Factors affecting the Prognosis of Patients with Pyelonephritis

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ABSTRACT

Introduction: Emphysematous pyelonephritis (EPN) is the necrotizing infection of renal parenchyma with the presence of gas in the renal parenchyma, collecting system or perinephric tissue. EPN is an uncommon life-threatening condition precipitated mainly by poorly controlled blood sugars and urinary tract obstruction. Current research aimed to study the clinical and biochemical factors determining the prognosis of patients with acute pyelonephritis.

Material and Methods: The study was conducted from June 2016 to June 2017 in Tirunelveli Medical college among 50 patients of pyelonephritis with classical clinical features. All basic blood investigations were done and radiological imaging like USG, KUB and CT abdomen was done for more detailing and followed up.

Results: Females above 50 years of age were more frequently affected by pyelonephritis. Altered sensorium, hypotension, HbA1c values > .5 and thrombocytopenia were noticed in a significant number of cases. Prognosis of cases with these comorbid conditions was found to be low. 6 patients died in this study due to poor glycaemic control, thrombocytopenia and renal dysfunction.

Conclusion: Long-standing and uncontrolled type II diabetes mellitus, hypotension, renal dysfunction, thrombocytopenia and radiological features of the high-risk disease are all associated with a poor prognosis.

Keywords: Pyelonephritis, Kidney, Diabetes, Bacteriuria, UTI.

INTRODUCTION

Acute pyelonephritis is a potential organ and/ or life-threatening infection that often results in renal scarring. Acute pyelonephritis is caused by bacterial invasion of the renal parenchyma. Bacteria may reach the kidney by ascending from the lower urinary tract and less often through the bloodstream. Timely diagnosis and management of acute pyelonephritis have a significant impact on patient outcomes.[1,2] Pyelonephritis is typically caused by E.coli and may present with nausea, burning while urinating, frequent urination, fever and flank tenderness.[3] The associated risk factors of the disease are diabetes, prior UTI, structural abnormalities of the urinary tract, sexual intercourse and the use of spermicide.[4] If left untreated pyelonephritis may result in pus around the kidney, sepsis or kidney failure.[5]

In a recent community-based estimate, UTI was found to be second only to LRTI among older diabetics.[6,7] The extent of involvement ranges from inconsequential lower urinary tract colonization to cystitis, pyelonephritis, renal or perirenal abscess.[8] Emphysematous pyelonephritis(EPN) is the necrotizing infection of renal parenchyma with the presence of gas in the renal parenchyma, collecting system or perinephric tissue. EPN is an uncommon life-threatening condition precipitated mainly by poorly controlled blood sugars and urinary tract obstruction.[9,10] Prevalence of diabetes in patients with emphysematous pyelonephritis ranges from 53-90%. It is treated with conventional parenteral antibiotics or with percutaneous /open surgical drainage with or without nephrectomy.[11]

Before the advent of antibiotics the mortality rates associated with EPN was high. Advances in imaging technology, diabetes control, resuscitative management, and minimally invasive treatment have improved the treatment outcomes in patients with EPN. EPN is a relatively rare condition and is reported in 1- 2 cases per year in the urology department of the United States. Of this 95% of the cases are associated with diabetes.[12,13] And over 66% of the cases are caused by E.coli, enteric gram-negative facultative anaerobes.[14] There have been few large studies, which have selectively looked into the clinical, microbial profile and treatment outcomes of diabetic patients with pyelonephritis both Non-emphysematous pyelonephritis (NEPN) and EPN.

Current research aimed to study the clinical and biochemical factors determining the prognosis of patients with acute pyelonephritis.

MATERIAL AND METHODS

During the study period of one year from June 2016 –June 2017 conducted in Tirunelveli medical college, 50 patients with pyelonephritis with classical clinical features of fever, chills, flank pain and tenderness and with radiological evidence of acute pyelonephritis were studied.

Inclusion Criteria: All patients admitted to Tirunelveli

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medical college and hospital with acute pyelonephritis during the study period June2016- June 2017.

Exclusion criteria: Terminally ill patients

Associated co-morbidities like DM, urolithiasis were noted. Blood investigations which include CBC, Serial RBS, FBS and PPBS, RFTS were done. Serum Electrolytes, LFT, HBA1C, Urine albumin, sugar, deposits acetone (if needed) and c/s was done.

Radiological imaging like USG abdomen, KUB, CT scan abdomen was taken patients prospectively and then followed for a period of 2 months and factors determining the prognosis of patients was studied. Patients who recovered with antibiotics, percutaneous nephrostomy and other supportive measures were considered to have good prognosis. Those who required nephrectomy or died were considered to have poor prognosis.

