

CLINICAL OUTCOMES IN PATIENTS WITH EMPHYSEMATOUS PYELONEPHRITIS [EPN] TREATED WITH MINIMALLY INVASIVE PROCEDURES.A SERIES OF 30 CASES.

Urology

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ABSTRACT

Background: Emphysematous pyelonephritis (EPN) is a severe infection of the renal parenchyma that causes gas accumulation in the tissues.[1] EPN most often occurs in people with diabetes mellitus, especially women. EPN is caused by glucose-fermenting bacteria;the most common causative organism being Escherichia coli. It is important to note that nondiabetic patients also get EPN. Clinically, most patients present symptomatically with fever,abdominal, flank pain or back pain consistent with signs of pyelonephritis.

Aims and objectives:

- 1)To assess the residual renal function in patients treated for Emphysematous pyelonephritis at one year.
- 2)To study rate of reinfection/recurrence.
- 3)To study if any other organism can cause EPN.
- 4)To study the microbial spectrum involved in the disease process.
- 5)To assess adequate control of diabetes.

Methods and materials: We studied 30 patients with EPN through our HIS software system. The major concern of our study was estimated GFR (eGFR) at the time of acute presentation and after one year. We studied the urine culture reports of the patients during the event. EPN was classified as per the Huang & Tseng classification. We also noted the patients who received treatment in the form of minimally invasive surgery that is stenting or nephrectomy or incision and drainage in case of any abscess formation. Lastly we focussed on the blood parameters and glycemic control of these patients who underwent minimally invasive surgeries for EPN. **Results:** Most commonly the disease involves diabetic female of age group 50-60 years. There was a significant difference in the eGFR, creatinine, Hemoglobin, RBS, HbA1c and platelets of the patients at one year of the procedure.

Conclusions: Minimally invasive procedures like Stenting helps in improving the renal function and provides better glycemic control with improvement in the blood parameters.

KEYWORDS

EPN :Emphysematous pyelonephritis, eGFR :Estimated Glomerular filtration rate, MDRD: Modification of Diet in Renal Disease, E.Coli: Escherichia Coli

INTRODUCTION:

Emphysematous 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%. The mortality of EPN patients has decreased to 25%.^[2]

EPN occurs commonly in diabetic patients and women 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%).

Risk factors for EPN include diabetes mellitus (DM), obstructive uropathy, vesicoureteric reflux and immunosuppression, although patients without DM are not immune against EPN and EPN may be a complication in patients with renal papillary necrosis.

Factors which have been implicated in the pathogenesis of EPN are : (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.^[3-7] Ureteral obstruction causes local tissue ischemia that provokes infection. Calculi act as a nidus for infection, and also causes stagnation and reflux of urine.

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 minimally invasive techniques, such as stenting, PCN drainage.

METHODS:

Our study was a retrospective observational study which was carried in Amrita Institute of Medical Sciences, Kochi. We collected the data through the HMS system of our hospital for the study with the help of our hospital records section department.

The data includes all the cases of EPN which presented to our hospital from the year 2010 to 2022.

We went to the records of these patients individually through their MRD numbers. We managed to collect data for 30 patients. We analysed their blood parameters like Complete blood count, Serum Creatinine, Random blood sugar levels and HbA_{1c} and the Urine culture at the time of their acute presentations. We calculated the Estimated GFR (eGFR) of all the patients using the Modification of Diet in Renal Disease (MDRD) formula. CT scan was studied in view of grading the severity of EPN according to Huang & Tseng classification. Operation records of these patients were viewed to see how many patients out of total underwent conservative management, Stenting, PCN drainage or Nephrectomy.

In accordance with the classification system of **Huang and Tseng**, which is based on the extent of air seen on CT, patients were divided into the following 4 types of EPN:

- Class 1: Gas in the collecting system only [Figure 1]
- Class 2: Gas in the renal parenchyma without extension to the extrarenal space [Figure 2]
- Class 3: Class 3A, extension of gas or abscess to the peri-nephric space [Figure 3]
- Class 3B, extension of gas or abscess to the pararenal space [Figure 4]
- Class 4: Bilateral EPN or a solitary kidney with EPN^[8] [Figure 5]

We analysed the same blood parameters of the same patients after 1

year. Calculation of the eGFR was done based on the creatinine value after one year.

