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Value of Unenhanced Spiral CT in Patients With Flank Pain and Clinical Suspicion of Urolithiasis

KEYWORDS: KUB, unenhanced spiral CT, ureteric calculi, ultrasonography

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ABSTRACT *Unenhanced spiral CT was performed in 100 patients using dual slice spiral CT scanner with a slice thickness of 3 mm and a collimation of 2 mm. Patients of all age groups and both sexes presenting with flank pain were included. Out of 61 patients diagnosed as urolithiasis mean age of presentation was 41 years and predominantly males (70%) were affected. Secondary signs of obstruction were present in 80% of cases. These data yield a sensitivity of 100%, specificity of 96%, positive predictive value of 98% and negative predictive of 100% for determining the presence or absence of urolithiasis.*

The present study concludes that unenhanced spiral CT is sensitive as well as specific not only to diagnose urolithiasis but also to diagnose other causes that mimic urolithiasis in the genitourinary system or other systems.

Imaging studies play a major role in the diagnosis and management of patients with acute and chronic urinary lithiasis. As newer imaging modalities have become available, like ultrasound & Doppler imaging, radionuclide scan, computed tomography, & Magnetic Resonance Imaging (MRI) each in turn has been applied to the diagnosis of acute urinary lithiasis with the hope of providing a less invasive and more rapid evaluation of these patients. Recent developments in CT technology have improved image quality and markedly reduced examination times. These factors combined with the unsurpassed tissue contrast inherent in CT images have allowed CT to become the imaging modality of choice in the diagnosis and management of patients with flank pain and suspected ureteral obstruction.

MATERIALS AND METHODS

The present study of 100 patients, clinically suspected of urolithiasis was done during the period of 15 months. Unenhanced spiral CT was done using SIEMENS Somatom spirit (Dual Slice Spiral CT) performed from the upper border of T12 vertebral body to the lower border of the symphysis pubis with a slice thickness of 3 mm and a collimation of 2 mm. Data acquired in a single breath hold, avoiding respiratory misregistration artifact and allows retrospective reconstruction to delineate small calculi.

A record of additional diagnostic studies (conventional radiography, IVU, sonography or follow-up CT) as well as therapeutic procedures (like surgical interventions, ureteroscopic calculus extraction or lithotripsy) which were used to complement the findings and diagnosis made by unenhanced spiral CT.

RESULTS

In sixty one patients diagnosed as urolithiasis the mean age of presentation was 41 years. The range of age presentation was from 21 years to 72 years. The maximum cases 27% are in the age group of 31-40 years. Male to female ratio of patients with urolithiasis is 2.4:1.

Out of 145 calculi, 93(64%) calculi were present in kidney that is nephrolithiasis. Mid pole calyces were the most common site of nephrolithiasis (26%). Rest 52(36%) calculi were present in ureter. The most common site of obstruction was lower ureter found in 17(12%) cases. The mean calculus size was 5.71 mm with a range of 2 to 78 mm. Out of 61 patients of urolithiasis, Hydronephrosis (80%) and Hydroureter (73%) were the most common secondary signs of obstruction. In 49(49%) patients obstruction with urolithiasis was present (ureterolithiasis). In 10(10%) obstruction because of other genitourinary cause than urolithiasis was present. 23(23%) patients had normal CT KUB study. In the present study additional diagnosis related to genito-urinary tract were present in 14(14%) cases and not related to genito-urinary tract were present in 6(6%) cases.

Of these 61 patients, 50 patients confirmed the presence of calculi by, ESWL (8), ureteroscopic basketing (5), percutaneous nephrolithotomy (2), DJ stenting (3), hydrotherapy with stone recovery (16), Ultrasonography (8), and spontaneous passage (7). Ten cases lost for follow-up. One case of 3 mm lower ureter calculus was not passed even after hydrotherapy. Multiple phleboliths in pelvis, which may be the cause of false positive diagnosis of urinary stone disease, was noted in same patient.

Statistical calculations were performed using confirmed data only. Fifty one true positive, 1 false positive, 26 true negative and 0 false negative yield a sensitivity of 100%, specificity of 96%, positive predictive value of 98% and negative predictive of 100% for determining the presence or absence of urolithiasis by unenhanced spiral CT.

Fig. 1 Unenhanced spiral CT showing left upper ureter calculus with mild left hydronephrosis

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Fig. 2 Unenhanced spiral CT showing right lower ureter calculus (curved MPR) with hydronephrosis and hydroureter

Fig. 3 Unenhanced spiral CT showing appendicitis with appendicolith

DISCUSSION

In sixty one patients diagnosed as urolithiasis the mean age of presentation was 41 years. The range of age presentation is 21 years to 72 years. The maximum cases were in age group of 31-40 years (27%). 71% cases belong to age group between 21 to 50 years. These observations of present study correspond with following studies. According to Fetter & Zimskind [1], Blalock RJ [2] the peak incidence of urinary calculi is from age 20 to 40 years.

In the present study out of 61 patients with urolithiasis males (70%) were more predominantly involved than females (30%). Male to female ratio of patients with urolithiasis was 2.4:1. IC Boridy [3] found in 82 patients with renal calculi 48 (58.5%) male patients & 34 (41.5%) female patients. Male to female ratio was 1.4:1.

