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Case Report

Emphysematous pyelonephritis: a rare case report

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ABSTRACT

Emphysematous pyelonephritis (EPN) is a rare and life threatening infection of kidney characterized by gas in the renal parenchyma and surrounding tissues. It occurs mostly in patients with diabetes mellitus and has a predilection for females. It is associated with a high mortality in the absence of rapid and effective treatment; therefore, aggressive medical management, early intervention or surgical approach is recommended. Reported here is a case of a 52-year female with previous medical history of diabetes presented with uncontrolled hyperglycaemia, fever and dysuria with right sided flank pain. She was diagnosed with emphysematous pyelonephritis and successfully treated. As emphysematous pyelonephritis is a life-threatening infection, it should always be considered in the differential diagnosis for a patient with fever with abdominal pain or suspected pyelonephritis particularly in a diabetic.

Keywords: Diabetes mellitus, Dysuria, Emphysematous, Hyperglycaemia, Pyelonephritis

INTRODUCTION

Emphysematous pyelonephritis (EPN) is a rare but severe life threatening infection characterized by the presence of gas in the renal parenchyma, with or without extending to the surrounding perinephric tissues. The first case was described in 1898 by Kelly and MacCullum.[1] It has been described under various terminologies since then such as renal emphysema, pyelonephritis emphysematousa and pneumonephritis. Schultz and Klorfein proposed the term "EPN" in 1962.[2,3] Escherichia coli is the most common causative pathogen, however, Klebsiella, Clostridium, Proteus, Pseudomonas, Enterobacter, Citrobacter, Candida, Aspergillus and Cryptococcus were also reported from urine or blood culture of many patients of EPN. Though EPN is mostly unilateral with the left kidney affected more than the right, in approximately 5 to 10% of cases it is bilateral. Risk factors for emphysematous pyelonephritis are diabetes mellitus, impaired immune mechanisms, alcoholism, neurogenic bladder, obstructive uropathy, renal stones and developmental abnormalities in urinary system. It occurs mostly in patients with diabetes mellitus and has a predilection for females. EPN may present with many vague clinical symptoms such as fever, dysuria, flank pain, nausea and vomiting with rapid progression to sepsis unless managed earlier. CT scan is the most sensitive (100%) investigation to confirm the diagnosis.[3,4] As the mortality is very high, early diagnosis and prompt treatment is very much essential in managing these patients. The management strategy suggested by many reported studies include rapid diagnosis, aggressive medical management, early intervention followed by immediate nephrectomy in selected patients as indicated. We report here a case of emphysematous pyelonephritis in a female diabetic patient who recovered well on medical management

CASE REPORT

A 52-year-old female with a past medical history of diabetes (not on regular medication) and repeated

urinary tract infection presented to the emergency ward with complaints of fever, dysuria, abdominal pain, nausea and vomiting of two weeks duration. She was treated outside for the same duration and was transferred to our hospital. She had stopped taking insulin since last few weeks and started taking oral hypoglycaemic agents. On the second day of admission, she started complaining of right sided flank pain.

There was no history of haematuria. On clinical examination, patient was febrile (103°F), blood pressure 110/70 mm Hg. in right arm in supine position, heart rate 126 beats/min, respiratory rate 22 cycles/min and oxygen saturation was 99% in room air. Per abdominal examination showed epigastric tenderness and right costovertebral angle tenderness and there was no organomegaly clinically. Cardiovascular, respiratory, nervous system and other relevant system examination revealed no abnormality.

