

Severe emphysematous cystitis complicated with perforation, bilateral renal cortical atrophy and sepsis: a case report

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Abstract

Emphysematous cystitis (EC) is a rare bladder infection characterized by the presence of gas in the wall or cavity of the bladder. Most patients with EC will present with the typical symptoms of cystitis (e.g. frequent micturition, urgent micturition and dysuria), but other signs include distension and pain in the lower abdomen, drum sounds on percussion and a large amount of gas in the bladder. There can also be other complications such as sepsis. However, it is usually characterized by the typical symptoms of infection combined with pneumaturia, the passage of gas mixed with urine. The early stage of EC is mostly limited to the submucosa and the symptoms of infection can be mild. Some patients may have no obvious clinical symptoms. If the infection becomes severe, it may result in difficulty urinating and kidney dysfunction. Therefore, timely treatment of these rare bladder infections is essential. This current case report describes an 80-year-old female patient with severe EC complicated by significant bilateral ureteral dilatation, bilateral renal cortical atrophy and sepsis. The patient was successfully treated with antibiotics and surgery. This report provides clinical data, test results and treatment experience that might be useful for clinicians that are involved in the treatment of EC.

Keywords

Emphysematous cystitis (EC), infection, complications, treatment

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Introduction

Emphysematous cystitis (EC) is a rare clinical disease that results from a bladder infection.¹ Most patients are elderly women, with approximately 7% of patients having no clinical symptoms, but the majority will present with the typical symptoms of cystitis (such as frequent micturition, urgent micturition and dysuria).^{2,3} The typical signs of EC include distension and pain in the lower abdomen, drum sounds on percussion and a large amount of gas in the bladder.⁴ Severe bladder infection and a build-up of gas can lead to rupture of the bladder wall, bladder dysfunction, obstruction of urination, which can eventually lead to bilateral renal dysfunction and even sepsis.⁵ Therefore, the timely control of infection and spread of inflammation is the first measure to control EC and it is an important measure to reduce complications. This current case report describes an elderly female patient with severe EC that had symptoms of high fever and shock. This patient was treated with antibiotics and urine drainage, which resulted in an improvement in her symptoms, but the condition remained unstable. As a consequence, the patient underwent a surgical procedure that successfully controlled the patient's condition. This report provides clinical data, test results and treatment experience that might be useful for clinicians that are involved in the treatment of EC.

Case report

An 80-year-old female patient with a history of abdominal pain and fever for a month presented at the First People's Hospital of Fuzhou City, Jiangxi Province, China on 21 August 2019. Recently, her abdominal pain had worsened and she was initially treated at the First People's Hospital of Fuzhou City. After 1 week of antibiotic treatment, the abdominal pain was relieved slightly, but her symptoms did not improve

significantly. Therefore, the patient was transferred to the Department of Gastrointestinal Surgery, The Second Affiliated Hospital, Nanchang University, Nanchang, Jiangxi Province, China on 22 August 2019 for further treatment. The patient had symptoms of dysuria, urinary urgency, urinary frequency, urinary retention, abdominal pain and fever. Physical observations noted that the patient's face was pale and the mucosa were jaundiced. She was conscious and interactive. During palpation, the abdomen was soft and there was tenderness in the lower abdomen. Her vital signs were as follows: body temperature 39°C; blood pressure 150/102 mmHg; respiratory rate 24 breaths/min; SpO₂ 91%. The results of her blood biochemical analyses were as follows: creatinine 258 µmol/l; fasting blood glucose 8.06 mmol/l; haemoglobin 8.9 g/dl; blood urea nitrogen 37.8 mg/dl; erythrocyte sedimentation rate 52 mm/h; white blood cell count $17 \times 10^9/l$; platelet count $30\,000/mm^{-3}$; C-reactive protein 332 mg/dl. In addition, the patient had a history of type 2 diabetes mellitus but did not take hypoglycaemic agents regularly.

Computed tomography (CT) imaging found that the bladder was enlarged, the wall of the bladder was significantly thickened and the density was uneven; and a purulent low-density shadow was observed inside the bladder (Figure 1a). A large number of low-density gas shadows could be seen inside the bladder cavity and the edge of the bladder wall was unclear (Figure 1a). A large amount of liquid exudation shadows could also be seen (Figure 1a). In addition, the bilateral ureters were obviously dilated and there was hydronephrosis, the bilateral kidneys were atrophied, and there was a large amount of fluid exudation and a small amount of gas shadow in the abdominal cavity (Figure 1b). The density of the liquid and gas could be seen in the abdominal cavity (Figure 1c). Based on these CT results and the patient's history, the diagnosis was a

