

# Emphysematous pyelonephritis treated successfully with conservative management: A case report

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## ABSTRACT

**Introduction:** Emphysematous pyelonephritis (EPN) is defined as an acute, severe necrotizing infection of the renal parenchyma and peri-renal tissue, which results in the presence of gas within the renal parenchyma, collecting system or perinephric tissue. EPN is a rare, life-threatening condition. Traditionally, immediate nephrectomy was the treatment of choice for such cases which posed high mortality rate (up to 40%). Recently, the mortality rates are reducing because of improved staging modalities due to better imaging modalities and effective antibiotics, percutaneous catheter drainage, double J stenting. **Case Report:** A 63-year-old female, known case of ischemic heart disease, hypertension and long standing diabetes mellitus type II on insulin presented with picture suggestive of extensive emphysematous pyelonephritis. Due to her

comorbidities and high risk for any anesthesia or major surgical intervention, we opted to treat patient conservatively with hydration, IV fluids, antibiotics and percutaneous nephrostomy drainage. Patient had a very successful course and she was fully recovered with conservative therapy. **Conclusion:** Minimal invasive technique like percutaneous nephrostomy drainage can be considered as a safe and valid modality of treating selected patients with extensive emphysematous pyelonephritis thus reducing risk of mortality and major alternative procedures.

**Keywords:** Conservative, Emphysematous Pyelonephritis, Kidney, Percutaneous nephrostomy

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## INTRODUCTION

The term Emphysematous Pyelonephritis (EPN) was first proposed by Schultz and Klorfein in 1962 [1]. The first case was reported by Kelly and MacCullum in 1898 [2]. EPN is defined as an acute, severe necrotizing infection of the renal parenchyma and peri-renal tissue, which results in the presence of gas within the renal

parenchyma, collecting system or perinephric tissue. [3–7]. It's more common in elderly diabetic females with mean age of 55 years [2, 8, 9]. The exact mechanism of pathogenesis is still not fully understood, nevertheless, few theories have been suggested in the literature [4,10-12]. The clinical presentation varies from one patient to another and ranges from being asymptomatic to having a severe sepsis [13]. EPN is considered as an uncommon disease with no clear-cut guidelines for diagnosis and management [14]. In former times, Nephrectomy was the treatment of choice for all cases, Consequently, surgery was interrelated with 40-50% mortality rate. Nowadays, minimally invasive approaches have been developed to decrease the mortality rate and to salvage the renal unit function with the era of technology and advanced imaging [15–16]. Herein, we report a case of EPN in a diabetic lady, which was managed successfully by a conservative treatment.

## CASE REPORT

A 63-year-old female, known case of Diabetes Mellitus type 2 on insulin, Hypertension and Ischemic Heart Disease presented to the emergency department with a history of severe right flank pain and fever from the last four days. The pain was severe, dull in nature, located in the right flank, radiating to the right upper quadrant, not relieved by analgesics, associated with dysuria, one episode of nausea and vomiting. She gave history of recurrent urinary tract infections. She was admitted in another hospital and given Tazocine and Clindamycine empirically then shifted to our hospital for further management.

Upon examination the vitals were Blood pressure= 105/52 mmHg, heart rate= 71 bpm, respiratory rate: 18 bpm, temperature= 37.0 °C, saturation in room air is 98%, connected to intravenous fluids and Foley's catheter. Local examination of abdomen reported soft and lax, moderate tenderness over right costovertebral angle, positive bowel sounds.

Laboratory examination showed leukocytosis ( $19.8 \times 10^9/L$ ), anemia (Hgb 8.6 g/dl), hyponatremia (128 mEq/L), hypokalemia (3.2 mEq/L), elevated creatinine (146  $\mu\text{mol/L}$ ), hypoalbuminemia (18 g/L), hyperglycemia (14.58 mmol/l), elevated hemoglobin A1C (10.5). Urine analysis was acidic, light yellow in color, hazy, pyuria (50-100), microscopic hematuria (2–5), positive for leukocyte esterase, negative for nitrite.

