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Original Research Article

A prospective, two arm, observational study to analyze the factors predicting the role of double J stenting technique in management of acute pyelonephritis

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ABSTRACT

Background: Acute pyelonephritis is a severe urinary tract infection with variable presentation, ranging from mild illness to septic shock. While most patients respond to antimicrobial therapy, some require early urological intervention such as Double J (DJ) stenting. Identifying predictors for intervention is crucial. Aim was to assess factors determining the need for DJ stenting and analyse the clinical profile and predisposing factors in patients with acute pyelonephritis.
Methods: This prospective study was conducted over one year at a tertiary care centre and included 60 patients diagnosed with acute pyelonephritis. Patients were divided into Group A (conservative management) and Group B (DJ stenting). Clinical features, laboratory parameters, imaging findings, and treatment outcomes were analysed. Statistical analysis used chi-square and unpaired t tests, with $p<0.05$ considered significant.
Results: Most patients were aged 51-70 years, with female predominance (61.7%). Age, gender, diabetes, and comorbidities did not differ significantly between groups. Significant predictors of DJ stenting included chills (p=0.004), flank pain (p=0.035), lower urinary tract symptoms (LUTS) (p=0.009), nausea/vomiting (p=0.045), high-grade fever >100.4°F (p=0.001), persistent tachycardia (p=0.001), tender palpable kidney (p=0.001), pyuria (p=0.0001), thrombocytopenia (p=0.001), hyponatremia (p=0.004), and HbA1c >9% (p=0.001). Elevated creatinine, total leukocyte count, and positive blood and urine cultures were also significantly associated with stenting (p=0.001).
Conclusions: Multiple adverse clinical and laboratory parameters predict failure of conservative management. Patients with three or more poor prognostic factors may benefit from early DJ stenting, potentially improving outcomes and preventing complications.

Keywords: Acute pyelonephritis, DJ stenting, Serum creatinine, Fever

INTRODUCTION

Acute pyelonephritis is a severely complicated urinary tract infection. Pyelonephritis usually occurs when enteric bacteria enter the bladder and ascend to the kidneys.[1] It typically manifests suddenly with signs and symptoms of both systemic inflammation (e.g., fever, chills, and malaise) and bladder inflammation (e. g., urinary frequency, urgency, and dysuria).[1] There are various different criteria to diagnose pyelonephritis, however absence of any of them does not negate presence of pyelonephritis. It can present in any way from mild discomfort to life threatening septic shock. Despite the morbidity related to this disease, epidemiological data on incidence and causal organisms are limited.[2] Urinary tract infection is one of the most common infections globally, especially in women. 1% percent of all women diagnosed with cystitis were diagnosed with pyelonephritis within 30 days from the cystitis event, of which over half seemed to acquire it in proximity (within the first five days) to the

cystitis event.[3] Escherichia coli cause approximately 60-80% of uncomplicated infections.[4] Other gram negative pathogens like *Proteus mirabilis, Klebsiella, Enterobacter* and *Pseudomonas* species.[4] In older hospitalized patients, because of increased usage of catheters (portals to infection), Gram-negative organisms such as *P. mirabilis*, *Klebsiella, Serratia*, and *Pseudomonas* are more common etiologies.[4]

The treatment plan varies depending on disease severity and patient symptoms. Patients with mild form can be treated with a short course antibiotic like oral cephalosporins or aminoglycosides while those with severe form require hospitalization and long term intravenous antimicrobial treatment. Diseases Society of America (IDSA) recommend empirical therapy with a fluoroquinolone if the prevalence of resistance to fluoroquinolones among local uropathogens is less than 10%.[1] Among women who have susceptible pathogens, the rates of clinical success are high (>90%) with a 5-to-7-day course of a fluoroquinolone or aminoglycoside or a 14-day course of trimethoprim-sulfamethoxazole.[1] Although organism sensitive antimicrobial treatment is the most important part of definitive management, minimally invasive urological interventions like DJ stenting or percutaneous nephrostomy are gaining importance. The role for stenting in acute pyelonephritis with obstruction due to necrosed papilla, turbid pus flakes or stone are straightforward.[4] It is also accepted and recommended for DJ stenting in pyelonephritis even in the absence of hydronephrosis, due to ureteric dyskinesia.[4] Multiple factors like diabetes mellitus (DM), deranged renal function, persisting fever unresponsive to high dose antimicrobials or multidrug resistance organisms ultimately warrant he use of surgical interventions to reduce symptoms. Thus, conservative treatment is a first step approach for the treatment of these patients before subjecting them to DJ stenting. The purpose of this study is to determine the factors needed for DJ stenting in patients with acute pyelonephritis and to study the clinical profile and factors associated with acute pyelonephritis. This is a single centre prospective study correlating these factors for decision of early urological intervention to prevent or regress complicated acute pyelonephritis.

