Loin pain and a normal CT KUB: what to do?

Nicholas Faure Walker, Specialty Trainee in Urology, Guy’s Hospital, London; Roger Kirby, Editor-in-Chief, Trends in Urology and Men’s Health, and President-elect, Royal Society of Medicine, London

Persistent loin pain and a normal CT KUB can present a significant challenge to urologists. A thorough history and examination may well identify the underlying cause. Further investigations may be indicated, but the benefits of more invasive testing and further radiation exposure must be carefully balanced against the risks.

Hospital Episode Statistic analyses showed over 90 000 patients presented to emergency departments in England in 2014 requiring treatment of renal colic, representing a 20% increase over the previous 10 years.1 Urologists (and patients) are fortunate that low dose (less than 3 millisieverts) computed tomography of the kidneys, ureters and bladder (CT KUB) is over 93% specific (and 97% specific for urinary tract calculi), and can also identify other non-urological causes of loin pain.2

However, large retrospective UK studies of CT KUBs performed for investigation of acute loin pain only revealed ureteric or renal stones in 52.8%, while 23.3% of patients had no abnormalities identified on CT KUB.3 Patients with persistent loin pain and a normal CT KUB can therefore present a significant challenge to the urologist. Depending on history and examination findings, the clinician will need to consider the appropriateness of further, more invasive investigations that may also expose the patient to significantly more radiation.

Contrast CT
CT KUB can reliably identify many urological causes of loin pain. CT KUB of a duplex system may show a ‘faceless’ kidney, as demonstrated in Figure 1, though the duplex system can only be reliably identified on the delayed phase of a CT intravenous urogram (CT IVU), as shown in Figure 2. Small retrospective studies have shown that CT KUB can miss up to a third of cases of duplex collecting systems, while a CT IVU has a 96% sensitivity.4

The reported prevalence of duplex systems is approximately 0.2% in the general population, though 20% remain asymptomatic into adulthood.5 The duplex usually only becomes apparent if it is accompanied by obstruction, reflux or infection. Hence, in a patient with colic type pain and a normal CT KUB, a CT IVU may identify a previously undiagnosed duplex system with an obstructed upper pole.

The other rare urological condition that a CT IVU could potentially identify is the ‘Nutcracker syndrome’, which was first described by John C Boileau Grant in 1937.6 Symptoms including loin pain, haematuria and gonadal varices can arise from compression of the left renal vein between the superior mesenteric artery and the aorta.6 Contrast CT may show compression of the left renal vein (see Figure 3), distension of the gonadal veins, or pelvic congestion. However, the gold standard for diagnosis remains endovascular ultrasound or venography.

The addition of contrast to a plain CT may also identify several non-urological causes of loin pain. In a retrospective study of 708 patients presenting with suspected renal colic,
the addition of contrast CT identified significant findings in 67 (9.4%) patients that were not visible on plain imaging.7 Findings included splenic artery aneurysm, renal vein thrombosis, pulmonary embolus, appendiceal mucocele, arterial bypass occlusion and gallbladder adenomyomatosis. Although it is associated with significantly more radiation than a CT KUB, a CT IVU is an appropriate next-line investigation in a patient with otherwise unexplained loin pain and a normal CT KUB.

Retrograde studies
Before CT IVU started to be widely recommended for the investigation of visible haematuria, studies comparing the ability of CT IVU, and retrograde studies to detect urothelial neoplasms, found that retrograde studies and CT IVU were 96% and 97% sensitive, 97% and 93% specific, and had negative predictive values of 97% and 99%.8 The study also identified one false negative retrograde study where the CT IVU identified a concentric tumour. From the limited data available, a retrograde study does not appear to add much value to a contrast CT – though it may be helpful in equivocal cases or if the patient also requires cystoscopic evaluation.

Micturating cystourethrogram
Vesico-ureteric reflux (VUR) disease does not normally present for the first time in adults unless it is secondary to surgery at the vesico-ureteric junction (VUJ), such as a transurethral resection of a bladder tumour at the VUJ or ureteric reimplantation. Previously undiagnosed primary VUR may manifest itself in adulthood with recurrent urinary tract infections or renal failure.9 As such, a micturating cystourethrogram (MCUG) is an appropriate investigation if a patient reports pain when voiding or if there is a concurrent history of otherwise unexplained recurrent pyelonephritis or renal failure.

Mercapto acetyl triglycine renogram
A patient with ureteric obstruction will normally demonstrate hydronephrosis on a CT scan. Non-dilated obstructive uropathy is a rare cause of obstructive uropathy but has been reported in the context of dehydration, renal failure and in patients with known pelvic malignancy.10 A mercapto acetyl triglycine (MAG3) renogram can assess the drainage of the kidney in patients with sufficient renal function. An indirect MAG3 renogram can also look for VUR and can be used as an alternative to MCUG if VUR is suspected.

If a patient has a normal CT scan, a MAG3 renogram is an appropriate next step if a patient has risk factors for obstruction or reports pain with high fluid intake, caffeine or alcohol.

Ureteroscopy
Owing to the high sensitivity and specificity of CT scanning, MCUG and dynamic renograms, ureteroscopy does not have a routine place in investigating a patient with loin pain unless the patient also reported haematuria. If this was the case, direct imaging of the upper and lower urinary tracts is essential to look for transitional cell carcinoma that is not visible on CT IVU.

Loin pain haematuria syndrome
This rare ‘constellation of clinical features including flank pain and intermittent haematuria’, that can be visible or non-visible, was first described in three women by Peter Little in 1967.11 Up to half of patients with loin pain haematuria syndrome (LPHS) have a history of renal calculi.12 Multiple mechanisms for LPHS have been proposed, including vascular disease, complement activation, coagulopathy, venocalyceal fistula, abnormal ureteric peristalsis, hypersensitivity, psychopathology, IgA nephropathy, glomerular basement membrane disease and microcrystal formation in the renal tubules.13

There is no consensus of diagnostic features, and diagnosis can only be achieved after extensive investigation has confirmed that there is no organic urological cause of loin pain. Up to half of cases may resolve within four years without intervention.14 In cases that do not respond to analgesia, renal denervation and even nephrectomy have been attempted. In one of the larger published studies from the UK, a total of 25 patients underwent renal denervation.15 ‘Success’ (cure of pain) was reported in seven (28%) unilateral cases, and

Box 1. Urological causes of loin pain

- Loin pain haematuria syndrome
- Nutcracker syndrome
- Glomerulonephritis
- Polycystic kidney disease
- Duplex kidney (with obstruction)

● Identifiable on CT KUB
- Ureteric calculus
- Pyelonephritis
- Pelvicoureteric junction obstruction
- Obstruction from ureteric tumour
- Retroperitoneal fibrosis
- Ureterocele
- Ureteric stricture
- Polycystic kidney disease
- Duplex kidney (with obstruction)

● Not identifiable on CT KUB
- Glomerulonephritis
- Nutcracker syndrome
- Loin pain haematuria syndrome
nine patients went on to have nephrectomies for pain. Following nephrectomy, three (33%) patients developed contralateral pain, while two (22%) developed debilitating wound pain.

Surgery for this complicated and poorly understood condition is only appropriate in highly selected cases and only after extensive work up has ruled out primary renal and ureteric pathology.

Summary
CT KUB will reliably identify most urological causes of loin pain. Pathologies not readily identifiable on CT KUB such as LPHS are thankfully rare. Diagnosis and management of such conditions can be challenging, but a thorough history and examination, combined with a step-wise approach to onward investigation, will hopefully identify the cause. Clearly, if any non-urological cause is suspected, the patient should be promptly referred to the appropriate specialty.

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References