

Emphysematous pyelonephritis: Dilemma between radical or conservative treatment (report of 3 cases)

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ABSTRACT

Emphysematous pyelonephritis (EPN) is a rare form of renal suppuration. It is associated with a high mortality in the absence of rapid and effective treatment. Nephrectomy is suggested as the reference treatment associated to medical treatment. However, medical treatment exclusive is a conservative therapeutic option which is effective and successful in some cases. Many clinical and radiological criteria must be analyzed and gathered; we describe three cases of EPN treated successfully with medical treatment alone in two cases and associated to nephrectomy in one case.

Key words: Emphysematous pyelonephritis, medical treatment, nephrectomy, prognosis

INTRODUCTION

Pyelonephritis emphysematous is defined by the presence of bacterial gas within the renal parenchyma and peri-renal spaces. This is a rare and serious condition, it is burdened with a heavy death outside a fast and aggressive treatment. Nephrectomy principle is advocated by authors but conservative treatment may be appropriate in particular cases. Through three observations and a review of the literature, we recall the general characteristics of this disease and its urgent management emphasizing the interest of conservative treatment in localized forms, bilateral or occurring solitary kidney.

CASE REPORTS

Observation 1

A patient aged 57 years not known diabetic, hypertensive for 5 years is admitted in Intensive Care Unit (ICU) for an

impaired general condition and acute dehydration. Physical examination at admission found a conscious patient; his Glasgow scale was 15 and showed no signs of loss.

The respiratory frequency was 23 cycles/min and blood oxygen saturation was 99% in the open air. Hemodynamically, heart rate was 90 beats/min and blood pressure 120/70 mmHg.

The temperature was 38°C. The blood count revealed 17,150 cells/mm³ (predominance of neutrophils), platelets 247,000/mm³. Blood glucose was 37.62 mmol/L with the presence of sugar and ketones in the urine.

Serum potassium was 372 mEq/L, serum sodium to 136 mEq/L, blood urea to 990 mmol/L, creatinine at 104.42 mmol/L. At the cyto-bacteriological examination of urine, there was leukocyturia with presence of Gram-negative rod. The evolution was marked by the sudden onset of left back pain at the 2nd day of hospitalization. Physical examination revealed a defense, slurring and left lumbar crackles. A urinary tract without preparation revealed clarity


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areas beside the renal space [Figure 1]. The abdominal CT scan [Figure 2] showed the presence of air bubbles in the urinary tract predominant left.

Observation 2

A 30-year-old patient without medical history is admitted in ICU for a septic shock complicating pyelonephritis emphysematous. Clinical examination results on admission temperature 38.5°C, blood pressure 80/40 mmHg, heart rate 120 beats/min, arterial oxygen saturation 90% in the open area, urea 2.15 mmol/L; creatinine 495,04 mmol/L; glycemia 7.15 mmol/L; natremia 147 mEq/L, serum potassium 3.76 mEq/L, hematocrit 29.8%, hemoglobin 9.4 g/dL, 16,900 leukocytes/mm³, platelets 377,000/mm³, and prothrombin time 67%.

The cytobacteriological urine study found poly hydroxyl alkanoates, no nitrites. The cytology noted leucocytes, rare erythrocytes and some epithelial cells. There are neither crystals nor cylinders nor yeasts. Leukocyturia was at 80000/mL and hematuria at 8000/mL. Culture found many colonies of *Enterobacter Cloacae* SSP (count 10⁵ CFU).

The bacteriological profile showed a resistance to amoxicillin-clavulanic acid: MIC ≥32, to ticarcillin ≤8. Cefalotin MIC ≥64, cefoxitin MIC ≥64 cefotaxime 8, ceftazidime 16, nalidixic acid and ofloxacin 2.

It was sensible to piperacillin-tazobactam MIC ≤4, imipénème MIC ≤0,25, ertapenem MIC ≤0,5, tobramycin MIC ≤1, Amikacin MIC ≤2, gentamicin MIC ≤1, ciprofloxacin 0,5, trimethoprim-sulfamethoxazole ≤20.

Standards phenotype based on global European phenotypic noted beta-lactamase extended spectrum.

Phenotype: Beta-lactam antibiotics (beta-lactamase extended spectrum).



Figure 1: Urinary tract without preparation. Evocative aspect of an emphysematous pyelonephritis

Procalcitonin was at 11.96 ng/mL (normal <0.5) (chemiluminescence technique BRAHMS-ROCHE COBAS 6000).

