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Study On Emphysematous Pyelonephritis: Conservative Management

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Objective: *Objective of the study was to report the prognostic factors, management and outcome of our cases on emphysematous pyelonephritis*
Materials and Methods*: All EPN patients admitted to the SSIMS hospital, between 2013 to 2015, were included in the study after informed consent. All these cases met the following criteria*
(1) symptoms and signs of upper UTI, or fever with a positive urine culture or pyuria without other identified infectious foci;(2) radiological evidence by CT scan of gas accumulation in the collecting system, renal parenchyma, or perinephric or pararenal space; (3) no fistula between the urinary tract and bowel; and (4) no recent history of trauma, urinary catheter insertion, or drainage.
Results: *Out of 21 patients studied,the mean age of the 21 patients was years 55.The male to female ratio was -1.6:1.The most common predisposing factor is diabetes (17, 80.9%) , followed by urolithiasis (3,14.2 %).Right side(12,57.1%) was more commonly affected than left(8,38.1%) , 1 patients(4.7%) had bilateral involvement .The urine culture was positive in 21 patients with Escherichia coli was the most common organism isolated (18 patients) followed by klebsiella (3)blood cultures were positive in 11 patients which are similar to urine cultures, all are E.coli .The overall survival rate was 85.7%(18/21 patients)*

I. Introduction

Emphysematous pyelonephritis (EPN) is a severe, necrotizing infection of the renal parenchyma; it causes gas formation within the collecting system, renal parenchyma, and/or perirenal tissues EPN is common in diabetics and females. The presentation of EPN is similar to that of acute pyelonephritis. However, the clinical course of EPN can be severe and life-threatening if not recognized and treated promptly[1] Escherichia coli is most common organism isolated followed by Klebsiella, Proteus, Pseudomonas, and Streptococcus species. Mixed organisms are observed in 10%.[2]

The conventional treatment of EPN has historically been emergency nephrectomy or open surgical drainage along with antibiotic therapy, and with a reported mortality rate of 40-50% .Advances in image – guided procedures, the availability of effective antibiotics and supportive care resulted in open surgical procedures being less common and mortality has improved significantly[3].In recent years the focus has been not only on improving the mortality rate but also salvage of renal unit in appropriate cases .Achieving the optimum result requires graduated active management[4].

II. Materials And Methods

The aim of the study was to report the prognostic factors, management and outcome of our cases. All EPN patients admitted to the SSIMS hospital, between 2013 to 2015, were included in the study after informed consent. All these cases met the following criteria

1) Symptoms and signs of upper UTI, or fever with a positive urine culture or pyuria without other identified infectious foci;
2) Radiological evidence by CT scan of gas accumulation in the collecting system, renal parenchyma, or perinephric or pararenal space;
3) No fistula between the urinary tract and bowel; and
4) No recent history of trauma, urinary catheter insertion, or drainage.

Data on demographic profile, clinical features, and laboratory investigations, imaging studies, outcome of patients and the follow-up details were recorded prospectively. The baseline characteristics included age, sex, co morbid disease, and status of glycemic control. The clinical features included symptoms at presentation, duration of symptoms and physical findings like mental status, haemodynamic status, and flank tenderness
Shock was defined as a systolic blood pressure less than 90 mm Hg.
Disturbance of consciousness included confusion, delirium, stupor, and coma.
Leukocytosis was defined as a blood leukocyte count higher than 12,000/µL.

Thrombocytopenia was defined as platelet count lower than 100,000/µL
Renal failure at presentation was defined as serum creatinine is > 2.5mg/dL

The initial management included- fluid, electrolyte management, aggressive sugar control and antibiotic administration. Broad-spectrum I.V antibiotics (cefaperazone + sulbactum, piperacillin + tazobactm) and Fluconazole 150 mg OD were used initially, which were changed to specific antibiotic once the culture and sensitive report was available.Based on CT staging, Hydronephrosis/ hydrourteronephrosis/collection were managed with Percutaneous nephrostomy(PCN) / DJ stenting/percutaneous drainage (PCD).Patients were routinely re-imaged after 3 days to assess the proper placement of tubes and the need for additional drainage tubes.If there is no clinical response or deterioration in spite of drainage and antibiotic therapy, these patients had an early nephrectomy. In patients who improved with PCD/PCN, the tubes were removed either as an inpatient or outpatient basis. After ensuring the complete drainage of all collection. Patients were discharged with culture specific antibiotics for 2 weeks .The function of affected kidney was assessed by DTPA renogram and CT imaging during follow-up(4-6 weeks).Patients who had Non functioning/poorly functioning kidney (<10%) had delayed nephrectomy