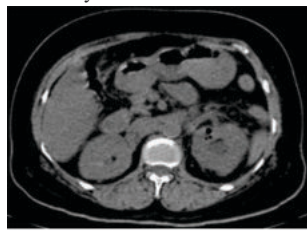


Figure 1

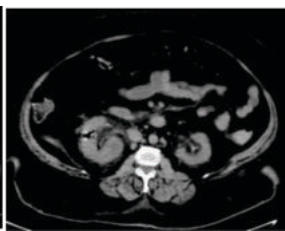


Figure 2



Figure 3

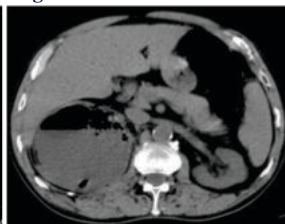


Figure 4

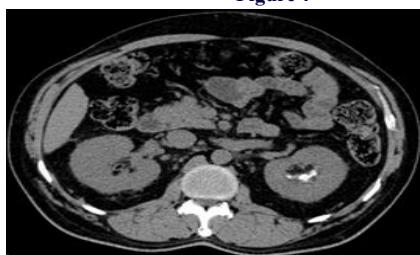


Figure 5

MDRD Formula:

$GFR \text{ in mL/min per } 1.73 \text{ m}^2 = 175 \times \text{SerumCr}^{-1.154} \times \text{age}^{-0.203} \times 1.212 \text{ (if patient is black)} \times 0.742 \text{ (if female)}.$ ^[9]

Renal function of all these patients was assessed using the eGFR value of these patients before procedure and one year after it using MDRD formula.

We analysed the changes in blood parameters like complete blood counts of the patients after one year. We analysed the diabetic control of these patients after 1 year of the procedure. Common presentation of the severity of EPN was noted. Organisms which can cause EPN were noted. Most common age and the commoner gender for EPN was analysed.

RESULTS:

Statistical analysis:

Statistical analysis was performed using IBM SPSS version 20.0 software. Categorical variables were expressed using frequency and percentage. Numerical variables were presented using mean and standard deviation. Paired sample t test was used to study the statistical significance of the difference in the mean values of changes in blood parameters from baseline to follow-up. A p value of less than 0.05 was considered to be statistically significant.

All patients included in the study were of Indian origin so the race considered for all patients was black race.

Majority of the patients in our study belonged to the age group of 50-70 years. 5 patients belonged to the age group of 40-50 years. 5 patients were found to be in the age group of 70-80 years.

On analysing the results and comparing the various categories and parameters we observed that out of 30 patients, 21 were female patients (30%) and the rest were male (7%). Most common grade of EPN was found to be Grade 1 (40%). Grade 2 were 9 patients (30%). Grade 3a with 4 patients 13.3% and 3 patients with 3b grade were found (10%). There were only two patients with Grade 4 (6.7%).

Commonest side noted was right side with 18 patients (60%), 10 patients having left sided disease (13.3%). There were 2 patients with bilateral disease (6.7%).

Table 1

Table 1 Paired Differences							t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	EGFR_baseline - EGFR on follow up MDRD Formula (ml/min/1.73m2)	-18.23296	30.34424	5.83975	-30.23675	-6.22918	-3.122	26	.004

Table 2

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Sr. Creatinine - Follow up Creatinine	.91267	1.78620	.32611	.24569	1.57964	2.799	29	.009
Pair 2	RBS baseline - RBS (FU)	31.200	54.965	10.035	10.676	51.724	3.109	29	.004
Pair 3	HbA1c baseline - HbA1c (FU)	.4533	.9168	.1674	.1110	.7957	2.708	29	.011
Pair 4	Hbbseline - HB (FU)	-.6323	1.3634	.2489	-1.1414	-.1232	-2.540	29	.017
Pair 5	WBCbaseline - WBC (FU)	-.11767	2.71435	.49557	-1.13122	.89589	-.237	29	.814
Pair 6	Plateletsbaseline - Platelets (FU)	-11.200	28.739	5.247	-21.932	-.468	-2.135	29	.041

