

Q1 **Emphysematous Pyelonephritis Case Series**
From South India

Q31 Mahesh Eswarappa¹, Sarita Suryadevara¹, Manns Manohar John¹, Mahesh Kumar¹,
Sujeeth Bande Reddy¹ and Mohammed Suhail¹

¹Nephrology, Ramaiah Medical College & Hospitals, Bangalore, India

Introduction: Emphysematous pyelonephritis (EPN) is a rare, life-threatening necrotizing infection of the kidney. The mortality rate for EPN is as high as 25%. We conducted a retrospective study at MS Ramaiah Hospital between January 2011 and May 2016 to observe the clinical, biochemical, and microbiological patterns of EPN at our institute.

Methods: The clinical and laboratory data, imaging findings, and microbiological patterns of 51 patients chosen for the study were recorded. The data were analyzed to identify the prognostic variables that could predict the morbidity and mortality of patients with EPN, and the focus of this study was to determine risk factors for and outcomes of patients who presented with EPN and who required hemodialysis. Primary endpoints were successful treatment and all-cause mortality. Secondary endpoints included need for hemodialysis and the need for a specific treatment.

Results: There was an equal incidence among both sexes (median age: 59 years). Common symptoms were abdominal pain (94.11%), fever (83.2%), dysuria (74.5%), vomiting (72.54%), frequency of micturition (68.62%), oliguria, generalized weakness (66.67%), and breathlessness (66.67%); 98.03% (n = 50) of the patients had diabetes. The most common organism cultured was *Escherichia coli* (37.2%). Nineteen patients (37.2%) required dialysis; their mean age was 60.25 ± 11.74 years. Male sex, diabetes mellitus, shock, high serum creatinine at presentation, and uremic symptoms showed no statistically significant association. Indefinite hemodialysis was required by 12.5% of patients. The antibiotic-treated group had a 100% success rate, whereas the DJ stenting group had 96.42% success rate.

Conclusion: Early diagnosis and broad spectrum antibiotics, together with an appropriately timed intervention, resulted in decreased mortality. Pain in the abdomen and renal angle tenderness were the most common clinical finding. *E. coli* was the most found organism, and early use of broad spectrum antibiotics decreased mortality.

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KEYWORDS: emphysematous pyelonephritis; necrotizing renal infection

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Q6 **E**mphysematous pyelonephritis (EPN) is a rare, severe life-threatening necrotizing renal parenchymal infection that is characterized by the production of intraparenchymal gas. Until the mid-1980s, the standard treatment was nephrectomy of the affected kidney because efforts in preserving the kidney by surgical methods led to mortality from 60% to 80%. However, in recent years, the mortality of EPN patients has decreased to 25% (1%–46%).¹

Q7 EPN occurs most commonly in women, and diabetic populations are at increased risk of infection. In nondiabetic population, the common associated

comorbidities are renal stone disease, structural abnormalities of the urinary tract, and immunosuppression. Although a high tissue glucose level could provide a favorable environment for the growth of gas-producing bacteria in patients with diabetes, this was not associated with increased mortality or need for the dialysis, even in patients with poorly controlled diabetes mellitus (glycosylated hemoglobin [HbA_{1c}] >8%).²

Four factors have been implicated in the pathogenesis of EPN: (i) gas-forming bacteria; (ii) a high tissue glucose level (favoring rapid bacterial growth); (iii) impaired tissue perfusion (diabetic nephropathy can lead to additional compromise of regional oxygen delivery in the kidney, which results in tissue ischemia and necrosis, as well as nitrogen released during tissue necrosis); and (iv) a defective immune response due to an impaired vascular supply. Ureteral obstruction

Correspondence: Mahesh Eswarappa, Nephrology, MS Ramaiah Memorial Hospital, Bangalore, Karnataka 560054, India. E-mail: manasnephro2002@gmail.com

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causes local tissue ischemia that provokes infection. Calculi act as a nidus for infection, and also causes stagnation and reflux of urine.

Although there are no specific symptoms or signs to diagnose EPN, poor response to antibiotic treatment in patients with diabetes mellitus who are believed to have uncomplicated pyelonephritis should immediately arouse suspicion of this life-threatening infection. A prompt computed tomography (CT) scan of the abdomen should be taken to confirm the diagnosis and to plan treatment.

