



E-ISSN: 2616-3470
P-ISSN: 2616-3462
© Surgery Science
www.surgeryscience.com
2019; 3(3): 68-72
Received: 11-05-2019
Accepted: 13-06-2019

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Clinical profiles and outcomes of emphysematous pyelonephritis: A single center experience

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DOI: <https://doi.org/10.33545/surgery.2019.v3.i3b.148>

Abstract

Introduction: Emphysematous pyelonephritis (EPN) is a severe and life-threatening necrotising infection of the kidney characterised by the presence of gas in the parenchymal tissue. The mortality rate for EPN is as high as 25%. We present the retrospective analysis of clinical profiles and Outcomes of a series of patients with EPN who were managed either, medically or with early Double J stenting (DJ) between June 2016 and January 2019 at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences And Research Foundation.

Methods: The clinical and laboratory data, imaging findings, and microbiological patterns of 15 patients and their medical management, between June 2016 and January 2019 at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation chosen for the study were recorded.

Results: The mean age of the study group patients was 56.6 ± 6.2 years (range 43–74 years). There were nine females (60.3%) and six males (39.7%). Symptoms were abdominal pain (80%), fever (73.3%), dysuria (73.3%). 86.6% of the patients had diabetes. The most common microbial pathogen organism cultured was *Escherichia coli* (71.42%). Patients who had minimal gas on CT scan which was restricted to the collecting system (stage I Huang and Tseng class) received medical treatment only. Patients with grade 2,3 and 4 eventually required DJ stenting as there was no clinical improvement after 48 hours of medical and supportive management.

Conclusion: Medical management and early minimally invasive drainage procedures form the main stay in the management of EPN cases. In today's era, the role of radical procedures like nephrectomy in EPN is minimal. Among the drainage procedure, DJ stenting in our study showed a good outcome. As DJ stenting can be done under regional/local anesthesia and has less morbidity for the patient, it was preferred over PCN.

Keywords: EPN, DJ stenting, PCN

Introduction

Emphysematous pyelonephritis (EPN) is a severe and life-threatening necrotising infection of the kidney characterised by the presence of gas in the parenchymal tissue^[1], collecting system or peri-nephric tissue demonstrated by computed tomography (CT) scan of the abdomen and pelvis. EPN is more common in patients with diabetes mellitus (DM)^[2, 3], and patients with a compromised immune function. In the non-diabetic population, EPN is associated with comorbidities such as urolithiasis, anatomical abnormalities of the urinary tract. Treatment pattern has evolved over decades from a radical approach like nephrectomy to endoscopic techniques like DJ stenting and or percutaneous ultrasound guide drainage (per cutaneous nephrostomy). Despite being a life-threatening illness with a mortality rate of 50%^[2], there is no consensus vis-a-vis best management of these patients. Some studies recommend that Emergency Nephrectomy (EN) as the mainstay of treatment, others recommend a more conservative approach with percutaneous drainage (PCD), or medical management (MM). In the last 2 decades, more conservative approaches have decreased the mortality of EPN from 80% to 21%. Misgar *et al.*^[4] Nagappan^[5] and Kletchko, Grozel *et al.*^[6] and Tahir *et al.*^[7] showed successful nonsurgical management of bilateral EPN in their studies. Drainage procedures can be another alternative which includes per cutaneous drain (PCD) and double J (DJ) stenting. Significant advances in the field of endo urology made it possible to have DJ stent as a treatment option for EPN.

The presence of bilateral disease, uncontrolled diabetes, thrombocytopenia, hypotension, altered sensorium, and impaired renal function are predictors of poor outcome and carry poor prognosis. We present the clinical profiles and Outcomes of a series of patients with EPN in which the patients were managed either, medically or with early Double J stenting (DJ).

