Case Report

Emphysematous pyelonephritis in two diabetic patients with complete uterine prolapse and cystocele

Ing-Ching Jong¹, Jeng-Jong Huang², Rong-Rue Lan², Ming-Cheng Wang², Chin-Chung Tseng² and Kwan-Wen Chen³

¹Department of Internal Medicine, Chia-Yi Christian Hospital, and Departments of ²Internal Medicine and ³Emergency Medicine, National Cheng Kung University Hospital, Chia-Yi and Tainan, Taiwan, Republic of China

Key words: diabetes mellitus; emphysematous pyelonephritis; percutaneous nephrostomy; urinary tract obstruction; uterine prolapse

Introduction

Emphysematous pyelonephritis is a rare and fatal renal necrotizing infection, which is commonly encountered in patients with diabetes mellitus or urinary tract obstruction [1]. Uterine prolapse, especially the complete type, may lead to obstruction of the ureter at the ureterovesical junction. Herniation of urinary bladder and uterus with significant degrees of urinary tract dilatation or obstruction, increases the susceptibility to urinary tract infection. We observed two unusual cases, i.e. diabetic women with complete uterine prolapse, who suffered from emphysematous pyelonephritis.

Cases

Case 1

A 76-year-old type II diabetic female controlled with irregular oral hypoglycemic medication presented with left flank pain and intermittent fever for 3 months. Medical history revealed a 20-year history of recurrent uterine prolapse but no definite urinary tract infection. Physical examination revealed a mentally alert, acutely ill female with blood pressure: 130/80 mmHg, pulse rate: 90 b.p.m, respiratory rate: 22 breaths/min, and body temperature: 39°C. Left flank pain and percussion pain localized to the left costovertebral angle were noted. Examination of the external genitalia disclosed complete uterine prolapse (Figure 1) and cystocele. Laboratory data revealed a white blood count of 12,700/µl with a left-shift, fasting blood sugar 231 mg/dl, blood urea nitrogen (BUN) 12 mg/dl, creatinine (Cr) 1.6 mg/dl, and serum albumin 1.5 g/dl. Urinalysis demonstrated glucosuria, pyuria and haematuria. Thoracic radiographs were normal, plain film of the abdomen (i.e. KUB) demonstrated an abnormal gas collection in the left renal fossa (Figure 2). Renal ultrasound (echo) revealed bilateral hydronephrosis and multiple echogenic lesions with acoustic shadow in the left peri-renal area. Abdominal computed tomography (CT scan) showed an air–fluid collection in the left peri-renal space and bilateral hydronephrosis (Figure 3). Left emphysematous pyelonephritis was diagnosed. Blood culture was negative, but both cultures of urine and pus revealed Escherichia coli. Her general condition improved after antibiotic therapy with left percutaneous nephrostomy. Serial renal ultrasound and CT scan disclosed reduction of the gas and purulent accumulation. Fistulography was suggested, but the patient refused. She was discharged later in a stable condition.

Correspondence and offprint requests to: Dr Jeng-Jong Huang, Department of Internal Medicine, National Cheng Kung University Hospital, 138 Shing-Li Road, Tainan 70428, Taiwan, Republic of China.

© 1998 European Renal Association–European Dialysis and Transplant Association
Her body temperature was 39.8°C, pulse rate: 130 b.p.m., and respiratory rate: 24 breaths/min. Auscultation revealed wheezing and crackles over both lung fields. The abdomen was soft with decreased bowel sound. Her extremities were cold, clammy and cyanotic. Examination of external genitalia disclosed complete uterine prolapse (Figure 4) and cystocele, grade III. Laboratory data revealed a white blood count of 24 000/μl with a left–shift, BUN 96 mg/dl, Cr 5.7 mg/dl, Na+ 120.5 meq/l, K+ 5.9 meq/l, serum albumin 1.7 g/dl, fasting blood sugar 365 mg/dl, haemoglobin A1c 13.6% (normal: 3.8–6.1%) and C-reactive protein: 216 mg/l. Arterial blood gas analysis indicated hypoxaemia and metabolic acidosis. Urinalysis revealed proteinuria, glucosuria, haematuria and pyuria. Thoracic radiographs were consistent with pulmonary congestion. Abdominal CT scan disclosed multiple hypodense wedge lesions within renal parenchyma and gas collection over the upper pole of left kidney (Figures 5 and 6). Left emphysematous pyelonephritis and acute bacterial nephritis were diagnosed. Cultures of blood, urine and pus (aspirated from left kidney) all grew E.coli. Appropriate antibiotics, strict