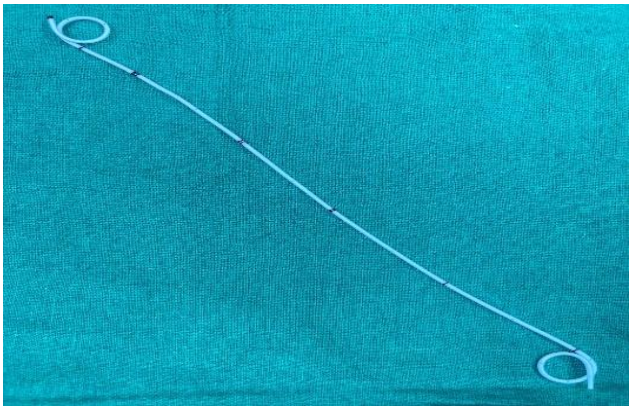

Figure 1: DJ stent.

Aim

Aim was to assess the factors determining need for DJ stenting in patients with Acute Pyelonephritis and to study the clinical profile and predisposing factors associated in patients with acute pyelonephritis.

Objectives

Objectives were to analyze the factors determining the need for DJ stenting in patients with acute pyelonephritis. To analyze the clinical profile of patients with acute pyelonephritis, to analyze the predisposing factors associated in patients with acute pyelonephritis and to analyze the factors that led to switching from conservative management to DJ stenting in patients with acute pyelonephritis.

METHODS

Type of study

It was a prospective observational study.

Place of study

Study conducted at Department of Urology at Bhaktivedanta Hospital and Research Institute, Mira Road.

Period of study

Study conducted for 1 year (February 2024 - February 2025).

Sample size

The 60 patients were recruited, 2 groups-A and B. Group A-Patients who were treated conservatively. Group B-Patients who had DJ stenting done.

Inclusion criteria

All patients admitted with diagnosis of acute pyelonephritis, all patients admitted with diagnosis of emphysematous pyelonephritis, patients giving consent for taking part in the study and patients above 18 years of age and of either gender were included in the study.

Exclusion criteria

Patients with pyonephrosis, perinephric abscess and renal abscess, pregnant females, patients who needed percutaneous nephrostomy, patients who needed an external drainage of collection and patients who do not consent to participate in the study.

Study methodology

A total of 60 patients were recruited in this prospective study after obtaining IEC clearance. Informed consent was

taken from all the patients before including them in the study. These recruited patients were subdivided into Group A (Patients who were treated conservatively) and Group B (Patients who had DJ stenting done). All patients admitted in the Department of Urology Bhaktivedanta Hospital and Research Institute, Mira Road, from February 2024 to February 2025 who met the inclusion criteria were recruited in our study. All patients who presented in the hospital either in the OPD or emergency department with complaints of fever, chills, nausea, vomiting, burning micturition and dysuria were assessed and imaging appropriately was done. If Ultrasound imaging proved bulky enlarged kidney, perinephric fat stranding or any fluid collection, or a strong suspicion of acute pyelonephritis was made clinically, a computed tomography (CT) KUB was done either plain or contrast enhanced depending on the renal parameters of the patients.