Patients were grouped into:
Group A: Survived with salvage of renal unit
Group B: Survival after nephrectomy
Group C : Death

Clinical features , prognostic factors , treatment modalities and outcome were compared.Differences between the groups were analysed using the ANOVA test for continuous variables .chi-square test for categorical variables, with $P < 0.05$ considered to indicate statistical significance

III. Results

Out of 21 patients studied**,** the mean age of the 21 patients was years 55.The male to female ratio was -1.6:1**.**The most common predisposing factor is diabetes (17, 80.9%) , followed by urolithiasis (3,14.2 %).Right side(12,57.1%) was more commonly affected than left(8,38.1%) , 1 patients(4.7%) had bilateral involvement **.**The urine culture was positive in 21 patients with *Escherichia coli* was the most common organism isolated (18 patients) followed by klebsiella (3)**.**blood cultures were positive in 11 patients which are similar to urine cultures, all are *E.coli* **.**The overall survival rate was 85.7%(18/21 patients) .overall kidney salvage rate was 73%.

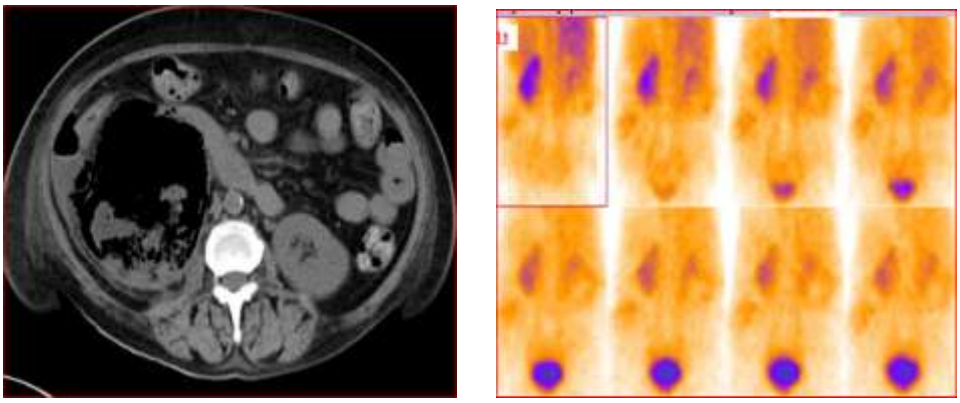

Figure 1: 62 Yrs Old Female Right Epn Class III

Table1: Baseline Risk Factors & Final Outcome

Base line factor	**overall**	**Group A**	**Group B**	**Group C**
Total patients	21	13	5	3
Age, years	55	53	56	59
Male/female	13/8	8/5	3/2	2/1
Poor glycemic control (HbA1c >7.5%)	17	10	4	3
Delay in presentation	16	11	2	3
Positive blood cultures	11	4	5	2
Initial dialysis	12	5	4	3

No significant differences were noted in patients mean age, glycosylated hemoglobin HbA1c level and duration of symptoms among the three groups.
Positive blood cultures and need for initial hemodialysis is associated with poor outcome.

Table 2: Prognostic Factors And Out Come

Prognostic factor	Overall (34)	Group A (25)	Group B(4)	Group C (5)	p
Mental status,Confusion,delirium,stupor, coma	3	0	1	2	< 0.001
Shock at presentation SBP<90mm /Hg	12	6	3	3	0.050
Renal failure at presentation (Scr >2.5mg/dl)	17	10	4	3	0.2062
Thrombocytopenia (< 100,000/micro L)	10	5	2	3	< 0.001
Leukocytosis (>12000/ micr L)	21	13	5	3	0.682

Initial presentations of thrombocytopenia, disturbance of consciousness, and shock were significantly associated with mortality.

Table 3: Ct Classification-Final Outcome

Haung & Tseng Classification	Overall	Group A	Group B	Group C	P value
Class 1	3	3	0	0	0.5531
Class 2	11	9	3	0	0.851
Class 3	6	4	2	2	0.4161
Class 4	1	0	0	1	0.6501
Parenchymal destruction>50%	7	2	2	3	<0.001

Parenchymal destruction >50% associated with poor outcome and high mortality

Table 4: Management-Final Outcome

Management	**overall**	**Group A**	**Group B**	**Group C**	**p**
Antibiotics alone (6%)	2	2	0	0	0.6822
PCD/PCN alone (73%)	11	11	0	0	<0.001
Early nephrectomy (12%)	5	0	2	3	<0.001
Delayed nephrectomy (9%)	3	0	3	0	<0.001

Two (9.5%) patients received antibiotics alone, 5 (23.8%) had an early nephrectomy, 11(52.3%) received PCD/PCN and 3(14.2%) had delayed nephrectomy after initial PCD .The early nephrectomy group had higher mortality rate (three).

