed hydronephrosis followed by hydroureter in 51.1% of patients.

Conclusions: Unenhanced MDCT is an excellent modality with many advantages and high sensitivity for evaluation of nephroureterolithiasis.

Keywords: Unenhanced MDCT, Nephroureterolithiasis, Calculi

INTRODUCTION

Acute flank pain is a common clinical problem and urolithiasis is the primary consideration in many of these patients. Urolithiasis is reported to affect up to 12% of the population during their lifetime. Males are affected more commonly than females; in the ratio of approximately 3:1 female patients have a higher incidence of infected hydronephrosis. The peak age of onset of symptomatic nephrolithiasis is in the third and fourth decades of life.¹

Most of the urinary calculi originate within the kidney and proceed distally, creating various degrees of urinary obstruction as they become lodged in narrow areas including the ureteropelvic junction, pelvic brim and ureterovesical junction. Location and quality of pain are related to position of the stone within the urinary tract. Severity of pain is related to degree of obstruction, presence of ureteral spasm, and presence of any associated infection.²

Clinical findings are often non-specific and may overlap other conditions. Imaging plays an important role in both diagnosis and subsequent management of urinary stone disease. For this reason direct urinary system graphy, ultrasonography, intravenous urography and CT might be used. All of these imaging methods have some advantages and disadvantages of their own.³

¹Associate Professor, Department of General Surgery, Great Eastern Medical School, Sri Kakulam, Andhra Pradesh, India

²Assistant Professor, Department of Radio Diagnosis, Great Eastern Medical School, Sri Kakulam, Andhra Pradesh, India

Increasing availability of MDCT with higher number of detectors has made it an initial modality of choice with higher degree of sensitivity and specificity, over and above the other modalities.⁴

Present study was carried out to evaluate patients with acute loin pain for nephroureterolithiasis and secondary signs using unenhanced MDCT.

METHODS

This is a prospective study done over a period of one year. It includes all patients with loin pain, who are clinically suspected for urinary stone disease. The study is performed on Philips Brilliance 64 slice MDCT with the following scan protocol:

Slice thickness: 2 mm Increment: 1.0 mm Collimation: 0.625 mm

Pitch: 0.891 KVP: 120 MA: 420

All the studies are done without oral or IV contrast material. The patient's KUB region is scanned from the level of mid-liver to just beneath the level of the mid symphysis pubis. The patients are asked to hold their breath and in a single breath hold, the entire volume is scanned. All the images are reviewed at soft tissue windows. In selected cases, multiplanar reconstructions and/or post contrast delayed urography can be used to better define the location of a stone or to determine whether or not a stone is indeed in the ureter. The ability to provide thin collimation helps provide better datasets for 3-D rendering.

Inclusion criteria

- 1. All patients with flank pain who are advised directly CT- KUB.
- 2. Patients with suspected Renal/Ureteric calculus, negative on other modalities (X-Ray KUB and Ultrasound).

Exclusion criteria

 Diagnosed cases of urinary calculi on other modalities like Ultrasound X-Ray KUB and IVU.

Statistical analysis

The data was entered in Microsoft Excel worksheet and analysed.

RESULTS

It was found that maximum patients belonged to the age group of 41-50 years followed by 31-40 years. There was no patient below the age of 20 years.

Table 1: Age distribution of study subjects.

| Age (years) | Number of patients (%) |
|-------------|------------------------|
| 0-20 | 00 (00) |
| 21-30 | 09 (20) |
| 31-40 | 12 (26.6) |
| 41-50 | 13 (28.8) |
| 51-60 | 06 (13.4) |
| > 60 | 05 (11.2) |
| Total | 45 (100) |

Table 2: Gender distribution of study subjects.

| Gender | Number of patients (%) |
|--------|------------------------|
| Male | 29 (64.4) |
| Female | 16 (35.6) |
| Total | 45 (100) |

Males were more than females. The male to female ratio was 1.8:1.

Table 3: Distribution of study subjects as per the location of calculi.

| Location | Number (%) |
|---------------------------------|------------|
| Renal calculi | 13 (28.8) |
| Ureteric calculi | 18 (40) |
| Both renal and ureteric calculi | 06 (13.4) |
| No calculi | 04 (8.9) |
| Other pathology | 04 (8.9) |
| Total | 45 (100) |

Table 3 shows the distribution of study subjects as per the location of calculi. Maximum patients presented with ureteric calculi i.e. 40% followed by renal calculi (18.8%). Six patients (13.4%) were diagnosed as having both renal and ureteric calculi.

Table 4: Distribution of side of renal calculi.

| Renal calculi | Number (%) |
|---------------|------------|
| Bilateral | 11 (57.9) |
| Right renal | 05 (26.3) |
| Left renal | 03 (15.8) |
| Total | 19 (100) |

Overall 19 patients were having the renal calculi. Among them, majority (57.9%) were found to have bilateral renal calculi. On comparison of right and left side, it was found that right sided renal calculi were more common than the left side.

A total of 23 patients were found to have ureteric calculi. Out of them majority presented with distal ureteric calculi (34.8%) followed by calculi at proximal ureter.

