



EMPHYSEMATOUS PYELONEPHRITIS : OUTCOMES WITH CONSERVATIVE MANAGEMENT IN A TERTIARY CARE CENTER

Dr.k.sitharamaiah*	Professor and Hod, Department Of Urology,kurnool Medical College,kurnool*Corresponding Author
Dr.Chenna Saikrishna	Urology Resident, Kurnool Medical College,kurnool
Dr.P.Mutyasri	Associate Professor , Department Of Urology,kurnool Medical College,kurnool
Dr.Raja Reddy	Assistant Professor, Department Of Urology,kurnool Medical College,kurnool
Dr.Bala Ravi Teja	Assistant Professor, Department Of Urology,kurnool Medical College,kurnool

(ABSTRACT) **INTRODUCTION:** Emphysematous pyelonephritis (EPN) is a urologic emergency characterized by an acute necrotizing parenchymal and perirenal infection caused by gas-forming uropathogens. A majority of cases occur in patients with diabetes mellitus (DM). **AIMS AND OBJECTIVES:** The aim of this study was to analyze the characteristics of patients with EPN with respect to patient demographics, clinical presentation, diagnostic investigations, microbiological findings, treatment modality and outcome, and the influence of prognostic factors on the outcome. **MATERIALS AND METHODS:** This is the prospective study of 21 patients diagnosed with EPN conducted at Government General Hospital, kurnool during the period of January 2021 to May 2022. We applied the reported prognostic factors to our patients to find out whether these factors correlated with failure of conservative treatment. **RESULTS:** Out of 21 patients we studied, 10 (47.6%) patients had more than two bad prognostic factors. 7 patients had class 1 or 2 EPN and all patients improved with either medical management alone or with medical management and DJstenting (DOUBLE J). 14 patients had class 3 or 4 EPN and all patients improved with medical management or medical management with percutaneous drainage or medical management with percutaneous drainage and DJ stenting. **CONCLUSION:** Based on the results of our study, we concluded that patients with class 1 and 2 EPN should be treated with medical management based on culture reports, if not improving, then plan for DJ stenting. Patients with class 3 EPN with extensive air pockets or perinephric or paranephric collection should be treated with medical management first based on culture reports, if not improving then plan for percutaneous drainage.

KEYWORDS: Emphysematous pyelonephritis, prognostic factors, outcomes, dj stent, percutaneous drainage.

INTRODUCTION :

Emphysematous pyelonephritis is a urologic emergency characterized by an acute necrotizing parenchymal and perirenal infection caused by gas-forming uropathogens (1). In the literature, the first case of EPN was reported by Kelly and MacCallum in 1898 (2). Over half a century later, the term "emphysematous pyelonephritis" was recommended by Schultz and Klorfein because of its emphasis on the relationship between the gas formation and the nature of the infectious process (3). The pathogenesis is poorly understood. A majority of cases occur in patients with diabetes mellitus (DM). It has been postulated that the high tissue glucose levels provide the substrate for microorganisms such as E. coli, which are able to produce carbon dioxide by the fermentation of sugar (1). In addition to diabetes, many patients have urinary tract obstruction associated with urinary calculi or papillary necrosis and significant renal functional impairment. The overall mortality rate has been reported to be between 19% (4) and 43% (5). In EPN, early aggressive medical treatment may avoid nephrectomy. EPN is a life-threatening infection with a mortality rate as high as 80% in earlier studies. (6,7)

AIMS AND OBJECTIVES :

The aim of this study was to analyze the characteristics of patients with EPN with respect to patient demographics, clinical presentation, diagnostic investigations, microbiological findings, treatment modality and outcome, and the influence of prognostic factors on the outcome.

MATERIALS AND METHODS :