Basic routine investigations on admission showed high blood sugar (676 mg/dl) with HbA1c of 17.2%. Urine routine and microscopy examination showed plenty of pus cells but negative results for ketone bodies. Renal function tests were slightly deranged (serum urea 61mg/dl, and serum creatinine 1.93mg/dl). Arterial blood gas analysis revealed normal pH with normal oxygen saturation. CBC (complete blood count) showed leukocytosis (29.47×10^3/µL) with dominant polymorphs (88%), low haemoglobin (8.4gm/dl), and normal platelet count (212×10^3/µL). Liver function tests and serum electrolytes were within normal limit with normal coagulation profile. Chest X-ray showed features suggestive of bronchitis. With the above routine investigation and clinical findings, a diagnosis of uncontrolled diabetes mellitus with pyelonephritis (right) with sepsis was made and patient was shifted to intensive care unit. Blood and urine samples were sent for culture and empirical antibiotic therapy (Imipenem injection and metronidazole injection), intravenous fluids and short acting insulin infusion pump was started. Plain X ray KUB revealed no significant abnormality. Urgent ultrasound of abdomen and pelvis reported suspected right emphysematous pyelonephritis and CT scan of the abdomen and pelvis revealed bulky right kidney with air fluid level within it and perirenal fat stranding with surrounding air suggestive of emphysematous pyelonephritis (Figure 1 and 2).So, with the help of the above radiological findings a revised clinical diagnosis of uncontrolled diabetes mellitus with emphysematous pyelonephritis (right) with sepsis was made and the same treatment was continued in ICU with an importance given to management of hyperglycemia. After 24 hours, urine cultures reported growth of Klebsiella species and subsequent drug sensitivity pattern showed multi drug resistant strains of Klebsiella species sensitive to carbapenems. Her blood cultures were negative. So the same line of management was continued and intravenous metronidazole was withdrawn. After five days of treatment in the ICU, she started improving clinically, became afebrile and biochemical parameters started returning to normal range. The patient was shifted from ICU on the sixth day of admission and intravenous antibiotics and short acting subcutaneous insulin was continued. She received intravenous antibiotics for 14 days and recovered completely. The patient was subsequently discharged home in a stable clinical condition on the eighteenth day of admission with subcutaneous basal bolus insulin and advised to follow up in both urology and medicine out patients department at frequent interval. On subsequent follow up visits, she was asymptomatic.

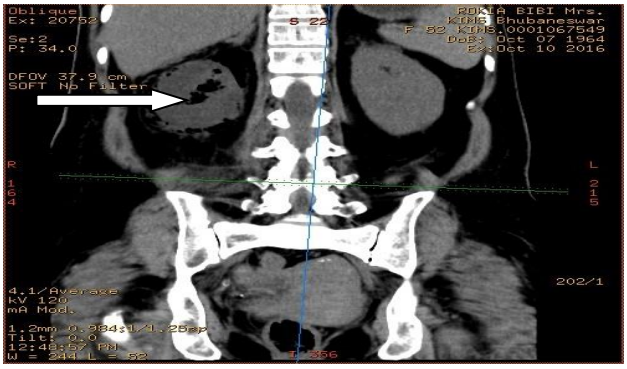

Figure 1: Coronal view of CT scan of abdomen and pelvis showing right kidney with air fluid level within it and perirenal fat stranding with surrounding air suggestive of emphysematous pyelonephritis.

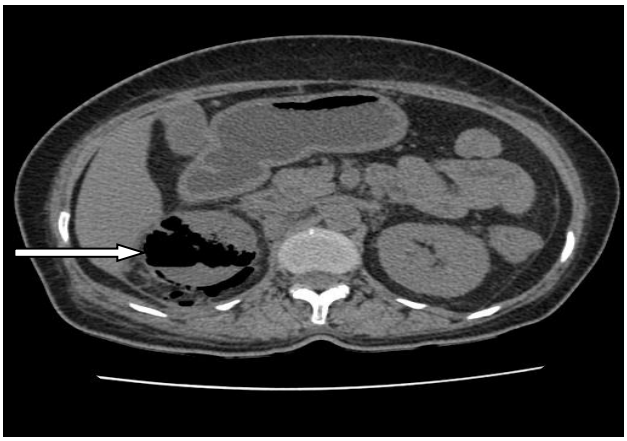

Figure 2: Axial view of CT scan of abdomen and pelvis showing right kidney with air fluid level within it and perirenal fat stranding with surrounding air suggestive of emphysematous pyelonephritis.

