Case Report

Emphysematous Pyelonephritis: A Case Report and Review of Literatures

Bussaya Sujitranooch MD*

** Department of Radiology, Chonburi Hospital, Chonburi*

Emphysematous pyelonephritis (EPN) is a rare fulminating, gas-forming infection of the renal parenchyma. Diagnosis of EPN is difficult if it is based only on the history, physical examination and laboratory results. But the radiological evidence is valuable for diagnosis. CT scan is the most valuable method for diagnosis. This is a case report of EPN diagnosed by plain film of the abdomen and confirmed by non-contrast CT. The patient underwent nephrectomy and EPN was confirmed by pathological finding. Diagnostic investigation of this condition was reviewed.

Keywords: *Emphysematous pyelonephritis, Renal infection, Diagnostic investigation*

J Med Assoc Thai 2008; 91 (2): 240-3
Full text. e-Journal: *http://www.medassocthai.org/journal*

Emphysematous pyelonephritis (EPN) is a rare, life-threatening condition. It is a fulminating, gas-forming infection of the renal parenchyma. More than 90% of patients have diabetes mellitus. The diagnosis by history, physical examination and laboratory findings is difficult. But the radiological findings are typical and lead to diagnosis and further management. This disease is fatal if missed managed.

Case Report

A 64-year-old woman presented with a one-day history of right upper quadrant (RUQ) pain and palpable mass. She had no known underlying disease except a medical history of thyroidectomy from hyperthyroidism. On physical examination, the woman appeared to be ill. She had a fever with body temperature of 39 □c. Blood pressure was 110/60 mmHg. She had a palpated firm mass at RUQ. Laboratory investigation was notable for leucocytosis of 18,020 (neutrophils 92%, lymphocytes 7% and eosinophils 1%), BUN of 46 mg/dl (normal 10-20), creatinine of 2.1 mg/dl (normal 0.9-1.8), blood glucose of 659 mg/dl (normal 65-110), numerous white blood cells in urine and glycosuria. Plain abdomen and abdomen upright were done and findings are shown in Fig 1a and 1b. The patient underwent only non contrast CT to confirm the diagnosis because of high serum creatinine and findings as shown in Fig 2a and 2b.

Correspondence to : Sujitranooch B, Department of Radiology, Chonburi Hospital, Chonburi 20000, Thailand. E-mail: busujit@yahoo.com

Clinical Course

The patient was diagnosed as DM with right EPN class 3A. She was treated with IV antibiotics and insulin. Subsequently, she underwent right nephrectomy. The right kidney was spongy in appearance, air in the right Gerota's fascia with about 100 ml of pus and a thrombosed right renal artery and vein. The pathology showed markedly acute and chronic pyelonephritis with hemorrhage and necrosis. She made a good post operative recovery but developed a surgical wound infection and needed debridement twice. She was discharged 65 days after admission and referred to treat DM at community hospital. The hemoculture and urine culture are negative. But pus culture revealed E. coli. The serum creatinine had returned to 1.7 mg/dl at the time of discharge. The fasting blood/sugar at the time of discharge was 115 mg/dl.

Discussion

Emphysematous pyelonephritis (EPN) is a rare fulminating, gas-forming infection of the renal parenchyma. More than 90% of patients have diabetes mellitus. More of the affected patients are women, with a female: male ratio of 1.8:1. The average age at presentation is about 54 years, with a range of 19 to 81 years. Most clinical presentations are fever with chills, flank

Fig. 1a Plain film of abdomen shows enlarged right kidney with bubbles of gas (arrow)

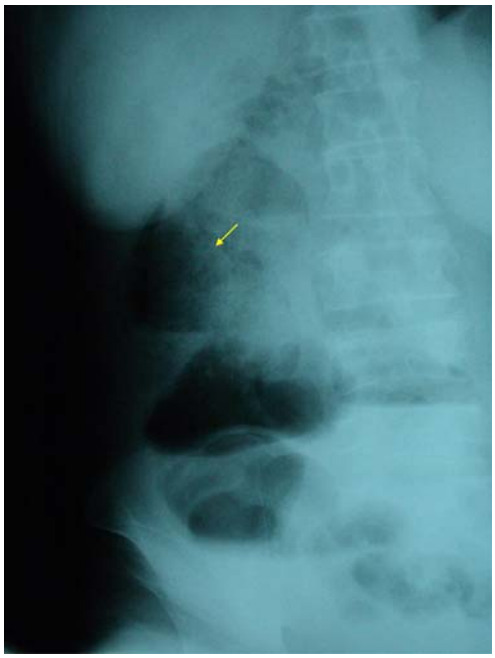

Fig. 1b Abdomen upright shows air fluid level collection in the right kidney (arrow), no free gas in peritoneal cavity

