

## Emphysematous cystitis due to *Klebsiella pneumoniae*

Nisar Ahmed,<sup>a</sup> Sohail Sabir,<sup>b</sup> Nasiruddin Khan<sup>c</sup>

From the Departments of <sup>a</sup>Radiology, <sup>b</sup>Medicine and <sup>c</sup>Pathology, Armed Forces Hospital, Sharourah, Saudi Arabia

Correspondence and reprints: Nisar Ahmed · Armed Forces Hospital, Sharourah · PO Box 272, Sharourah, Saudi Arabia · T: +966-556954346 · nisarahmed\_rad@yahoo.com · Accepted for publication January 2007

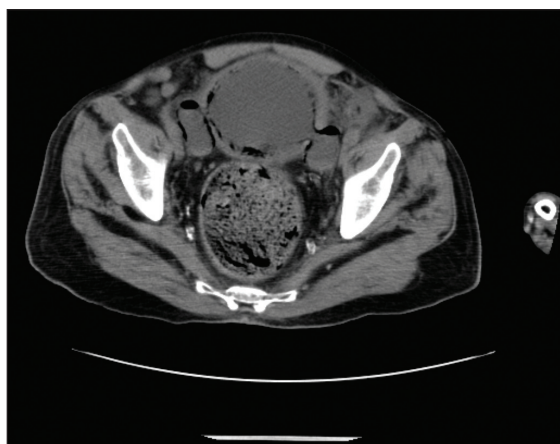
Ann Saudi Med 2008; 28(1): 50-52

**E**mphysematous cystitis is a rare disease characterized by the presence of gas in the urinary bladder walls and often in the bladder lumen due to infection by gas-forming organisms. Clinical symptoms of dysuria, increased urinary frequency and hematuria may be present. Underlying diabetes mellitus is present in over half of reported cases with women being affected twice as often as men. CT is a highly sensitive imaging modality used in the detection of intraluminal or intramural gas<sup>1</sup> which forms the radiologic basis of the diagnosis. The most common offending organisms are *E. coli* and *Enterobacter aerogenes*, and less frequently, other agents such as *Streptococci*, *Nocardia*, and *Candida albicans*. Although a case of emphysematous pyelonephritis in a pediatric transplant patient<sup>2</sup> and another case of emphysematous pyelonephritis with extra-renal gas forming abscesses<sup>3</sup> in an adult male have been reported in Saudi Arabia, to the best of our knowledge no case of emphysematous cystitis has been reported in Saudi Arabia. We report a case of a 95-year-old diabetic male who was diagnosed as having emphysematous cystitis secondary to *Klebsiella pneumoniae* infection.

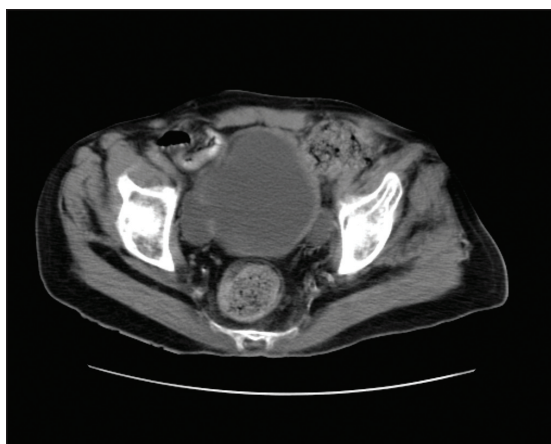
### CASE

A 95-year-old male presented with a history of deteriorating level of consciousness, productive cough and fever of 6-day duration. According to an attendant there was no history of preceding headaches, weakness of any limb, vomiting, diarrhea or urinary complaint. His past medical history is significant as he was diagnosed to be suffering from diabetes mellitus 15 years previously and recently established to have retinopathy, nephropathy and peripheral neuropathy and dementia for the previous 2 years. He had been on regular insulin 12 units subcutaneously before meals three times daily administered by the attendant, but had infrequent follow-up visits to the hospital, as he was not fully ambulatory. His glycemic control had remained poor previously. On examination, the patient