Out of 145 calculi detected in 61 patients, nephrolithiasis is present in 93 cases (64%). Mid pole calyces were the most common site of nephrolithiasis (40%). This observation is similar to the study by Smith et al [4] in which 71 (67%) of the 109 patients with ureteral stone disease had nephrolithiasis. Out of 145 calculi found in 61 patients, 52 (36%) calculi were present in ureter. The most common site of obstruction is lower ureter found in 17 patients (33%). In their series of 60 patients with calculus disease, Zakaria Assi et al [5] found on CT the location of ureteral calculi as follows: 9 (15%) were located in upper ureter, 7 (11.6%) in mid ureter, 21 (35%) were in lower ureter and 23 (38%) were located at vesico-ureteric junction. The location of stone is an important factor that can be used to determine the likelihood of spontaneous passage and help guide interventional therapy when stone fails to pass spontaneously. In the present study, 23 patients passed calculi spontaneously or with hydrotherapy and in 5 cases ureteroscopic basketing was done. Interventional therapy is determined by stone location as more proximal stones are treated by extracorporeal shock wave lithotripsy, while more distal stones treated by ureteroscopic interventions.

In 61 patients diagnosed as urolithiasis on unenhanced spiral CT, 145 calculi were found. The mean calculus size is 5.71 mm with a range of 2 to 78 mm. Keir Fowler et al [6] found mean calculus size 4.2 mm $\pm$ 0.4 with a range of 0.5 – 26 mm. In a study of 520 patients by Ueno et al [7], the rate of spontaneous stone passage, as a function of stone width, was as follows: 100% for stones that were 1 mm or smaller in width, 90% for 2 to 3 mm, 80% for 4 mm, 55% for 5 mm, 25% for 7 mm and 12% for 8 mm.

In the present study it was found that Hydronephrosis (80%) and Hydroureter (73%) are most common secondary signs of obstruction. We found other secondary signs of obstruction in descending order as: perinephric fat stranding (47%), Periureteric fat stranding (29%) and Renomegaly (19%). Present study results match with a study by Smith et al [4], where hydronephrosis was present in 94 (83%) cases out of 109 patients with urolithiasis.

In present study we have following radiological diagnosis on unenhanced spiral CT study: out of 100 patients 61(61%) patients had evidence of urolithiasis, in 49(49%) patients obstruction with urolithiasis was present (ureterolithiasis), in 10(10%) obstruction because of other genitourinary system cause than urolithiasis was present, 23(23%) patients had normal CT KUB study and 6(6%) patients had causes of flank pain other than genitourinary system. In their series of 220 patients with suspected renal calculi. Smith et al [4] found urolithiasis in 109 patients, 76 had no abnormality on CT, 25 patients had the diagnosis unrelated to genitourinary tract and in 10 the diagnosis related to genitourinary tract. The diagnosis related to genitourinary tract in present study were; pyelonephritis and urethral stricture in 4 cases each, renal cyst in 3 cases and PUJ obstruction, ? recently passed calculus and autosomal dominant polycystic kidney disease in 1 case each. The diagnoses not related to genitourinary tract in our study are; appendicitis and Cholelithiasis in 2 cases each, one case of RIF mesenteric adenopathy and one case of Spondylolisthesis of L5 over S1. In their study of patients with acute flank pain examined with unenhanced helical CT by Dalrymple et al [8], they found 65 patients had CT findings positive for other diagnoses; 43 with abnormalities unrelated to the urinary tract and 22 with abnormalities of the urinary tract unrelated to stone disease. The six most common diagnoses unrelated to the urinary tract were ovarian mass-

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es, appendicitis, diverticulitis, Choledocholithiasis, Crohn's disease and pancreatitis. The two most common diagnoses related to the urinary tract but unrelated to stone disease were pyelonephritis and bladder outlet obstruction.

In present study we found a sensitivity of 100%, specificity of 96%, positive predictive value of 98% and negative predictive of 100% for determining the presence or absence of urolithiasis by unenhanced spiral CT. Present study results agree with a number of studies that have reported the accuracy of unenhanced helical CT, in detecting renal calculi and obstructing ureteral calculi and in detecting extraurinary causes of flank pain. In a study comprising 210 patients with acute flank pain, Smith et al [9] reported that unenhanced helical CT had a sensitivity of 97%, specificity of 96%, positive predictive value of 96% and negative predictive of 97% for determining the presence or absence of urolithiasis. In another study comprising 163 patients with acute flank pain, Paul J Dorio et al [10] reported a sensitivity of 98.5%, specificity of 95.6%, and positive predictive value of 95.6%.

CONCLUSION

In the present study we found a sensitivity of 100%, specificity of 96%, positive predictive value of 98% and negative predictive of 100% for determining the presence or absence of urolithiasis by unenhanced spiral CT. Thus this study concludes that unenhanced spiral CT is sensitive as well as specific not only to diagnose urolithiasis but also to diagnose other causes that mimic urolithiasis in the genitourinary system or other systems.

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