CT urography showed that right kidney was with hydronephrosis on pyelocaliceal and stones, rolling the renal cortex, seat air-fluid level with delay excretion. A right retroperitoneal collection extended to the pelvis Sege air bubbles with infiltration of the perirenal fat. This collection delivers the liver in upward and forward and the bowel loops forward, and comes into contact with the iliopsoas muscle and lumbar remaining homogeneous density. Left kidney increased in size, measuring 13 cm long axis, well differentiated, secreting within the normal time, with excretion delay; liver ,spleen and pancreas had normal scannography apparence but it showed peitoneal effusion. Lymphadenopathy aorto-caval. CT appearance was in favor of emphysematous pyelonephritis complicated by retroperitoneal abscess.

Observation 3

A patient aged 59, known diabetic DID for 3 years, and 5 years hypertension was admitted in intensive care for a poor general condition, vomiting. Clinical examination showed Glasgow scale 14; blood pressure 120/70 mmHg, and heart rate 81 beats/min. Respiratory-frequency to 30 cycles/min and oxygen saturation was 97% at the open air. Abdomen was soft and compressible. Blood glucose was at 27,5 mMol/L. The urine examination noted glycosuria at 3 cross, acetonuria at 3 cross. The temperature of the patient was at 37°C.

Setting conditions done were perfusion, oxygen therapy, non invasive hemodynamic monitoring (arterial pressure and cardiac frequency), respiratory monitoring (respiratory frequency, SpO₂).

Laboratory tests showed: Na + 127 mEq/L; K + 5.42 mEq/L; blood glucose 38 mmol/L; urea 16.83 mmol/L;



Figure 2: Scannographic aspect of emphysematous pyelonephritis

creatinine 292 mmol/L. Hemoglobin 13.3 g/dL; WBC 10020/mm³; 196,000 platelets/mm³. Prothrombin was at 74%. Electrocardiogram noted a normal cardiac rhythm.

Chest X-ray was normal and the abdominal ultrasound, large partitioned cystic mass subhepatic back the hepatic parenchyma up arriving until pelvis. Abdominal CT showed bulky cystic lesion extended hepatic pelvis (33 cm × 16 cm). Right kidney and adrenal weren't viewed. Major right ureterohydronephrosis was with parenchymal destruction. Right kidney and adrenal were not viewed straight. Moderate left ureterohydronephrosis [Figure 3a and b]. Homogeneous hepatomegaly. The urine cytobacteriological study showed leucocytes <104. Direct Exam was negative. Sterile culture.

The therapeutic management was perfusion, insulin, gastric protection, prevention of thromboembolic disease.

The evolution was marked by clinical improvement in the 2nd day of hospitalization: Glasgow scale 15, improved renal function urea 6.44 mmol/L, creatinine 875 mmol/L, and stabilized daily glycemic profile.

At the 4th day of hospitalization, the patient presented abdominal pain predominant at the right iliac fossa with abdominal distension in a context of apyrexia, dyspnea, stable hemodynamically. Three hours later, he presented 39°C fever and worsening of neurological status (anxiety, agitation), hemodynamic instability. Abdominal CT showed CT appearance in favor of a right pyonephrosis ruptured into the peritoneal cavity in the portal branches [Figure 4a-c].

Visceral surgery noted after xypho-pubic incision, at exploring: Huge right lateral mass (retroperitoneal) back the colon ascendant. paracolic decollement. Dissection of the mass, dissection of "air" at the level of the renal vein and vein pedicle cave. Ligature, release and extraction of mass [Figure 5a-c].

Recurring peritoneal fluid identified *Klebsiella pneumoniae*, sensitive to imipenem, amikacin. Histological examination showed a cyst, lined by a flattened, even coating, often off.

The fibrous wall was home to many small secondary cystic formations with presence in places of renal parenchyma containing coating flattened tubes, and light filled with eosinophilic material and atrophic glomeruli.

The wall was also punctuated by a lymphocytic infiltrate.

The evolution was marked by withdrawal of norepinephrin. The biology noted: Na + 139 mEq/L; K + 3.77 mEq/L; glycemia 8.08 mmol/L; urea 6.43 mmol/L; creatinine: 937 mmol/L; TGO: 194 IU/L; TGP: 68 IU/L; Hb: 11.7 g/dL; leukocytes: 1920 cells; 80% neutrophils; 12% myelocytes; lymph 6%; 2% monocytes; inserts: 41,000 cells/mm³.

