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Original Research Article

Emphysematous Pyelonephritis: Radiologic Diagnosis

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Abstract: Emphysematous pyelonephritis (EPP) is a severe and necrotizing form of acute bacterial pyelonephritis with a life-threatening outcome. It is a rare condition, occurring preferentially in diabetic patients and linked to the development of anaerobic germs. There is a predominance of women (2/1). The CT scan is the best technique, which allows the positive diagnosis by the presence of gases in the renal parenchyma, in the collecting system or in the peri- renal spaces. The evolution of the disease is the basis of its radiological classification in 4 stages. The therapeutic attitudes diverge between surgical treatment, percutaneous drainage and conservative treatment.

Key words: Emphysematous pyelonephritis, CT scan.

INTRODUCTION

Emphysematous pyelonephritis (EP) is a necrotic infection of the kidney characterized by the presence of gas within the renal parenchyma, excretory cavities or perirenal spaces [1]. It is a rare condition, occurring preferentially in diabetic or immunocompromised patients, with a female predominance. Without early diagnosis and management, the evolution can be fatal with the development of septic shock and multivisceral failure.

The objective of our study is to:

- Show the value of CT in the management of emphysematous pyelonephritis.
- To enlighten the clinicians on the details of the localization and the associated lesions.

MATERIALS AND METHODS

We conducted a retrospective study over a period of 34 months, from February 01, 2019 to November 31, 2021, from the records of patients referred for CT workup in a setting of renal symptomatology.

The criterion of judgment is the presence of gas within the renal parenchyma.

Data processing was performed using Excel software.

RESULTS

Five patients (5) were collected. The average age was 54 years, with extremes of 42 and 72 years. 4 patients were female and 1 male. All our patients were known diabetics.

Renal involvement was localized bilaterally in one patient, on the right side in 3 patients and on the left side in one patient. An obstruction of the upper excretory tract due to pyelic renal lithiasis was found in one patient. The average delay of consultation was 6.2 days with extremes of 5 days to 8 days after the onset of the symptoms. Feverish low back pain with alteration of the general state was the reason for consultation in all our patients. The clinical picture was that of a typical acute pyelonephritis common to three (3) patients and two patients had consciousness disorders related to a state of diabetic ketoacidosis.

Biologically, hyperglycemia was noted in all our patients with extreme values from 4.3 g/l to 6g/l. The CRP level was above 140 mg/l in all our patients. The blood count showed hyperleukocytosis in all cases with extremes of 16000 to 28000 elements/mm3, with

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microcytic hypochromic anemia in 2 cases. Three patients had functional acute renal failure related to the sepsis which had regressed after resuscitation measures. Urine dipstick examination was used to diagnose diabetic acidosis in all our patients and urine cytobacteriological examination was positive in all cases, with isolated Escherichia Coli in all cases. Ultrasound was performed in all our patients and showed gas interposition in four cases and reverberation echoes in the renal parenchyma in one case. The diagnosis was made on CT scan in all our patients. It showed the presence of gas in the renal parenchyma and excretory tracts in 3 cases and air diffusion in the retroperitoneal spaces in 2 cases. All our patients had benefited from resuscitation measures to restore hydroelectrolytic balance, insulin therapy and bi-antibiotic therapy based on third generation cephalosporin and an aminoside. Surgical drainage of peri-renal collections in two patients. Drainage of the excretory tract by percutaneous nephrostomy was performed in three patients. The clinical and radiological evolution was excellent with renal conservation in four of our patients and a left nephrectomy in one patient.

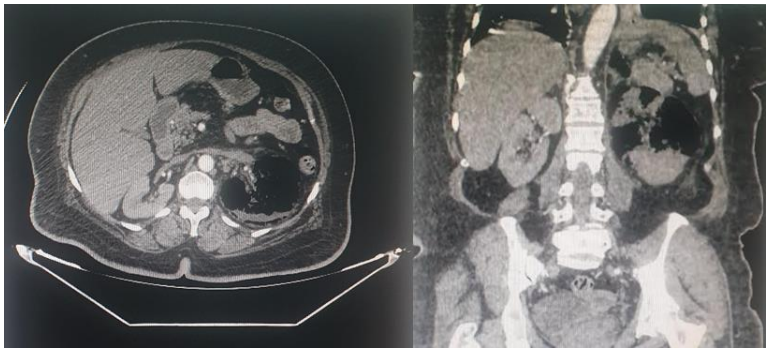

Figure 1: Abdominal CT scan in axial (A) and coronal (B) sections showing destruction of the left kidney with the presence of air in the left renal pelvis and diffusion of air into the retroperitoneal spaces in a 42-year-old patient with type 2 diabetes