RESULTS

34% of the patients belonged to the age group 51-60 years, which says that pyelonephritis is more common in old age (fig 1). A female predominance was observed with 38 patients being females and 12 patients being males (fig 2). Comorbid conditions like diabetes (Type II) was seen in 37 (74%) patients and urolithiasis was seen in 4 (8%) patients (fig 3). Symptoms like fever (82%), abdominal pain (64%), dysuria (56%) and pedal edema (6%) was observed (table-1). Altered sensorium present in 12% of the patients. Hypotension was seen in 14% of the cases while the vitals were stable in the rest of the cases (table-2). Thrombocytopenia was noticed in 48% of the cases. HbA1c values were > 7.5 in 58% of the cases which is significant. This states that patients with pyelonephritis had poor glycaemic control (fig 5). A significant number of cases (29 cases) had renal dysfunction with creatinine values more than 1.5 (table 3). LFT was altered in 12% of the cases which is not significant.

Urinalysis showed the presence of pus cells in all the patients and about 28% of the cases more than 10 pus cells. Urine culture showed positive growth in (22) 44% patients. Among

Symptoms	No of patients	Percentage
Fever	41	82%
ABD pain	32	64%
Dysuria	28	56%
Pedal edema	3	6%

Table-1: Symptoms distribution

Vitals	No of patients	Percentage
Hypotension	7	14%
Stable	43	86%

Table-2: Vitals distribution

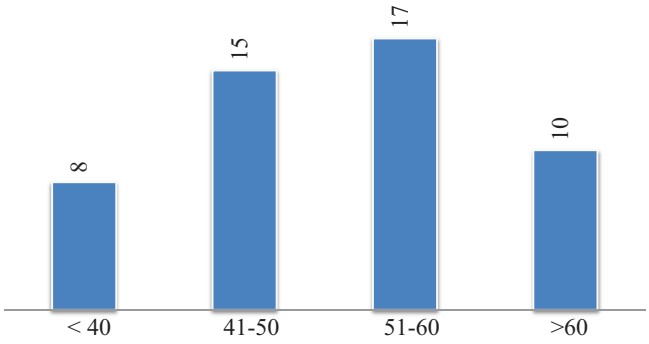

Figure-1: Age distribution

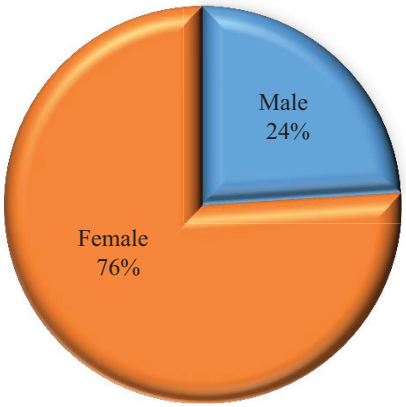

Figure-2: Gender distribution

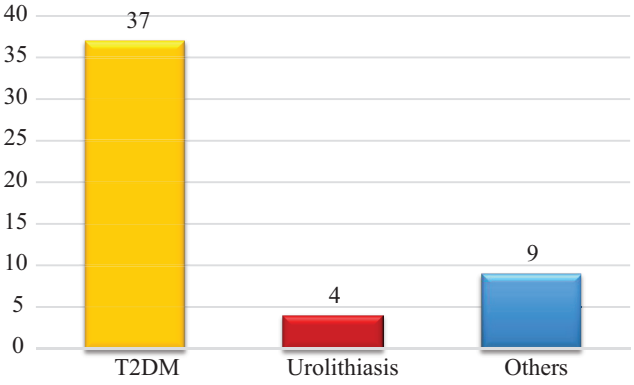

Figure-3. Co-morbidities distribution

	Minimum	Maximum	Mean	SD
Age	24	70	51.12	11.888
TC	5200	35800	14590.00	5073.470
Hb	6.5	16.8	10.806	1.5495
Platelets	18000	460000	175580.00	97190.763
HbA1C	5.0	12.0	7.408	1.6829
Urea	15	241	65.98	44.015
Creatinine	.6	6.9	1.922	1.2572
Sodium	120	146	135.72	5.268
Potassium	.8	5.3	3.912	.7858