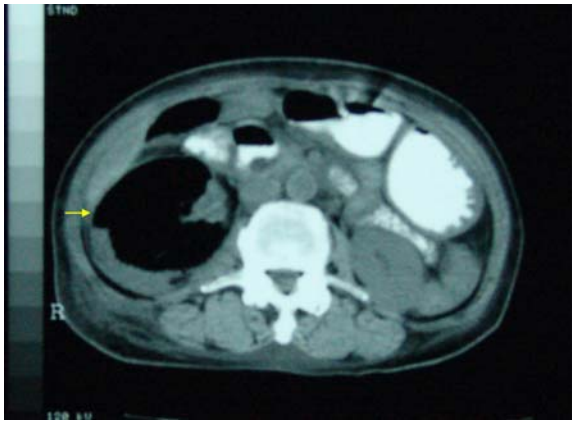

Fig. 2a Non contrast CT abdomen shows gas occupying in entire right kidney parenchyma and air fluid level perinephric space (arrow)

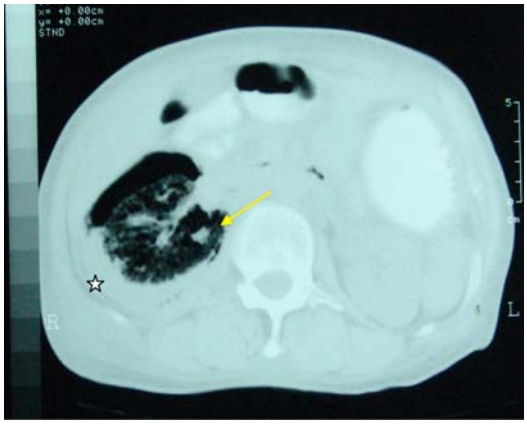

Fig. 2b Non contrast CT as lung window setting shows streak of gas in right renal parenchyma (arrow) and air fluid level collection in right perinephric space (*)

or abdominal pain, and nausea and vomiting. Mostly affected on one side but bilateral EPN is occasionally reported in about 10%. The most infecting organism is E. coli. and subsequently Klebsiela pneumoniae, Proteus mirabilis or even fungus such as Bacteroides fragilis.

Diagnosis of EPN is difficult if it is based only on the history, physical examination and laboratory results. It requires radiological confirmation of gas within the kidney and/or collecting system. Abdominal radiographs, intravenous pyelography (IVP), and ultrasonography (US) are able to suggest the presence of

gas in approximately 85% of cases. Plain abdomen shows evidence of gas at the renal fossa with or without enlargement of renal outline. Ultrasound shows high echogenic areas with a dirty shadow or reverberation artifact over the renal fossa or within the kidney. CT even non contrast CT is the best imaging technique for detecting gas and for defining the extension of the disease. Summary of the radiological findings is shown in Table 1.

There are many classifications of this disease, mostly based on radiological evidence that lead to management selection as shown in Table 2.

Now the classification by Wan et al (two types) and Huang et al (4 classes) are widely used. The Wan et al type 1 EPN is diffuse gas throughout the parenchyma in a streaked or mottled pattern, and little or no fluid Type 2 EPN is renal or perirenal fluid collection in association with air bubbles or loculated gas pattern., or gas in the collecting system. Suggested management is based on type or classification. The prognosis and mortality rate are based on type. Wan et al reported all survivors with type 1 EPN underwent either nephrectomy or other surgical intervention, whereas 46% of the patients who died received medical treatment only. Among type 2 the mortality rate is about 29%. Huang et al analyzed 46 cases and concluded that class 1, class 2, class 3 and class 4 EPN with fewer than 2 risk factors (eg. thrombocytopenia, elevated serum creatinine, altered sensorium and shock) could be managed by percutaneous drainage but in class 3 and class 4 EPN with more than 2 risk factors, nephrectomy is indicated. In conclusion, surgical therapy is the treatment of choice in most patients with EPN type 1 or class 3 and class 4 even if some literatures reported successful percutaneous drainage cases and medical treatment alone.

Conclusion

This is a rare case of renal infection in a patient who had no previous history of DM, but high serum glucose at the time of diagnosis of EPN and clinical manifestration was not typical as fever with RUQ mass but the plain film and non contrast CT finding were typical for EPN class3A. The pus culture result was confirmed and gross finding on operation and pathological proven. CT is the imaging modality of choice for diagnosis and classification for treatment planning.

Table 1. Radiological findings of EPN

Radiological investigation	Findings suggested EPN
Plain film of the abdomen and Excretory urography or intravenous pyelography	Gas bubbles or mottling gas shadow at renal fossa, in collecting system, crescent gas shadow of perinephric space
Ultrasonography (US)	High echoic or dirty shadow over renal fossa or in renal parenhyma
CT scan	Gas bubbles or streaks in renal parenchyma, perinephric gas or air fluid collection even extension of gas beyond perinephric region

Table 2. Classification of EPN

Radiological findings	Classification			
Gas in the collecting system	-	-	Wan et al type 2	Huang et al class 1
Gas within the renal parenchyma	Langston and Pfister pattern 1	Michaeli et al stage I	Wan et al type 1, 2	Huang et al class 2
Gas within the perinephric tissue	Langston and Pfister pattern 2	Michaeli et al stage II	Wan et al type 1, 2	Huang et al class 3A
Extension of gas beyond the Gerota fascia	Langston and Pfister pattern 3	Michaeli et al stage III	Wan et al type 1, 2	Huang et al class 3B
Bilateral EPN or EPN in solitary kidney	-	Michaeli et al stage III	-	Huang et al class 4