was drowsy and disorientated. He was normotensive (110/70 mm Hg) with a pulse of 96 beats per minute and regular and a temperature of 38°C. Examination of the chest and heart was unremarkable and there was no hepatosplenomegaly on abdominal examination. Neurological examination revealed a Glasgow Coma Score of 13/15, an absence of neck rigidity and no motor deficit. A digital rectal examination found a normal prostate. Urgent investigations found a hemoglobin of 10.8 g/dL, a total lymphocyte count of  $10.8 \times 10^3$ , a random blood glucose of 18.8 mmol/L, with normal renal and liver functions and serum electrolytes. A portable chest X-ray showed left lower zone haziness. The ECG was normal. Routine urine examination showed a pH of 5.0, and was nitrite positive, protein 2+, sugar 3+, with pus cells and numerous red blood cells (50-60/HPF). He was empirically treated with ceftriaxone 2 g intravenously once daily and gentamicin 80 mg intravenously every 8 hours pending the result of sputum and a urine culture and sensitivity (C/S) along with sliding scale regular insulin and intravenous fluids. The next morning the patient developed frank hematuria for which an urgent abdominopelvic ultrasound was requested that showed a thick walled urinary bladder with diverticula and echogenic foci along the bladder wall. The estimated weight of the prostate by transabdominal ultrasonography was 16 grams. A CT scan of the abdomen/pelvis showed bilateral hydronephrosis, a thick-walled urinary bladder with diverticula and air in the bladder wall suggestive of emphysematous cystitis (Figure 1). The urine C/S revealed growth of a highly resistant *Klebsiella pneumoniae* sensitive to only gentamicin/amikacin whereas sputum C/S revealed growth of *Streptococcus pyogenes* sensitive to all commonly used antibiotics including ceftriaxone. He responded with defervescence and a decline in his white cell count. Repeat CT scan examination after 2 weeks showed complete disappearance of intramural gas (Figure 2). He was discharged home after 4 weeks of therapy.



**Figure 1.** Axial CT scan image showing intra-mural gas in the walls of the urinary bladder and two large diverticula.



**Figure 2.** Axial CT scan image after two weeks of therapy shows complete disappearance of intra-mural gas from the urinary bladder walls, but diverticula still persist.

## DISCUSSION

Although gas-producing infections account for a very small percentage of all bacterial infections of the urinary tract, they are extremely important because of their life-threatening potential.<sup>4</sup> The spectrum of gas-producing infections includes emphysematous pyelonephritis, emphysematous pyelitis, and emphysematous cystitis. These are three distinct clinical entities whose clinical course, management, and ultimate prognosis differ appreciably. Gas collections within the urinary bladder wall were first described in an autopsy by Eisenlohr in 1888.<sup>5</sup> It was first reported in a living human in 1932 and described radiologically by Mulrow in 1934.<sup>6</sup> In 1961 Bailey proposed that emphysematous cystitis be used to describe gas collection within the bladder wall and lumen secondary to infecting micro-organisms.<sup>7</sup> Emphysematous cystitis is defined by the presence of gas in the urinary bladder walls and often in the bladder lumen due to infection by gas-fermenting organisms.<sup>8</sup> The major risk factors for the disease include old age and female sex, diabetes mellitus, neurogenic bladder and bladder outlet obstruction, although it has also been reported with other pre-existing conditions such as alcoholism,<sup>9</sup> undernutrition<sup>10</sup> or a disabled general medical condition.<sup>11</sup> Our case had poorly controlled diabetes with a neurogenic bladder. The most common organism is *E. coli*, but other organisms reported to produce emphysematous cystitis include *Enterobacter aerogenes*, *Klebsiella pneumoniae*,<sup>12</sup> *Proteus mirabilis*, *Staphylococcus aureus*, streptococci, *Clostridium perfringens*,<sup>13</sup> and *Candida albicans*.<sup>14</sup> In our patient *Klebsiella pneumoniae* was the causative organism.

Patients may complain of dysuria, increased frequency of micturition, abdominal discomfort, lower

abdominal pain or pneumaturia. A history of pneumaturia is highly suggestive, but is rarely offered by the patient. The clinical features are inconclusive or actually unhelpful.<sup>15</sup> The radiologic findings provide the most reliable diagnostic clues. Demonstration of intramural gas in the walls of the urinary bladder is the basis for the radiologic diagnosis of emphysematous cystitis. In emphysematous cystitis both intramural and intraluminal gas can be seen, but the intramural gas is diagnostic because intraluminal gas could be due to other conditions like recent urinary bladder instrumentation, trauma, or vesicocolic fistula due to colon/bladder malignancy or inflammatory bowel disease.

Conventional radiography of emphysematous cystitis characteristically shows curvilinear areas of increased radiolucency within the pelvis in the expected location of the urinary bladder. Ultrasound commonly demonstrate diffuse bladder wall thickening. Focal regions of high-amplitude echoes with posterior dirty acoustic shadowing into the lumen may be seen in extensive cases of emphysematous cystitis and these echogenic shadows may be misinterpreted as bladder calculi with ultrasound. CT is a highly sensitive examination that allows early detection as well as differentiation of intraluminal or intramural gas.<sup>16</sup> Free intraluminal air is usually seen in nondependent areas, forming an air-fluid level with urine in the bladder lumen while intramural air is seen as multiple small pockets of air along all the walls regardless of gravity as was seen in our patient. It is also useful in evaluating other causes of intraluminal gas such as enteric fistula formation from adjacent bowel carcinoma or inflammatory disease. An abdomino-pelvic CT scan can further delineate the extent of disease, whether the infection has spread to

involve pelvicalyceal systems and renal parenchyma. It is important to differentiate emphysematous cystitis from emphysematous pyelonephritis, in which gas involves the renal parenchyma, since the latter has an increased mortality and generally requires nephrectomy. In contrast, surgical intervention is rarely needed in emphysematous cystitis except when an anatomical abnormality like an obstruction or stone is present.<sup>17</sup>