This is the prospective study of 21 patients diagnosed with EPN conducted at Government General Hospital, kurnool during the period of January 2021 to May 2022. The diagnosis of EPN was based on clinical features and documentation of gas within the renal parenchyma, collecting system, or perinephric tissue on computed tomography (CT) of abdomen. We evaluated the clinical, laboratory, radiological, and microbiological findings, treatments given, and outcome. The severity of EPN was graded as per the Huang classification. The severity of EPN was graded as per the Huang classification. According to this classification, class 1 EPN is defined as gas in the collecting system only, class 2 as gas in the renal

parenchyma with no extension to the extrarenal space, class 3A as extension of gas or abscess to the perinephric space, class 3 B as extension of gas or abscess to the pararenal space, and class 4 as bilateral EPN or EPN in a solitary kidney (4). Certain factors have been associated with poor outcome. These include grade of EPN, shock (systolic blood pressure less than 90 mm hg at presentation), altered consciousness, need for emergency hemodialysis, thrombocytopenia, polymicrobial infection, azotemia. We applied the reported prognostic factors to our patients to find out whether these factors correlated with failure of conservative treatment (which includes both medical management and minimally invasive treatment in the form of double J stenting or percutaneous intervention). The success of conservative treatment was defined as clinical resolution of symptoms, decreased wbc counts, and disappearance or decrease of gas on follow up imaging. As per the protocol followed in our department, the treatment included adequate fluid resuscitation, rapid control of blood sugar levels, antibiotics, close clinical and biochemical monitoring and if the patient is not improving, then minimally invasive management in the form of double J stenting or percutaneous intervention. The antibiotics were revised according to culture reports.

RESULTS: Among the 21 patients studied, 11 patients are female and 10 are male. Mean age is 53.76 years (21-70 yrs), 18 (90.4%) patients are diabetic, 5 (23.8%) pts had calculi. Clinical manifestations included fever (66.6%), loin pain (95.2%), vomitings (38%), pyuria (52%), pneumaturia (9%), 2 (9.5%) patients are without any comorbidities. 42.8% patients had left sided EPN, 47.6% patients had right sided EPN, bilateral in 9.5% of patients. Severity of EPN is classified on the basis of CT findings using HUANG TSENG classification. Among them 2 (9.5%) patients belong to class 1, 5 (23.8%) patients belong to class 2, 5 (23.8%) patients belong to class 3a, 7 (33.3%) patients belong to class 3b, and 2 (9.5%) patients belong to class 4. Of 21 patients studied, leucocytosis present in 21 patients, three patients had hypotension at the time of admission with systolic blood pressure of less than 90 mm of hg. Thrombocytopenia in 4 patients, mean creatinine of 2.54 mg/dl with range of (0.5-10.4), mean blood sugar level of 225.67 mg/dl with range of (74-379). Three patients underwent hemodialysis. Microbiological analysis showed E. coli in 13 patients, klebsiella in 4 patients and 4 patients are culture

negative.

We have considered DM, thrombocytopenia, hypotension, need for emergent hemodialysis at the time of admission, and presence of renal calculi, altered sensorium as bad prognostic factors and applied these factors on our subjects to evaluate for outcomes. We have divided our subjects into those who belong to class 1 and class 2 with presence of less than 2 and more than 2 bad prognostic factors and those who belong to class 3 and class 4 with presence of less than 2 and more than 2 prognostic factors and evaluated the outcome with medical management, medical management with DJ stenting, medical management with percutaneous drainage, medical management with DJ stenting and percutaneous drainage and nephrectomy and results are shown in the table

Table1 PATIENT CHARACTERISTICS,LATERALITY,CLASS OF EPN

CHARACTERISTICS	n
Age (in yrs)*	53.76(11.59)
Female	11(52.3)
Male	10(47.6)
DM	19(90.4)
Renal stones	5(23.8)
Fever	14(66.6)
Flank pain	20(95.2)
Vomitings	8(38)
Pyuria	5(23.8)
Pneumaturia	2(9.5)
No comorbidities	2(9.5)
Left EPN	9(42.8)
Right EPN	10(47.6)
Bilateral	2(9.5)
HUANG CLASS	
CLASS I	2(9.5)
CLASS II	5(23.8)
CLASS IIIA	5(23.8)
CLASS IIIB	7(33.3)
CLASS IV	2(9.5)

n = number of patients, in brackets percentage of patients, *SD for age

Table 2 LABORATORY CHARACTERISTICS

Laboratory characteristics	Mean(SD)
Leucocytosis(>10,000 cells/mm3)	16,200 (5,210)
Thrombocytopenia(<1.2laks/mm3)	2.07 laks(1.02laks)
Creatinine	2.54(2.29)
RBS	225.67(96.84)

