



Research Article

RENAL PRESERVATION, AN ACCEPTABLE APPROACH IN PATIENTS WITH EMPHYSEMATOUS PYELONEPHRITIS: A TERTIARY CARE CENTER EXPERIENCE IN SOUTH INDIA

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ABSTRACT

Introduction: Emphysematous pyelonephritis (EPN) is severe necrotizing infection of renal parenchyma mainly involving diabetic patient. Main modality of treatment for EPN is prompt medical therapy with antibiotic and percutaneous catheter drainage, nephrectomy is the last option for the patients not responding to renal preserving approaches or in situations with poor prognostic factors.

This study was conducted at tertiary care centre for interpreting the role of various renal preservation strategies applied for different grades of EPN.

Materials and Methods: We have done prospective analysis of clinical outcome of 35 patients suffering from EPN in twenty four months study period. These patients are treated by aggressive resuscitation, parenteral antibiotics, relieving the urinary tract obstruction and effective drainage of infected fluid/gas. For patients assortment and deciding suitable treatment modality Huang-Tseng CT Scan-based classification system was used.

Results: In our study mean age of the patients was 55.7 ±23 years with female predominance (2:1). Escherichia coli was commonest (67%) causative organism. Diabetes mellitus (95%) was commonest comorbidity found in our patients.

We found that causes of upper tract obstruction were ureteric calculi(22%), renal papillary necrosis(9%), ureteric stricture(6%), and fungal bezoar(3%) in the descending order of frequency. Total 31 patients were managed according to renal preserving protocol and only 1(3%) patient required salvage nephrectomy in this study. The median survival rate was 96%.

Conclusion: In our institutional study majority of patients with EPN were having diabetes mellitus with female predominance. Most commonly isolated organism was E. coli, with majority of patients were having GRADE I or II (64%) EPN. These renal preserving strategies improved the overall survival rate as well as decreased the need for nephrectomy.

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INTRODUCTION

Emphysematous pyelonephritis (EPN) is a life threatening renal parenchymal infection characterized by gas formation within the collecting system and renal parenchyma (1,2). The first case of EPN in the literature was reported by Kelly and MacCallum in 1898.[3] Schultz and Klorfein coined the term emphysematous pyelonephritis on the basis of the relationship between the nature of the infection and gas formation in kidney.[4] Uncontrolled diabetes mellitus (DM) is most commonly associated comorbidity in patients with Emphysematous pyelonephritis (in 95% cases). Incidence of urinary tract infections (UTIs) and EPN is higher in females. In most of the cases Escherichia coli is responsible causative organism.[5]

Multiple factors are playing role in pathogenesis of EPN, including reduced host immunity, raised glucose level in tissues, infection with bacteria causing gas production, obstruction in urinary tract and microangiopathy causing reduced tissue blood supply.(6) Bacterial infection causes fermentation of tissue glucose resulting in gas production.[7] Carbon dioxide and hydrogen were main constituents of gases in EPN kidney when Huang-Tseng performed image-guided needle aspiration of infected kidney.[8] We evaluated study participants on the basis of clinical presentation, demographic profile, laboratory and radiological investigations,

microbiological findings, different management strategies and their final outcome.

METHODS AND MATERIALS

Study population

This observational (prospective) study conducted at Madurai Medical College from January 2021 to January 2023. Total 35 patients were included.

Inclusion criteria

Patients admitted in our urology ward who were diagnosed and managed till final outcome during this study period.

Exclusion criteria

Patients with prior treatment before admission in our Institute, Patient with incomplete records of previous treatment, Patients who died before confirmation of diagnosis, Patients who left against medical advice.

According to our Institutional protocol, all the patients with clinical diagnosis of EPN were subjected to radiological investigations (X rays KUB, CT scan) for diagnosis confirmation and staging of disease.

Patients were categorized into four Classes based on Huang - Tseng CT-scan based classification system.

Class I: collection of gas in pelvicalyceal system only

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Class II: Gas found in the renal parenchyma without extension to extrarenal space

Class IIIA: Gas/fluid collection extended to perinephric space

Class IIIB: Gas/fluid extended to pararenal space (beyond the Gerota's fascia) and

Class IV: Bilateral EPN or solitary kidney with EPN.



