

CHANGING IMAGE MODALITIES IN ACUTE URETERIC COLIC

Ureteric colic is an important and frequent emergency, that urologist and other clinician faces in their day to day practice throughout the world. It is most commonly caused by the obstruction of the urinary tract by calculi. Between 5-12% of the population will have urinary tract stone during their life time and recurrence rate approach 50 %¹. Incidence of ureteric colic in Bangladesh appears to be rising particularly among the working people returned from Middle East. It is important to reach an early diagnosis for better management. But the diagnosis of ureteric colic is sometime confronted. It is traditional to check urine for RBC and a plain X-ray KUB immediately. Loaded bowel sometimes obscures the pathology and decreases the sensitivity of plain KUB. Plain abdominal radiography may be sufficient to diagnose ureteric stone in patients with known calculus disease with a previous KUB X-ray. The sensitivity of KUB in other patients is poor with reported sensitivities of 58%-62%^{2,3}. KUB should not be used alone in the selection of patients for undergoing non-contrast CT evaluation. It may be a valuable component of the IVU or US assessment of acute flank pain.

Use of ultrasound scan increases the sensitivity of diagnosis of ureteric colic. Ultrasound is a safe and non-invasive imaging modality that is useful in the evaluation of the urinary tract. Ultrasonography allows direct demonstration of PUJ and VUJ stone. But stones located in-between is extremely difficult to locate sonographically⁴. Sometimes hydronephrotic change in the kidney gives an indirect evidence of the presence of distal stone or obstruction when stone is not visible. But hydronephrosis may not appear in early stage and it may not be possible to exclude obstruction in presence of previously dilated non obstructive system. The assessment of the ureteric jet is the other US parameter that is helpful in the evaluation of urinary obstruction. Ultrasound has significantly lower sensitivity than IVU and misses more than 30% of stones⁵. Intrarenal Doppler US improves the detection of early obstruction by determining the elevated resistive index (RI) in kidneys with stones and nondilated collecting systems⁶. A

combination of US and KUB has been recommended to improve the sensitivity of detecting ureteric calculi⁷. The lack of ionizing radiation makes US the initial screening method of choice for evaluating the pregnant patient with hydronephrosis.

The use of IVU has been used for ureteral stone detection for long time and has a sensitivity of 59.1–87.0 %.⁸ Loin pain, fever along with a non excreting kidney warrant urgent intervention. IVU is indicated if the findings of US/KUB are inconclusive or interventional treatment is anticipated. It provides information regarding the location and size of the renal calculi, the degree of obstruction and the effect on renal function. The technique permits the complete evaluation of the urinary system. Its main disadvantages are the use of ionizing radiation and intravenous administration of iodinated contrast media with risk of contrast reaction. It is important to see that the patients have normal or near normal renal function before doing an IVU. Contrast allergy however decreased with the use of low molecular agent. Badly prepared bowel in emergency situation also obscure the pathology and decreases the sensitivity of IVU. If the collecting system cannot be opacified in cases of severe stone obstruction, then the interpretation of IVU would be the same as that of KUB. Pregnancy and dehydration are relative contraindications of doing IVU. IVU has been the standard imaging modality for the investigation of ureterolithiasis until the advent of CT. Compared with NCT, the technique is more time consuming and is unable to offer alternative diagnosis.

Over the past decades noncontrast CT (NCT) scan has been establish as an image modality in the emergency department for diagnosing ureteric stone in the developed world. Helical CT is widely used nowadays, and is more familiar to physicians who might produce a more accurate diagnosis. Non-contrast CT has high sensitivity (97%) and specificity (96%) for ureterolithiasis^{9,10}. Nearly all stones are opaque on CT, and stone size can be accurately measured with this technique. CT can provide additional information such as periureteral stranding or urinoma to disclose the degree of stone

obstruction. It is less time consuming, does not require any contrast, therefore no contrast allergy and no adverse effect of contrast agent on renal function. Non-contrast CT is equal to IVU in diagnosis of obstruction and is more reliable in detecting the presence of ureterolithiasis. NCT also provide alternate or coexisting pathologies like acute appendicitis, diverticulitis, twisted ovary or presence of ureteric TCC. It is more rapid than IVU and does not depend on the technical expertise that is required by US. Further more, with the increased use of NCT; there was no significant decrease in the positive rate of renal colic detection¹¹. Main concern against standard NCT is the greater radiation exposure of 10mSv than estimated exposure of 2.5 mSv in IVU. Recent development Low dose NCT has got the calculated mean effective radiation dose was 1.40 mSv for males and 1.97 mSv for females and can detect stone size of < 2 mm which comparable to standard NCT¹². Multi-detector CT (MDCT) is the most recent advance in CT technology. CT urography (CTU) employing MDCT technique has the potential to replace IVU in the complete evaluation of the kidney and urinary collecting system¹³.

Magnetic resonance imaging (MRI) can be used to detect ureteral stones. MRU utilizing heavily T2-weighted (T2W) pulse sequences can easily depict a dilated ureter and demonstrate the level of obstruction without the use of ionizing radiation and contrast material¹³. The accuracy of MRU for ureteric stones may be lower than that of IVU as its spatial resolution is not high enough for the detection of small stones. However using breath-hold heavily T2-weighted sequences in acute flank pain found sensitivity of 54-58% and specificity of 100%. Sensitivity and specificity increased to 96.2-100% and 100%, respectively, using gadolinium-enhanced 3-D FLASH MR urography. Ureteric stones are seen as filling defects in the ureter on MRU. Perirenal and periureteral T2W high signal intensity can also be observed in patients with acute obstruction. MRU in combination with US may be used instead of IVU or CT in the evaluation of pregnant women with renal colic who have nondiagnostic findings from a sonogram.

So it is now appeared that non-contrast CT is the most accurate and efficient technique in the imaging evaluation of acute renal colic. The question may be raised whether it is practically feasible or economically viable in our country to do NCT in every patient with ureteric colic presenting to emergency department, probably not. In patients with known renal calculi, plain radiography only may be used for the imaging follow up.

In other cases, a plain x-ray KUB and a renal USG still appears to the first line imaging and will remain so for few more years, as these are readily available in this country. When intervention warranted or diagnosis remains unclear, intravenous urography, being the method familiar to most clinicians, can be used if CT scan is not available or affordable. Urologist can make an special arrangement with the radiologist to reduce the cost of NCT. On the other hand the waiting for 2 days in hospital for bowel preparation also increases the cost of IVU. In pregnant patients, ultrasound is the best initial imaging modality. When US findings are inconclusive, MRU has the potential to evaluate acute urinary tract obstruction without the use of ionizing radiation.

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