Once admitted, detailed history of the patient was taken. History of any previous hospital admission or any treatment history data were collected, including parameters such as age, sex, duration of illness, duration and treatment of comorbidities like DM or hypertension, previous kidney disease, history of urolithiasis, or any previous urological intervention or surgery. Patients underwent complete clinical and physical examination-temperature charting, tachycardia, abdominal or renal angle tenderness or flank tenderness, baseline blood investigations including complete blood count (CBC), renal function test (RFT) with serum electrolytes, random blood sugar (RBS), HbA1c levels, urine routine microscopy and urine culture and sensitivity, blood culture and sensitivity if required. Patients were initially managed conservatively-started on broad spectrum antibiotics usually Beta lactams or third generation Cephalosporins with or without Aminoglycosides, which were then switched to culture specific antibiotics as and when required.

Patients who responded well to conservative medical therapy were continued with the same treatment until full recovery achieved. Those patients with failed conservative treatment in terms of persistent fever spikes, tachycardia, increasing tenderness, persistently elevated total leucocyte counts (TLC), deranged RFT (rising serum creatinine), persistent hyponatremia were classified as non-responders or failed conservative trial and were switched over to DJ stenting group (Group B).

If the patients presented with either a failed Group A trial (conservative trial), or if they had gross symptomatology or clinical picture warranting emergency urological intervention, they were subjected to upfront DJ stenting (Group B). The clinical and laboratory results which were significantly present in the non-responder's patients were analyzed. Post-operative treatment course and resolution of symptoms and improvement was monitored and recorded.

Statistical methods

All the data will be noted down in a pre-designed study proforma. Qualitative data will be represented in the form of frequency and percentage. Association between qualitative variables will be assessed by Chi-Square test. Quantitative data will be represented using mean±SD and Median; IQR (Interquartile range). Analysis of Quantitative data between the two groups will be done using unpaired t-test if data passed 'normality test' and by Mann-Whitney test if data failed 'normality test'. Optimal cut-off and screening efficacy of the SWIFT will be computed via ROC curve analysis. A p value and lt; 0.05 will be taken as level of significance. Results will be graphically represented where deemed necessary. SPSS version 21.0 will be used for most analysis and Microsoft excel 2010 for graphical representation.

Ethical considerations and confidentiality of the data

Approval was obtained from the institutional ethics committee (IEC Number: BMRC/14/2024) before commencement. Written informed consent was taken from all participants. Patient confidentiality was maintained by coding data, and only the research team had access to it. Data intended for publication ensured anonymity of subjects.

RESULTS

The age distribution between Group 1 and 2 shows that in the 31 to 50 years age group, 16.70% of participants are in Group 1 and 10.00% are in Group 2. In the 51 to 70 years age group, which comprises most of the study population at 75.00%, 76.70% are in Group 1 and 73.30% are in Group 2. For the 71 to 90-year-old age group, 6.70% of participants are in Group 1, whereas 16.70% are in Group 2. The chi-square test yields a p=0.485, indicating no statistically significant difference in age distribution between the two groups, suggesting that the age distribution is comparable across both groups.

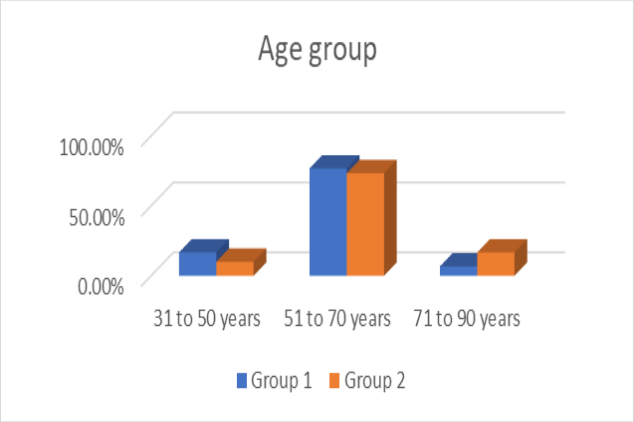

Figure 2: Age-wise distribution of the study population.

