

THE CLINICAL PICTURE

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Emphysematous cystitis

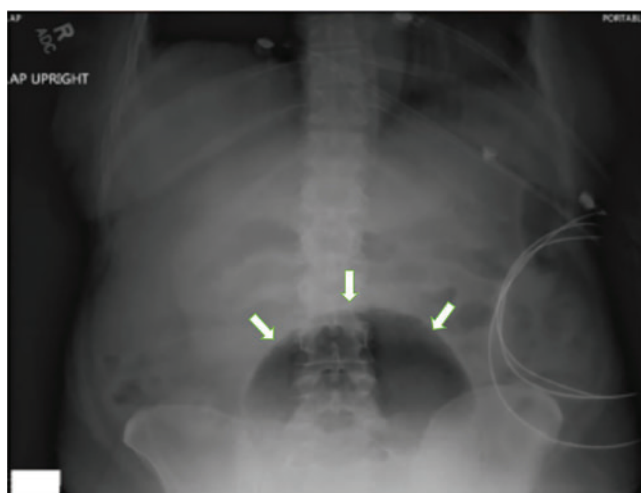


Figure 1. Plain abdominal radiography showed bladder distention with gas (arrows).

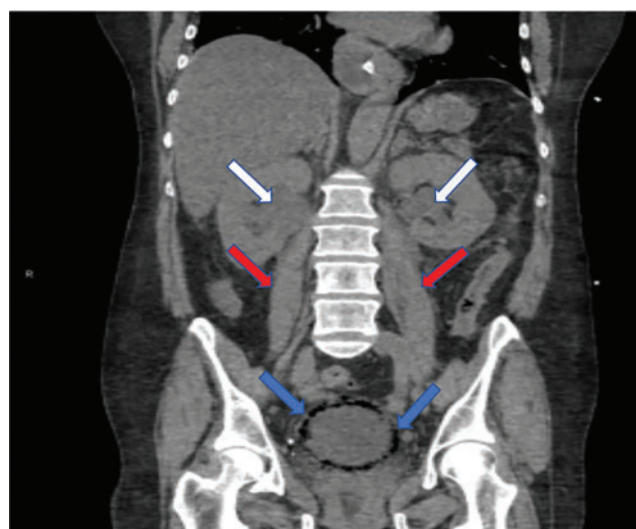


Figure 2. Coronal computed tomography of the abdomen and pelvis revealed a diffuse collection of gas within the bladder wall (blue arrows), bilateral hydronephrosis (white arrows), and bilateral hydroureter (red arrows).

A 59-YEAR-OLD WOMAN with a history of chronic kidney disease and atonic bladder was brought to the hospital by emergency medical services. She had fallen in her home 2 days earlier and remained on the floor until neighbors eventually heard her cries and called 911. She complained of abdominal pain and distention along with emesis.

On presentation, she had tachycardia and tachypnea. The examination was notable for pronounced abdominal distention, diminished bowel sounds, and costovertebral angle tenderness.

The emergency department physician started empiric treatment for abdominal sepsis, including fluid resuscitation and broad-spectrum antibiotics. Initial imaging studies included abdominal radiography, which revealed a nonobstructive bowel gas pattern but

raised suspicion of gas in the bladder (Figure 1). Arterial blood gas analysis showed lactic acidosis.

While laboratory work was being done, the patient's tachypnea progressed to respiratory distress, and she ultimately required intubation. Vasopressors were started, as the patient was hemodynamically unstable. A Foley catheter was placed, which yielded about 1,100 mL of purulent urine.

Laboratory workup showed:

- Procalcitonin 189 ng/mL (reference range < 2.0 ng/mL)
- White blood cell count $10.7 \times 10^9/L$ (4.5–10.0)
- Myoglobin 20,000 ng/mL (< 71)
- Serum creatinine 4.8 mg/dL (0.06–1.10).

Urinalysis was positive for infection; blood and urine cultures later were positive for *Escherichia coli*.

doi:10.3949/ccjm.86a.18063

Computed tomography of the abdomen and pelvis showed diffuse bladder dilation with urine and gas. It also revealed gas within the bladder wall and moderate hydroureter and hydronephrosis (**Figure 2**).

The patient went into shock that was refractory to pressors, culminating in cardiac arrest despite resuscitative measures.

■ EMPHYSEMATOUS CYSTITIS, A FORM OF URINARY TRACT INFECTION

Emphysematous cystitis is a rare form of complicated urinary tract infection characterized by gas inside the bladder and in the bladder wall. While the exact mechanisms underlying gas formation are not clear, gas-producing pathogens are clearly implicated in severe infection. *E coli* and *Klebsiella pneumoniae* are the most common organisms associated with emphysematous cystitis; others include *Proteus mirabilis*, and *Enterobacter* and *Streptococcus* species.^{1,2}

More than 50% of patients with emphysematous cystitis have diabetes mellitus. Other risk factors include bladder outlet obstruction, neurogenic bladder, and female sex.³ The severity of disease ranges from asymptomatic pneumaturia (up to 7% of cases)² to fulminant emphysematous cystitis, as in our patient.

The clinical presentation of emphysematous cystitis is nonspecific and can range from minimally symptomatic urinary tract infection to acute abdomen and septic shock.⁴

Some patients present with pneumaturia

(the passing of gas through the urethra with micturition). Pneumaturia arises from 3 discrete causes: urologic instrumentation, fistula between the bladder and large or small bowel, and gas-producing bacteria in the bladder (emphysematous cystitis).⁵ Pneumaturia should always raise the suspicion of emphysematous cystitis.

The diagnosis can be made with either radiographic or computed tomographic evidence of gas within the bladder and bladder wall, in the absence of both bladder fistula and history of iatrogenic pneumaturia. Emphysematous cystitis should prompt urine and blood cultures to direct antimicrobial therapy, as 50% of patients with emphysematous cystitis have concomitant bacteremia.⁶

Our patient had an elevated serum level of procalcitonin, a marker of bacterial infection. Procalcitonin is a more specific biomarker of bacterial infection than acute-phase reactants such as the erythrocyte sedimentation rate or the C-reactive protein level. Measuring procalcitonin may help physicians make the diagnosis earlier, differentiate infectious from sterile causes of severe systemic inflammation, assess the severity of systemic inflammation caused by bacterial infections, and decide whether to start or discontinue antibiotic therapy.⁷

Most cases of emphysematous cystitis can be treated with antibiotics, though early diagnosis is crucial to a favorable outcome. Delay in diagnosis may contribute to the 20% mortality rate associated with this condition.⁶ ■

**Pneumaturia
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