Regarding imaging, chest X-ray showed pulmonary edema and moderate cardiomegaly. Abdomen and pelvic non-contrast CT-scan showed significant enlargement of the right kidney, presence of air within right renal parenchyma except the lower pole, air in the right renal pelvis and right renal vein, focus of air in the inferior vena cava (IVC) at the renal level and poor enhancement [Figure 1]. Also, mild to moderate right ureteric dilatation with mucosal thickening suggestive of infectious and inflammatory disease, and moderate

perinephric fat stranding with non-drainable free fluid (Figure 1).

Diagnosis of emphysematous pyelonephritis was confirmed, and she was admitted for conservative management which includes fluid resuscitation, wide spectrum intravenous antibiotic (Tazocine and Metronidazole), blood sugar control, and monitoring of clinical statuses. Right nephrostomy size 8.5 Fr and perinephric drainage tube size 6 Fr insertion was done in the second day of admission by interventional radiologist, the drain drained minimal yellow pus less than 50 ml daily that was sent for culture.

During hospital admission, patient was doing well with much improvement of her condition and had on/off fever (38.5 °C) during the first four days of admissions that responded to intravenous Paracetamol. The initial blood and urine culture were negative but the pus culture was positive for *Citrobacter Koseri*, which was sensitive to Tazocine so we continue the same management. Cardiology team evaluated the patient and decided that she was in a high risk for nephrectomy. Abdomen and pelvic non-contrast CT-scan was done seven days later and showed interval reduction of air foci and streaks at the right kidney with interval resolution of air mottled in the right renal vein, renal pelvis, IVC and right ureter. Also, pulmonary edema improved. On the 11<sup>th</sup> day, re-adjustment of drain was done and it was changed to a bigger size (10 Fr) for better drainage of perinephric collection. Her WBC counts and renal function dropped gradually. Nephrostomy tube was clamped but she developed pain and fever then it was unclamped. Two weeks after, we counseled the patient after stabilization of her condition either to go for nephrectomy with high risk due to cardiology issues or long term conservative therapy in the form of percutaneous drainage that might last for 3 months. She refused any surgical intervention since she's improving and agreed to continue conservative course. We repeated the abdomen and pelvic non-contrast CT-scan and it showed mild interval decrease in the size of right kidney with decrease internal air loculi and interval resolution of the bilateral pleural effusion. After few days, we followed up with a chest X-ray and it was clear. On the 24<sup>th</sup> day, her labs were within normal, Foley's catheter was removed, and she was discharged home with draining nephrostomy, drainage tube, oral antibiotic Bactrim 960 mg twice daily for one month, and to be followed up with abdomen and pelvic non-contrast CT-scan and laboratory workup two weeks later.

After 45 days, nephrostogram was done as an outpatient and it showed normal patent right pelvicalyceal and ureter. Thus, nephrostomy tube and drainage tube were removed and we stopped the oral Bactrim.

After 75 days, another abdomen and pelvic non contrast CT-scan was done and it showed a significant reduction of the internal air loculi in the right renal mid pole and wall thickening. On the other hand, it showed 2.5 cm cystic lesion in the right renal upper pole, which is most likely an abscess, interventional radiologist was consulted and we decided it doesn't need any intervention since it's too small.

Table 1: Wan et al EPN classification

Type	CT scan findings	Characterized by	Mortality rate
1	Renal necrosis with presence of gas but no fluid	Reduced immune response limits the formation of pus collection and this leads to the spread of the inflammation culminating in a fulminant course of the disease	70%
2	Parenchymal gas associated with fluid in renal parenchyma, perinephric space, or collecting system	A better immune response results in the formation of pus in the kidney, leading to a slower course of the disease and better prognosis	16%

Table 2: Huang and Tseng EPN classification:

Class	Subclass	CT scan findings	Management plan
Class I		Gas in collecting system only	Percutaneous procedures and antibiotics
Class II		Parenchymal gas only	
Class III	Class IIIA	Extension of gas into perinephric space	Less than two risk factors: 85% survival rate with percutaneous drainage and antibiotics.
	Class IIIB	Extension of gas into pararenal space	
Class IV		EPN in solitary kidney, or bilateral disease	Two or more risk factors: 92% failure rate with percutaneous drainage and antibiotics

After 180 days, last abdomen and pelvic non contrast CT-scan was done and it showed almost complete resolution of the abscess (Figure 2). She's still on regular follow up with clinical, laboratory, and radiological investigations on our urology clinic.

