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## Unusual case of emphysematous cystitis mimicking intestinal perforation: A case report

Hye Yoon Kang, Dae-Sup Lee, Donghyoun Lee

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### Abstract

#### BACKGROUND

Emphysematous cystitis (EC) is a bladder condition commonly caused by gas-generating bacterial infections. Factors that increase the risk for developing this condition include female gender, age  $\geq 60$  years, and diabetes mellitus, glycosuria, and urinary stasis. The symptoms of EC often lack specificity, making diagnostic imaging techniques crucial for accurate identification of the condition.

#### CASE SUMMARY

This report presents an unusual case of EC that mimicked intestinal perforation. While it was initially challenging to differentiate between intestinal perforation and EC on admission, the patient managed to avoid unnecessary surgery and made a good recovery solely through antibiotic treatment.

#### CONCLUSION

Successful treatment of the patient described herein highlights the importance of accurately diagnosing EC, which can be difficult to differentiate from intestinal perforation.

**Key Words:** Emphysematous cystitis; Intestinal; Bowel; Perforation; Bladder; Case report

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**Core Tip:** Emphysematous cystitis (EC) is a rare form of complicated urinary tract infection characterized by gas within the bladder wall and lumen. Even with imaging examination(s), such as computed tomography, it can be difficult to differentiate between conditions when there is a significant amount of free air in the abdominal cavity, such as in cases of intestinal perforation and other diseases. Successful treatment of the patient described herein highlights the importance of accurately diagnosing EC, which can be difficult to differentiate from an intestinal perforation.

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## INTRODUCTION

Emphysematous urinary tract infections are infectious conditions of the upper or lower urinary tract characterized by the presence of gas within the tissues. They usually involve the renal pelvis or kidney and, in rare cases, the bladder. Diabetes mellitus, urinary tract obstruction, and female sex are the major risk factors for emphysematous cystitis (EC), followed by neurogenic bladder, indwelling catheter, and immunosuppression[1]. In most cases, it can be differentiated using abdominopelvic computed tomography (CT); however, in rare cases, when air leaks out of the bladder, it can be difficult to differentiate it from intestinal perforation[2]. Herein, we report a rare case of EC mimicking intestinal perforation in an 83-year-old woman.

## CASE PRESENTATION

### Chief complaints

An 83-year-old woman presented to the emergency department with abdominal pain and diarrhea.

### History of present illness

Lower abdominal pain persisted for 1 wk with progressively increasing severity.

### History of past illness

The patient's medical history included hypertension, dementia, hypothyroidism, and osteoporosis. She resided in a nursing home and was a non-smoker and non-drinker.

### Personal and family history

The patient had worked as a diver, mainly harvesting seafood before retiring 10 years ago.

### Physical examination

Physical examination results were as follows: Body temperature, 37.4 °C; blood pressure, 141/88 mmHg; heart rate, 81 beats/min; and respiratory rate, 22 breaths/min. During examination, the patient complained of suprapubic tenderness and displayed diffuse lower abdominal guarding. No signs of abdominal distension or rebound tenderness were observed.

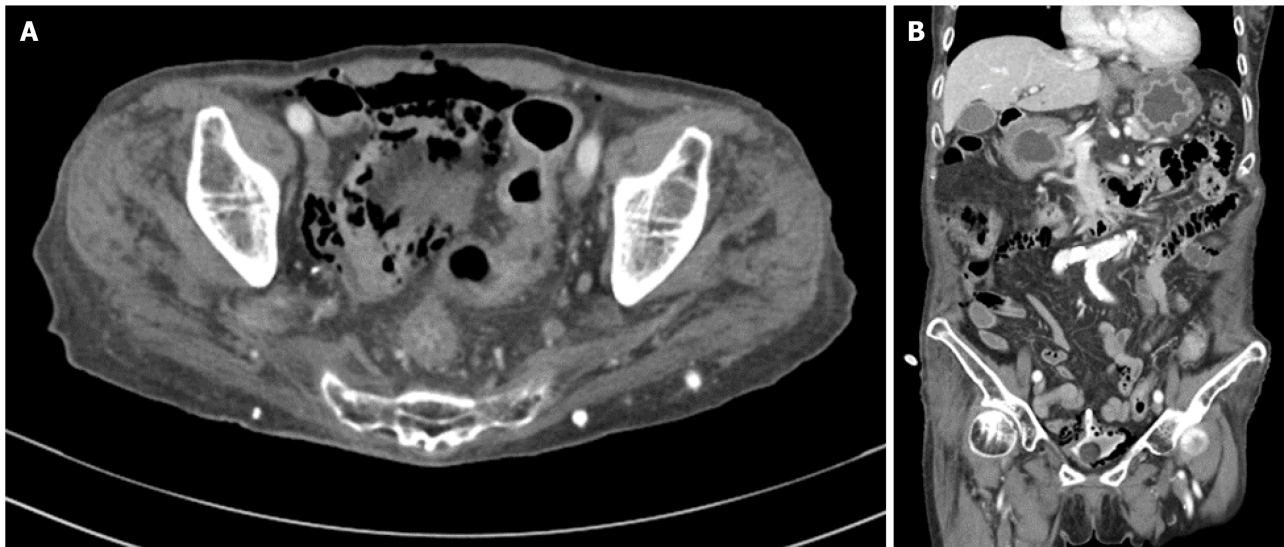
### Laboratory examinations

Blood test results at the time of admission indicated slight elevations in white blood cell (WBC) count and C-reactive protein (CRP) level. The patient's WBC count was 11600 cells/mm<sup>3</sup> and CRP level was 0.8 mg/L.

