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Title: Gas around the bladder

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Section/Category: CE - MEDICAL ILLUSTRATION

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Response to Reviewers: For reviewer:
Thank you very much for Reviewers' valuable opinions. The paper was revised based upon your constructive suggestions. And the followings are in response to your comments:

Q1. The language is in need of a total edit by someone for whom medical English is more familiar. For example, you use could, the subjunctive tense where you mean can, the present tense.

Answer: Thank you for this comment. We have now had the manuscript edited by a native English speaking expert.

Q2. More importantly, the article needs focus for the emergency physician. How would one separate this patient from any elderly patient with septic shock?

Answer: The clinical presentation of emphysematous cystitis (EC) 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, but 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 and computed tomography is a better imaging modality to confirm this entity.

Q3. Why would you wish a plain abdominal x-ray study?
Answer: Plain abdominal radiographs have a low sensitivity (less than 50%) in emphysematous pyelonephritis. However, plain abdominal X-rays are highly sensitive (97.4%) for emphysematous cystitis. Nevertheless, computed tomography is considered to be the preferred method because of its high sensitivity and specificity in the detection of abnormal gas and its anatomic extension.

Q4. What role does ultrasound bedside play?
Answer: Bedside ultrasound can still 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.

Q5. Why wouldn't this patient be considered immediately for surgical managment as she is in shock?
Answer: Patients not responding to medical management or those with severe necrotizing infections might require partial cystectomy, cystectomy, or surgical debridement (10%). BJU Int. 2007;100(1):17-20.

We are looking forward to hearing from you and deeply appreciate your kind help.

Sincerely yours,

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January 10, 2011

Dear Editor-in-chief:

We thank you and the referees for your careful consideration of our manuscript entitled, "Gas around the bladder," code IAEM-D-10-00346. Following your helpful comments, we have compiled our responses to the reviewers' comments and modified our manuscript accordingly.

Please find two attached files including a list of the modifications to the original manuscript and our replies to the comments, and a full-text of the revised manuscript. We are confident that this revised paper is now suitable for publication in Internal and Emergency Medicine.

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Gas around the bladder

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A 63-year-old woman presented to the emergency room with a 1-week history of malaise, dysuria and urinary frequency. She denied fever, chills, nausea, cough or expectoration. She had type II diabetes mellitus (DM) and hypertension which were controlled using medication. In the week before presenting to the emergency room, 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/min, body temperature 35.4°C, respiration rate 18/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 leukocytosis with elevated C-reactive protein. Urine analysis showed a high white blood cell count with bacteriuria. An abdominal X-ray showed a curvilinear area of radiolucency delineating the urinary bladder wall (Figure 1). Emergency abdominal computed tomography (CT) showed multiple punctate foci of gas delineating the bladder wall (Figure 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 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 to 66%) (1). Middle age (mean age, 60-years-old), female gender (female-to-male ratio of 2:1), urine 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 urine 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 reaching a diagnosis. Thus, image scans are the standard diagnostic tool, including plain abdominal films and/or CT, 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 important to recognize the disease and are often ignored by physicians. Plain abdominal radiographs have a low sensitivity (less than 50%) in diagnosing emphysematous pyelonephritis. However, plain abdominal films are highly 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).

Urine tract pathogens can be isolated in 90% of patients with EC. *Escherichia coli* is 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 to 10%. Initial treatments contain broad spectrum antibiotics, bladder drainage, and glycemic control. No consensus on the duration of antibiotic treatment has yet been reached, however a three- to six-week course has been recommended (3). Emphysematous cystitis can usually be treated with medical therapy alone, but up to 10 to 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 (EC) 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, but 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, and CT is a better imaging modality to confirm this entity.

Figure 1

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

Figure 2

Abdominal computed tomography showed air accumulating in the bladder wall.

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Figure 1

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Figure 2

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