Renal colic is a common cause of severe acute abdominal pain in clinical practice. Classical symptoms include acute frank pain radiating to the groin, nausea and vomiting. There is often laboratory evidence of haematuria. Men are more often affected than women and the incidence increases with age. Acute renal colic is usually due to renal or ureteric stones. Most stones measuring 5mm or less in size will pass spontaneously. In the absence of fever and suspected pyonephrosis, patients are treated expectantly with analgesics and intravenous fluids. Advances in ureteroscopy and lithotripsy offer effective, minimally invasive options for those with larger stones that fail to pass spontaneously. Calculous disease tends to be recurrent and imaging evaluation is recommended at initial presentation. Imaging confirms the presence of stone, its size and location as well as the effect on renal function.

**Imaging evaluation of renal colic**

Patients with suspected renal colic have traditionally been evaluated with plain abdominal radiography (KUB), intravenous urography (IVU) and ultrasound (US). Computed tomography (CT) and magnetic resonance imaging (MRI) are the more recent imaging techniques available for the assessment of these patients.

Plain abdominal radiography may be sufficient to diagnose ureteric stone in patients with known calculous disease and previous KUB. The sensitivity of KUB in other patients is poor with reported sensitivities of 58%-62%\(^1\),\(^2\). KUB should not be used alone or 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.

Non-contrast CT is the imaging modality of choice in the initial evaluation of acute flank pain with high sensitivity (97%) and specificity (96%) for ureterolithiasis.\(^3\),\(^4\). Nearly all stones are opaque on CT, and stone size can be accurately measured with this technique. Perinephric and perireteric strandings, hydromephrosis and hydrourereter are the other CT signs of ureteric obstruction. Non-contrast CT is equal to IVU in diagnosis of obstruction and is more reliable in detecting the presence of ureterolithiasis.\(^5\). The technique is also useful in the diagnosis of flank pain due to other causes such as appendicitis, diverticulitis, and torsion of ovarian masses. Non-contrast CT is safer than IVU since no contrast media is used. It is more rapid than IVU and does not depend on the technical expertise that is required by US. Concerns on radiation exposure in CT have led to the development of dose reduction regimens. Contrast CT can be performed if there is uncertainty about whether a calcific opacity detected on non-contrast scans represents a phlebolith or ureteric stone. 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 system.\(^6\)

IVU has been the standard imaging modality for the investigation of ureterolithiasis until the advent of CT. 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 ionising radiation and intravenous administration of iodinated contrast media with risk of contrast reaction. Relative contraindications of IVU are renal insufficiency, past severe contrast reaction, pregnancy and dehydration. The availability of non-ionic contrast has decreased the incidence of contrast reaction. Compared with CT the technique is more time consuming and is unable to offer alternative diagnosis.

Ultrasound is a safe and non-invasive imaging modality that is useful in the evaluation of the urinary tract. The US diagnosis of obstructive urinary tract calculi is made by identifying the offending stone with proximal dilatation of the ureter and pelvicalyceal 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 stones.\(^7\). The use of intrarenal Doppler US improves the detection of early obstruction by determining the elevated resistive index (RI) in kidneys with stones and nondilated collecting systems.\(^8\) A combination of US and KUB has been recommended to improve the sensitivity of detecting ureteric calculi.\(^9\) However IVU is indicated if the findings of US/KUB are inconclusive or interventional treatment is anticipated. The lack of ionising radiation makes US the initial screening method of choice for evaluating the pregnant patient with hydronephrosis. Major disadvantages of US are that the size of the stones cannot be accurately measured, the technique requires an experienced operator and its ability to detects some stones only.
Magnetic resonance urography (MRU) utilising heavily T2-weighted (T2W) pulse sequences can easily depict a dilated ureter and demonstrate the level of obstruction without the use of ionising radiation and contrast material. 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. 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.

Summary

Non-contrast CT is the most accurate and efficient technique in the imaging evaluation of acute renal colic. In patients with known renal calculi, plain radiography may be used for the imaging follow up. Intravenous urography, being the method familiar to most clinicians, can be used if CT is not available. In pregnant patients, ultrasound is the best initial imaging modality. While currently limited IVU is employed in pregnancy to evaluate acute frank pain when US findings are inconclusive, MRU has the potential to evaluate acute urinary tract obstruction without the use of ionising radiation.

References