Man With Severe Flank Pain and Nausea

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A previously healthy 40-year-old man presents with a 2-hour history of excruciating colicky pain of acute onset that emanates from the right flank and radiates to the groin. He rates the severity of the pain at 9 on a scale of 1 to 10. Before arriving at the emergency department, the patient experienced nausea and 2 episodes of nonbilious, nonbloody vomiting.

The patient denies previous episodes of similar pain. He has no history of fever, rigors, chills, diaphoresis, cough, shortness of breath, palpitations, ankle edema, or rash. He has dark-colored urine but no frequency, dysuria, or hematuria. There is no history of trauma. The patient takes no medication, does not use alcohol or tobacco, and is monogamous.

**Examination.** This well-built, well-nourished man has difficulty in finding a comfortable position because of the pain. Heart rate, 90 beats per minute and regular; respiration rate, 24 breaths per minute; blood pressure, 148/86 mm Hg. The patient is afebrile and well hydrated. The head and neck examination reveals no erythema, evidence of candidal infection, or icterus. The thyroid is not palpable. There is no lymphadenopathy. The contours of the abdomen are normal, and no organomegaly, tenderness, or fluid is noted. The hernial orifices and lungs are clear. Results of cardiac and neurologic examinations (including the spine) are normal.

**Laboratory studies.** White blood cell (WBC) count, 5200/µL; hemoglobin, 13.6 g/dL; platelet count, 176,000/µL; erythrocyte sedimentation rate, 15 mm/h. Urinalysis reveals pH, 7.5; protein and glucose, negative; WBC esterase and nitrite, negative. Microscopic red blood cell count, 240 per high-power field; WBC count, 2 to 5 per high-power field. Serum sodium, 138 mEq/L; potassium, 4 mEq/L; chloride, 95 mEq/L; glucose, 98 mg/dL; blood urea nitrogen, 23 mg/dL; creatinine, 1 mg/dL; serum lipase, 96 IU/L; amylase, 48 U/L. The noncontrast abdominal CT scan is shown here.

Based on the clinical, laboratory, and CT findings, the most likely diagnosis is:

A. Acute cholecystitis
B. Acute pancreatitis
C. Nephrolithiasis
D. Aortic dissection
E. Vertebral osteomyelitis

**WHAT'S WRONG:**

The CT scan shows a renal stone and mild hydronephrosis. In a patient with acute-onset right flank pain that radiates to the groin, no localizing signs, and microscopic hematuria, these findings strongly suggest **nephrolithiasis, C.**

**Hospital course.** Additional laboratory results include a serum calcium level of 10 mg/dL; phosphate, 2.2 mg/dL; alkaline phosphatase, 126 U/L; serum uric acid, 6.2 mg/dL.
Intravenous fluids, 200 mL/h, are started. A morphine pump is placed for pain control. All urine samples are strained. The pain subsides after 12 hours of hydration and analgesia. A small calcium oxalate stone is retrieved.

The patient is discharged and advised to drink adequate amounts of fluid daily. **EPIDEMIOLOGY**

Nephrolithiasis develops in about 12% of Americans. Kidney stones are 2 to 3 times more common in men than in women and affect whites more than blacks. Rates of stone formation vary geographically; nephrolithiasis is most common in the Southwest. **ETIOLOGY**

Approximately 80% of kidney stones are composed of calcium; 10% are uric acid, 8% are struvite, and 2% are cystine.

In patients with calcium stones, 60% to 70% have hypercalciuria (24-hour urinary calcium excretion of more than 300 mg in men). Most cases are idiopathic, but comorbid disorders, such as hyperparathyroidism or sarcoidosis, may be responsible. Hyperuricosuria, hyperoxaluria, and hypocitraturia may also contribute to the formation of calcium stones.

Uric acid stones occur in patients with very low urinary pH and volume. Hyperuricosuria is common and is seen in patients with primary gout, myeloproliferative disorders, and high-purine diets. Patients with chronic diarrheal illness are also susceptible.

Struvite (magnesium ammonium phosphate) stones occur in persons with persistently high urinary pH. These patients—usually women—have recurrent urinary tract infections caused by urease-producing bacteria, especially *Proteus* species. The large stones, known as staghorn calculi, may fill the renal pelvis.

Cystine stones, which occur in children, are rare; they result from a congenital metabolic error. Medications implicated in stone formation include triamterene, indinavir, and sulfonamides.