**Case 2**

A 70-year-old type II diabetic female with unknown history of urinary tract infection and diabetes mellitus suffered from fever, increasing lethargy and decreased urine output for 1 week. She was transferred to our hospital with septic shock, acute respiratory failure and acute renal failure. Initial evaluation disclosed a comatous female with a blood pressure of 105/60 mmHg with high-dose infusion of dopamine.

**Fig. 2.** Case 1. Plain film of the abdomen showed abnormal gas collection (white arrow) in the left renal fossa.

**Fig. 3.** Case 1. Abdominal CT scan revealed marked enlargement of the left kidney, peri-renal air–fluid collection and bilateral hydronephrosis.

**Fig. 4.** Case 2. Complete uterine prolapse was seen over the perineal area.

**Fig. 5.** Case 2. Abdominal CT scan disclosed multiple hypodense wedge lesions (i.e. acute bacterial nephritis) throughout the enlarged left kidney.
blood sugar control, hemodialysis therapy, isotropic agents and ventilator support were given. Her clinical condition got worse, and left nephrectomy was suggested, but the patient’s family refused. She expired due to septic shock 2 weeks after admission.

Discussion

There are three sources of gas in the urinary tract: (i) gas coming from hollow visceral organs through fistulae connecting with the urinary tract, (ii) gas introduced from trauma or during invasive diagnostic procedures, and (iii) gas produced by bacteria in the urinary tract [1,2]. Emphysematous infection in the urinary tract was first described by Kelly and MacCallum in 1898 [3] and later diagnosed as emphysematous pyelonephritis by Schultz and Klorfein in 1962 [4]. Four conditions (mechanisms) favouring gas formation in emphysematous pyelonephritis are: (i) pathogenic gas-forming bacteria, such as *E. coli*; (ii) the host is immunocompromised (e.g., diabetes mellitus), allowing bacteria to multiply; (iii) under a hyperglycemic environment, gas-forming bacteria ferment glucose to produce carbon dioxide and hydrogen; and (iv) ischaemia of local tissue due to severe inflammation, microangiopathy or urinary tract obstruction may impair tissue perfusion (i.e. gas transport to blood stream), allowing gas to accumulate, especially in patients with diabetes mellitus and/or urinary tract obstruction [5].

According to the review by Evanoff *et al*. [6], abdominal tenderness (83.8%), fever (80.4%) and flank pain (55.4%) are the most common clinical manifestations. Eighty-seven percent of patients with emphysematous pyelonephritis had diabetes mellitus and 37% had urinary tract obstruction. The average age of patients was 54 years with women affected twice as often as men. Typical laboratory finding include hyperglycaemia (>200 mg/dl; 94%), pyuria (95.8%) and leukocytosis (>10 000/µl; 80%). Urine cultures universally grew the pathogen, but micro-organisms were recovered from blood cultures in only 75% of patients. *Escherichia coli* is the commonest pathogen, accounting for 71% of the episodes and mixed infection occurred in 19% of the reported cases.

Plain film of the abdomen is the most simple study to screen for emphysematous pyelonephritis. The mottled gas shadow was noted in about 50% of patients undergoing plain film of the abdomen and intravenous urography. In some cases with peri-renal gas, crescent gas shadow around the kidney could be found. Although intravenous urography can disclose the site of obstruction, it is not the routine examination, because acute renal failure may occur with impaired excretory function. Therefore, retrograde pyelography is indicated if urinary tract obstruction is highly suspected. Renal ultrasound and abdominal CT scan are the main diagnostic tools. With ultrasound, gas appeared as a linear hyperechoic lesion with an acoustic shadow which could be differentiated from a renal stone by the shape and distribution. Abdominal CT scan, initially applied as diagnostic tool by Kim *et al*. in 1987 [7], can demonstrate the distribution of gas and pus accumulation, and serves to monitor catheter drainage.