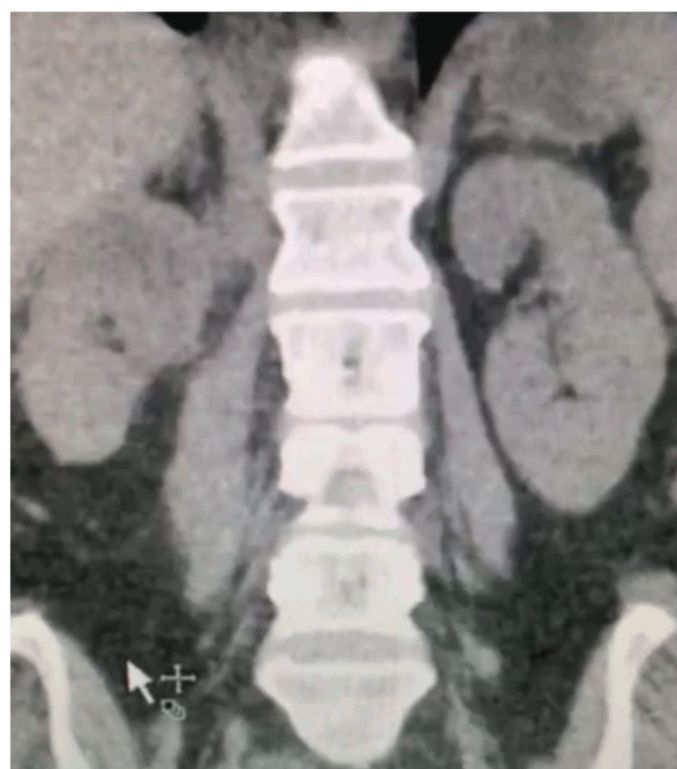


Figure 2: Post conservative therapy, complete resolution of gas within right renal parenchyma and right renal pelvicalyceal system.

## DISCUSSION

Emphysematous pyelonephritis (EPN) is considered a rare, life-threatening condition. It's defined as an acute, severe necrotizing infection of the renal parenchyma and peri-renal tissue, which results in the presence of gas within the renal parenchyma, collecting system or perinephric

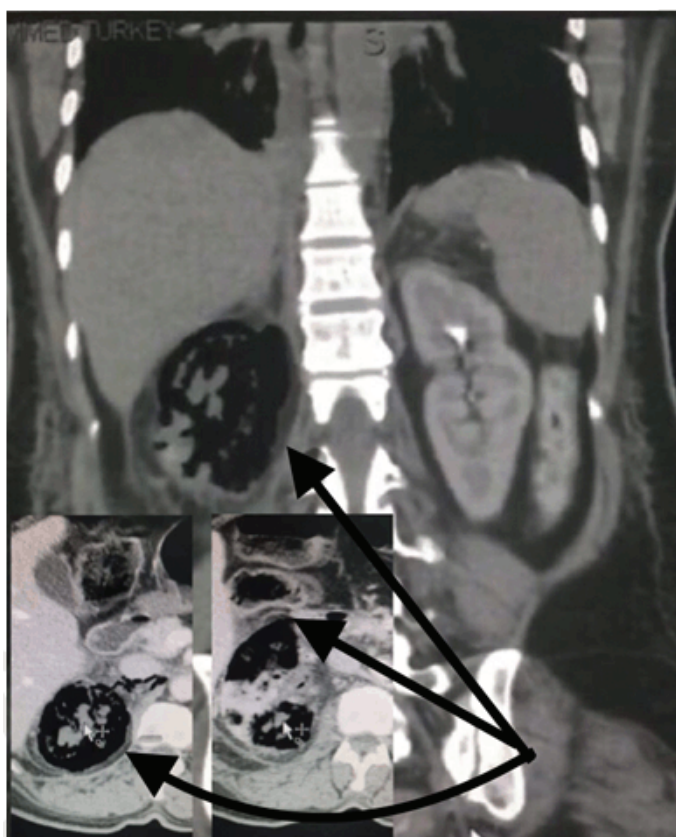


Figure 1: Initial images, enlarged right kidney and replaced by gas in comparison to the left kidney. Also, there is air within right pelvicalyceal system with the diagnosis of an extensive right emphysematous pyelonephritis.



tissue [3–7]. It is more common in elderly (mean age is 55 years) females with the left kidney being more frequently involved (90–95% of all cases) [3–8].