Figure 1 X-RAY KUB showing features suggestive of right emphysematous pyelonephritis

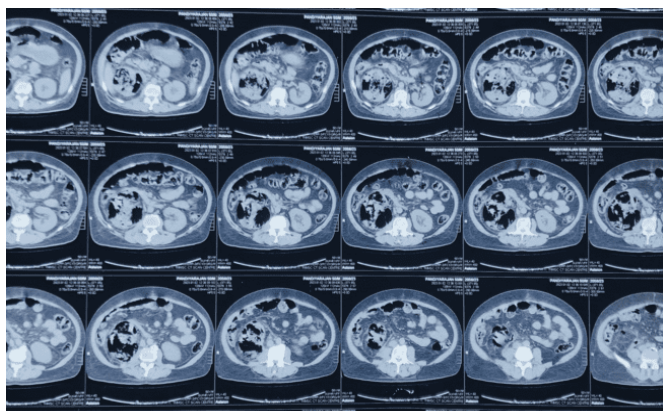


Figure 2 NCCT KUB showing left emphysematous pyelonephritis

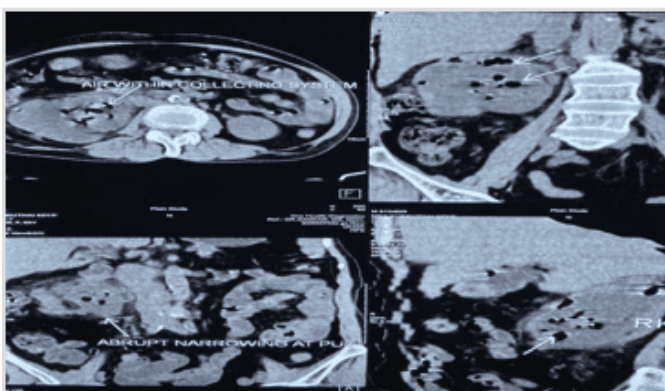


Figure 3 NCCT KUB showing right emphysematous pyelonephritis

Based on CT findings, diagnosis of EPN was established. Initially all participants were treated on the basis of renal salvage protocols which include aggressive resuscitation, intravenous antibiotics, controlling glucose level, early tackling of urinary tract obstruction by adequate drainage.

The various drainage procedures used are described below-

1. Percutaneous nephrostomy (PCN).
2. Percutaneous catheter drainage (PCD)
3. DJ Stent
4. Open drainage (OD)

Nephrectomy was done only in those patients with non responding progressive disease or patients having intractable sepsis with clinical manifestations of hemodynamic instability or refractory pyrexia.

Study subjects were divided into following treatment groups,

1. Parenteral antibiotics alone
2. PCN with parenteral antibiotics,
3. Double J (DJ) stenting with antibiotics
4. PCD/ Open drainage
5. Nephrectomy

GLYCEMIC CONTROL
INTRAVENOUS
ANTIBIOTICS
RESUSCITATION

RENAL PRESERVATION
STRATEGIES

ALLEVIATING URINARY
TRACT OBSTRUCTION

PROMPT DRAINAGE OF
PURULENT FLUID AND
GAS

Figure 4 EPN - various renal preserving strategies.

RESULTS

In this institution based observational study, initially various renal preserving strategies were analysed on total thirty five patients with CT scan based diagnosis of EPN. All patients were managed as per our institution based renal preserving protocols. Four patients were excluded; three patients with EPN diagnosed elsewhere were referred to our institution. one of them left our institution before complete workup and treatment initiation. Three most common symptoms noticed in our study were fever, abdominal pain, and burning micturition. In our study mean age of the patients was 55.7 ± 23 years with female predominance (2:1). Left kidney is affected more commonly (19,61%) compared to right kidney and both kidneys are involved in three patients (9%). Diabetes was most common (30, 95%) comorbidity associated with this disease. Abnormal laboratory values in descending order of frequency were elevated blood sugar level (97%), WBCs in urine (91%), elevated HbA1c (24,81%) and anaemia. Most common pathogen isolated from urine culture was E. coli (21,67%). Apart from above mentioned pathogen Enterobacteriaceae organisms were found in 29% of the cases.

Participants were divided into four classes based on the CT findings,

Class I

Class II A with <50% renal tissue involved

Class II B with >50% renal tissue involved

Class III A ,

Class III B , and

Class IV

Patients are divided into mild disease (Class I and IIA) (18, 58%).

and severe disease (Class IIB, III A, IIIB, and Class IV) (13, 42%).

