Case Report

My Flanks Aches: Emphysematous Pyelonephritis in a Newly Diagnosed Case of Diabetes Mellitus

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Abstract

Emphysematous pyelonephritis (EPN) is a rare, severe necrotising infection of the renal parenchyma and surrounding tissues. It is usually life-threatening and should be promptly treated. Here, we report a clinical case of a 54-year-old male who presented with the left flank pains of 3-week duration. The flank pain was described as dull, constant with associated fever. He was diagnosed with diabetes mellitus (DM) while on admission. A clinical diagnosis of the left pyelonephritis was made. The abdominopelvic computed tomography scan confirmed bilateral EPN by showing a thin film of perinephric fluid (13.2 ml) in the left lower pole. He was managed conservatively with fluid therapy, adequate glycaemic control and intravenous antibiotics with no percutaneous drainage done. This highlights the importance of early initiation of appropriate medical treatment to avoid interventional urological procedures of nephrectomy. It also highlights the importance of clinical suspicion of EPN in patients presenting with symptoms of urinary tract infection and DM.

Keywords: Conservative management, diabetes mellitus, emphysematous pyelonephritis, flank aches

Introduction

Emphysematous pyelonephritis (EPN) is a life-threatening infection of the renal parenchyma and surrounding perinephric tissues with gas accumulation within the tissues. It is a rapidly progressive disease with high morbidity and mortality.[1] It was first described in 1962.[2] It is often associated with gas-forming organisms.

The exact aetiology is unknown, but diabetes remains a risk factor. This is due to impaired host immune response, high tissue level of glucose serving as a substrate for the production of carbon dioxide.[2] The organisms implicated are glucose fermenting such as *Clostridium perfringens*, *Klebsiella pneumoniae*, *Escherichia coli*, *Proteus mirabilis*, *Amoeba*, *Aspergillus* and *Candida* among others.[3,4] There is a rapid destruction of the renal parenchyma often rendering the kidney non-functional.

It is more common in females than males (with ratio 3:1), which is likely due to increase susceptibility to urinary tract infection in women.[2,5] The disease may be bilateral in 10% of cases with the left kidney more commonly affected than the right kidney.[2,6] The pathogenesis remains controversial; however, uncontrolled diabetes mellitus (DM) has been implicated in 95% of cases.[2,4] Other predisposing factors are urinary tract obstruction, impaired immune response, impaired tissue perfusion and gas-forming organisms.[2-4] Diagnosis is usually radiological by the computed tomography (CT) scan of the abdomen. The patient with EPN usually presents extremely unwell with systemic sepsis. It is best managed with intravenous broad-spectrum antibiotics and hydration, and if necessary, minor surgical procedures such as percutaneous drainage of the abscess.[2] In rare cases, nephrectomy may be required as a life-saving procedure after stabilisation.[2]

Case Report

Mr. O.O is a 54-year-old male who presented at our University Teaching Hospital on the 7th day of May 2019 with a 3-week

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history of the left flank pain and fever. The pain was described as dull, constant and occasionally sharp in nature. It was severe enough to disturb his daily routine with a pain scale of 9 out of 10. The pain was said to radiate to his loins aggravated by coughing and deep breathing. There were no known relieving factors. The fever was described as high grade, accompanied by the passage of large volume of urine, excessive fluid intake with associated weight loss. He had no symptoms of the lower urinary tract infection such as dysuria and urgency. However, there was a history of frothiness of urine, nocturia, facial puffiness, bilateral leg swelling and the passage of dark-coloured urine. There was associated generalised body weakness but no nausea or vomiting. He had no history of DM but was diagnosed with hypertension 3 months prior to presentation with poor medication adherence. He consumed alcohol occasionally and smoked three to four wraps of Indian hemp per day for approximately 20 years, which was stopped 3 months prior to presentation.

On examination, he was conscious but lethargic, febrile with a temperature of 38°C, mildly pale and moderately dehydrated with bilateral pitting pedal oedema up to the distal third of the leg. His blood pressure was 150/100 mmHg with a pulse rate of 105 bpm. His abdominal examination showed the presence of the left renal angle tenderness. A clinical diagnosis of the left acute pyelonephritis with suspected undiagnosed type 2 DM was made.

Laboratory urinalysis showed proteinuria (1+), haematuria (3+), haemoglobinuria, glucosuria (4+) and the presence of leucocyte esterase (2+). Urine microscopy revealed the presence of pus cells of >50 count/high-power field (hpf), red blood cells count of 11–20/hpf, scanty epithelial cells and the absence of yeast and casts cells and the ova of schistosoma. Urine culture isolated heavy growth of *E. coli* which was sensitive to meropenem and levofloxacin.