In Group 1, 53.3% were female (16 out of 30) and 46.7% were male (14 out of 30). In Group 2, 70.0% were female (21 out of 30) and 30.0% were male (9 out of 30). Overall, the total percentage was 61.7% female and 38.3% male across both groups. The chi-square test showed a p=0.184, indicating no significant difference in sex distribution between the two groups.

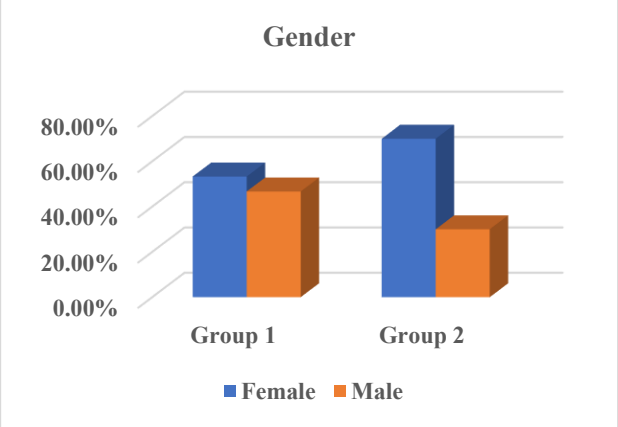

Figure 3: Gender wise distribution of the study population.

In Group 1, 6.7% had bilateral involvement (2 out of 30), 20.0% had left-sided involvement (6 out of 30), and 73.3% had right-sided involvement (22 out of 30). In Group 2, 20.0% had bilateral involvement (6 out of 30), 46.7% had left-sided involvement (14 out of 30), and 33.3% had right-sided involvement (10 out of 30). Overall, the total percentage was 13.3% bilateral, 33.3% left-sided, and 53.3% right-sided across both groups. The chi-square test showed a p=0.008, indicating a significant difference in laterality between the two groups.

In Group 1, 30.0% were non-diabetic (9 out of 30) and 70.0% were diabetic (21 out of 30). In Group 2, 33.3% were non-diabetic (10 out of 30) and 66.7% were diabetic (20 out of 30). Overall, the total percentage was 31.7% non-diabetic and 68.3% diabetic across both groups. The chi-square test showed a p=0.781, indicating no significant difference in DM status between the two groups.

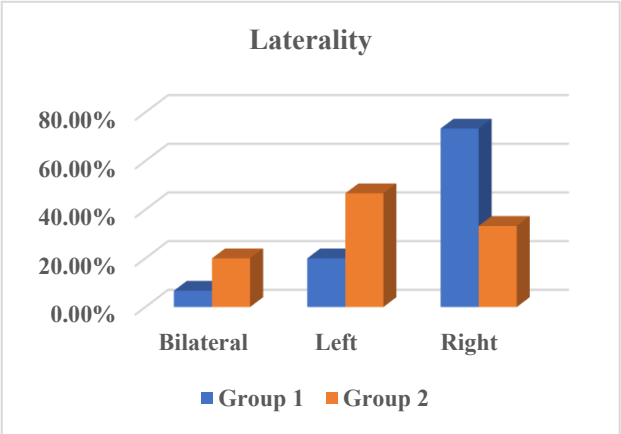

Figure 4: Distribution of the study population according to the laterality of pyelonephritis.

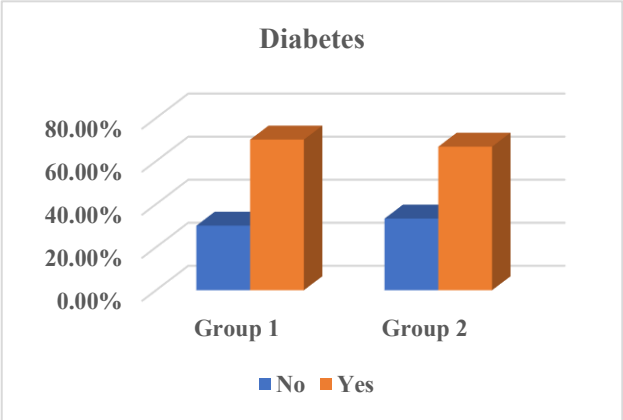

Figure 5: Distribution of the study population having DM.