**CLINICAL MANIFESTATIONS**

Renal colic typically involves excruciating flank or lower abdominal pain of acute onset, although some patients present with only a "dull ache." Paroxysms of pain that last 20 to 60 minutes are typical. Nausea and vomiting are common in patients with severe pain. The location and radiating pattern of the pain depend on the site of the stone. Stones in the kidney or upper ureter cause flank or upper abdominal pain. As the stones progress distally, lower abdominal pain that radiates to the ipsilateral groin is likely. Distal ureteral or bladder stones may cause dysuria or urinary frequency. Many kidney stones are asymptomatic and are detected by chance when radiographic studies are performed for other reasons.

**DIAGNOSIS**

Physical findings are generally nonspecific, but costovertebral angle or abdominal tenderness may be noted.

Hematuria, either gross or microscopic, is common in patients with nephrolithiasis; however, its absence does not rule out a stone. About 15% to 20% of patients do not have hematuria. Imaging studies are essential to confirm the presence, size, and location of a calculus. Each imaging modality has advantages and limitations. Plain radiography of the kidney, ureter, and bladder will identify radiopaque stones, such as those containing calcium, but it lacks sensitivity and specificity. Moreover, radiolucent uric acid stones, small stones, and stones overlying bony structures may be missed. Plain radiography may be helpful in patients with recurrent calcium-containing stones. Abdominal ultrasonography detects obstruction and renal calculi but has limited ability to identify ureteral stones. Ultrasonography is preferred when exposure to radiation is a concern—for example, in pregnant women.

Intravenous pyelography (IVP) is a highly sensitive and specific test that was once considered the gold standard. It provides information about stone size, location, and the presence of obstruction, as well as overall renal function. Disadvantages of IVP include the need for bowel preparation, prolonged waiting time to visualize the entire urinary tract, and the risk of potential allergic and/or nephrotoxic reactions.

Noncontrast CT has become the preferred modality in patients with renal colic. It is fast and highly sensitive (98%) and specific (95%), does not require contrast material, and can detect nonurologic causes of abdominal pain. **TREATMENT**

Most patients can be treated on an outpatient basis with adequate pain control and close follow-up until the stone passes. Patients with evidence of pyelonephritis; severe, uncontrollable pain; or intractable nausea and vomiting should be admitted.

Narcotic analgesics and NSAIDs are equally effective for acute renal colic. NSAIDs relax ureteral smooth muscle, which addresses the underlying pathophysiology. Antiemetics are sometimes useful. Calcium channel blockers and prednisone are not recommended. Encourage patients to drink 2 to 3 L of water every 24 hours and strain their urine until the stone passes. The likelihood that a stone will pass is related to its size and location. Generally, stones smaller than
4 mm pass spontaneously in 1 to 2 weeks. Larger stones and those that are more proximal are less likely to pass without intervention. Evaluation by a urologist is warranted for patients who have smaller stones that do not pass spontaneously within 4 weeks. Newer noninvasive or minimally invasive techniques have revolutionized the surgical treatment of renal calculi. Extracorporeal shock wave lithotripsy (ESWL) is the treatment of choice in 85% of patients. Distal ureteral stones can be treated with ureteroscopic extraction or in situ SWL.

**PREVENTION**

After a first episode of urolithiasis, 50% of patients will have a recurrence within the next 10 years. The basic workup for these patients includes measurement of electrolyte, blood urea nitrogen, creatinine, calcium, phosphate, and serum uric acid levels. Pay particular attention to the pH in the urinalysis results.

Encourage patients to drink 2 to 3 L of fluid throughout the day, as well as just before bedtime. Patients usually do not adhere to recommendations to restrict ingestion of sodium, purines, and oxalate-containing foods. Calcium-restricted diets are not recommended.

In patients with recurrent episodes of stones, a 24-hour urine collection is recommended to measure oxalate, citrate, calcium, creatinine, sodium, and uric acid levels. A thiazide diuretic is recommended for patients with calcium stones and hypercalciuria. Hyperuricosuria is treated with allopurinol, and hypocitraturia with potassium citrate. Struvite or staghorn calculi generally require surgery or ESWL.


**Links:**

[1] [http://www.diagnosticimaging.com/authors/j-paul-miller-md](http://www.diagnosticimaging.com/authors/j-paul-miller-md)