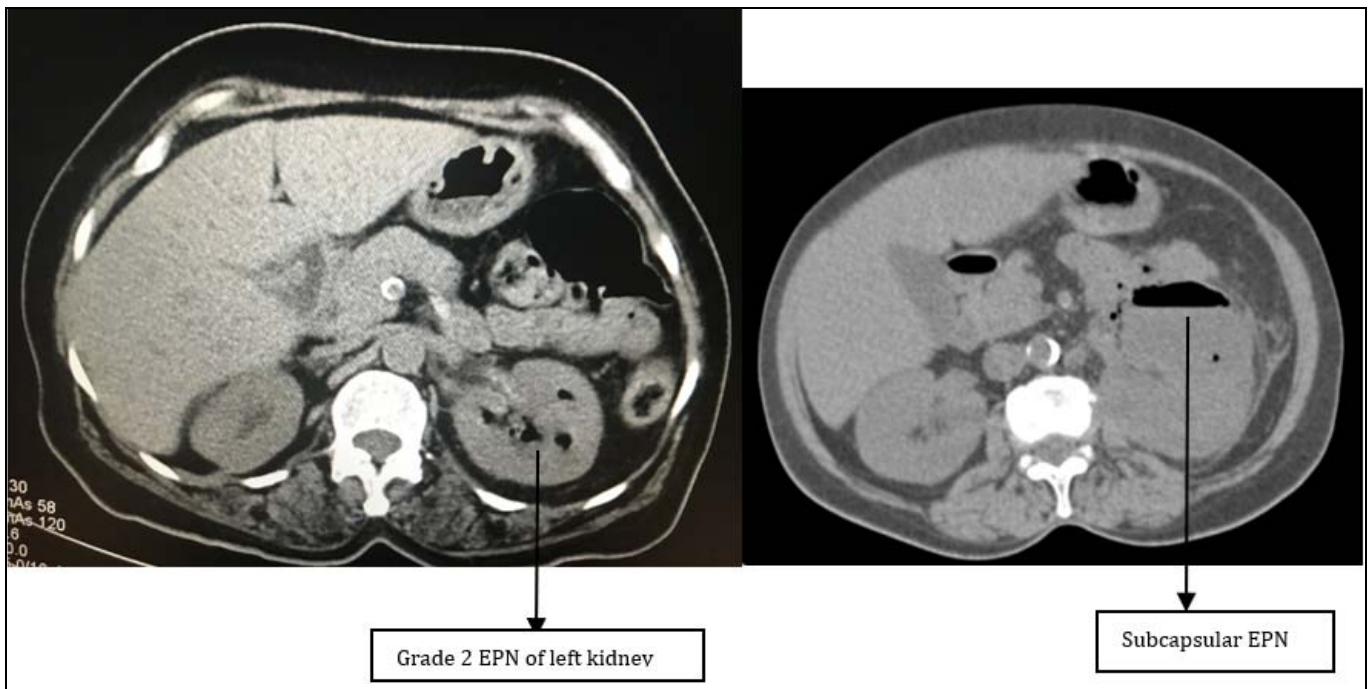
Material & Methods

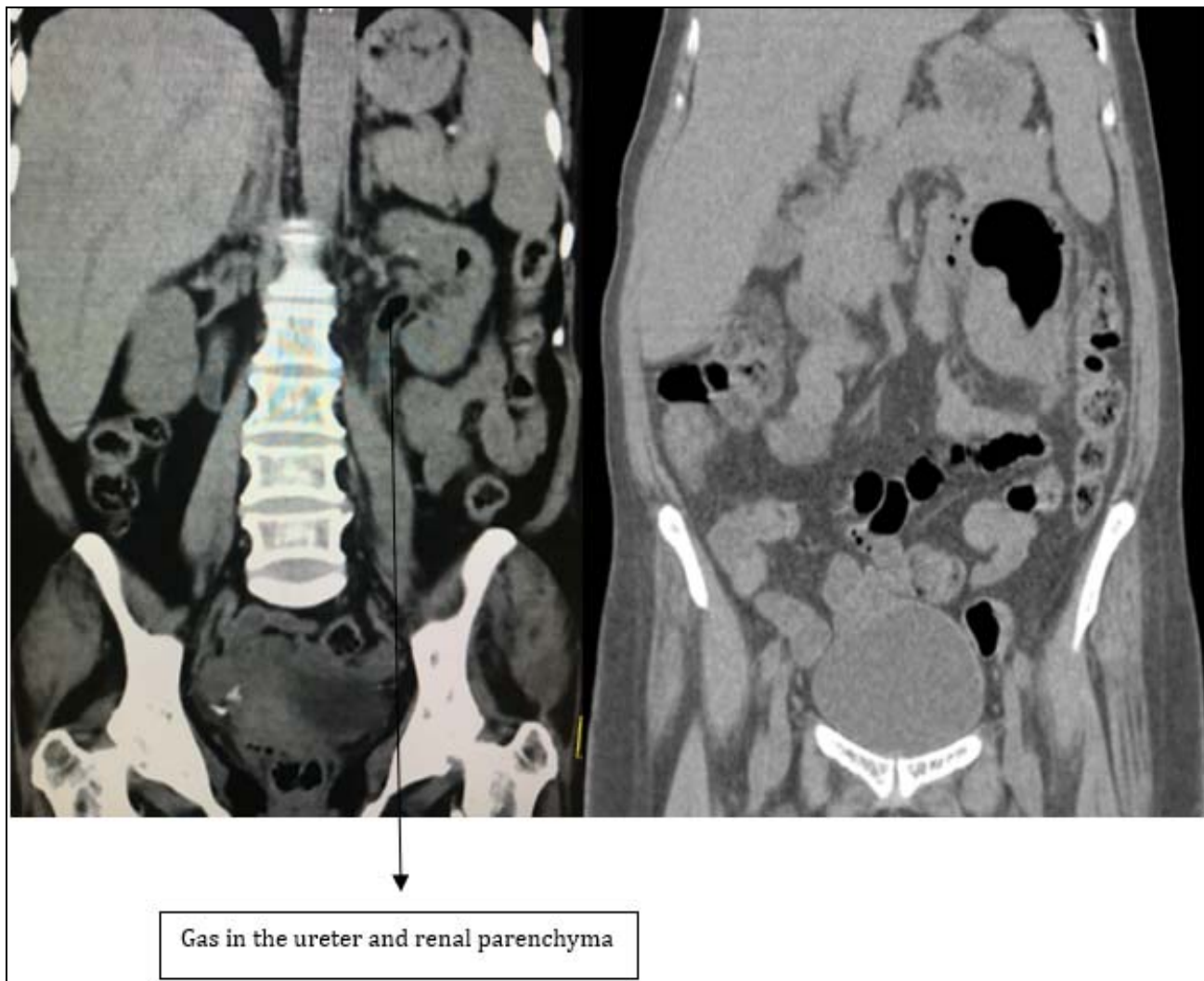
A retrospective chart review study was carried out between June 2016 and January 2019 at our center. All Patients with emphysematous infections of the kidney and urinary tract admitted in the Nephro-Urology units for management of EPN were enrolled in the study. Patients with incomplete data, patients who died of a suspected diagnosis of EPN before the diagnosis was confirmed, or patients who had an early transfer to another center for further management were excluded from the study. All the parameters affecting the clinical outcome such as demographic profile, clinical profile, laboratory data and treatment modalities were recorded. The treatment modalities included either antibiotics alone or DJ stenting in addition to antibiotics. According to Huang and Tseng⁸ classification based on Computed Tomography (CT) scan, patients with EPN were