His random blood glucose at presentation was 293 mg/dl, with glycated haemoglobin of 8.6%. Complete blood count showed leucocytosis of 20.26 × 10^9/L predominately neutrophilia. There was anaemia with packed cell volume of 26.7%, with no thrombocytopenia. The erythrocyte sedimentation rate was elevated with 112 mm/h. The results of his serial complete blood count and renal function investigations are displayed in Table 1. His viral screening for human immunodeficiency virus and hepatitis B and C virus infections were negative.

His abdominopelvic ultrasound scan showed the left kidney measured 131 mm × 63 mm with intra-parenchymal echogenic foci with reverberation artefacts suggestive of gas shadows. The left ureter was not visualised. The right kidney measured

Table 1: Serial investigation results

Electrolytes, urea and Cr		**Complete blood count 1st day on admission**		**Urinalysis**	
Na+ (mmo/L)	134 (135-145)	WBC (×10^9)	20.26	pH	5
K+ (mmol/L)	3.5 (3.3-5.0)	PCV (%)	26.9	Ketones	−
Cl− (mmol/L)	102 (95-105)	Hb (g/dl)	9.3	Glucose	3+
HCO_3 (mmol/L)	18 (18-31)	Neutrophils (%)	83.8	Nitrite	−
Urea (mmol/L)	9.1 (1.7-9.1)	Lymphocytes (%)	12.2	Leucocytes esterase	2+
Cr (umol/L)	104.1 (53-115)	Basophils (%)	0.1	SG	1.015
		Monocytes (%)	3.8	Blood	3+
		Eosinophils (%)	0.01	Hb	+
		Platelets (×10^9)	153		
Electrolytes, urea and Cr		**Complete blood count 22nd day on admission at discharge**		**Urinalysis**	
Na+ (mmo/L)	132 (135-145)	WBC (×10^9)	9.92	pH	6
K+ (mmol/L)	3.9 (3.3-5.0)	PCV (%)	29.5	Ketones	−
Cl− (mmol/L)	96 (95-105)	Hb (g/dl)	10.19	Glucose	−
HCO_3 (mmol/L)	25 (18-31)	Neutrophils (%)	74.5	Nitrite	−
Urea (mmol/L)	2.3 (1.7-9.1)	Lymphocytes (%)	15.2	Leucocytes esterase	−
Cr (umol/L)	77.0 (53-115)	Basophils (%)	0.00	SG	1.020
		Monocytes (%)	8.8		
		Eosinophils (%)	0.07		
		Platelets (×10^9)	165		

Cr: Creatinine, Hb: Haemoglobin, PCV: Packed cell volume, SG: Specific gravity, WBC: White blood cell

122 mm × 51 mm with a normal parenchymal echogenicity. No renal gas was seen.

The abdominopelvic CT scan showed the left kidney is normal in location, but was enlarged measuring 130.4 mm × 79.9 mm with irregular outline, and multiple areas having air density suggestive of emphysematous changes. There was a significant stranding into the surrounding fat, and a collection measuring about 13.2 ml in the left perinephric space medially [Figure 1a-c]. The right kidney is normal in location and measures 109.9 mm × 63.3 mm but with the presence of stranding into the surrounding fat. There was associated calcification of the left distal ureter, seminal vesicles and walls of the urinary bladder [Figure 2a and b]. A diagnosis of bilateral EPN in a newly diagnosed type 2 DM was made.

Mr. O.O. was managed with intravenous fluids and insulin therapy to achieve target glycaemic control. He was transfused with two units of packed cells to optimise his packed cell volume. He was commenced on intravenous meropenem1g 8 hourly and metronidazole 500mg 8 hourly for 21 days. The fever resolved on the 3rd day after the commencement of intravenous antibiotics with gradual decline in leucocyte count to normal levels on the 16th day of therapy. He was also administered oral frusemide 40 mg daily and subcutaneous enoxaparin 40 mg daily. His blood pressure was controlled with administration of oral amlodipine and lisinopril 10 mg daily, respectively.

His clinical progress was monitored with serial complete blood count, urinalysis and renal function investigations. Serial abdominal ultrasound scan done showed the resolution of the perinephric fluid collection with antibiotic therapy; hence, there was no need for percutaneous drainage. He made remarkable clinical improvement and was discharged home on the 23rd day of admission on subcutaneous insulin aspart/protamine crystallised insulin aspart 30/70 given as 12 units in the morning, 12 units in the afternoon and 10 units nocte with meals, oral antihypertensives, haematinics and cefuroxime 500 mg twice daily for 5 days. Mr. O.O., however, defaulted his outpatient visit appointments and was lost to follow-up.

