

## CASE REPORT

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# A rare case of emphysematous cystitis

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**Abstract:** Emphysematous cystitis is a rare complication that can occur as a result of a lower urinary tract infection. Diabetic patients are at a high risk of developing emphysematous cystitis due to their susceptibility to urinary infections caused by gas-producing bacteria. The recommended diagnostic test for this condition is a computed tomography (CT) scan, which is effective in identifying gas buildup in the bladder wall and lumen. The prognosis of this condition depends on how quickly it is treated. In this report, we describe a woman with diabetes mellitus type-2 presented with emphysematous cystitis. Fortunately, she was treated with a combination of antibiotics, insulin therapy, and bladder drainage.

**Keywords:** Diabetes Mellitus; Emphysematous Cystitis; Urinary Tract Infection

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## 1. Introduction

Emphysematous cystitis (EC) is a rare complication that can arise from a lower urinary tract infection (UTI). It is a severe infection that poses a risk to life and is most commonly seen in diabetic patients with poor blood sugar control, immunocompromised individuals, and patients with bladder obstruction or neurogenic bladder. Diagnosis is typically made through radiological imaging, which shows gas buildup in the bladder's lining or walls. The true prevalence of this condition may be underestimated as not all patients undergo radiological tests, particularly those without risk factors or with mild symptoms. The prognosis of EC is heavily influenced by prompt treatment (1,2).

In the emergency department (ED), it is essential to think about EC when assessing a patient with UTI symptoms. While most genitourinary infections are straightforward and display common symptoms like painful urination, frequency, and urgency, it is crucial not to ignore the potential for more serious conditions such as EC in patients experiencing visible blood in the urine, severe abdominal or pelvic pain. Failing to identify and promptly treat EC can result in severe complications such as bladder rupture, tissue death, abscess formation, and potentially fatal septic shock (2,3).

Managing patients with EC and systemic infections requires a comprehensive approach involving both medical and surgical treatments, with surgery being necessary in around 10% of cases (3).

## 2. Case presentation

A 58-year-old woman with a past medical history of diabetic mellitus type 2 presented to the ED with severe lower abdominal pain. In addition to dysuria, she mentioned incomplete emptying of bladder. She did not report vomiting, diarrhea,

or recent UTI. Two weeks before, she had a fall and was diagnosed with stroke and she had had an indwelling urinary catheter since then.

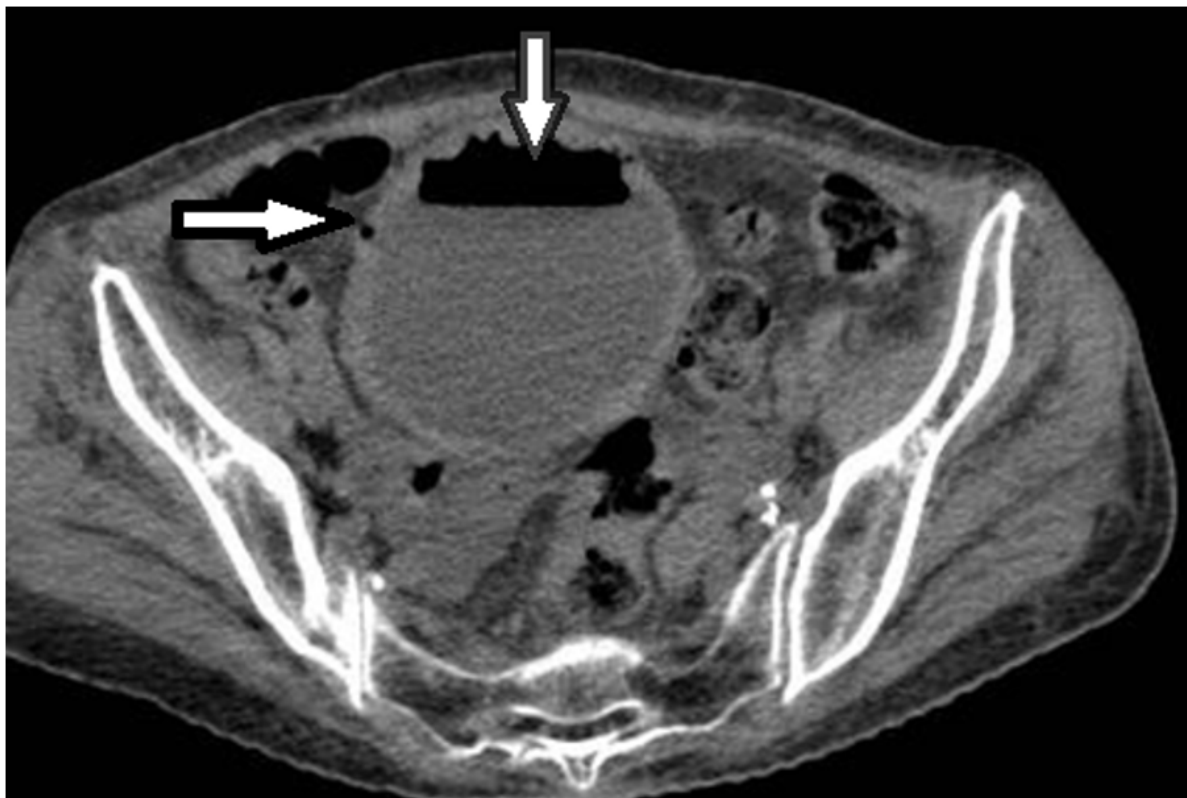
On initial assessment, she was febrile with blood pressure of 140/75 mmHg and pulse rate of 110 beats/min. Her physical examination showed no unusual finding except diffuse hypogastric tenderness. The results of her blood test showed a normal complete blood count, but her serum creatinine level was 1.7 mg/dL. All other electrolytes were within normal range. Her glycosylated hemoglobin level was 8.4%. Urinary catheterization revealed urine that was bloody and cloudy, leading to the start of antibiotic treatment. A non-contrast abdominopelvic computed tomography (CT) scan was performed (Figure 1). The CT images showed bladder wall thickening and gas within the bladder as well as the bladder wall (arrows). The diagnosis of EC was made.