Table-3: Distribution of patients' parameters

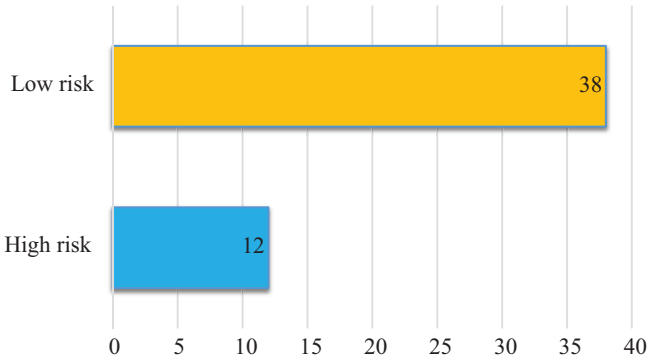

Figure-4: USG & CT findings

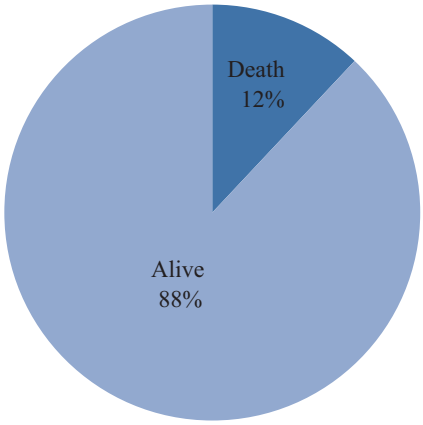

Figure-5: Prognosis

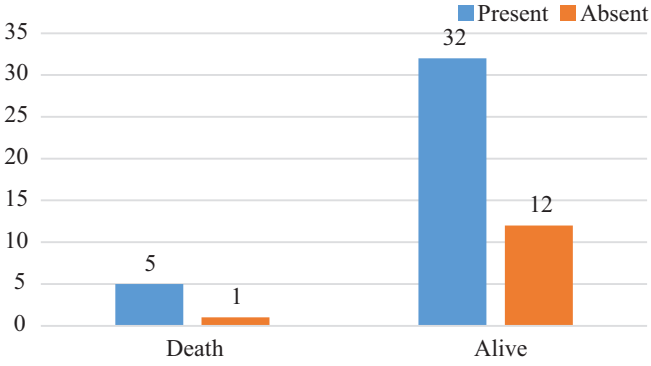

Figure-6: Diabetes vs prognosis

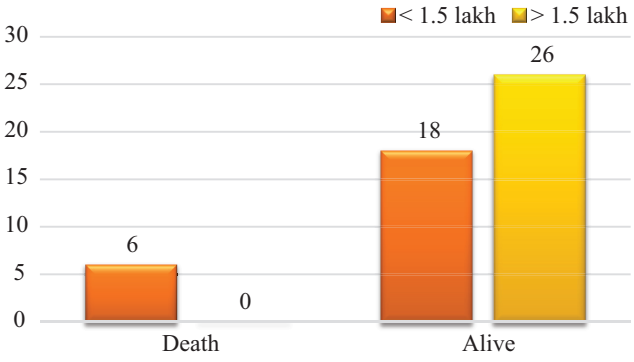

Figure-7: Platelet count vs prognosis

the 22 patients who had positive growth, E.coli was the most commonly observed organism (16cases, 72.70%) followed by Klebsiella (4 cases, 18.3%) and Pseudomonas (1 case, 4.5%). Fungal growth was also seen in one patient. Urine

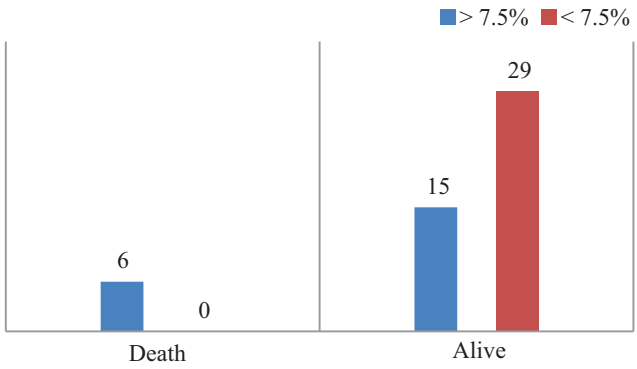

Figure-8: HBA1C vs prognosis

acetone was positive in 9 patients. USG and CT findings revealed that high-risk B/L Pyelonephritis, Emphysematous pyelonephritis, Papillary necrosis and Renal abscess was present in 12 (24%) patients (fig 4).

Percutaneous nephrostomy(PCN) was done in 3 (6%) patients. 6 patients(12%) died during the study period which is insignificant (fig 5). 5 out of 6 patients who died had diabetes and all the 6 patients had poor glycaemic control (fig 6,8). 5 out of 6 patients who died had hypotension. All the patients who died had a platelet count of less than 1.5 lakh (fig 7). 5 out of 6 patients who died had renal dysfunction. Acetone was positive in 3 out of 6 patients who died and is significant. 5 out of 6 patients who died had high-risk radiological features. Mean age at death was 48.83%. All these suggest that patients with uncontrolled diabetes or patients with diabetes for over 4 years, hypotension, thrombocytopenia, renal dysfunction, positive acetone values, and high-risk radiological disease have poor prognosis and survival rates.