Table 3 RESULTS WITH INTERVENTION

CT CLASS	PROGNOSTIC FACTORS	MEDICAL ALONE	MEDICAL AND DJS	MEDICAL AND PCD	M + P + DJS	NEPHRECTOMY	SURVIVAL
1 & 2 n=7	<2 = 5 >2 = 2	4 0	1 2	0 0	0 0	0 0	5 2
3 & 4 n=14	<2 = 6 >2 = 8	2 1	0 0	3 5	1 2	2 0	6 8

DISCUSSION :

EPN is a necrotising infection predominantly seen in patients with diabetes. About 90.4% of our patients are diabetic with almost equal male:female ratio. In our study apart from diabetes, renal calculi(both obstructive and staghorn) also contributed to the development of EPN. The most common clinical features in our study and reported by others include fever, flank pain, vomitings but this doesn't differentiate EPN from usual pyelonephritis. Pneumaturia (9.5% of our patients) though rare can provide some clue to the presence of EPN. Patients with DM and presenting with features of pyelonephritis and having poor response to antibiotic treatment should arouse the suspicion of this life threatening infection and prompt an early CT abdomen to clinch the diagnosis and plan treatment. Pathogenesis of EPN include gas forming bacteria, high tissue glucose concentrations, impaired tissue perfusion and defective immune response which occurs in patients with DM. The high tissue glucose level acts as a substrate for bacteria to produce CO₂ by fermentation. In a study by Huang et al., all the six

gas samples collected contain CO₂. E.Coli is the most common causative organism involved in EPN, other commonly involved organisms include proteus mirabilis, K.pneumoniae, Entorococcus species and P.aeruginosa. (8,9,10). We also found E.coli as the most common organism involved(62%) and the next most common being klebsiella species(19%)

In EPN, left kidney is more frequently involved than the right. A recent meta-analysis has reported that 52% of patients had left-sided, 37.7% right-sided, and 10.2% bilateral EPN.(9). In our study, 42.8% had left sided, 47.6% had right sided and 9.5% had bilateral EPN.

Some studies have focused on the factors that are associated with poor outcome in EPN. Wan and Rullard reported that thrombocytopenia, azotemia, and hematuria were predictors of poor outcome in EPN.(11) Huang et al. have reported that initial presentations of thrombocytopenia, altered consciousness, severe proteinuria, shock (systolic BP <90 mmHg), and extension of infection to the perinephric space are significantly associated with mortality.(4) A recent meta-analysis has reported that in patients with EPN, shock is associated with high mortality rate.(9)

Out of 21 patients we studied, 10 (47.6%) patients had more than two bad prognostic factors. 7 patients had class 1 or 2 EPN and all patients improved with either medical management alone or with medical management and DJstenting. 14 patients had class 3 or 4 EPN and all patients improved with medical management or medical management with percutaneous drainage or medical management with percutaneous drainage and DJ stenting. 2 patients underwent delayed nephrectomy after recovery from EPN as they showed non functioning kidney on follow up DTPA scan and both of them had a smooth post operative recovery.

The treatment of EPN is controversial. Traditionally, early nephrectomy has been considered the treatment of choice in EPN. However, surgery is often poorly tolerated in EPN due to poor hemodynamic status; the mortality rate in a series by Ahlering et al. advocating emergency nephrectomy was 42%.(12). Kapoor et al. have also reported that early nephrectomy is associated with higher mortality rates than an initial conservative approach.(13).The treatment of EPN has evolved over the years from invasive surgery to more conservative approaches due to the availability of better imaging modalities, potent antibiotics, and image-guided drainage. Over the last two decades, improvements in management techniques have drastically reduced the mortality rate of EPN to 21%.(14,15).A recent meta-analysis has shown that compared to emergency nephrectomy, percutaneous drainage and medical management alone are associated with a significantly lower mortality rate.(9). Our results also reflect the evolving trends in the management of EPN.

CONCLUSION :

In our study, we observed that most of our patients had DM with equal male to female distribution, 33% had class 1 or 2 and 67% had class 3 or 4 EPN. E. coli was isolated in 62% of patients and klebsiella in 19% of patients. Considering the results in our study, we concluded that patients with class 1 and 2 EPN should be treated with medical management based on culture reports, if not improving, then plan for DJ stenting. Patients with class 3 EPN with extensive air pockets or perinephric or paranephric collection should be treated with medical management first based on culture reports, if not improving then plan for percutaneous drainage. With this management protocol, we achieved 100% improvement in our patients and only 2 patients went on for delayed nephrectomy in the follow up due to the presence of non functioning kidney on renogram.

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