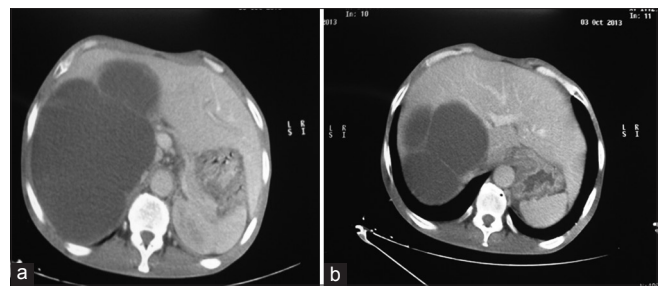


Figure 3: (a and b) Ureterohydronephrosis with parenchymal destruction

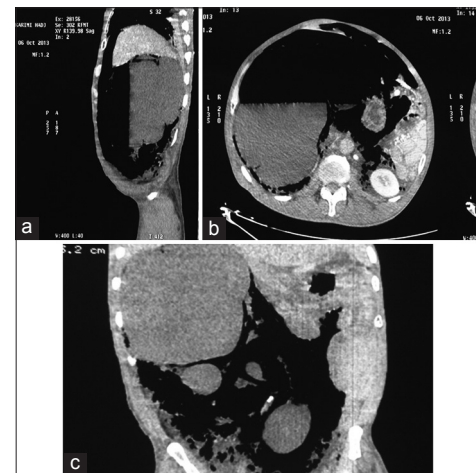


Figure 4: (a-c) Right pyonephrosis ruptured into the peritoneal cavity

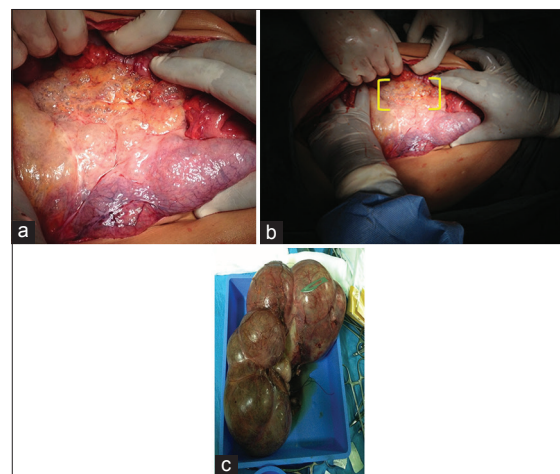


Figure 5: (a-c) Huge right lateral mass (retroperitoneal) back the colon ascendant

The patient died in multiorgan failure on the 7th day of hospitalization.

DISCUSSION

Emphysematous pyelonephritis (NCB) is a necrotizing infection of the renal parenchyma and suppurative and perirenal tissues with *in situ* production of bacterial gases.

It is rare but a serious condition. It mainly occurs in diabetics (70-95% of cases), female, 54 years old.

The pathogenesis is explained by factors involved as infection by a bacterium gasifier, tissue concentration of high glucose, failure of tissue perfusion, and the alteration of the immune response.

Germs responsible are facultative anaerobic Gram-negative *Bacilli* as *Escherichia coli*, *K. pneumoniae*, *Proteus mirabilis*, and *Enterobacter aerogenes*. Rarely, *tropicalis* or *Candida albicans*; *Cryptococcus neoformans*.

Anaerobes are exceptional.

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 vascularization is poor. The gas passes into the renal pelvis, then fuse it along the pyramids and in the perinephric space, and the presence of gas in the perinephric space does not worsen the prognosis. The low renal flow decreases the effectiveness of antibiotics, which explains the rapid progression to septic shock, multiple organ failure and death.^[1-10]

Clinical symptoms are non specific which delay its diagnostic. Furthermore, that urinary infection is common but less symptomatic in diabetics.

The usual signs of acute pyelonephritis aren't constant. Somehow, lumbar pain 48-71% impaired general condition, fever and chills 21-44% or in constant hematuria which have poor prognosis meaning severe renal destruction and venous thrombosis.

Septic shock may reveal acute emphysematous pyelonephritis in 16-29% as are metabolic complications of diabete.^[11-21]

The abdominal CT is the best exam as it helps for diagnosis, to specify the type of pyelonephritis and to identify the extension of the damages. It allows also prognostic classification and therapeutic indications. There are two types of emphysematous pyelonephritis:

- Type I: Presence of air in intra- and/or peri-renal
- Type II: More than a collection of pus in intra- or peri-renal or presence of gas in the urinary tract.

This classification has a prognosis significance.

There is a correlation between radiological aspects and the histological types:

- Type I is associated to histological aspect of dotted kidney necrosis and infarcts associated to vascular thrombosis
- Type II: There are non compromised renal vasculature.

The type II is correlated to an acute interstitial inflammation with micro abscesses. Poor prognosis in the radiological classification is due to the gas confined to the renal parenchyma. The mortality rate is at 60% if the patient receive antibiotics either with drainage or not. It rises to 80% if the gas is extended to perinephric space. Nephrectomy may reduce this rate to 20%.