The exact mechanism of pathogenesis is still not fully understood, nevertheless, few factors have been identified: 1-High level of tissue glucose, 2-Glucose-fermenting bacteria, 3-Impaired host immunity, 4-Decreased tissue perfusion and 5-Urinary tract obstruction in nondiabetics [7, 9–11, 17]. The most common organisms involved are *E. coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Aerobacter aerogenes*, *Citrobacter* and rarely yeast [16]. Gas formation in EPN is due to pathogenic bacteria causing mixed acid fermentation in a hyperglycemic environment in tissues that are ischemic, which results in tissue destruction and encourages purulent infection and inhibition of removal of locally produced gas [18]. Prognostic risk factors include altered consciousness level, thrombocytopenia, hypotension, and acute renal failure. Factors such as age, sex, site of infection, and blood glucose level have not been found to have rule in determining prognosis [7, 10].

The clinical presentation varies from one patient to another and ranges from being asymptomatic to having a severe sepsis [13]. When symptomatic, patient present with fever, flank pain, and pyuria which suggest severe acute pyelonephritis, however, these are non-specific symptoms and it may delay diagnosis. In addition, patient may present with abdominal pain, nausea, vomiting, depressed levels of consciousness, shock, renal angle tenderness, dysuria, crepitations in the flanks, and pneumaturia [1, 4, 10, 19, 20].

Diagnosis of EPN is mainly radiological. KUB can show abnormal gas shadow in the renal region and typical ultrasonographic image is a high amplitude echoes with low level dirty acoustic shadow. Yet, CT is the most effective radiological method to confirm the diagnosis. It shows intra-renal gas with or without perirenal region and parenchymal destruction [3]. Two classifications had been reported in literature, both are based on CT findings. The first classification is by Wan et al. where he divides EPN into two types which has a rule in defining prognosis: type1 which has renal necrosis with presence of gas without fluid with mortality of 70% and type 2 which has parenchymal gas associated with fluid in parenchyma, perinephric space, or collecting system with mortality of 16% (Table 1) [4, 10, 17]. A more detailed staging has been written by Haung et al. This classification is more used due to its better prognostic value and help in selecting a management plan. Hang and Tseng classification divided in four types based on site of presence of gas and unilateral or bilateral disease (Table 2) [10, 21].

Treatment of EPN initially involves fluid and electrolyte resuscitation, antibiotic therapy, glycemic control, and relief of urinary tract obstruction. In former times, nephrectomy was the treatment of choice for all cases. Consequently, it was interrelated with 40–50% mortality rate. Nowadays, minimally invasive approaches

have been developed to decrease the mortality rate and to salvage the renal unit function with the era of technology and advanced imaging [15–16, 22].

There are many reports where a conservative treatment has been found to be successful with a combination of good metabolic control and antibiotics. We believe that percutaneous drainage in some selected cases with EPN, like bilateral EPN, localized EPN, EPN in solitary kidney, patients who cannot tolerate general anesthesia or unfit due to multiple comorbidities (like in our case) is a safer option with less mortality yet effective treatment modality. This is supported by many other published data. [16, 19, 21, 23, 24].

## CONCLUSION

Emphysematous pyelonephritis (EPN) is a rare, life-threatening condition. Traditionally EPN was treated with immediate nephrectomy which posed high mortality rate (up to 40%). Recently, the mortality rates are reducing because of improved staging modalities due to better imaging modalities and effective antibiotics, percutaneous catheter drainage, double J stenting. Identification of prognostic factors categorize patients for conservative or surgical management. Personally, we recommend all the physicians around the world to report such cases and their mode of treatment to allow for a large meta-analysis study, thus, clear-cut guidelines establishment.

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### Author Contributions

Riyad T. Al Mousa – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Hend Alshamsi – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Khadijah Eid – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Basma Malalla – Acquisition of data, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Ali Al Abandi – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published

Ahmed Al Naami – Substantial contributions to conception and design, Revising it critically for important intellectual content, Final approval of the version to be published

### Guarantor of Submission

The corresponding author is the guarantor of submission.

### Source of Support

None

### Consent Statement

Written informed consent was obtained from the patient for publication of this case report.

### Conflict of Interest

Authors declare no conflict of interest.

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