Table 1: Distribution of the study population according to the symptomatology.

Variables		Groups		Total	P value
		Group 1	Group 2		
Fever	Count	22	25	47	0.347
	% Within groups	73.30%	83.30%	78.30%	
Chills	Count	9	20	29	0.004
	% Within groups	30.00%	66.70%	48.30%	
Flank pain	Count	8	16	24	0.035
	% Within groups	26.70%	53.30%	40.00%	
LUTS	Count	12	22	34	0.009
	% Within groups	40.00%	73.30%	56.70%	
Nausea or vomiting	Count	18	25	43	0.045
	% Within groups	60.00%	83.30%	71.70%	
Turbid urine/ pyuria	Count	2	24	26	0.0001
	% Within groups	6.70%	80.00%	43.30%	
Temp >100.4 F	Count	9	24	33	0.001
	% Within groups	30.00%	80.00%	55.00%	

Continued.

Variables		Groups		Total	P value
		Group 1	Group 2		
Persistent tachycardia	Count	7	21	28	0.001
	% Within groups	23.30%	70.00%	46.70%	
Tender palpable kidney	Count	6	22	28	0.001
	% Within groups	20.00%	73.30%	46.70%	
Leucocytosis (>20000)	Count	4	10	14	0.06
	% Within groups	13.30%	33.30%	23.30%	
Thrombocytopenia <1 lakh	Count	4	16	20	0.001
	% Within groups	13.30%	53.30%	33.30%	
Hba1c >9	Count	2	13	15	0.001
	% Within groups	6.70%	43.30%	25.00%	

Fever

In Group 1, 73.3% had fever (22 out of 30), while in Group 2, 83.3% had fever (25 out of 30). Overall, 78.3% of the total population had fever. The chi-square test showed a p-value of 0.347, indicating no significant difference in the occurrence of fever between the two groups.

Chills

In Group 1, 30.0% experienced chills (9 out of 30), whereas in Group 2, 66.7% experienced chills (20 out of 30). Overall, 48.3% of the total population had chills. The chi-square test showed a p=0.004, indicating a significant difference in occurrence of chills between 2 groups.

Flank pain

In Group 1, 26.7% reported flank pain (8 out of 30), while in Group 2, 53.3% reported flank pain (16 out of 30). Overall, 40.0% of the total population had flank pain. The chi-square test showed a p=0.035, indicating a significant difference in occurrence of flank pain between 2 groups.

LUTS

In Group 1, 40.0% had LUTS (12 out of 30), compared to 73.3% in Group 2 (22 out of 30). Overall, 56.7% of the total population had LUTS. The chi-square test showed a p=0.009, indicating a significant difference in the occurrence of LUTS between the two groups.

Nausea or vomiting

In Group 1, 60.0% experienced nausea or vomiting (18 out of 30), whereas in Group 2, 83.3% experienced these symptoms (25 out of 30). Overall, 71.7% of the total population had nausea or vomiting. The chi-square test showed a p=0.045, indicating a significant difference in the occurrence of nausea or vomiting between 2 groups.

Turbid urine/pyuria

In Group 1, 6.7% had turbid urine or pyuria (2 out of 30), while in Group 2, 80.0% had these symptoms (24 out of 30). Overall, 43.3% of the total population had turbid urine or pyuria. The chi-square test showed a p=0.0001, indicating a highly significant difference in the occurrence of turbid urine or pyuria between the two groups.

Temperature >100.4° F

In Group 1, 30.0% had a temperature greater than 100.4°F (9 out of 30), whereas in Group 2, 80.0% had this temperature (24 out of 30). Overall, 55.0% of the total population had a temperature greater than 100.4°F. The chi-square test showed a p=0.001, indicating a significant difference in the occurrence of high temperature between the two groups.

Persistent tachycardia

In Group 1, 23.3% experienced persistent tachycardia (7 out of 30), while in Group 2, 70.0% experienced it (21 out of 30). Overall, 46.7% of the total population had persistent tachycardia. The chi-square test showed a p=0.001, indicating a significant difference in the occurrence of persistent tachycardia between the two groups.

