

CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 28 year old white woman woke in the middle of the night with right flank pain and nausea. Urinalysis showed 5-10 WBCs. A pregnancy test is negative.

What is the imaging study of choice for acute onset of flank pain of suspected renal origin (renal colic)?

- (a) abdomen and pelvis CT, performed without contrast
- (b) abdomen and pelvis CT, performed without and then with contrast
- (c) intravenous pyelogram (IVP)
- (d) renal ultrasound

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION

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- (c) intravenous pyelogram (IVP)
- (d) renal ultrasound

Answer: (a), abdomen and pelvis CT, performed without contrast (also known as “CT-KUB”) is the study of choice for the evaluation of acute onset flank pain of suspected renal origin or renal colic. This study allows evaluation of the urinary tract from the kidneys through the bladder. CT-KUB will allow documentation of the size and position of renal stones.

While abdomen and pelvis CT, performed without and then with contrast (b) does yield information regarding the kidneys, it is typically not done for acute flank pain of suspected renal origin since the noncontrast study will show the side and location of renal stones, and adding contrast to the exam will only add expense without additional information (unless the unenhanced study does not provide the complete answer). The intravenous pyelogram (IVP) (c) is a study which has been entirely replaced by CT-KUB. Renal ultrasound (d) has a significantly lower sensitivity compared to CT-KUB, but may be used in pregnant women.

IMAGING STUDY AND QUESTIONS

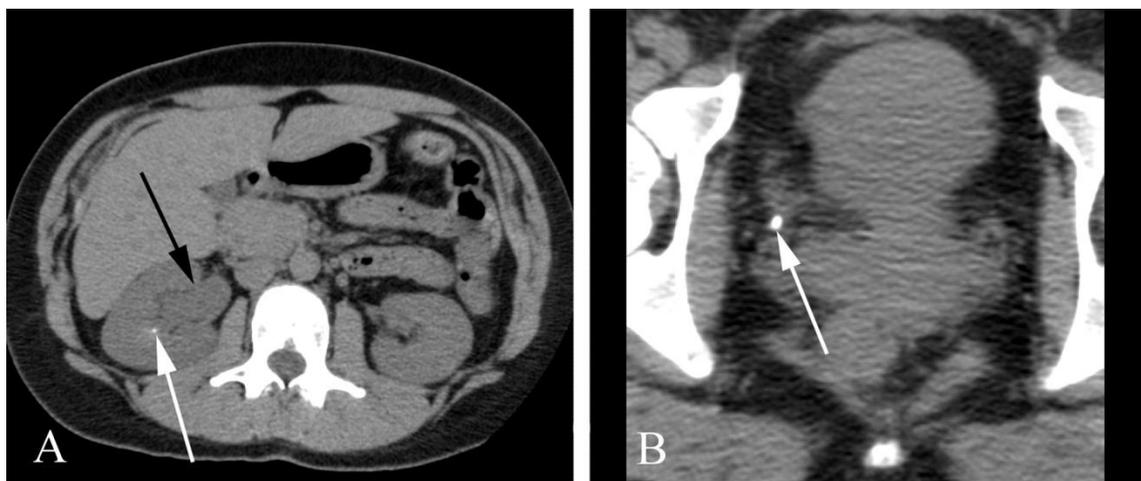
An unenhanced CT of the abdomen and pelvis (CT-KUB) was obtained. Selected images from the study are shown below.



Imaging questions:

- 1) What is the abnormality indicated by the white arrow in A?
- 2) What is the abnormality indicated by the black arrow in A?
- 3) What is the abnormality indicated by the white arrow in B?
- 4) (Bonus imaging question!) What frequently seen asymptomatic benign lesion can have a similar appearance the abnormality in B?
- 5) What is the diagnosis?
- 6) What is the appropriate next step in patient management?

IMAGING STUDY QUESTIONS AND ANSWERS



- A. Axial unenhanced CT at the level of the kidneys shows a small, nonobstructing renal stone in the right kidney (white arrow), and distention of the right collecting system (hydronephrosis) (black arrow).
- B. Axial unenhanced CT at the level of the ureterovesical junction (different magnification) shows a 3 mm ureteral calculus in the distal right ureter (white arrow) which was obstructing the ureter and producing the patient's renal colic.

Imaging questions:

- 1) What is the abnormality indicated by the white arrow in A? A nonobstructing right renal calculus (remember that CT's are displayed as if you are looking up from the patient's feet, with the right on the left and vice versa).
- 2) What is the abnormality indicated by the black arrow in A? A distended right renal pelvis (hydronephrosis).
- 3) What is the abnormality indicated by the white arrow in B? A distal, obstructing right renal calculus.
- 4) (Bonus imaging question!) What frequently seen asymptomatic benign lesion can have a similar appearance the abnormality in B? A venous phlebolith.
- 5) What is the diagnosis? Distal right ureteral calculus with associated hydronephrosis causing renal colic.
- 6) What is the appropriate next step in patient management? Many practitioners refer all such patients to urology. Patients with small, distal stones will often be treated with "medical expulsive therapy" (alpha-blockers, steroids, and nonsteroidal anti-inflammatory medication).

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP
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The patient was referred to urology. Medical expulsive therapy was not successful in facilitating passage of the patient's ureteral stone. She underwent ureteroscopic stone extraction for the distal ureteral stone, followed by ultrasonic lithotripsy for the renal stone.

SUMMARY

Presenting symptom: In patients with flank pain, diagnostic considerations include renal stone disease, diverticulitis, appendicitis, dissecting aortic aneurysm, and musculoskeletal abnormalities including intervertebral disc herniation.

Imaging work-up: In patients who present with flank pain and who are suspected to have renal colic, unenhanced CT of the abdomen and pelvis (CT-KUB) is now the study of choice. This examination allows documentation of the size and location of renal stones. It will also frequently allow alternative diagnoses such as aortic aneurysm, diverticulitis, and appendicitis to be made. If the unenhanced study does not provide all required information, a contrast-enhanced exam may be added. In patients with recurrent stone disease, imaging may be modified to reduce radiation dose.

Establishing the diagnosis: The diagnosis of ureteral calculus is generally made on the CT study. A blood count and urinalysis are usually performed to exclude infection, and serum levels of calcium, phosphorus, and uric acid are obtained to try to identify the cause of urolithiasis. Chemical analysis of the stone (calcium oxalate, calcium phosphate, uric acid, struvite, cystine, etc.) is typically performed on any available passed or retrieved stone.

Treatment: Treatment options include medical expulsive therapy, ureteroscopy for extraction of distal stones, extracorporeal shock-wave lithotripsy, percutaneous nephrolithotripsy, and laparoscopic pyelolithotomy. The urologist will base treatment on the size and location of the stone, stone composition, previous patient history, and failure of less intrusive treatment.

Take-home message: Unenhanced abdomen and pelvic CT (CT-KUB) is the imaging study of choice for evaluation of possible renal stone disease.

FURTHER READING

Curhan CG, Aronson MD, Preminger GM. Diagnosis and acute management of suspected nephrolithiasis in adults. UpToDate, accessed 11/28/08.

Kambadakone AR, Eisner BH, Catalano OA, Sahani DV. New and evolving concepts in the imaging and management of urolithiasis: urologists' perspective. RadioGraphics 2010; 30:603-623.

Preminger GM, Curhan GC. The first kidney stone and asymptomatic nephrolithiasis in adults. UpToDate, accessed 11/15/2010.

Renfrew, DL. Renal symptoms. Chapter 1 of *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.