

Prognostic Factors Determining Outcome in Emphysematous Pyelonephritis – A Tertiary Care Center Experience

ABSTRACT

Introduction and Objective: Emphysematous pyelonephritis (EPN) is an acute necrotizing parenchymal and perirenal infection caused by gas-forming organisms commonly occurring in diabetic patients. A discreet evaluation of these patients for specific prognostic factors is extremely important. Objective was to study impact of individual prognostic factors on need for nephrectomy and outcome with regard to mortality in these patients. **Materials and Methods:** A total of 147 cases of EPN were prospectively studied at Goa Medical College between April 2008 and March 2022. Their mode of presentation, comorbid conditions, severity of sepsis, and five prognostic factors (altered sensorium, shock, acidosis, thrombocytopenia, and need for dialysis) were analyzed. All cases initially underwent DJ stenting/percutaneous nephrostomy/percutaneous drain insertion. **Results:** All patients were found to be diabetic. Ninety-six patients had acidosis on presentation, 75 patients presented in shock, and 45 in altered sensorium. Sixty-six patients had obstructed system. Thirty patients underwent nephrectomy and overall mortality was 17%. Among four prognostic factors found statistically significant, altered sensorium followed by acidosis had the highest odd's ratio with maximum impact on the outcome of patients (logistic regression test). **Conclusion:** Among five prognostic factors studied, the presence of altered sensorium followed by acidosis was found to have maximum impact on the need for nephrectomy and mortality. In cases of EPN, the need for nephrectomy after minimally invasive intervention depends not only on the class of EPN but also on general condition of patient and involvement of other systems in the cascade of sepsis.

Key words: Emphysematous pyelonephritis, Nephrectomy, Prognostic factors

INTRODUCTION

Emphysematous pyelonephritis (EPN) is a urologic emergency characterized by an acute necrotizing parenchymal and perirenal infection caused by gas-forming uropathogens.^[1] This term was first used in 1962 by Schultz and Klorfein.^[2] The most common causative organisms include *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Aerobacter aerogenes*, and rarely yeast.^[3,4] Diabetes mellitus is associated with EPN in 70–90% of cases and has a high mortality rate of approximately 75% along with need for urgent nephrectomy.^[5] Management should include fluid resuscitation, broad-spectrum antibiotics, and relief of urinary tract obstruction according to the hemodynamic status. In recent years, treatment has evolved from surgical approaches to more conservative approaches in the form of medical management and percutaneous drainage (PCD).^[6] A discreet evaluation of these patients for specific prognostic factors is extremely important. Our objective was to study the impact of individual prognostic factors on need for nephrectomy and outcome with regard to mortality in these patients.

MATERIALS AND METHODS

A total of 147 cases of EPN were prospectively studied at Goa Medical College between April 2008 and March 2022.

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Their mode of presentation, comorbid conditions, severity of sepsis, and five prognostic factors (altered sensorium, shock, acidosis, thrombocytopenia, and need for dialysis) were analyzed. Diagnosis of EPN was made by clinical history and examination, radiological investigations (ultrasonography and non-contrast CT scan), and blood investigations including complete hemogram, renal function tests, and arterial blood gas analysis. All cases initially underwent DJ stenting/percutaneous nephrostomy/percutaneous drain insertion.

RESULTS

All the patients were found to be diabetic. Mean age of presentation was 58.1 years (range 32–88 years) with a female

preponderance (female: male–3:2). Ureteric obstruction was found in 66 patients (44.8%). Bacteriological study of the urine culture done showed that the most common organism isolated was *E. coli* (74.1 %) followed by *Klebsiella* (17%) and *Proteus* (2%). Mixed growth was seen in 7%. Twenty-eight patients had a bilateral involvement. Patients were classified based on the CT scan findings according to Huang and Tseng, as shown in Table 1.

Initially, all 147 patients were managed with minimally invasive procedures. Subsequently, 30 patients underwent nephrectomy at a later stage. Table 2 shows the impact of class of EPN on management and the mortality rate in each class of EPN.