Tender palpable kidney

In Group 1, 20.0% had a tender palpable kidney (6 out of 30), compared to 73.3% in Group 2 (22 out of 30). Overall, 46.7% of the total population had a tender palpable kidney. The chi-square test showed a p=0.001, indicating a significant difference in the occurrence of a tender palpable kidney between the two groups.

Leukocytosis (>20,000)

In Group 1, 13.3% had leukocytosis (4 out of 30), whereas in Group 2, 33.3% had leukocytosis (10 out of 30). Overall, 23.3% of the total population had leukocytosis. The chi-square test showed a p=0.06, indicating no significant difference in the occurrence of leukocytosis between the two groups.

Thrombocytopenia (<100,000)

In Group 1, 13.3% had thrombocytopenia (4 out of 30), compared to 53.3% in Group 2 (16 out of 30). Overall,

33.3% of the total population had thrombocytopenia. The chi-square test showed a p=0.001, indicating a significant difference in the occurrence of thrombocytopenia between the two groups.

HbA1c >9

In Group 1, 6.7% had an HbA1c level greater than 9 (2 out of 30), while in Group 2, 43.3% had this level (13 out of 30). Overall, 25.0% of the total population had an HbA1c level greater than 9. The chi-square test showed a p=0.001, indicating a significant difference in the occurrence of high HbA1c levels between the two groups.

Urine routine and microscopy

In Group 1, 6.7% had Glycosuria (G) (2 out of 30), 23.3% had glycosuria and proteinuria (7 out of 30), 40.0% had no urinary renal manifestations (N) (12 out of 30), and 30.0% had proteinuria (P) (9 out of 30). In Group 2, 3.3% had glycosuria (G) (1 out of 30), 56.7% had glycosuria and proteinuria (17 out of 30), 26.7% had no urinary renal manifestations (N) (8 out of 30), and 13.3% had proteinuria (P) (4 out of 30). Overall, 5.0% had glycosuria, 40.0% had glycosuria and proteinuria, 33.3% had no urinary renal manifestations, and 21.7% had proteinuria. The chi-square test showed a p=0.065, indicating no significant difference in urinary renal manifestations between the two groups.

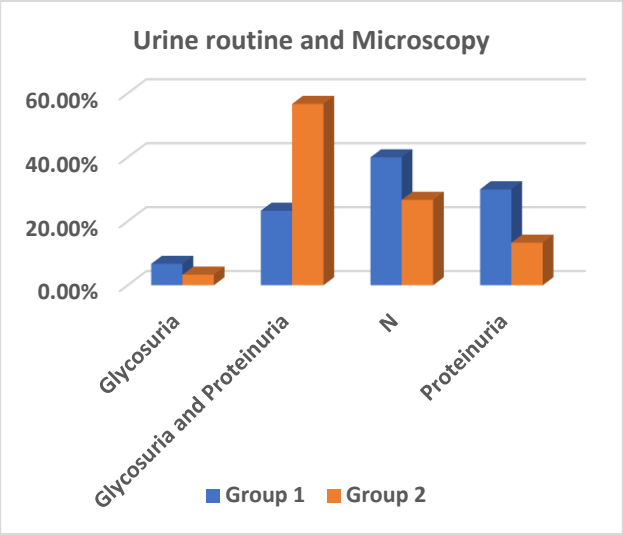

Figure 6: Distribution of study population based on urine routine and microscopy findings.
*N- No urinary renal manifestations.

In Group 1, 3.3% had positive blood cultures (BC+) (1 out of 30), 80.0% had negative cultures (N) (24 out of 30), 16.7% had positive urine cultures (UC+) (5 out of 30), and 0.0% had both positive urine and blood cultures (UC+, BC+) (0 out of 30). In Group 2, 3.3% had positive blood cultures (BC+) (1 out of 30), 30.0% had negative cultures (N) (9 out of 30), 10.0% had positive urine cultures (UC+) (3 out of 30), and 56.7% had both positive urine and blood cultures (UC+, BC+) (17 out of 30). Overall, the total percentage was 3.3% positive blood cultures, 55.0% negative cultures, 13.3% positive urine cultures, and 28.3% both positive urine and blood cultures across both groups. The chi-square test showed a p=0.001, indicating a significant difference in culture results between the two groups.