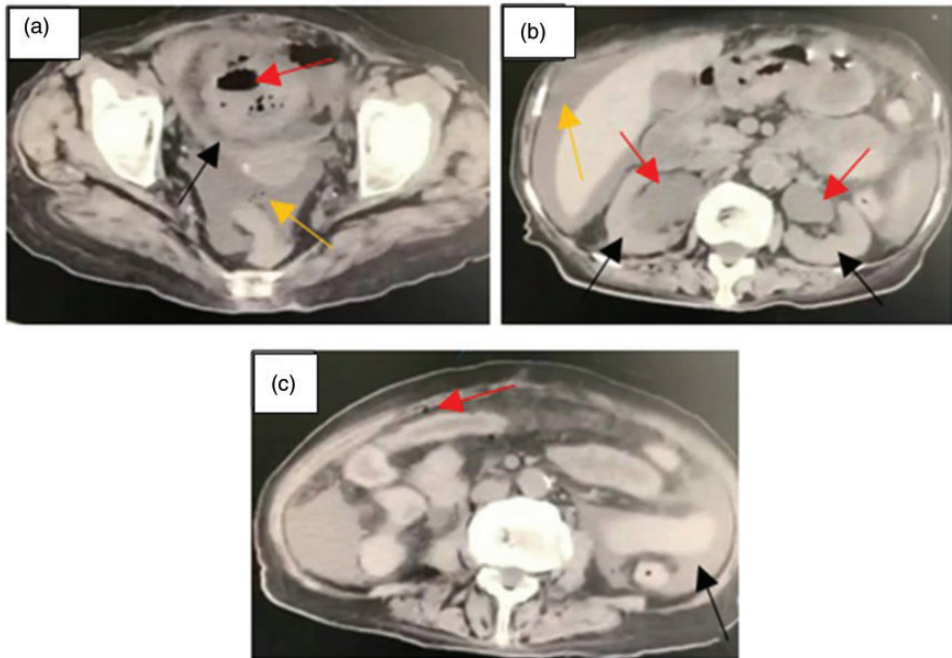


Figure 1. Computed tomography manifestations of emphysematous cystitis complicated by double ureteral dilatation and double kidney atrophy in an 80-year-old female patient that presented with abdominal pain, fever, dysuria, urinary urgency, urinary frequency and urinary retention. (a) The bladder wall was significantly thickened and liquid density was visible inside (black arrow). More gas could be seen in the bladder cavity (red arrow) and a large amount of exudate could be seen around the bladder (yellow arrow). (b) There was bilateral ureter dilatation (red arrow), bilateral kidney atrophy (black arrow) and more fluid could be seen in the abdominal cavity (yellow arrow). (c) The density of the liquid (black arrow) and gas (red arrow) could be seen in the abdominal cavity. The colour version of this figure is available at: <http://imr.sagepub.com>.

severe bladder infection complicated with perforation. The patient was immediately administered 250 mg sulfamethoxazole intravenous injection, twice a day, for 7 days. A catheter was inserted for urine drainage. The urine was turbid and had bubbles. The final diagnosis was EC.

To determine the type of infection in order to target the antibiotic treatment, further urine and blood samples were taken for bacterial analysis and culture. It was a *Klebsiella pneumoniae* infection and the patient was treated with 500 mg/day imipenem, intravenous infusion, for 7 days. After 1 week of antibiotic treatment, the patient's condition was improved.

Considering the severity of the patient's infection, in order to control the infection and reduce complications, a surgical procedure was undertaken.² After the abdominal cavity was opened, the bladder was observed to be significantly enlarged with a reddened swollen mucosa; and a large amount of purulent fluid and necrosis could be seen on most of the bladder wall (Figure 2). During the surgical procedure, the necrotic tissue was removed, the bladder cavity was repeatedly cleaned to purge the purulent fluid and six drainage tubes were installed for urine drainage. After the surgical procedure, the patient was administered 300 mg/day imipenem, intravenous

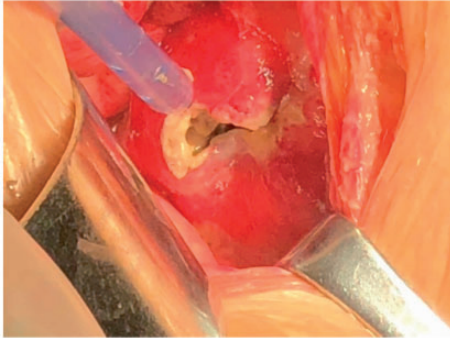


Figure 2. Intraoperative findings of severe emphysematous cystitis characterized by severe infection, bladder enlargement, mucosal swelling, purulent fluid and necrosis of the bladder wall in an 80-year-old female patient that presented with abdominal pain, fever, dysuria, urinary urgency, urinary frequency and urinary retention. The colour version of this figure is available at: <http://imr.sagepub.com>.

infusion, for 10 days and given fluid replacement therapy. The drainage tubes were cleaned and drained regularly. After 6 weeks, the patient's condition was improved and her condition was stable. After continued observation for 2 weeks, the patient's condition remained stable and she was able to urinate by herself, so the drainage tubes were removed. After discharge, the patient was followed up and there was no recurrence of infection.