classified as follows Class I: Gas in collecting system only ;Class II: Parenchymal gas only; Class IIIA: Extension of gas into peri-nephric space ; Class IIIB: Extension of gas into para renal space ; Class IV: EPN in solitary kidney, or bilateral disease. The classification by Huang and Tseng is superior due to the better prognostic value and is also helpful in selecting a management protocol. Patients who had minimal gas on CT scan which was restricted to the collecting system (stage I Huang and Tseng class) received medical treatment only. All patients were managed with (a) empirical broad-spectrum intravenous (i.v.) antibiotics (carbapenems or third generation cephalosporin or ureidopenicillins) followed by the antibiotics as per sensitivity pattern, (b) aggressive glycemic control in diabetics, (c) supportive therapy including fluid administration, electrolyte correction. Patients with grade 2,3 and 4 eventually required DJ stenting as there was no clinical improvement after 48 hours of medical and supportive management.

Statistical analysis

Data was collected in paper form, then it was digitalized in Excel Spread sheet 2016. Data was cleaned and tabulated, results were described as median.





Results

We identified a total of 16 patients’ records with EPN during the study period. Of this, one patient was excluded as he left the hospital before a complete workup and treatment initiation. The mean age of the study patients was 56.6±6.2 years (range 43–74 years). There were nine females (60.3%) and six males (39.7%). Twelve patients (86.6%) had pre-existing diabetes; the mean blood sugar of the patients at presentation was 204.4±44.56 mg/dL. The mean HbA1C was 7.59±0.9%. One patient of grade 4 EPN had uncontrolled glycemic levels with HbA1c of 10.2%. The left urinary tract was more commonly involved 8/15 (52.8%) than the right side 6/15 (39.6%) and, 1/15 (6.66%) patient had bilateral involvement. Fever was seen in 11/15 patients (73.3%), dysuria in 11/15 patients (73.3%) and flank

pain was seen in 12/15 patients (80%). In our study, we found that abdominal pain (80%) was the most common symptom, followed by dysuria (73.3%), fever (73.3%). Leukocytosis was seen in 10/15 patients (66.6%) (mean TLC 13,607/mm³) counts were highest among grade 4 with 27000/mm³. Elevated serum creatinine was seen in 11/15 patients (73.3%). Patient with grade 4 EPN had serum creatinine level of 3.1 mg/dl. Urine culture was positive in 7/15 (46.66%) cases with the growth of E. coli in 5/7 (71.42%), Klebsiella in 2/7 (28.58%). Computed Tomography (CT) was done in which 3 patients were found to be in grade 1; 4 patients to be Grade 2; 7 patients to be grade-3 and 1 had been grade 4(bilateral) EPN. All patients in our study recovered well with medical management and drainage procedures at discharge without the requirement of PCD or nephrectomy.