Table 5: Distribution of ureteric calculi based on the distance from kidney.

| Ureteric calculi | Number (%) |
|--------------------------------|------------|
| Proximal ureter | 05 (21.7) |
| Mid ureter | 04 (17.4) |
| Distal ureter | 08 (34.8) |
| Pelvi Ureteric Junction (PUJ) | 02 (08.7) |
| Vesico Ureteral Junction (VUJ) | 04 (17.4) |
| Total | 23 (100) |

Table 6: Distribution of study subjects as per their secondary signs.

| Secondary sign | Number (%) |
|-------------------------|------------|
| Hydronephrosis | 30 (66.6) |
| Hydroureter | 23 (51.1) |
| Perinephric stranding | 15 (33.3) |
| Soft tissue rim sign | 15 (33.3) |
| Peri ureteric stranding | 10 (22.2) |

Table 6 shows the distribution of study subjects as per the secondary signs they developed following the calculi. Maximum i.e. 66.6% developed hydronephrosis followed by hydroureter in 51.1% of patients.

DISCUSSION

Radiological imaging has a very important role in the evaluation of stone disease. For this reason, direct urinary system graphy, ultrasonography, intravenous pyelography, computed tomography, magnetic resonance imaging might be used. All of these imaging methods have some advantages & disadvantages.

Unenhanced spiral CT was first used by Smith et al in 1995 to evaluate urinary stones. Unenhanced spiral CT is more sensitive & specific in defining ureteral stones compared to other imaging methods.

In diagnosis of ureteral stones, findings secondary to the urinary system obstruction may be used as contributory. These secondary signs include hydronephrosis, hydroureter, perinephric stranding, and periureteral stranding & soft tissue rim sign.

Many studies investigating the sensitivity & specificity of unenhanced CT in urinary system stone disease in comparison with other radiological modalities have been published. According to these studies, the sensitivity of unenhanced CT in the detection of urinary system stone disease is higher compared to other imaging methods. In a study conducted by Strouse PJ et al the sensitivity and specificity of unenhanced helical CT was 94.1% and 94.2% against 85.2% and 90.4% for IVU.⁷ The

unenhanced helical CT took an average in room time of 23 min vs. 1 hour 21 min for IVU.⁷

According to a study conducted by Ketelslegers E et al the diagnostic accuracies of direct signs on IVU and UHCT for the diagnosis of ureteral stones were 79.3% and 98.8% respectively.⁸

In a study by Wang LJ et al spiral CT was found to be the best modality for depicting ureteral stones with a sensitivity of 94% and a specificity of 97%. For us, the figures were 19% and 97% and for IVU, 52% and 94% respectively.

This prospective study is based on 45 symptomatic patients, that is patients with loin pain who are randomly selected. Unlike the published studies no specific comparison was drawn between the imaging modalities. This study population constitutes 65% male patients and 35% females.

Among the study group, 20% were in the age group of 21-30 years, 27% were in the age group of 31-40 years, 29% were in the group of 41-50 years, 13% were in 51-60 years and 11% were above 60 years. Maximum number of symptomatic patients in this study was in 4th & 5th decades.

82% of the study group had renal or ureteric calculi, 9% had symptoms due to other pathology like pyelonephritis, tubo-ovarian mass, PUJ obstruction, renal vein compressing the ureter. 9% of the study group did not have renal or ureteric calculi, but showed secondary signs of urinary obstruction.

In the study population who had nephroureterolithiasis, 38% had only ureteric calculi, 29% had only renal calculi and 13% had both renal and ureteric calculi.

Of the patients, 42% had renal calculi, 24% had bilateral renal calculi, 11% had only right renal calculi and 7% had only left renal calculi.

80% of the study population showed secondary signs. Of them, 66% showed hydronephrosis. In different studies hydronephrosis was detected with CT in 69-83% of patients. ⁹⁻¹¹

Ege G et al reported proximal ureteric dilatation in 82.3% of the patients with ureterolithiasis, accounting for the most common secondary sign. They also found perinephric stranding in 47.2% of patients. In our study perinephric stranding was found in 33% patients.

In our study periureteric stranding is found in 22% patients. In the study by Ege et al, periureteric edema was noted in 59% of adult patients with ureterolithiasis.¹²

Hill MC et al reported a frequency of tissue rim sign of 34%.¹³ In our study, tissue rim sign was present in 15% of our study population.

CONCLUSION

Unenhanced MDCT demonstrates very well the size and location of renal and ureteric calculi and their secondary signs with high sensitivity and specificity. MDCT also demonstrates the mimics of ureteral stones very well.

In our study, MDCT has detected urinary stones in 37 out of 45 suspected cases, and secondary signs without stones in 4 cases with an overall sensitivity of 91%. In the rest 9% of the study group MDCT detected other pathologies mimicking urinary stones very well.

Other advantages of unenhanced MDCT include shorter scan time, done in a single breath hold and lack of need for intravenous contrast media.

In summary, unenhanced MDCT is an excellent modality with many advantages and high sensitivity for evaluation of nephroureterolithiasis.

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Ethical approval: The study was approved by the

institutional ethics committee

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