The patient's condition was closely monitored under antibiotic treatment and within 48 hours, there was no longer any fever. By the 5th day of hospitalization, inflammatory markers such as CRP has been decreased. The patient had uneventful follow up afterward.

## 3. Discussion

EC is a rare condition characterized by air trapped in the bladder wall and lumen. The average age of EC is 68 years, with most cases occurring in females over 60 years old. Predisposing factors to EC are diabetes mellitus, neurogenic bladder, chemotherapy for malignancy, and immunosuppression (3).

Gas production is a result of microorganisms that produce carbon dioxide (CO<sub>2</sub>) through fermenting glucose, which is found in abundance in the urine and tissues of these patients. This process leads to the buildup of acidic compounds, causing a decrease in local pH that allows bacteria



**Figure 1** Axial non-contrast pelvic CT imaging revealed diffuse bladder wall thickening and air bubbles within bladder and bladder wall (arrows)

with specific enzymes to convert acids into CO<sub>2</sub>. The accumulation of gas raises local pressure, disrupts circulation, and promotes ischemia in nearby tissues, creating an environment that fosters bacterial growth in a continuous cycle. In individuals without diabetes mellitus, urinary lactose or tissue proteins can also be used as a substrate for gas production. The most commonly identified microorganism is *Escherichia coli*, with a predominance of 70-75%, followed by *Klebsiella pneumoniae* (20-30%) and, less frequently, other pathogens (4,5).

It can manifest with minimal symptoms like minor pneumaturia or voiding issues, or it can cause severe symptoms like acute abdomen and sepsis. Patients with diabetes and females are at a higher risk of developing EC (3,4).

Imaging modalities like traditional abdominal X-rays, ultrasound, and CT scans are essential for diagnosis. The CT scan is the diagnostic tool with the highest level of sensitivity and specificity. CT scan can help determine the size and location of gas build-up. It can also reveal the severe complication, such as infections, abscesses. In addition, CT scans can identify other sources of pelvic air, such as trauma or fistulas connecting to the bowel or vagina (5,6).

Effective management relies on timely identification and correction of underlying factors, maintaining proper blood sugar levels as needed, promptly administering the antibiotics, ensuring proper bladder drainage, and performing surgical removal of affected tissue when necessary. Urinalysis,

testing urine culture, and utilizing gram staining are crucial in identifying the causative organism and directing the treatment with antibiotics. About 90% of cases can be treated with medication alone, while the remaining 10% may require a combination of surgical and medical approaches, such as cystectomy, partial cystectomy, cystostomy, bladder irrigation, or nephrectomy in cases of emphysematous pyelonephritis (5,6).

#### 4. Conclusion

EC is an uncommon but serious complication of UTI caused by bacteria that produce gas. A plain abdominal X-ray can help diagnose the condition, but CT scan is the preferred imaging modality. Prompt treatment includes identifying and addressing any underlying causes, administering of effective antibiotics, ensuring proper bladder drainage, and surgically removing affected tissue if necessary for favorable outcome.

#### 5. Declarations

##### 5.1. Acknowledgement

None.

##### 5.2. Authors' contribution

NA.

### 5.3. Conflict of interest

None.

### 5.4. Funding

No funding was received for this study.

### 5.5. Ethical considerations

All information, including the photograph and radiological images, is deidentified. We acknowledge that we are aware of the journal's ethical publication guidelines and confirm that this case-based review follows those guidelines.

### 5.6. Informed consent

The patient provided written informed consent for the publication of her clinical details and/or clinical images.

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