Discussion

EPN is a very rare necrotising infection of the renal parenchymal surrounding tissues with gas formation, which is almost exclusively seen in patients with type 2 DM. Uncontrolled DM is the leading cause in almost 95% of cases like in the index case presented.[7] Other causes include impaired renal blood flow, ureteric obstruction and immunosuppression among others.[7,8] It can occur in transplanted or normal kidneys.[8] Its occurrence in transplanted kidney can be linked to the immunosuppressive medications given.[8] The kidney involvement can either be unilateral or bilateral,[6,8] as seen in the index case.

The pathogenesis of the disease can be explained by the presence of high blood glucose levels, poor tissue perfusion and the presence of fermenting pathogenic organisms, leading to the production of gas such as carbon dioxide and hydrogen.[7,9-11] The gas-producing organism most commonly implicated is *E. coli* in 47%–90% of cases,[12] as seen in the index case presented. The clinical presentations of EPN are non-specific. Most patients usually present with fever and flank pains similar to what was observed in the case presented.

Diagnosis is mainly radiological with an abdominal CT scan. Abdominal ultrasound and plain abdominal X-ray may be suggestive of the disease when there is evidence of gas formation within the renal parenchymal and perinephric tissues. There is various CT classification of EPN.[4,9] Using the Huang and Tseng's CT classification system, EPN is classified into four classes.[2] Class 1 affects only the collecting system, and it is usually managed medically without surgical interventions. Class 2 indicates the presence of gas in the renal parenchymal. These patients are managed medically with or without percutaneous drainage. Class 3 can be subdivided into A and B. Class 3A indicates gas or abscess in the perinephric space while in Class 3B, the pathology extends beyond the kidney. Class 4 is the involvement of both kidneys and or solitary kidney. The index patient had Class 4 EPN using Huang and Tseng's CT classification.

Treatment of EPN can be conservative with or without minor interventions or nephrectomy. Conservative management involves the use of intravenous antibiotics usually for 3 to 4 weeks, with adequate fluid hydration, prompt glycaemic control, relieve of obstruction if present and electrolytes management. The patient was given a low-dose oral frusemide after adequate hydration, because he had signs of fluid retention evidenced by the presence of bilateral pedal oedema up the

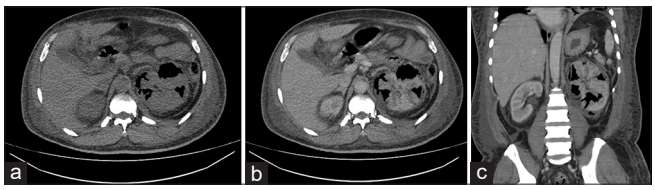

Figure 1: (a) Non-contrast axial slide showing air density within the left kidney parenchymal with fat stranding and fat stranding on the right kidney. (b) Contrast-enhanced axial slide showing air density within the left kidney parenchymal with fat stranding on the right. (c) Coronal reformatted images showing enlarged left kidney with air density seen within its parenchymal with minimal perinephric fluid collection

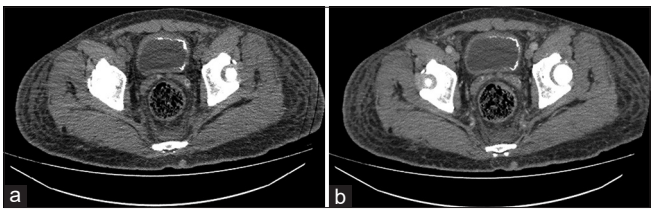

Figure 2: (a) Non-contrast-enhanced axial slide showing bladder calcification. (b) Contrast-enhanced axial slide showing bladder calcification

distal half of the legs. Minor surgical interventions include percutaneous perinephric catheter drainage of abscess under ultrasound guidance, the use of ureteral stents and nephrostomy tubes. Nephrectomy is often done in life-saving situations, especially with a non-functioning kidney.[13]

The mortality rate of the disease ranges between 11% and 54%.[7,14] High serum creatinine level, low platelet count, renal or perinephric fluid with loculated gas pattern or gas in the collecting system have been associated with poor prognostic outcomes.[2] However, Mr. O.O. responded well to conservative management despite the presence of some poor prognostic indices. This is probably due to aggressive antibiotic therapy, fluid management and good glycaemic control. Studies have shown that prompt and aggressive antibiotic therapy, good glycaemic control and adequate fluid hydration gives a good clinical response; hence, some patients might not need surgical intervention.[2,5,8]

Conclusion

Our case report highlights the importance of screening all patients with EPN for DM. High index of clinical suspicion of EPN is needed in any DM patient presenting with flank pain or symptoms suggestive of pyelonephritis. Prompt and appropriate intravenous antibiotics therapy and good glycaemic control are needed to salvage the kidneys. Less invasive interventions such as percutaneous drainage with nephrostomy tubes may also be required. Patients presenting with haemodynamic compromise, and fulminant EPN might require nephrectomy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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