

Intern Emerg Med (2011) 6:455–457
DOI 10.1007/s11739-011-0547-1

CE - MEDICAL ILLUSTRATION

Gas around the bladder

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Received: 6 December 2010 / Accepted: 17 February 2011 / Published online: 5 March 2011
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A 63-year-old woman presented to the emergency department (ED) with a history of malaise, dysuria and urinary frequency of 1 week's duration. She denied fever, chills, nausea, cough or expectoration. She had type II diabetes mellitus (DM) and hypertension that were medically controlled. In the week prior to the ED visit, the patient gradually developed malaise. In addition, an altered mental state and unstable levels of blood glucose were noted. At the admission examination, her consciousness level was E3 V4 M6 according to the Glasgow Coma Scale. Her blood pressure was 237/118 mmHg, pulse rate 146 beats/min, body temperature 35.4°C, respiration rate 18 breaths/min, and blood glucose level 463 mg/dl. A physical examination revealed lower abdominal distension without tenderness or muscle guarding. Laboratory data showed a hyperosmolar hyperglycemic state without ketoacidosis, and

aleukocytosis with an elevated C-reactive protein. Urinalysis showed a high white blood cell count with bacteriuria. An abdominal X-ray study showed a curvilinear area of radiolucency delineating the urinary bladder wall (Fig. 1). Emergency abdominal computed tomography (CT scan) showed multiple punctate foci of gas delineating the bladder wall (Fig. 2). No colovesical fistulas, adjacent neoplasms, emphysematous ureteritis, or pyelonephritis was observed in the images. With the presumptive diagnosis of emphysematous cystitis (EC), the patient was treated with a third-generation cephalosporin. A urine culture yielded *Escherichia coli*, but the blood cultures showed no growth of bacteria. After antibiotic treatment for a few days, the patient's general condition and consciousness level had significantly improved. A follow-up abdominal X-ray revealed the disappearance of the gas around the bladder.

Emphysematous urine tract infections (UTIs) can manifest as cystitis, ureteritis, pyelitis, or pyelonephritis. The severity of the disease is due to the level of gas based upon the findings on CT scans. Diabetes mellitus is the major risk factor for emphysematous urine tract infections (prevalence, 62–66%) [1]. Middle age (mean age, 60 years old), female gender (female-to-male ratio of 2:1), urinary tract pathology (neurogenic bladder or recurrent UTI), and immunosuppressive comorbidity (malnutrition, alcohol abuse, or malignancy) are also known risk factors. The clinical presentation of EC is non-specific and can range from asymptomatic UTI to septic shock. The common presenting features include abdominal pain (80%), pneumaturia (70%), and abdominal tenderness (65%). However, the typical symptoms for lower urine tract infections, including urination frequency, urgency, and dysuria, are only seen in up to 50% of cases [2]. Because the clinical features are inconclusive, the symptoms are of no help in

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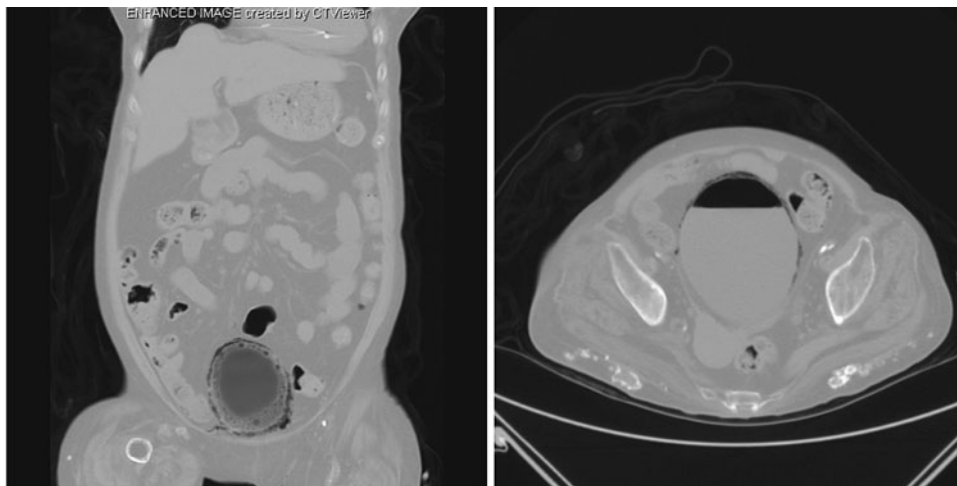
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Fig. 1 Abdominal X-ray showed a curvilinear area of radiolucency (arrow) delineating the urinary bladder wall

reaching a diagnosis. Thus, image scans are the standard diagnostic tool, including plain abdominal films or CT scanning, which can demonstrate intramural or intraluminal gas. Computed tomography has a higher sensitivity than plain films, and it is an accurate diagnostic method to access the severity of disease and to differentiate the causes of emphysematous conditions, such as fistulas or adjacent neoplasms [3]. However, plain abdominal films are also useful to recognize the disease, and should not be ignored by physicians. Plain abdominal radiographs have a low sensitivity (<50%) in diagnosing emphysematous pyelonephritis. However, plain abdominal films are highly

Fig. 2 Abdominal computed tomography showed air accumulating in the bladder wall



sensitive (97.4%) for emphysematous cystitis [2]. In addition, bedside ultrasound scanning can be a first-line tool to survey patients with a suspicion of emphysematous cystitis, even though the sensitivity is only 46.1%. Ultrasound scans commonly show diffuse bladder wall thickening and increased echogenicity. Focal regions of high-amplitude echoes with posterior dirty acoustic shadowing into the lumen may be seen in extensive cases [4].

Urinary tract pathogens can be isolated in 90% of patients, with EC. *Escherichia coli* being the most prevalent pathogen (60%) followed by *Klebsiella pneumoniae* (20%). Other pathogens, including *Enterobacter aerogenes*, *Clostridium perfringens*, *Candida albicans*, *Pseudomonas aeruginosa*, and *Proteus mirabilis* have been cultured. The pathogenesis of these gas forming infections is still not well understood, and the combination of the presence of gas-producing organisms, a high tissue glucose concentration, and impaired tissue perfusion all favor the development of EC [5].

The clinical course of EC is usually benign, and the overall mortality rate is around 7–10%. Initial treatments consist of broad spectrum antibiotics, bladder drainage, and glycemic control. No consensus on the duration of antibiotic treatment has yet been reached; however, a 3- to 6-week course has been recommended [3]. Emphysematous cystitis can usually be treated with medical therapy alone, but up to 10–20% of cases require combined medical and surgical therapy. Patients not responding to medical management, or those with severe necrotizing infections may require partial cystectomy, cystectomy, or surgical debridement [1].

The clinical presentation of emphysematous cystitis is nonspecific, and can range from a minimally symptomatic urinary tract infection (UTI) to a scenario of peritonitis and septic shock. The most common symptom is abdominal pain, and the classic symptoms of UTI have been reported in only approximately 50% of cases. As symptoms are of

no help in reaching a diagnosis, appropriate diagnostic imaging is imperative to establish the diagnosis of EC. Plain abdominal radiography is a highly sensitive tool (sensitivity 84–97%). As a result, diagnostic imaging is highly recommended in diabetic patients with UTI who present with abdominal pain and hematuria. Abdominal X-ray films can be the first-line tool to survey patients, although the CT scan is a better imaging modality with which to confirm this entity.

Conflict of interest None.

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