DISCUSSION

The common predisposing factor for UTI is diabetes mellitus. Epidemiological studies have shown that the relative risk of UTI in diabetics increases by a factor of 1.2-2.2 when compared to non-diabetics.[15,16] DM has been shown to be the single most common predisposing cause among hospitalized patients with acute pyelonephritis.[17] The severity of UTIs also increases in DM.[18] Pyelonephritis in DM is associated with greater complications, poor prognosis and increased mortality. This fact is corroborated by the present study, along with analysis on the other determinants of prognosis of pyelonephritis.

In a study done by Akhaira et al, in April 2009 clinical profile and prognostic factors and outcomes of 19 patients with emphysematous pyelonephritis were studied. Patients were followed for a period of 6 months. From 2001-2007, 19 cases were studied, out of which 16 were females and 3 were males. 4 patients were diabetics. E.Coli was the predominant causative organism. Shock (P=0.03), S.CREATININE > 5 mg/dl (p=0.035) and DIC (p=0.017) were independent poor prognostic factors. 5 cases underwent percutaneous drainage and 3 underwent nephrectomy,10.5% expired. These findings are concomitant with the present study findings.[19]

In another study of Acute pyelonephritis in diabetes mellitus single center experience, done in 2010 -2012

where 105 diabetic patients were studied, in which 79 had non-emphysematous pyelonephritis (75.2%), 26 had emphysematous pyelonephritis. E.Coli was the most common cultured organism. The Renal abscess was seen in 13% and papillary necrosis in 4% of the cases. Worsening renal function was observed in 92% of EPN and 9% of NEPN. Nephrectomy was done in 5 patients (19.2%) and 13 patients expired. 4 had EPN and 9 had NEPN. EPN patients presented with shock and had poorly controlled blood sugar levels. Shock and altered sensorium were associated with poor outcome in patients with EPN. DM with pyelonephritis was associated with severe disease. Emphysematous pyelonephritis had poor treatment outcome than NEPN, but no difference in mortality was observed between them. There was a greater need for nephrectomy in EPN compared to NEPN.[20]

In our study the mean age group of occurrence of pyelonephritis is 51-60 years. Ageing is associated with a higher incidence of the disease. The female population is more frequently affected than males. Associated co-morbidities like DM(74%), urolithiasis(8%) were noted. This shows that diabetes increases the risk of occurrence of pyelonephritis. HbA1c values were above 7.5 in 58% of the cases which states that uncontrolled diabetes mellitus can result in poorer disease outcomes. These findings coincide with other studies in the literature. Thrombocytopenia (platelets <1.5 lakh) was seen in 24 patients which could be related to renal dysfunction and absence of erythropoiesis (48%). Renal dysfunction with creatinine levels >1.5 was seen in 29 patients.

Urine culture showed positive growth in 22 patients (44%) of which E.Coli is the most common organism (72%). This is also in concordance with the other studies. Klebsiella, Pseudomonas and fungal species were present in 1 patient each. Urine acetone was positive in 9 patients. Radiological imaging showed the presence of high-risk disease in 12 patients. Emphysematous pyelonephritis was seen in 11 patients (22%). After follow up period of 2 months, 41 patients recovered with antibiotics, 3 needed percutaneous nephrostomy and 6 patients died.

Diabetes with pyelonephritis is associated with 5 deaths (p-value 0.578) and is non-significant. 5 out of 6 patients who died presented with altered sensorium (p-value 0.001 –significant). 5 out of 6 Patients who died presented with hypotension (p-value 0.001 –significant (chi-square test). All 6 patients who died presented with thrombocytopenia (p-value 0.007 –significant). All 6 patients who died had HBA1C OF > 7.5% (P VALUE 0.002 –significant). 5 patients out of 6 who died presented with renal dysfunction. High-risk radiological findings were seen in 5 out of 6 patients who died (p-value 0.001 –significant).

All these factors reflect that long-standing and uncontrolled diabetes, associated renal dysfunction and low platelet count and high-risk disease are all the determining factors in the outcome and prognosis of pyelonephritis. The only limitation in the study is the small sample size which could be a bias.

CONCLUSION

Acute Pyelonephritis is more common in females in the age group 51-60 years. Diabetes mellitus is the most common co-morbidity associated followed by urolithiasis. E.Coli is the predominant organism that causes pyelonephritis. Presence of altered sensorium and hypotension at admission was associated with poor outcome. Thrombocytopenia, renal dysfunction and long-standing DM with poor glycaemic control are associated with poor prognosis. Presence of radiological features of Emphysematous pyelonephritis, B/L pyelonephritis, renal abscess and papillary necrosis is also associated with poor prognosis. More elaborate studies should be hosted in future regarding the clinical features and outcomes of the disease on a large study population which in-turn can familiarize the physicians about the frequency and severity of the infection and also develop an effective management approach.

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