### Imaging examinations

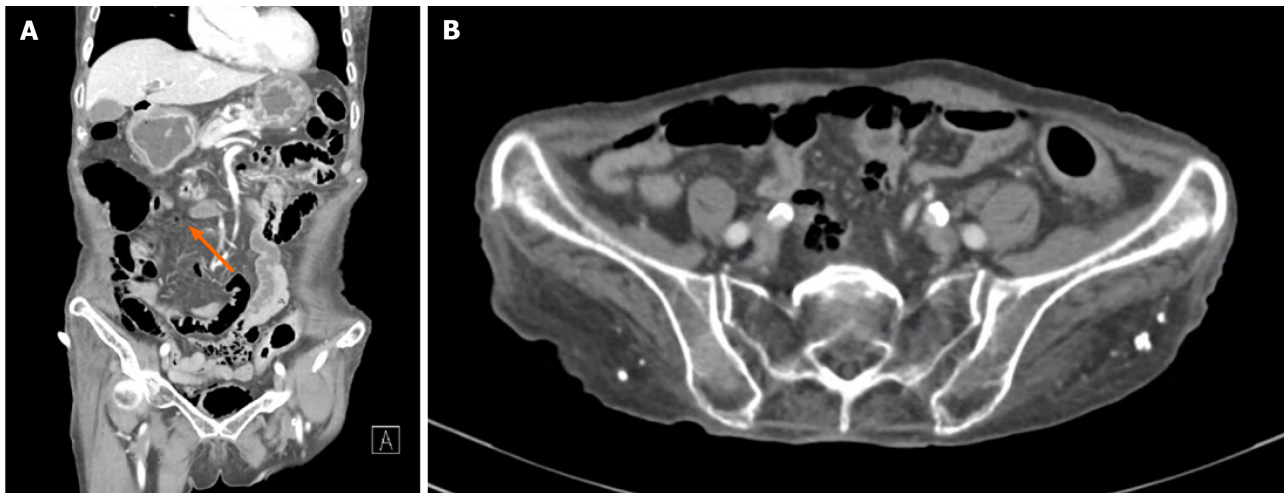
The patient was admitted to the internal medicine department and started on antibiotic treatment. On the day of admission, abdominopelvic CT revealed air collection in the pre- and peri-vesical areas, along with pneumatosis intestinalis near the pelvic small bowel loop. The imaging results are presented in [Figure 1](#). However, a subsequent abdominopelvic CT scan performed 2 d later revealed free air in the pelvic cavity, leading to a referral to the department of surgery. Free air was also detected within the mesentery of the ascending colon proximal to the middle colic artery ([Figure 2](#)). Enhancement of the small intestinal wall in the pelvic cavity appeared to be reduced. Initial assessment suggested a potential bowel perforation originating from the pelvic small bowel loop.





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**Figure 1 First abdominopelvic computed tomography results.** A: Axial image; B: Coronal image. Both images show the pre- and peri-vesical areas along with pneumatosis intestinalis near the pelvic small bowel loop.



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**Figure 2 Second abdominopelvic computed tomography results.** A: Abdominopelvic computed tomography revealed free air in the mesentery of the ascending colon, proximate to the middle colic artery (orange arrow); B: The enhancement of the small intestine wall in the pelvic cavity seemed to be reduced.

## FINAL DIAGNOSIS

Despite the acute findings on CT, the patient's vital signs remained relatively stable. However, owing to the scattered presence of free air throughout the abdominal cavity, including visibility under the gallbladder, definitively ruling out intestinal perforations remains challenging. The final diagnosis was intestinal perforation, although EC could not be definitively ruled out. Consequently, due to the potential concern for intestinal perforation and the need for close monitoring, the patient was admitted to the surgical intensive care unit.

## TREATMENT

After urinary catheterization, peripheral blood and urine samples for culture were obtained in the emergency room, and empirical administration of piperacillin/tazobactam (4.5 g) three times daily was initiated. After 7 d of treatment, bacterial cultures yielded positive results for *Staphylococcus aureus* in both samples. On admission to the intensive care unit, bladder rest was maintained by inserting a Foley catheter with gravity drainage, as per consultation with a urologist. This approach was adopted due to the formation of gas in the perivascular space. Initially, intestinal perforation was suspected; however, with the administration of antibiotics, the patient's abdominal pain improved, although urinary

symptoms, including dysuria and pyuria, became more prominent. The catheter was removed on day 12 because the patient's condition improved.

