

Emphysematous cystitis

Introduction

Emphysematous cystitis is a rare form of acute inflammation and infection of the bladder mucosa and underlying muscle caused by gas-forming organisms. *Escherichia coli* is the most frequently isolated pathogen. While relatively uncommon, early diagnosis and treatment is generally associated with a favourable outcome and this depends on a high clinical index of suspicion. In the severely ill diabetic patient, a computed tomography (CT) scan of the abdomen is indicated as a first-line investigation.

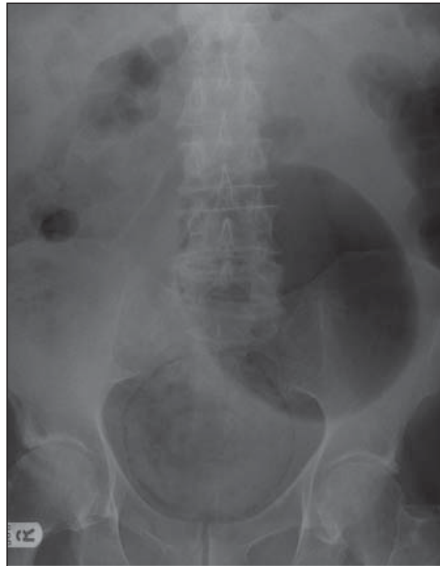
Background

Emphysematous cystitis is a rare form of acute inflammation and infection of the bladder mucosa and underlying muscle. Carbon dioxide and nitrogen gas are produced by fermentation of excess glucose within the urothelium by some species of bacteria, resulting in gas bubbles within the bladder wall and often the bladder lumen (Quint et al, 1992).

Long-standing or poorly-controlled diabetes mellitus is present in over 50% of reported cases, with female patients affected twice as commonly as males

(Patel et al, 1992). A number of other reported predisposing factors include neurogenic bladder, bladder outflow obstruction, recurrent urinary tract infection, urinary stasis, diabetes and trans-

Figure 1. Plain film of abdomen demonstrating air within the wall of the bladder (black arrow) as well as a large lucent area in the left upper pelvis in keeping with a large bladder diverticulum (white arrow).



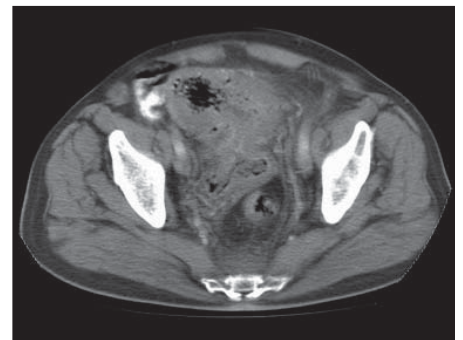
plantation, and the immunocompromised are also particularly prone to this condition.

Discussion

E. coli is the most frequently isolated pathogen from urine cultures in affected patients, accounting for up to 70% of cases (Quint et al, 1992). Other less commonly isolated pathogens include *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Clostridium perfringens* and *Staphylococcus aureus*, and aerobic and anaerobic urine cultures are required for identification of the causative microorganism. Fungal infection with *Candida* spp. is much less common, but should be considered in the immunocompromised patient and in the intensive care setting (Bartkowski and Lanesky, 1988).

Pneumatouria, although highly suggestive of emphysematous cystitis, is rarely the presenting complaint and is usually elicited by the admitting physician rather

Figure 2. Computed tomography scan of the abdomen and pelvis with oral and intravenous contrast demonstrating thick-walled bladder with extensive air within the bladder wall.



Case Report

A 70-year-old poorly-controlled type 2 diabetic male presented with a 48-hour history of dysuria, frequency and frank haematuria. He described a 6-week history of worsening bladder outflow obstructive symptoms with nocturia and hesitancy. On examination he had a temperature of 37.5°C and tenderness in the left iliac fossa. Digital rectal examination revealed a tender, smoothly enlarged prostate gland. Blood glucose measurement was significantly elevated at 17 mmol/litre and serum white cell count was elevated at 19×10^9 /litre, demonstrating a marked neutrophilia. A plain film of the abdomen demonstrated the presence of a well-defined area of lucency in the region of the bladder suggestive of air within the bladder wall. A large lucent area was also noted in the left lower quadrant suggestive of a large bladder diverticulum distended with air (Figure 1). Based on these findings, a diagnosis of emphysematous cystitis was considered likely and the patient was commenced on broad-spectrum intravenous antibiotics, intravenous fluids and subcutaneous insulin sliding scale.

Subsequent computed tomography of his abdomen and pelvis with intravenous and oral contrast confirmed the presence of emphysematous cystitis with a markedly abnormal, thick-walled bladder as well as air within the bladder wall (Figure 2). The large lucency seen in the left lower quadrant on plain film was shown on computed tomography to represent a 9.7 cm bladder diverticulum, also containing air within its wall (Figure 3). There was no evidence of a colovesical fistula. Urine culture demonstrated a significant growth of *Escherichia coli*. His clinical course was uneventful and he was discharged home well 7 days later on oral antibiotics for a total of 14 days. He is due for further investigation of his lower urinary tract symptoms with cystoscopy.