Table 1: Clinical Profile of Patients with EPN

Clinical feature	No. of cases	% of patients
Fever	11	73.3
dysuria	11	73.3
Flank pain	12	80
oliguria	8	52.8
Shock	2	13.2
Renal calculi	4	26.4

Table 2: Laboratory Profile of Patients with EPN

S. No	Investigation	Mean
1	Hemoglobin (g/dL)	9.12±1.2
2	Total leukocyte count (/cc mm)	13,607±700
3	Platelets (/cc mm)	2.52±0.54
4	Blood sugar (at admission; mg/dL)	204.4±44.56
5	Creatinine (mg/dL)	1.7±0.2
6	Serum potassium (mEq/L)	4.1±1.1
7	Serum sodium (mEq/L)	138.2±12.2
8	Glycosylated hemoglobin (%)	7.59±0.9

Discussion

EPN is an acute necrotizing infection of the kidney or urinary system caused by gas forming organisms. EPN is commonly seen in diabetics and immune compromised patients. The reason being a combination of high tissue glucose concentrations, impaired tissue perfusion, and the presence of gas-producing organisms, which forms the ideal environment for developing EPN. The high tissue glucose level acts as a substrate for the micro organisms to produce hydrogen and carbon dioxide by fermentation.

There were nine females (60.3%) and six males (39.7%) in our study. There is a preponderance of EPN in females according to Wan *et al.* [9] Lu *et al.* [10] which was statistically significant. Female preponderance is seen in almost all studies because women are more susceptible to urinary tract infections. As in our study, there was no gross difference in the incidence of disease, with a female/male ratio of 1.5:1. Study by Huang and Tseng showed fever in 79% of their patients, abdominal or back pain in 71%. In our study, we found that abdominal pain (80%) was the most common symptom, followed by dysuria (73.3%), fever (73.3%). A meta-analysis reported that 52% of patients had left-sided EPN, 37.7% had right-sided EPN, and 10.2% had bilateral EPN. Huang and Tseng reported that 67%, 25%, and 8% of EPN patients had left-sided, right-sided, and bilateral disease, respectively. In our study, 52.8% of patients had left-sided EPN, 39.6% had right-sided EPN, and 6.6% had bilateral EPN. Prevalence of diabetes in our study was 86.6%. In their study, Huang and Tseng reported that 96% of the patients had diabetes mellitus. In their studies, Huang and Tseng, Wan *et al.*, and Pontin [11] *et al.* Showed that *E coli* was the most common causative organism for EPN, which was isolated in 47% to 90% of their patients, the other commonly involved organisms included *P. mirabilis*, *Klebsiella pneumoniae*, *Enterococcus* species, and *Pseudomonas aeruginosa*. Urine culture was positive in 46.6% of our study participants. The most common organism to be cultured from blood and urine was *E coli*. The other organisms included *Klebsiella pneumoniae* (28.58%). The treatment of EPN has changed over the years from radical nephrectomy to more conservative approaches that involve antibiotics and percutaneous drainage techniques due to better imaging modalities and early diagnosis with better antimicrobials. Huang and Tseng concluded that nephrectomy provided the best management of their 48 cases of EPN and should be promptly attempted for extensive EPN with a fulminant course. In 1996, Chen *et al.* [12] reported that antibiotic therapy combined with CT-guided percutaneous drainage of EPN was an acceptable alternative to antibiotic therapy with surgical intervention. In the last 2 decades, more conservative approaches have decreased the mortality of EPN from 80% to 21% [13,14]. The meta analysis by Aboumarzouk [15] *et al.* showed that compared with emergency nephrectomy, percutaneous

drainage and medical management alone were associated with a significantly lower mortality rate. Misgar *et al.*, Nagappan and Kletchko, Grozel *et al.* and Tahir *et al.* showed successful nonsurgical management of bilateral EPN in their studies. All patients in our study recovered well with medical management and drainage procedures at discharge without the requirement of PCD or nephrectomy.

Conclusion

Medical management and early minimally invasive drainage procedures forms the main stay in the management of EPN cases. In recent era, the role of radical procedures like nephrectomy in EPN is minimal. Among the drainage procedure, DJ stenting in our study showed a good outcome. As DJ stenting can be done under regional/local anesthesia and has less morbidity for the patient, it was preferred over PCN. A combined team approach by a nephrologist, urologist may be adopted for better outcome of this condition.

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