The prognosis for this condition is generally favorable, but there have been reports of severe necrotizing cystitis requiring cystectomy, and a mortality rate of 20%.<sup>18</sup> As with any gas-producing infection, patient survival de-

pends on early diagnosis with the correction of underlying causes, strict glycemic control, a prolonged course of antibiotics (3-6 weeks), relief of obstruction to urinary outflow, and surgical excision where necessary.<sup>19</sup> Delayed diagnosis may lead to unfavorable outcomes including overwhelming infection, extension to ureter and renal parenchyma,<sup>20</sup> bladder rupture and death. Improved outcomes may be achieved by early recognition of the infection, by clinical and radiological assessment, and by appropriate antibiotic therapy. Prognosis for emphysematous cystitis is favorable as in our case if it is diagnosed promptly and treated properly.

## REFERENCES

1. Grayson DE, Abbott RM, Levy AD, Sherman PM. Emphysematous infections of abdomen and pelvis: a pictorial review. *Radiographics* 2002;22: 543-561.
2. Abdulkarim S. Al-Makadma and Samhar I. Al-Akash. An unusual case of pyelonephritis in a pediatric renal transplant recipient. *Pediatric Transplantation*. 2005 April;9(2):258.
3. Hamza A.E, Abutaleb N, Obeidin AG, Yousif H. et al. Saudi J Kidney Dis Transplant 2004;15(1):61-65.
4. Turney JH. Renal conservation for gas-forming infections. *Lancet* 2000; 355: 770-771.
5. Eisenlohr W. Das interstitielle vagina, darm und harnblasenemphysem zurückführt auf gasentwickelnde bakterien. *Beitr Path Anat Allg Path* 1888; 3:101
6. Mulsow I.W., Gilles C.I. Primary pneumaturia with report of a case. *J. of urology* 1934; 32:161-9.
7. Baily: cystitis Emphysematosa 19 cases with intraluminal and interstitial collections of gas. *Am J Roentgen* 1961; 86:850-61.
8. Hoepelman AIM, Meiland R, Geerlings E. Pathogenesis and management of bacterial urinary tract infections in adult patients with diabetes mellitus. *Int J Antimicrob Agents*. 2003; 22: 35-43.
9. O'Connor P, Davies M, Feely J. Emphysematous cystitis - another alcohol-related problem? *Ir Med J*, 1987; 80: 420-1.
10. Ebe T, Oshima H, Takeda N, Matsumoto T. Emphysematous cystitis developed in a patient with an eating disorder and schizophrenia. *J Infect*, 2003; 47: 260-1.
11. Greene MH. Emphysematous cystitis due to *Clostridium perfringens* and *Candida albicans* in two patients with hematologic malignant conditions. *Cancer*, 1992; 70: 2658-63.
12. Monllor J., Merino C., Oliver C., Carbalido J.: Emphysematous cystitis caused by *Klebsiella pneumoniae*. *Actos - Uro-Esp*. 1992 July;16(7):582- 584
13. West TE, Holley HP, Lauer AD. Emphysematous cystitis due to *Clostridium perfringens*. doi: 10.1001/jama.246.4.363 *JAMA*. 1981;246:363-364.
14. Bartkowski DP, Lanesky JR. Emphysematous prostatitis and cystitis secondary to *Candida albicans*. *J Urol*. 1988;139:1063-5
15. Ravi K Bobba, Edward L Arsuru\*, Pawanjit S Sarna and Amar K Sawh. Emphysematous cystitis: An unusual disease of the Genito-Urinary system suspected on imaging. *Annals of Clinical Microbiology and Antimicrobials* 2004; 3:20.
16. Bohlman ME, Fishman EK, Oesterling JE, Goldman SM. Case profile: CT findings in emphysematous cystitis. *Urology* 1988; 32:63-64
17. Ankel F, Wolfson AB, Stapczynski JS. Emphysematous cystitis: a complication of urinary tract infection occurring predominantly in diabetic women. *Ann Emerg Med*. 1990;19:404-6
18. Quint HJ, Drach GW, Rappaport WD, Hoffmann CJ. Emphysematous cystitis: a review of the spectrum of disease. *J Urol* 1992; 147: 134-137
19. Yasumoto R, Asakawa M, Nishisaka N. Emphysematous cystitis. *Br J Urol*. 1989;63:644
20. Patel NP, Lavengood RW, Fernandes M, Ward JN, Walzak MP. Gasforming infections in genitourinary tract. *Urology* 1992;39: 341-5.