Five prognostic factors, that is, altered sensorium, shock, acidosis, thrombocytopenia, and need for dialysis were analyzed in the study and patients were grouped into two based on the number of prognostic factors present (Group 1 ≤ 3 factors and Group 2 > 3 factors). Table 3 shows

Table 1: Classification of EPN

Class of EPN	Description	No. of patients (n=147)
Class 1	Gas in collecting system only	28
Class 2	Gas present in renal parenchyma without extra renal extension	63
Class 3 ^a	Gas/abscess in perinephric area	19
Class 3 ^b	Gas/abscess in pararenal area	8
Class 4	Bilateral EPN or EPN in solitary kidney	29

Table 2: Management and mortality in different classes of EPN

Class of EPN	Minimally invasive procedures sufficed	Delayed nephrectomy	Mortality
Class 1 (n=28)	27	1	1
Class 2 (n=63)	55	8	5
Class 3 (n=27)	11	16	14
Class 4 (n=29)	24	5	5

Table 3: Nephrectomy and mortality based on prognostic factors

Group	Minimally invasive procedures sufficed (n=117)	Delayed nephrectomy (n=30) (%)	Mortality (n=25) (%)
Group 1 (≤ 3 prognostic factors) (n=110)	102	8 (7.2)	8 (7.27)
Group 2 (> 3 prognostic factors) (n=37)	15	22 (59.4)	17 (45.9)
Total patients (n=147)	117	30 (20.4)	25 (17)

the nephrectomy and the mortality based on the number of prognostic factors present.

Further, we studied association of individual prognostic factors with the management and mortality rate, as shown in Table 4. Among the five prognostic factors, altered sensorium followed by acidosis had the highest odd's ratio with maximum impact on the outcome of patients (logistic regression test), as shown in Table 5.

DISCUSSION

Kelly and MacCallum reported the first case of EPN in 1898.^[7] EPN constitutes a serious condition that may present as a life-threatening disease. Acute renal infection in patients with diabetes mellitus with *E. coli* or *K. pneumoniae* with/without obstruction of urinary tract is the cornerstone for the development of EPN.^[8] Over the years, many authors have published different prognostic factors which are involved in the outcome of EPN. According to Ubee *et al.*, prognostic factors such as systolic blood pressure lower than 90 mmHg, altered mental status, and raised serum creatinine were found to be associated with mortality.^[9] Serum creatinine was the most reliable predictor of outcome according to Wan *et al.*^[10] A study by Aswathaman *et al.* showed that thrombocytopenia, shock, altered sensorium, and hemodialysis were the risk factors for mortality. The success rate with conservative management was 100% in the absence of risk factors. However, in the presence of one, two, and three risk factors, the mortality rate was 27%, 75%, and 100%, respectively.^[11] For localized EPN (classes 1 and 2), percutaneous drain combined with antibiotic treatment can provide a good outcome.^[8]

In a study by Park *et al.* of 17 patients, 10 patients underwent nephrectomy of which nine survived.^[12] The study concluded that immediate nephrectomy with glycemic control measures and antibiotic administration is crucial for the successful treatment of EPN. However, in patients not fit for immediate surgery, PCD can be an effective treatment option.^[12] Alsharif *et al.* recommended conservative management as a first-line therapy for patients with EPN.^[13] According to Alsharif *et al.*, the goal of our management should be kidney preservation and improvement of the quality of patients life, not ending them into dialysis dependency when they could have the chance to preserve their kidney, keeping nephrectomy as the last resort for those who fail to respond to conservative management.^[13] Patients with higher class of EPN (III and IV) with altered sensorium and thrombocytopenia at presentation have higher mortality and may require a more aggressive surgical approach.^[14] According to Olvera-Posada *et al.*, altered consciousness, hyperglycemia, elevated leukocyte count, and multiple organ failure are indicators of poor prognosis, and invasive management should be used judiciously.^[15] Shock at initial admission indicated a poor prognosis and warranted immediate attention according to a study by Krishnamoorthy *et al.*^[16]

Table 4: Association of prognostic factors with the management and mortality

Prognostic factors	Number of patients (n=147)	Minimally invasive procedures sufficed (n=110)	Delayed nephrectomy (n=30)	Mortality (n=25)
Shock	75	48	27	23
Altered sensorium	45	19	26	21
Acidosis	96	66	30	24
Thrombocytopenia	36	19	17	12
Need for dialysis	29	18	11	10

Table 5: Association and risk estimation of individual prognostic factors with mortality

Prognostic factors	Association with mortality (by Pearson Chi-square test)	Risk estimation with mortality
Shock	P<0.00001	Odds ratio=15.48
Altered sensorium	P<0.00001	Odds ratio=21.43
Acidosis	P=0.0004	Odds ratio=16.66
Thrombocytopenia	P=0.0026	Odds ratio=3.76
Need for dialysis	P=0.0069	Odds ratio=3.47

CONCLUSION

Minimally invasive procedure is a good option to preserve renal units in the management of patients of EPN, especially in those with three or less prognostic factors. Prognosis depends not only on class of EPN but also on number of poor prognostic factors. In patients with more than 3 prognostic factors, initial treatment with minimally invasive procedure helps in achieving better final outcome. Among all prognostic factors, altered sensorium and acidosis had maximum impact on the management and outcome of patient.

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