Ethical approval was not required by The Ethics Committee of Nanchang University, Nanchang, Jiangxi Province, China as this publication was a case report, on condition that the patient/patient's next-of-kin provided their written informed consent for publication. Written informed consent was provided by the patient for reporting this case and the accompanying images.

Discussion

Emphysematous cystitis, a rare disease that results from a bladder infection leading to

the accumulation of gas in the bladder wall, occurs most often in 50–70-year-old women with diabetes mellitus.^{6,7} Patients with immune dysfunction or urinary diseases also have a higher incidence of EC than the general population.⁸ EC is characterized by the general manifestations of bladder inflammation, such as frequent micturition, urgent micturition, dysuria, haematuria, pyuria, waist and abdominal pain. However, its typical manifestation is that of gas production during urination.⁹ EC is typically intractable and persistent, with a long treatment time and a high recurrence rate.¹⁰ Its treatment can be made more difficult by a series of associated complications, leading to an entire urinary tract infection, renal dysfunction and the development of sepsis.^{11,12} Therefore, early diagnosis and treatment, including the application of long-term antibiotics and the control of underlying diseases such as diabetes mellitus, can avoid complications and surgical intervention.¹³ This current patient had symptoms of dysuria, fever, increased creatinine and jaundice. CT examination showed bilateral ureteral effusion and bilateral renal cortical atrophy, which caused renal dysfunction. Therefore, on the basis of anti-infection and fluid replacement therapy, surgical intervention was needed.

The main pathogens associated with EC include *Escherichia coli*, *Aerobacter aerogenes*, *Proteus* and *Staphylococcus aureus*, which can enter the urinary tract system via the bloodstream or urothelial pathway.^{14,15} Once in the bladder, they can digest glucose in the urine or decompose proteins to produce gas.^{11,12} This gas can be formed from nitrogen, hydrogen, oxygen and carbon dioxide, but it is usually carbon dioxide.⁷ Currently, the pathogenesis of EC is not fully understood, but gas production is mainly due to glucose fermentation or protein breakdown.¹⁶ There are also some triggering factors, such as the presence of gas producing substances, high concentrations of glucose and tissue

damage, which are beneficial to the occurrence of urinary tract infections and gas production.^{17,18} Research has shown that the incidence of EC in patients with diabetes mellitus can reach > 60%.¹⁶ Disordered catabolism in the body is also another favourable factor for promoting gas formation.¹⁹ In this current case, the patient had a history of diabetes mellitus, but did not take hypoglycaemic agents regularly, so her fasting blood glucose (8.06 mmol) remained high on admission. Patients with severe EC may have the added complication of sepsis, resulting in insufficient blood perfusion and organ dysfunction.²⁰ The patient had a high level of creatinine, a decreased platelet count and haemoglobin levels, jaundice and a high fever, all of which suggested the presence of sepsis.

Clinically, the diagnosis of EC mainly depends on imaging examinations (such as B-scan ultrasonography, abdominal radiography and CT).²¹ The resolution of abdominal X-ray and B-scan ultrasonography is low, so although the thickening of the bladder wall can be observed, the sensitivity is not high and it is easy to misdiagnose.²² CT provides a number of advantages, such as clearly showing the morphology of the bladder, the structure of the bladder wall and cavity, the surrounding tissues and in particular the presence of gas and liquids, whilst having high sensitivity and diagnostic rates.²³ If an imaging examination cannot be performed, then additional cystoscopy should be performed.

Emphysematous cystitis can be treated initially with empirical antibiotics and then the antibiotic treatment adjusted after the results of bacterial culture. On the basis of antibiotic treatment, urine drainage can reduce inflammation and contribute to the recovery of bladder function. If the infection is severe, the bladder is likely to contain a lot of pus and necrosis, and there might be more fluid in the abdominal cavity, which can be treated

with surgery. Due to the severity of the bladder inflammation and infection in this current patient, surgery was undertaken to remove necrotic tissue and drain the pus, which alleviated their symptoms, stabilized their vital signs and achieved good results. However, these findings are from just one patient, which is not enough to provide detailed guidance for the clinical treatment of EC. Further research in more patients with EC is required.

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Author contribution

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Declaration of conflicting interest

The authors declare that there are no conflicts of interest.

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