Table 1 pathogens found in urine & blood culture

Pathogen	Urine culture	Blood culture
E.Coli	21	2
Klebsiella	4	-
Enterococcus sp	3	1
Candida	2	-
Polymicrobial	1	1

Table 2 Baseline characteristics of patients (N=31)

Age [yrs]	55.7 ± 23
Side [L>R]	L>R
Renal stone	7[22%]
Papillary necrosis	3[9%]
Ureteric narrowing	2[6%]
Obstructive uropathy	13[41%]

Table 3 Clinical Signs/Symptoms of the study population

Variable	N[%] of patients
Fever / chills	25/23 [82/74]
Flank pain	30 [96]
Vomiting	10 [32]
Dysuria	9 [29]
Haematuria	2 [6]
Renal angle tenderness	24 [77]
Altered sensorium	7 [21]

Table 4 Laboratory Parameters of the study population

Anaemia [Hb<10gm%]	29[92%]
Leucocytosis [TLC > 11000 mm ³]	30[96%]
Thrombocytopenia [<1.2 lakhs]	19[46%]
Uncontrolled DM [HbA1c >7]	24[81%]
Serum creatinine [>1.0]	13[41%]
Severe hypoalbuminemia [<3.0g/L]	23[74%]

Table 5 CT characteristics of patients

Class I	10[32%]
Class II [< 50% parenchyma inv.]	8[26%]
Class II [>50% parenchyma inv.]	2[6%]
Class III A	4[12%]
Class III B	5[16%]
Class IV	2[6%]

Table 6 Various Treatment modalities

Medical management	3
PCN	9
PCD	5
DJ Stenting	8
PCN/PCD + DJ stenting	3
Open surgical drainage	2

Incidence of metabolic acidosis, septic shock, elevated leukocyte count, raised serum creatinine levels were more in severe disease group compared to mild disease group. Initially renal preserving treatment is started for all cases. Medical management alone is given to three patients which consist of pugnacious resuscitation, parenteral antibiotics, control of blood sugar. Nine(29%) patients underwent PCN insertion. DJ Stent was performed in eight (26%) patients. PCD/PCN+DJS was performed in three (12%) patients and Open drainage ± DJS was performed in two (6%) patients. Salvage nephrectomy was performed in one (3%) patient. Two patients were having persistence perinephric collection on ultrasonography done by same radiologist after putting the drain tube and they underwent open drainage. One patient underwent salvage nephrectomy because of uncontrolled infections, inspite of initial renal preserving measures. The overall survival rate was 95% .One patient expired at postoperative period (day-3) of simple nephrectomy because of septic shock.

DISCUSSION

EPN is a systemic disease with severe, necrotizing infection and gas in collecting system/parenchyma. It has fiery course due to grave infection related complications. It is precipitated by high tissue glucose accompanied by infection of gas forming bacteria along with decrease tissue perfusion. It must be recognized and treated promptly through high level of awareness among treating surgeons. It is rare in renal transplant patients but if present then it may have fulminant course due to immunocompromised state. The demographics and clinical profile of our patients were apparently similar to previous studies. Upto 95% of EPN cases had underlying uncontrolled diabetes and hyperglycemic environment is one of the major factor reported for gas forming bacterial infection. In our institute, all patients with uncontrolled blood sugar level and clinical signs and symptoms indicative of acute pyelonephritis subjected to routine investigations and CT-scan for making diagnosis of EPN and to stage the disease.

EPN secondary to obstruction is common (20%–40%). Renal pelvic/ureteric stone, papillary necrosis and fungal ball were most common cause. In some cases ureteric stricture/narrowing with candida infection were also found. Our study aimed at improving patient survival along with preservation the renal parenchymal function by using various renal preserving measures according to stage of disease. Renal preserving approaches such as PCN insertion and DJ Stenting along with intravenous antibiotic coverage are now first-line therapeutic strategies. Early diagnosis with expeditious action in form of pugnacious resuscitation, subsequent drainage of septic fluid/gas and assuring urinary tract patency reduced mortality rate to 3% in our study. Relatively small study population constrains our study. Radio-isotope studies for objective evaluation of renal function is also lacking in this study. Hence, multicentric studies with larger study population which includes objective measurements of renal function in salvaged kidney are crucial to substantiate results of this study.

CONCLUSION

EPN can be managed effectively by using renal preserving protocol including aggressive resuscitation, intravenous antibiotics, immediate clearance of gas/ necrotic material by relieving the obstruction of urinary tract.

Following interpretations can be made based on our study results:

1. Emphysematous pyelonephritis is systemic disease with fulminant course; most commonly occur in diabetic patients.
2. Priority should be given to save affected kidney function as much as possible while improving the general condition of patient by employing the initial renal salvage methods.
3. Grades 1 and 2 EPN cases were successfully treated with strict glycaemic control with prompt administration of parenteral antibiotics, whilst grades 3 and 4 warranted further interventions such as PCN/PCD insertion or DJ stenting and nephrectomy.
4. Any obstruction of urinary tract when present should be relieved immediately.

5. Nephrectomy is last option in patients with progressive disease associated with severe sepsis and haemodynamic instability.
6. With the limitation of our study design and small sample size, our observation need large scale study to confirm the results.

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The authors report no conflict of interest.

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