Mr Rowan Casey is Specialist Registrar in Urology in the Department of Urology, **Dr Helen Stunell** is Specialist Registrar in Radiology in the Department of Radiology, **Dr William C Torreggiani** is Consultant Radiologist in the Department of Radiology and **Mr Ronald Grainger** is Consultant Urologist in the Department of Urology, Adelaide and Meath incorporating The National Children's Hospital, Tallaght, Dublin 24, Ireland

Correspondence to: Mr R Casey

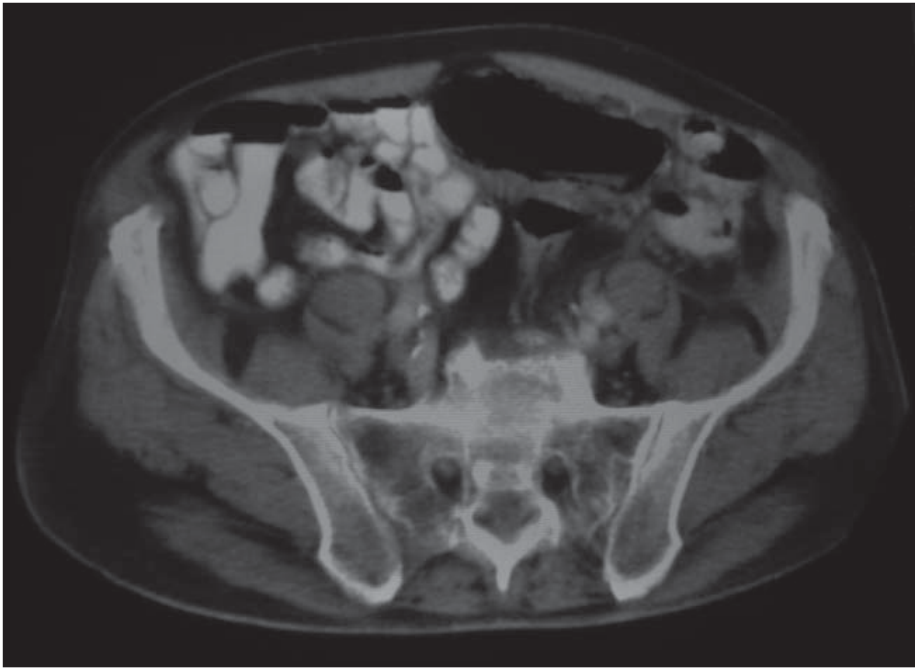


Figure 3. Computed tomography at a higher level confirms the presence of a giant bladder diverticulum. This diverticulum also contains air within its wall.

than volunteered by the patient. Patients typically present with urinary frequency, dysuria, pyrexia and haematuria on a background of long-standing or poorly-controlled diabetes mellitus. A marked leucocytosis is invariably present with varying degrees of metabolic acidosis, depending on the severity and duration of infection, which may require urgent correction. A number of cases reported in the literature describe non-specific clinical features (Bobba et al, 2004), which may result in a delay in diagnosis and consequent increase in morbidity and mortality. This highlights the need for suspicion in any diabetic or high-risk patient presenting with signs and symptoms of urinary tract infection.

The diagnosis is often first made or suspected based on the finding of pockets of gas within the bladder wall on plain film radiography. Characteristically, a curvilinear area of increased radiolucency is visualized in the region of the urinary bladder which is distinct from the more posteriorly located rectal gas (Grayson et al, 2002). A number of other potential sources of air within the urinary tract must be considered including recent bladder instrumentation, intraluminal gas secondary to trauma, and vesicocolic or vesicovaginal fistula formation as a result of diverticular disease, carcinoma of the bowel, inflammatory bowel

disease or radiation therapy, all of which may mimic the appearance of emphysematous cystitis (Grayson et al, 2002; Bobba et al, 2004). However, these can usually be included or eliminated based on the history and clinical examination, and cross-sectional imaging.

CT is a highly sensitive imaging modality in the evaluation of cases of suspected emphysematous cystitis (Bohlman et al, 1988; Grayson et al, 2002) as it facilitates early detection of intramural and intraluminal gas and is useful in differentiating it from other disease entities such as colovesical fistula formation as a result of co-existing undiagnosed diverticular disease or bowel carcinoma. In addition, CT is useful in defining the extent of disease, as it is important to accurately differentiate emphysematous cystitis from emphysematous pyelonephritis in which gas is seen to involve the renal parenchyma, and is associated with a far higher morbidity and mortality, often requiring intervention with percutaneous drainage techniques in cases of localized disease or nephrectomy in cases where the kidney is diffusely diseased (Grayson et al, 2002).

CT cystography techniques are also described whereby the bladder is retrogradely filled via a catheter with diluted iodinated contrast material while obtaining axial bladder images at 5 mm intervals

(Jarret and Vaughan, 1995; Joseph et al, 1996). Such techniques have been shown to compare favourably with cystoscopy or Gastrograffin enema in detecting fistulating disease between the bladder and bowel.

Treatment

Treatment for emphysematous cystitis is aggressive broad-spectrum intravenous antibiotic therapy. Urinary catheterization facilitates bladder drainage, and correction of hyperglycaemia, metabolic acidosis and electrolyte abnormalities, if present, are also essential in the management of this condition (Quint et al, 1992; Grayson et al, 2002).

While relatively uncommon, early diagnosis and treatment is generally associated with a favourable outcome and this depends on a high clinical index of suspicion. Delay may result in severe overwhelming urinary tract sepsis, ascending to involve the renal parenchyma and resulting in emphysematous pyelonephritis, which carries an overall mortality of approximately 50%. In the susceptible patient with symptoms and signs of urinary tract infection, a plain abdominal film should be performed to assess for emphysematous complications, with CT scanning if no improvement after 24 hours of antibiotic therapy. In the severely ill diabetic patient, a CT scan of the abdomen is indicated as a first-line investigation. **BJHM**

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