The NCB is a medical and surgical emergency. The initial empiric antibiotic therapy combines third-generation cephalosporin or imipenem to a fluoroquinolone or an aminoglycoside. Surgical drainage or percutaneous drainage guided by ultrasound or CT help safeguard the kidney. Nephrectomy is reserved for extensive forms with multiple organ dysfunction.^[21-29]

Prognostic factors are creatinemia >120 µmol/L, thrombopenia <60,000/mm³, microscopic and macroscopic hematuria. The mortality rate varies between 69 and 18% for type I and II, passes 92 and 53% when thrombocytopenia or renal impairment is present.^[29]

Emphysematous pyelonephritis is a rare and serious condition burdened with a mortality oscillating 7–75% depending on the series.^[1-7,15] It reaches a diabetic female population and in 80% of cases.^[1,4,12] The existence of a urinary tract obstruction is rarely observed in contrast to the shapes which occur in non-diabetic patients.^[3,6]

In almost all cases, the germs are *Bacilli*, *E. coli* 1 up in 60% of cases, *K. pneumoniae* in 25% of cases. Sometimes, it is *Pseudomonas* or *Proteus mirabilis* or vulgaris.^[2,5] Gas formation is explained by an intrarenal fermentation process glucose by bacterial infection.^[1,4] The clinical symptomatology is not specific, the usual picture is that of an infectious syndrome with urinary symptomatology diabetic;^[1,5,13] abdominal pain is often in the foreground. Physical examination reveals a slurred, sometimes redness or crepitus the flank. The pneumaturia is exceptional.^[3] leukocytosis is inconstant.

The abdominal X-ray can sometimes suggest the diagnosis by showing aeric images are projected on kidney area.^[14] The usefulness of ultrasound is appreciated differently by the authors, it can establish the diagnosis if objective carbonated pictures intra parenchymal unrelated gut gas, but may show false negatives. It retains an interest in the diagnosis of urinary tract obstruction.

Abdominal CT certifies the diagnosis and clarifies the extent of damage that can sometimes be bilateral. It also helps differentiate the NCB of perinephritis, better prognosis, and thus contributes to the therapeutic decision regarding the conservative or radical treatment.^[4,7,10,13]

WAN,^[15,29] in his series of 38 cases, most of the literature, two types of emphysematous pyelonephritis: Type I, where there is only air intra- and/or peri-renal and Type II, where

there are also a collection of pus within or kidney perished or presence of gas in the urinary tract. This classification has a prognostic significance because there is a correlation between radiological images and histological types.

In type I, the kidney is dotted with necrosis and infarcts related thrombosis than in type II renal vascularization is not compromised. This disparity histological lesions is related, according to WAN, with a more appropriate immune response in type II WAN^[15,29] insists on certain prognostic factors to consider in assessing the severity of an emphysematous pyelonephritis.

The prognosis is even more unfortunate that this is a type I, that creatinine >120 µmol/L thrombocytopenia with <60,000 elements per mm³ and presence of hematuria the importance of which translate the severity of renal destruction and the presence of venous thrombosis.

The overall mortality for types I and II is 69% and 18%, respectively. It spends 92% to 53% patients with a platelet count >60,000 per mm³ elements and an upper creatinine 120 µmol/L.^[1,10-12,15]

The standard treatment for emphysematous pyelonephritis is urgent nephrectomy^[3,5,11] short after resuscitation and platelet transfusions of packed red if necessary. However, in the absence of poor prognostic factors, some authors recommend conservative treatment consisting of medical treatment associated with a drainage renal pelvis caliceal cavities or renal collection.^[2,6,8-10,12] The under ultrasound guidance drainage is less efficient than the scanning appliance control. The number of punctures depends on the size of the collection and the evolution after the first drainage.

Some authors recommend percutaneous drainage in specific cases^[11,14] as patients who can't tolerate general anaesthesia or if emphysematous pyelonephritis is localized as was the two case-reports in our observations. It's also indicated in patients with a single kidney. This conservative treatment requires careful monitoring in intensive care units with regular scannographic checks. G.Gerzof and coll. have demonstrated the efficacy of percutaneous drainage even for multilocular lesions and extensive abscesses. CHEN^[8] published series of 25 patients whom had emphysematous pyelonephritis (12 type I and 13 type II). They were all treated with percutaneous drainage associated to medical treatment. 92% of the patients had a favourable evolution and there were no difference between the two types I or II. The drainage lasts 5 weeks as a mean time. The duration depended on the importance of the collection and the extent of the necrosis.

CONCLUSION

Emphysematous pyelonephritis is a rare and serious condition. Abdominal CT is the key consideration, and

it allows early diagnosis to study the extent of lesions and thus contributes to the therapeutic decision regarding the conservative or radical treatment.^[15,29] The support must be immediate, with a short ICU followed by emergency nephrectomy. Drainage associated with medical treatment per skin is a good alternative, it keeps the kidney in some forms of localized NCB bilateral or occurring solitary kidney.

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Conflicts of interest

There are no conflicts of interest.

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