Emergency Case

Harold Schubert, MD, MSC, CCFP(EM)

Renal colic

QUESTIONS

A young businessman was awakened from sleep by severe pain in his side. He presented to an emergency department clutching his side. He was pale and diaphoretic. What drug is most effective to alleviate this pain? What is the best test to confirm the diagnosis? What criteria must be satisfied before you can discharge this patient?

Renal colic affects 2% to 5% of the North American population and is a common reason for presentation to emergency departments (EDs). Renal colic is usually a recurrent disease. The severe pain of renal colic is caused by an object in the ureter. Features of renal colic are summarized in **Table 1**[1].

History and physical examination

History and physical examination might reveal only distress and diaphoresis. Shifting of pain from the flank to the groin and genitals indicates a stone in the lower one third of the ureter. Urinary urgency (without infection) suggests a stone at the ureterovesical junction. Fever should alert doctors to the possibility of urinary infection. There might be costovertebral angle or lower abdominal tenderness and localized

Table 1. **Features of renal colic**

OBJECT IN URETER	% OF CASES	ETIOLOGY AND ASSOCIATED CONDITIONS
Calcium-oxalate or calcium-phosphate stone	75-85	Familial, three times more likely in women, sedentary professionals, age 20 to 50 Summer peak—relative dehydration; oxalates in leafy green vegetables Hypercalciuria—diet, hyperparathyroidism, sarcoidosis, neoplasia, multiple myeloma, hyperthyroidism, renal tubular acidosis, antacid use (calcium, alkali), immobilization Hyperoxaluria—diet (summer), irritable bowel disease, radiation enteritis
Struvite stone (magnesium-ammonium phosphate)	10-15	Chronic urinary tract infection with urea-splitting organisms; usually secondary drainage problems—congenital, neurogenic bladder, chronic catheter placement Possibly "staghorn." These patients could form large bladder stones
Uric acid stone	5-8	Gout, uricosurics, myeloproliferative disorders, high-purine diet, chronically acidic or concentrated urine
Cystine stone	1	Cystinuria—inborn error of membrane transport; autosomal recessive
Xanthine stone	Rare	Xanthinuria—inborn error of purine metabolism; autosomal recessive
Blood clot	Uncommon	Kidney hemorrhage, secondary trauma or tumour
Tissue from kidney	Rare	Renal tumour, papillary necrosis, secondary acute renal failure

Adapted from Harrison.[1]

Dr Schubert *practises emergency medicine at the University of British Columbia Hospital in Vancouver.*

Table 2. **Imaging methods for renal colic**

METHOD	BENEFITS	DRAWBACKS
Excretory urograph	Shows renal functional anatomy Degree of functional obstruction is well assessed by time-lapse films Good for finding stones	Time required—hours Need for IV injection Risk of contrast reaction Degraded by lack of bowel preparation Little information on differential diagnoses Moderate radiation dose
Ultrasound	Good for assessing hydronephrosis, fluid-filled structures, and fluid extravasation Some information on differential diagnoses NO radiation	Poor for finding or sizing stones
Helical (spiral) CT scan: unenhanced, variable radiation dose	Time required—within 10 minutes Excellent for finding and sizing stones (85% to 90% accuracy) Good for structural information including information on differential diagnoses	No functional information High-to-moderate radiation dose

ileus. General health and comorbidities must be assessed. It is wise to quickly assess for abdominal bruit or mass and for femoral pulses and bruits, considering the differential possibility of abdominal aortic aneurysm (AAA).

Pain control

Controlling pain is a priority. Prostaglandin synthetase inhibitors (nonsteroidal anti-inflammatory drugs [NSAIDs]) are most effective: several (diclofenac, indomethacin, ketorolac, piroxicam) have been compared with narcotic analgesics for this condition[2] and have been found to be more effective than narcotics. Their onset of action is within 20 to 30 minutes, and they bring complete pain relief to 85% to 90% of patients. The pain is usually ameliorated so completely that pain severity and location can no longer be used as indicators of the stone's passage. The NSAIDs can be administered orally, rectally, or parenterally (sublingual preparations would be ideal for ED use).

While waiting for an NSAID to take effect, an intravenous line can be started and doses of antiemetic (dimenhydrinate, metoclopramide, or prochlorperazine) and narcotic analgesics given. Normal urine output should be assured, but high volumes of intravenous fluids might contribute to ureteral edema and slow passage of the stone.