The treatment of EPN has changed over the years from radical nephrectomy to more conservative approaches, such as antibiotics and percutaneous drainage techniques, due to the availability of better imaging modalities.

METHODS

This was a retrospective, observational study conducted at M.S. Ramaiah Medical College and its attached hospitals from January 2012 to September 2016. The data were obtained from the hospital electronic records using *International Classification of Disease* codes. The hospital medical records were searched electronically for EPN keywords using their *International Classification of Diseases* codes.

All patients who were admitted to the Department of Nephro-Urology for management of EPN were chosen for the study after fulfilling the study criteria. Those patients with incomplete data, patients who died of a suspected diagnosis of EPN before the diagnosis was confirmed, or patients who had an early transfer to another center after discontinuing treatment at the study center were excluded from the analysis. The chosen records were then assessed by the Departmental Committee for any incomplete records, and such subjects were also excluded from the study.

Inclusion Criteria

- All age groups; and
- All patients proved to have EPN by ultrasound or CT of the abdomen

Exclusion Criteria

- Incomplete data;
- Mortality with suspected diagnosis before confirming the diagnosis; and
- Early transfer to another center after discontinuing treatment at the study center.

We collected various variables from our chosen subjects that were suspected to have any effect on clinical outcomes, based on our knowledge of similar studies. We collected demographic characteristics and

clinical information, underlying medical conditions, laboratory findings, imaging findings, types of management, and patient outcomes. The clinical features included signs and symptoms at presentation, and the hemodynamic and mental status of the patients. The laboratory variables included hemoglobin, white blood cell count, platelet count, albumin, sodium, HbA_{1c}, serum creatinine levels, serum electrolytes, and the results of urinalysis, blood, and urine cultures.

Once data were obtained, we first analyzed the key clinical and laboratory data that could serve as predictors for a need of hemodialysis and further outcomes. The antibiotic culture sensitivity reports were also analyzed. The study subjects were divided into 3 treatment groups, that is, those on antibiotics alone, those who underwent DJ stenting in addition to receiving antibiotics, and finally, those patients who underwent nephrectomy despite receiving antibiotics and DJ stenting. Nephrectomy was considered if patient had progressive or persistent lesions detected on imaging, and if they had clinical manifestation of unstable hemodynamics or a prolonged fever.

The key variables were defined per standard definitions used in the literature and are shown in [Table 1](#).

Clinical, biochemical, and microbiological data were recorded in a tabular form. Data were analyzed using SPSS version 20.0 for Windows (IBM, Armonk, New York). Quantitative variables were expressed as mean \pm SD, whereas qualitative data were presented as the number of observations with percentages. Continuous data were compared by using Student's *t*-test. Paired data were analyzed by an independent sample *t* test. Univariate analysis was performed to identify risk factors of morbidity. A *P* value <0.05 was considered significant.

Table 1. Definitions

Parameter	Definition
Emphysematous pyelonephritis (EPN)	In accordance with the classification system of Huang and Tseng, ³ which is based on the extent of air seen on CT, patients were divided into the following 4 types of EPN: <ul style="list-style-type: none"> • Class 1: Gas in the collecting system only; • Class 2: Gas in the renal parenchyma without extension to the extrarenal space; • Class 3: <ul style="list-style-type: none"> ○ Class 3A, extension of gas or abscess to the peri-nephric space; ○ Class 3B, extension of gas or abscess to the pararenal space; • Class 4: Bilateral EPN or a solitary kidney with EPN
Recurrent EPN	Both clinical presentation of sepsis and progressive lesions disclosed on the image study were noted within 3 months after adequate treatment of EPN
Thrombocytopenia	A platelet count $<120,000/\text{ml}$
Hypoalbuminemia	A serum albumin $<3.0\text{g/dl}$
Hyponatremia	A serum Na $<135\text{mEq/L}$
Severe hyponatremia	A serum Na $<125\text{mEq/L}$
Shock	A systolic blood pressure $<90\text{mm Hg}$
Anemia	Hb% $<11\text{g/dl}$

CT, computed tomography; Hb, hemoglobin; Na, sodium.

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