Medical treatment including strict glucose control, appropriate antibiotics, fluid and electrolyte balance is the cornerstone of management. After the confirmation of urinary tract obstruction by intravenous urography or retrograde pyelography, the double-J stenting or percutaneous nephrostomy should be performed as soon as possible. If renal or peri-renal gas evidenced by subsequent renal ultrasound or CT scan still persists after medical therapy, surgical drainage or nephrectomy is mandatory. In 1968, Schainuck *et al*. [8] thought that gas could easily diffuse into the systemic circulation and away from the lesion. Persistence of gas after antibiotic treatment and drainage is an indication for nephrectomy.

The prognosis of emphysematous pyelonephritis depends on the underlying disease, clinical status and treatment modalities. In a previous review, the mortality rate of emphysematous pyelonephritis due to urinary tract obstruction, diabetes mellitus and both were 14.3%, 40% and 71%, respectively [9]. According to the study of Evanoff *et al*. in 1987 [6], the mean mortality rate of emphysematous pyelonephritis was 31.5%, which rose to 60% if medical treatment was given alone. If emphysematous change extended into the peri-renal area, the mortality rate was greater than 80%. The mortality rate decreased to 20% if total nephrectomy was performed, but the mortality rate could not be reduced by percutaneous nephrostomy with drainage only [6]. Some patients initially treated with percutaneous nephrostomy needed a total nephrectomy later because tissue necrosis was so severe that residual renal function was limited in the involved kidney [10]. The poor prognostic factors of emphysematous pyelonephritis include diabetes mellitus plus urinary tract obstruction, conservative medical therapy.
Emphysematous pyelonephritis with uterine prolapse and cystocele

only, gases extending into the peri-renal area and bilateral involvement.

Uterine prolapse is common and far more frequent in elderly than in young patients owing to increasing laxity of muscular and fascial structures in later life. It is associated with previous injury to the cardinal ligaments and perineal structures with the production of cystocele or rectocele. When the cervix of the prolapsing uterus is well within the vaginal orifice, the prolapse is defined as first degree: the cervix is at or near the introits in second degree prolapse and protrusion of the cervix well beyond the vaginal orifice is defined as third degree (procidentia uteri) [11].

The association of uterine prolapse and ureteral obstruction was initially reported in 1923 by Brettaver and Rubin [12]. The incidence is ~5%; however, hydronephrosis occurs as often as 30–40% in patients with severe uterine prolapse [13]. In a group of 18 patients with uterine prolapse, 10 patients had urinary tract infection, 10 severe hydronephrosis, two mild hydronephrosis and six had a normal urinary tract [14]. Although the mechanism is not clearly understood, the most reasonable explanation is the compression of the ureter outside the bladder. As the bladder, uterus and ureter herniate through the defect in the levator ani, the ureter may be compressed between the funds of the uterus and the bladder against the levator ani muscles. Compression by the lateral cervical ligaments of Mackenrodt have been implicated [15], the compression of the ureter against the inferior pubic ramus has also been reported. Older patients are more frequently affected, and bilateral obstruction is more common [16]. Both our cases had complete uterine prolapse associated with emphysematous pyelonephritis. In cases of uterine prolapse associated with urinary tract obstruction and urinary tract infection, surgical repair of prolapse by means of a vaginal hysterectomy and vaginoplasty is the preferred therapy. If operative therapy cannot be undertaken, a pessary may be used to reduce the uterine prolapse in an attempt to diminish the ureteral obstruction [17] and subsequent infection.

Because uterine prolapse may cause urinary tract obstruction and urinary tract infection, both gynecologist and urologist must consider intravenous urography or renal ultrasound to evaluate urinary tract obstruction in patients with (severe) uterine prolapse. Complete physical examination including the perineal area should be performed thoroughly in all female patients with urinary tract infection or even emphysematous pyelonephritis, especially in elderly diabetic women in order to disclose the existence of uterine prolapse.

References

3. Kelly HA, MacCallum WG. Pneumaturia. JAMA 1898; 31: 375

Received for publication: 6.5.98
Accepted in revised form: 29.7.98