References

1. Langston CS, Pfister RC. Renal emphysema. A case report and review of the literature. AJR Am J Roentgenol 1970; 110: 778-86.
2. Ramsey EW, Awad SA, Morrin PA. Emphysematous pyelonephritis. Can Med Assoc J 1974; 110: 1366-8.
3. Kim DS, Woesner ME, Howard TF, Olson LK. Emphysematous pyelonephritis demonstrated by computed tomography. AJR Am J Roentgenol 1979; 132: 287-8.
4. Michaeli J, Mogle P, Perlberg S, Heiman S, Caine M. Emphysematous pyelonephritis. J Urol 1984; 131: 203-8.
5. Evanoff GV, Thompson CS, Foley R, Weinman EJ. Spectrum of gas within the kidney. Emphysematous pyelonephritis and emphysematous pyelitis. Am J Med 1987; 83: 149-54.
6. Hill RA. Emphysematous pyelonephritis. J R Soc Med 1989; 82: 47-8.
7. Gervais DA, Whitman GJ. Emphysematous pyelonephritis. AJR Am J Roentgenol 1994; 162: 348.
8. Goyzueta JD, Katz R, Dumitrescu O, Choi HS, Kahn T. The disappearing kidney. A case of emphysematous pyelonephritis. Arch Intern Med 1994; 154: 2613-5.
9. Wan YL, Lee TY, Bullard MJ, Tsai CC. Acute gas-producing bacterial renal infection: correlation between imaging findings and clinical outcome. Radiology 1996; 198: 433-8.
10. Wan YL, Lo SK, Bullard MJ, Chang PL, Lee TY. Predictors of outcome in emphysematous pyelonephritis. J Urol 1998; 159: 369-73.
11. Roberts JA. Management of pyelonephritis and upper urinary tract infections. Urol Clin North Am 1999; 26: 753-63.
12. Huang JJ, Tseng CC. Emphysematous pyelonephritis: clinicoradiological classification, management, prognosis, and pathogenesis. Arch Intern Med 2000; 160: 797-805.
13. Grayson DE, Abbott RM, Levy AD, Sherman PM. Emphysematous infections of the abdomen and pelvis: a pictorial review. Radiographics 2002; 22: 543-61.
14. Muttarak M, Mai WN. Clinics in diagnostic imaging (99). Left emphysematous pyelonephritis. Singapore Med J 2004; 45: 340-2, quiz.
15. Liao HW, Chen TH, Lin KH, Lin HH, Hsu YH, Hou CC, et al. Emphysematous pyelonephritis caused by Bacteroides fragilis. Nephrol Dial Transplant 2005; 20: 2575-7.
16. Stone SC, Mallon WK, Childs JM, Docherty SD. Emphysematous pyelonephritis: clues to rapid diagnosis in the Emergency Department. J Emerg Med 2005; 28: 315-9.
17. Karasavidou L, Nikolaou S, Archontakis S, Papatheodorou G, Koroneos V, Drakoulis C. Non-surgical treatment of bilateral emphysematous pyelonephritis in a diabetic patient. J Nephrol 2006; 19: 664-7.
18. Vourganti S, Agarwal PK, Bodner DR, Dogra VS. Ultrasonographic evaluation of renal infections. Radiol Clin North Am 2006; 44: 763-75.
19. Portnoy O, Apter S, Koukoui O, Konen E, Amitai MM, Sella T, et al. Gas in the kidney: CT findings. Emerg Radiol 2007; 14: 83-7.
20. Mokabberi R, Ravakhah K. Emphysematous urinary tract infections: diagnosis, treatment and survival (case review series). Am J Med Sci 2007; 333: 111-6.

รายงานผู้ป่วยเป็น โรคติดเชื้อของไต ชนิด emphysematous pyelonephritis

บุษยา สุจิตรานุช

รายงานผู้ป่วยที่มีการติดเชื้อของไต ชนิด emphysematous pyelonephritis ซึ่งเป็นโรคที่ร้ายแรงที่พบได้ไม่บ่อย แต่พบมากขึ้นในคนไข้เบาหวานมีอัตราตายสูงถ้าได้รับการวินิจฉัยและรักษาไม่ทันการวินิจฉัยโดยประวัติ และตรวจร่างกายให้ได้แน่นอนนั้นทำได้ยาก แต่ในภาวะนี้มีลักษณะทางรังสีที่เฉพาะ ซึ่งให้การวินิจฉัยได้แน่นอน รวมทั้งสามารถเลือกวิธีการรักษา และสามารถพยากรณ์โรคได้ โดยเฉพาะอย่างยิ่ง CT scan แม้ไม่ฉีดสารทึบรังสี ผู้ป่วยรายนี้ได้รับการวินิจฉัยโดย plain film of the abdomen และ Noncontrast CT abdomen ผู้นิพนธ์ได้ทบทวนลักษณะทางรังสี และ classification รวมทั้งแนวทางการรักษา