On analysing the urine culture reports of all the patients at the time of acute crisis, we observed that majority of the patients that is 12 out of 30 (40%) were harbouring E. coli in their urine. 11 patients had a no growth report. We noted one patient with Candida Albicans (3.3%), one with Candida Glabrata (3.3%), one with Candida non albicans (3.3%). One patient was having Enterococcus (3.3%), one with Enterococcus faecium (3.3%), one with Klebsiella (3.3%). There was one patient harbouring both E. coli and klebsiella together (3.3%). We observed that out of 30, 86.7% of patients had undergone stenting. 2 patients had undergone nephrectomy and 2 patients had undergone stenting with incision and drainage. None of the patients was initiated on conservative measures in the form of antibiotics. Out of 30 patients only 2 patients were having chronic kidney disease from before. One patient had End stage renal disease (ESRD). On comparing the blood parameters at the time of the crisis with that of one year after procedure it was noted that Mean EGFR of the patients before 1 year was 33.53 with standard deviation of 22.7 and the mean EGFR of patients after 1 year was 51.7 with standard deviation of 26.6. On comparing the results and on calculation it was found that the p value was 0.004 which turned out to be significant.^[Table 1] There were significant differences noted in the baseline creatinine, Hemoglobin, and platelets when

compared to that of after 1 year with p value of 0.009,0.017,0.041 respectively. Difference in WBC was statistically insignificant. Surprisingly there was a significant difference in the Random blood Sugars (RBS) of these patients with p value of 0.004 and when we compared the HbA1c of these patients the p value came to be 0.011 which was again statistically significant.^[Table 2] It was observed that not even a single patient had recurrence of the disease.

DISCUSSION:

In our study we were able to figure out our objectives of the study. We studied 30 patients through our retrospective data of EPN patients. 20 patients were of age group 50-70 years which shows that the most common age group of EPN is 50-70 years. 21 patients in our study were female patients which points that the females are commonly found to harbour the disease. In a similar study by Karthikeyan *et al.*, male: female ratio was 1:1.4.^[10] The grades of EPN showed that most common grade found was Grade 1 followed by grade 2 followed by Grade 3a and 3b. 18 patients were having the disease on the right side which showed that the common side involved is the right side. 2 patients had bilateral disease.

Most common organism causing the disease was found to be E.coli. 11 patients had a no growth report which suggests that the patients were already on antibiotics. Some other organisms seen to cause EPN were Candida Albicans, Candida Glabrata, Candida non albicans, Klebsiella, Enterococcus species and Enterococcus faecium. One patient was found to have harbouring both E.coli and Klebsiella organisms together. Majority of the patients in our study underwent stenting. Two patients underwent stenting with incision and drainage and two patients underwent open nephrectomy which suggests that stenting is the most commonly done and most feasible option for patients with EPN specially lower grades of disease. Three patients were already having chronic kidney disease out of which one patient was CKD with ESRD. On comparing the renal function in the form of eGFR calculated by MDRD formula it was found that there was improvement in the eGFR of these patients after one year of their procedure with the p value of 0.004 by paired T test which is statistically significant. Similarly there was improvement seen in the other blood parameters like hemoglobin, and platelets. WBC did not show any change as most of the patients were having normal counts at the time of acute crisis. There was much improvement noted in the RBS and HbA1c which showed a good glycemic control after one year of the minimally invasive procedures.

CONCLUSION:

Minimally invasive procedures commonly Stenting for EPN patients proved to be successful in improving their renal function with course of time. Most commonly the disease occurs in diabetic females of age group 50 -70 years. Most common organism to cause the disease is E.coli but other organisms like Candida, Enterococcus, Klebsiella can also manifest the disease. Most common side involved is right side. The most common grade of EPN in clinical practice is Grade 1. Higher grades like 3b or 4 might require drainage or even nephrectomy. These procedures aid in improving the blood parameters such as Creatinine, Hemoglobin, Platelets and result in good glycemic control. EPN is a fatal disease which has to be attended as soon as possible and should be treated with minimally invasive procedures possibly stenting.

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