DISCUSSION

Emphysematous pyelonephritis is a rare, but severe life threatening necrotizing infection of renal parenchyma and perirenal tissues characterized by gas formation in those areas. Factors predisposing to emphysematous pyelonephritis are diabetes mellitus, alcoholism, impaired immune mechanisms, neurogenic bladder, obstructive uropathy, renal stones and developmental defects in

urinary system. Most of the EPN patients have diabetes mellitus. The common clinical features are fever, nausea, vomiting, abdominal pain, costovertebral angle tenderness, disorientation, dysuria and septicaemia. Current evidence suggests females are more susceptible to EPN as they are more susceptible to urinary tract infections.[4,5] Our patient was also a diabetic female with history of repeated urinary tract infection and was not on regular medication for diabetes. She presented to us with fever, abdominal pain, right sided flank pain, nausea, vomiting, dysuria with high blood count, very high plasma sugar and pyuria and improved with medical management.

The conditions required for the pathogenesis of EPN are (1) the presence of pathogenic organism capable of mixed acid fermentation, (2) high levels of glucose in the vicinity of tissue, (3) impaired tissue perfusion. These factors can work collectively resulting in a rapid progression of the disease; therefore, the level of suspicion should increase in conjunction with number of predisposing conditions.[6,7]

Although E. coli is the most common reported pathogen, Proteus, Pseudomonas, Klebsiella, Enterobacter, Candida, and Citrobacter freundii species have also been reported as the causative organism.[8,9] Though in present case blood cultures reports were sterile, but 24 hour urine culture report showed Klebsiella pneumoniae as the causative agent.

Gas production is explained by a change in metabolism of the bacteria as high glycosuria, low renal blood flow which are optimal conditions for certain bacteria to produce carbon dioxide and hydrogen from the fermentation of glucose. Gas formation is around the papilla where vascularisation is poor. The low renal flow decreases the effectiveness of antibiotics, which explains the rapid progression to septic shock, multiple organ failure and death.[10]

Most specific investigations to diagnose emphysematous pyelonephritis are ultrasonography of abdomen and pelvis to locate gas in the renal parenchyma and CT abdomen and pelvis which will demonstrate gas in renal parenchyma and perinephric tissues. Our patient also had gas in parenchyma and perinephric tissues as suggested by CT scan pictures of abdomen and pelvis (Figure 1 and 2). Renal ultrasonography confirms emphysematous pyelonephritis in approximately 80% of cases, however CT scan is 100% sensitive. The clinical approach to manage patients with EPN has changed over the years. Due to advances in imaging studies, interventional radiology, newer more effective broad spectrum antibiotic therapy, and readily available intensive care, patients with EPN have much better outcomes. Managing EPN more conservatively has thus become the standard of care. Our patient was treated with empirical broad spectrum antibiotics, intravenous fluid and short acting insulin, which were subsequently adjusted based on the clinical condition of the patient, biochemical parameters and culture reports. Mortality can be reduced by early diagnosis and prompt institution of necessary treatment. Usually 2 to 4 weeks of treatment is needed to manage a case of EPN without associated risk factors. However, in patients with extensive or fulminant disease with hemodynamic compromise many suggested that, together with fluid resuscitation and antibiotics, percutaneous drainage or immediate nephrectomy should not be delayed for the successful management.[11-13] Aggressive early surgical approach remains the gold standard in patients with risk factors.[14,15]As there was no associated risk factors, our patient received injection Imipenem for 2 weeks as per the antibiotic sensitivity report along with fluid resuscitation and short acting insulin and recovered completely. On subsequent follow-up visits, she was asymptomatic and her haematological and biochemical reports were within normal range.

CONCLUSION

EPN is a rare infection with a high mortality rate if not approached aggressively. An early suspicion of EPN is required when a poor clinical response is noted in a patient with diabetes thought to have pyelonephritis. Early imaging studies, prompt use of specific antibiotics and control of plasma sugar are the mainstay of treatment to reduce the mortality. However, in patients who are at high risk of mortality, in addition to medical management aggressive early surgical approach is also needed.

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