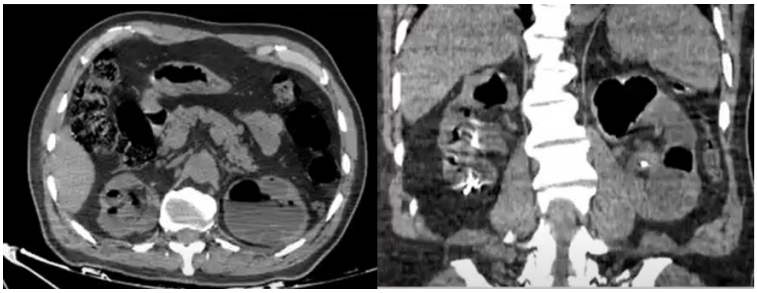

Figure 2: Abdominal CT scan in axial (A) and coronal (B) sections showing: Bilateral renal intraparenchymal gas bubble with appearance of right upper polar pyelonephritis in a 53-year-old female patient with type 2 diabetes

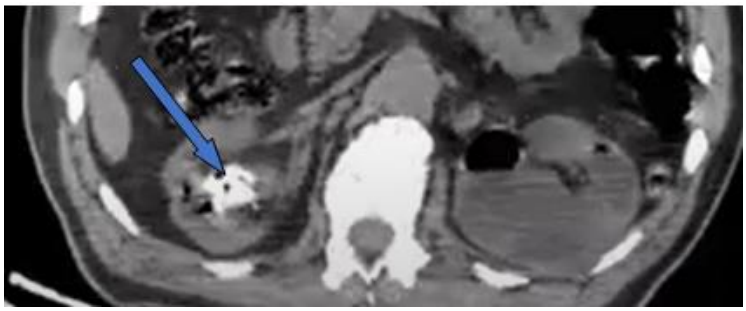

Figure 3: Axial section abdominal CT scan showing: Bilateral renal intra parenchymal gas bubble with appearance of pyelonephritis and right renal coralliform lithiasis (arrow)

DISCUSSION

Emphysematous pyelonephritis (EP) is a severe and necrotizing form of acute bacterial pyelonephritis, resulting from gas production within the renal parenchyma. Often, the infection, and consequently the gas, extends through the renal capsule into the female perinephric space [1].

Its incidence is increasing due to a better knowledge of the disease, the diffusion of CT scans, or the increase in the incidence of diabetes in Asia and in industrialized countries [2]. Renal involvement

predominates on the left side (60%). Bilateral forms are rare (5-20%) and are particularly severe (20 times higher mortality) [3]. The first etiological factor most frequently found is diabetes, especially poorly controlled [3, 4]. The second etiological factor is the existence of an obstacle in the urinary tract [5, 6]. The germ most often implicated is E. Coli, which is responsible for 60% of cases [7]. Bilateral involvement can also occur on a pre-existing abnormality: bilateral junction syndrome [8] or autosomal dominant polycystic kidney disease [9, 10]. Gas formation is explained by a process of intra-renal fermentation of glucose by bacterial infection [6].

The clinical symptomatology is that of acute pyelonephritis or renal abscess with fever and chills.

Physical examination reveals a lumbar contact, sometimes a redness or crepitation in the flank is suggestive but rarely found. Pneumaturia is exceptional [11].

The biological picture is made of hyperglycemia, hyperleukocytosis and renal failure. Pyuria is constantly found on urinary analysis.

X-ray of the urinary tree without preparation can sometimes evoke the diagnosis by showing aerial images projecting onto the renal area [12].

Renal ultrasonography can show clusters of microbubbles as hyperechoic areas with reverberation and posterior attenuation, but it does not allow an accurate assessment of the extension of the disease [13].

CT is the reference examination for the positive diagnosis and follow-up of emphysematous pyelonephritis [3]. It allows a precise localization of the aerial images in the renal parenchyma or collecting system, or in the peri-nephric space and thus specifies the extension of the lesions, for the therapeutic attitude and determination of the prognosis [14, 15]. Huang and Tseng have established another CT classification with therapeutic impact [15].

It classifies ENP into 4 stages:
Stage 1: Gas in the excretory tract only;
Stage 2: Gas in the renal parenchyma without extension into the extrarenal space;
Stage 3A: Extension of gas or abscess to the renal pelvis;
Stage 3B: Extension of gas or abscess beyond the fascia of Gerota;
Stage 4: Bilateral or single kidney emphysematous pyelonephritis.

TREATMENT

The reference treatment for emphysematous pyelonephritis is emergency nephrectomy for most teams. Currently, it should be indicated as a second-line treatment after failure of conservative treatment or exceptionally as a first-line salvage treatment in case of extensive forms with several organ dysfunctions [3, 16].

CONCLUSION

Emphysematous pyelonephritis is an extremely serious and life-threatening renal infection. The CT scan is the reference examination to confirm the diagnosis and make a precise assessment of the lesions. Conservative treatment should always be attempted and first-line nephrectomy should be reserved for severe extensive forms with organ dysfunction (liver, kidney); forms with non-functional kidney destroyed by the infectious process.

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