IV. Discussion

Kelly and MacCallum reported the first case of gas-forming renal infection (pneumaturia) in 1898. Since then, a multiplicity of terms such as "renal emphysema," "pneumonephritis," and "emphysematous pyelonephritis" had been used to describe this gas-forming infectious disease

The term emphysematous pyelonephritis is coined by Schultz and Klorfein (1962)[5] EPN is common in diabetics and females. Escherichia coli is most common organism isolated in 66% of patients and Klebsiella species are reported in 26%.Proteus, Pseudomonas, and Streptococcus species are other organisms found in patients with EPN .Mixed organisms are observed in 10%. Positive blood culture results are identical to urine culture results in 54% of patients[2] The factors that predispose persons with diabetes to EPN may include uncontrolled diabetes, high levels of glycosylated haemoglobin, and impaired
host immune mechanisms. In 1993, Guiard proposed alcoholic fermentation of glucose with carbon dioxide production by the organisms as the cause of gas in the tissues. In 1889, Muller first identified nitrogen, hydrogen, and carbon dioxide in a patient with pneumaturia. Schainuck et al proposed that fermentation products from tissue necrosis produced carbon dioxide[6] The most common clinical manifestations of EPN (i.e., fever, flank pain, and pyuria) were nonspecific and not different from the classic triad of upper UTI other than EPN.

Michaeli et al attempted to correlate the clinical features of EPN with outcome. They concluded that age, sex, blood urea nitrogen, and blood glucose level were not the prognostic factors[7] . We also showed that age, sex, blood urea nitrogen and blood glucose level was not associated with mortality or poor outcome. It has been supposed that high tissue glucose levels may be a risk for EPN to develop and cause a fulminant course in patients with DM, because it can provide gas-forming microbes with a microenvironment more favourable for growth and rapid catabolism. However, we do not demonstrate that poor control of blood glucose levels is a risk factor of poor prognosis for EPN,the duration from onset of symptoms and signs to diagnosis of EPN is not influenced the outcome.

Earlier diagnosis may have been made for mortality patients who also had a fulminant course .However, their outcomes were still poor. We suggest that patients who are initially seen with organ systems dysfunction will usually run a more rapid course and have a worse outcome. An early diagnosis is necessary, but aggressive and adequate management should be applied in these cases. The patients with class 1 EPN had the

best prognosis, and all are survived with conservative management.Parenchymal destruction on the CT will influence both the chances for nephrectomy as well as mortality

Klein et al(1986) reviewed 66 reported cases of EPN and found an overall mortality rate of 38%, but in a recent study mortality rate of only 23% noted(Cherif M et al 2012). The 14.2% mortality rate in our study is an improvement over this.[8]According to Pontin et al (1995)& Shokeir AA et al(1997) immediate nephrectomy should not be delayed, for successful management of EPN. But, our study differs with this as immediate nephrectomy was associated with high mortality(60%).

In recent years there has been a gradual shift in the management strategy, where more minimally invasive approaches have become important. Hudson *et al* first described fluoroscopically guided PCD for treating EPN, with successful clinical results. This report was followed by many series showing the good outcomes with US- or CT-guided PCD[9].For the EPN management, focus should not only be to reduce mortality but also to salvage the renal unit. The remaining nephrons in the affected kidney might still function once the infection is eradicated.

In recent study, Aswathaman et al(2008) reported renal salvage rate of 70% where as our renal salvage rate was 73%.In this same study by , Aswathaman *et al.* reported that in those who were not nephrectomised the mean relative function of the affected functioning kidney was 42% where as in our study it is 37%. [4]

V. Conclusion

Traditionally EPN is associated with high mortality, but recently the mortality rates are reducing because of improved staging modalities
and effective antibiotics/PCD/PCN/DJ stenting **.**Identification of prognostic factors may stratify patients for conservative or surgical management

In the era of effective antibiotics & interventional radiology the threshold for early nephrectomy should be high, which is associated with high mortality,the advantages of PCD include drainage of pus, relief of gas pressure to local circulation, and provide a high success rate in extensive EPN. Therefore, we suggest that for patients with extensive EPN (class 3 or 4) with the benign manifestation (less no of poor prognostic factors); PCD combined with antibiotic treatment may be attempted owing to the high success rate and so preserve their kidney.

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