The patient remained afebrile and exhibited stable vital signs, which led to transfer to a general ward on day 4 of hospitalization. On day 12, an abdominopelvic CT scan and a small bowel series were performed to reassess the possibility of perforation. The results indicated a reduction in discomfort, disappearance of air bubbles in the abdominal cavity, and near-complete resolution of air in the bladder wall (Figure 3A). A small bowel series confirmed the absence of perforation (Figures 3B and C). No evidence of intestinal perforation was observed. The patient was started on an oral diet after confirmation of the test results. On day 18 of hospitalization, the patient was discharged to her previous nursing home with a prescription of 1-wk oral antibiotics.

## OUTCOME AND FOLLOW-UP

The patient visited the hospital for a follow-up appointment 2 wk after discharge. There were no notable abnormalities in her laboratory results, nor did she complain of significant discomfort.

## DISCUSSION

EC is a urinary tract infection characterized by the presence of gas in the bladder wall and lumen. It primarily affects females with risk factors in their 60s and 70s, including diabetes, dysuria, recurrent urinary tract infections, and immunosuppressed conditions[3-5]. The typical causative bacteria are *Escherichia coli* and *Klebsiella pneumoniae*; however, *Proteus mirabilis*, *Staphylococcus aureus*, and *Candida albicans* can also cause EC, although the exact pathological mechanism is not yet fully understood[5,6]. Nevertheless, it is believed that the presence of sugars and albumin in urine can serve as a source for microbial fermentation, leading to gas production. Conditions that cause bladder over-inflation, such as neurogenic bladder, can disrupt blood flow to the bladder, further exacerbating the infection or contributing to gas accumulation.

EC has been characterized in diverse ways, ranging from a severe condition requiring aggressive treatment to prevent unfavorable outcomes, to a benign disease[7]. However, delayed diagnosis can result in infection spreading to the ureters and renal parenchyma, bladder rupture, and even death. Management primarily involves ensuring sufficient urinary drainage, appropriate antibiotic therapy, and improved blood glucose control. Once infection is eradicated, the gas is typically reabsorbed. There are no specific clinical symptoms characteristic of EC; however, common symptoms include lower abdominal pain, increased urinary frequency, urgency, difficulty urinating, and hematuria.

The diagnosis of EC is primarily made through urine culture to identify the causative organism and imaging examinations such as abdominal CT[8,9]. On abdominal CT, gas formation with a characteristic cobblestone or beaded-necklace appearance is typically observed predominantly on the bladder wall. For cases in which gas is detected not only in the bladder wall but also in the abdominal cavity, distinguishing it from intestinal perforation can be challenging[10]. Additionally, the presence of urogenital gas should be considered in the context of enterobladder fistulas, which can occur due to various underlying conditions such as diverticulosis, Crohn's disease, rectal sigmoid cancer, or radiation therapy[11,12].

Delayed diagnosis of EC can result in the infection spreading to the ureters and renal parenchyma, bladder rupture, and even death[13,14]. Management primarily involves ensuring sufficient urinary drainage, appropriate antibiotic therapy, and improving blood glucose levels[12,13]. Once infection is eradicated, the gas is typically reabsorbed. In rare cases, surgical debridement or cystectomy is necessary[13,15]. A previous study reported that hyperbaric therapy is beneficial for EC. However, it has not been widely adopted due to the limited number of hospitals with the requisite resources[16].

In the present case, the patient's vital signs were stable, and no other abnormalities were noted in blood tests aside from a small increase in CRP and WBC count. However, the presence of free air extending to the upper abdomen adds complexity to the diagnosis and makes it challenging to definitively rule out intestinal perforation. Additional diagnostic measures, such as thorough clinical assessment, imaging studies, and consultation with specialists, are crucial for making accurate diagnoses and guiding appropriate treatment decisions.

## CONCLUSION

EC is described as a critical condition that necessitates intensive treatment to avoid severe, life-threatening complications. However, delayed diagnosis can result in spread of the infection to the ureters and renal parenchyma, and even lead to bladder rupture or death. This case report highlights that EC can manifest in uncommon ways, suggesting that treatments should be personalized based on specific patient factors, even if this means deviating from standard procedures.



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**Figure 3 Results after treatment.** A: After antibiotic treatment, the computed tomography scan showed the disappearance of the air-bubble in the abdominal cavity, and a near-complete resolution of the air in the bladder wall; B and C: The small bowel series performed on the 12<sup>th</sup> hospital day showed no evidence of perforation.

## FOOTNOTES

**Author contributions:** Kang HY and Lee DS contributed equally to this work. Kang HY wrote and elaborated the manuscript, and performed both the clinical diagnosis and the subsequent patient follow-up; Lee DS contributed to data analysis, and drafting and revision of the manuscript; and all authors agree to take responsibility for all aspects of the work.

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