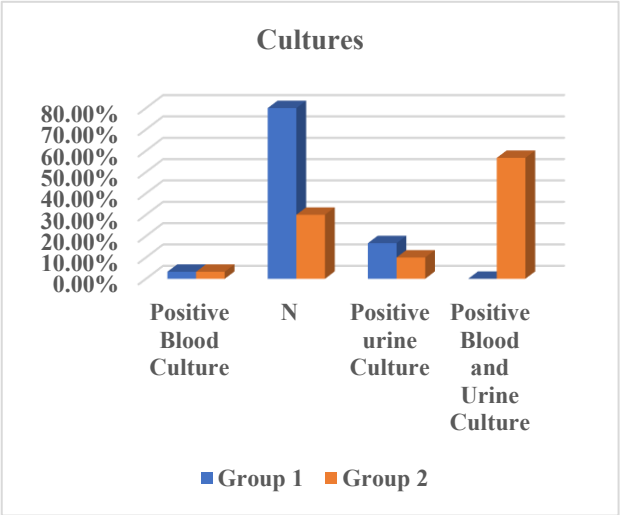

Figure 7: Distribution of the study population based on blood and urine culture findings.
*BC-Blood culture, UC-Urine culture, N-Negative culture

In Group 1, 66.7% did not have hyponatremia (N) (20 out of 30), and 33.3% had hyponatremia (Y) (10 out of 30). In Group 2, 30.0% did not have hyponatremia (N) (9 out of 30), and 70.0% had hyponatremia (Y) (21 out of 30). Overall, the total percentage was 48.3% without hyponatremia and 51.7% with hyponatremia across both groups. The chi-square test showed a p=0.004, indicating a significant difference in the occurrence of hyponatremia between the two groups.

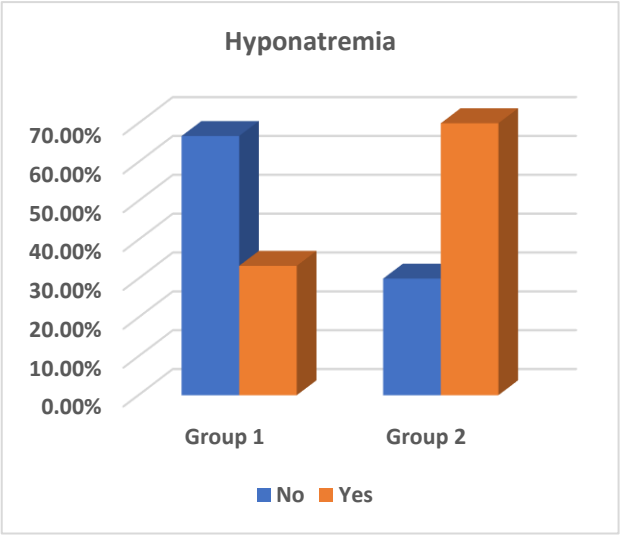

Figure 8: Distribution of the study population based on hyponatremia.

Table 2: Comparision of blood parameters at the time of admission and discharge.

Variables	Group 1		Group 2		P value
	Mean	SD	Mean	SD	
Age (in years)	58.5	8.989	61.87	10.037	0.176
Creatinine at admission (mg/dl)	1.718	0.58739	2.5233	0.86848	0.001
Creatinine at discharge (mg/dl)	1.147	0.224	1.287	0.3319	0.06
TLC at admission (cells/µL)	15904	3266.381	19603.03	4120.731	0.001
TLC at discharge (cells/µL)	7746.2	1595.753	8208.63	1823.737	0.3
HbA1c (%)	8.219	1.0787	9.365	0.9675	0.001

Age

The mean age in Group 1 was 58.5 years (SD=8.989), while in Group 2, it was 61.87 years (SD=10.037). The p=0.176, indicating no significant difference in age between the two groups.