Laboratory tests

Investigations help confirm diagnosis and assess renal function, the possibility of urinary infection, and metabolic disturbances that might have led to the condition. Presence of red blood cells in the urine strongly supports the diagnosis. Obtaining a urine sample under supervision will reduce concerns that the patient is seeking drugs. Renal colic without hematuria occurs, but is rare. Urine should be examined as soon as possible for red and white blood cells, leukocytes, crystals, acidity, and bacteria (cool normal urine will contain crystals). All urine passed should be strained for stones. Complete blood count, blood urea nitrogen, creatinine, electrolytes, uric acid, calcium, and phosphate should be measured.

Imaging

Imaging aims to identify the cause of symptoms and assess ureteral obstruction. In renal colic with obstruction, stone location and size are the most important factors in determining patient management.

Imaging traditionally begins with plain abdominal film (of kidneys, ureter, and bladder). All calcium-containing and struvite (magnesium-ammonium phosphate) stones (85% of stones) should be visible on plain film. In practice, plain films can only suggest the possibility of stones, and they give no information about renal function. If an intravenous pyelogram (IVP) is subsequently performed, a plain film is a valuable aid in identifying stones.

Intravenous pyelograms, ultrasound scans, or unenhanced helical computed tomography scans

provide more definitive imaging. Benefits and drawbacks of these imaging modalities are shown in **Table 2**.

Computed tomography has become the test of choice for renal colic, when it is available.[3] Cost is similar to the cost of an IVP, but CT provides more information than an IVP or ultrasound, including valuable information about alternative causes of flank pain, such as appendicitis, diverticulitis, ruptured AAA, choledocholithiasis, perinephric hematoma, and adnexal abnormalities. This wealth of information is, perhaps, a "terrible beauty" and the radiation dose is high. Concern about radiation is compounded by the recurrent nature of renal colic, and exposure of the ovaries is of special concern. For this reason, many imaging centres use various techniques to reduce radiation exposure and bring it into the range used for IVPs. The quality of the CT images will be lower, but is still very good for their intended purpose because most stones, including uric acid stones, are radiodense.

Imaging methods should be individualized for each patient (eg, for fertile women, ultrasound might be the best choice). You might not learn about stone location and size, but you can confirm the presence of two functioning kidneys and ureters, assess whether hydronephrosis (obstruction) is present, and manage patients expectantly.

Admit or discharge?

Admission is indicated if renal function is compromised, if the patient has ureteral obstruction with sepsis, or if pain cannot be adequately controlled by nonparenteral means. Relative indications for admission include large stones, solitary kidneys, significant comorbidities, and advanced age.

Referral

Referral to a urologist is advisable for patients who have renal colic for the first time. A urologist will complete investigations to establish etiology and institute any indicated therapy. Specific therapies will be indicated for few patients; most will benefit from increasing their daily fluid intake.

Most renal stones are 2 to 3 mm in diameter. The likelihood of passing the stone spontaneously within several weeks varies inversely with the size of the stone and falls off sharply at 5 to 6 mm. Lithotripsy is the treatment of choice for stones that do not pass within 3 to 4 weeks and for patients with complications. Early lithotripsy could be scheduled for very large stones (8-mm diameter) because they are very unlikely to pass spontaneously.

ANSWERS

Nonsteroidal anti-inflammatory drugs are most effective for relieving the pain of renal colic. Computed tomography is the best test to confirm the diagnosis, but CT radiation dose is of concern so this imaging method should be used discriminately. An otherwise healthy patient with renal colic can be discharged if renal function is normal, if there is no evidence of renal sepsis, and if pain management is satisfactory.

References

1. Fauci AS, Braunwald E, Isselbacher KJ, Wilson JD, Martin JB, Kasper DL, et al. *Harrison's principles of internal medicine*. 14th ed. New York, NY: McGraw-Hill Book Co; 1998.
2. Collaborative Group of the Spanish Society of Clinical Pharmacology. Comparative study of the efficacy of dipyrone, diclofenac sodium and pethidine in acute renal colic. *Eur J Clin Pharmacol* 1991;40(6):543-6.
3. Sourtzis S, Thibeau JF, Damry N, Raslan A, Vandendris M, Bellemans M. Radiological investigation of renal colic: unenhanced CT compared with excretory urography. *Am J Radiol* 1999;172:1491-4.