Creatinine at admission

The mean creatinine level at admission in group 1=1.718 mg/dL (SD=0.58739), while in group 2 was 2.5233 mg/dL (SD=0.86848). P=0.001, indicating significant difference in creatinine levels at admission between 2 groups.

Creatinine at discharge

Mean creatinine level at discharge in group 1 1.147 mg/dL (SD=0.224), while in group 2, it was 1.287 mg/dL (SD=0.3319). P=0.06, indicating no significant difference in creatinine levels at discharge between 2 groups.

TLC at admission

The mean TLC at admission in Group 1 was 15,904 cells/µL (SD=3266.381), while in Group 2, it was 19,603.03 cells/µL (SD=4120.731). The p=0.001, indicating a significant difference in TLC at admission between the two groups.

TLC at discharge

The mean TLC at discharge in Group 1 was 7,746.2 cells/µL (SD=1595.753), while in Group 2, it was 8,208.63 cells/µL (SD=1823.737). P=0.3, indicating no significant difference in TLC at discharge between 2 groups.

HbA1c

The mean HbA1c level in Group 1 was 8.219% (SD=1.0787), while in Group 2, it was 9.365% (SD=0.9675). The p=0.001, indicating a significant difference in HbA1c levels between the two groups.

DISCUSSION

Acute pyelonephritis is a bacterial infection and inflammatory disease of the renal parenchyma. The major causative pathogens are Gram-negative bacteria.[5] The most common Gram-negative pathogen is Escherichia coli causing approximately 60-80% of infections.[6] Other Gram-negative bacteria includes *Klebsiella, Enterobacter, Pseudomonas* and *Proteus* species.[4] *Proteus mirabilis* is frequently associated with complicated urinary tract infections. This is more common in patients with functional and anatomic abnormalities, history of urolithiasis or a chronic indwelling catheter.[7]

Acute pyelonephritis occurs most commonly in diabetic patients. The presence of glucose in urine (glycosuria) acts as a nidus for bacterial growth.[8] In our study, Diabetes mellitus was an important prognostic factor for acute pyelonephritis. The total percentage was 31.7% non-diabetic patients and 68.3% diabetic patients across both groups 1 and 2 in our study. Random blood sugar levels were variable with daily monitoring, but the Hba1c levels were found to be consistent with the disease prognostication. High Hba1c levels (>9%) indicated a lesser chance of disease resolution with medical treatment alone. Wie et al and Kim et al in one of the largest prospective, observational, multicentric cohort studies of women with acute pyelonephritis involving 1062 women, showed that diabetes mellitus is considered to be a major risk factor for early clinical failure of patients with community onset acute pyelonephritis.[9] Efstathiou et al showed that diabetes mellitus lead to a prolonged hospital stay and a longer convalescence period.[10]

Temperature >100.4°F is an important finding and a poor prognostic marker supporting the diagnosis. Pinson et al showed that temperature >100°F was strongly correlated with acute pyelonephritis.[11] 55.0% of the total population had a temperature greater than 100.4°F in our study.

Any history of fever with chills, flank pain and irritative lower urinary tract infections (frequency, urgency, burning micturition and dysuria) in any patient should prompt a workup. The classical triad of fever, flank pain and nausea or vomiting occurs more commonly in patients with pyelonephritis.[12] Symptomatology such as fever with chills, flank pain and tenderness, nausea and vomiting were the common presenting complaints noted in our study. Wie et al showed that between the groups, symptoms of fever, flank pain, chills, nausea and vomiting were constant in the stented group.[9]

The most common organism in our study noted in culture was Escherichia coli in 20 cases, *Klebsiella* in 3 patients, *Pseudomonas* in 2 patients and *Candida* in 2 patients across both the groups. Wie et al showed that in a total 1062 women patients, 784 gave positive urine cultures and *Escherichia coli* was the most common pathogen (90.3% in 708 patients).[11]

Urine routine and microscopy examination showed pyuria/ turbid urine. Glycosuria and proteinuria were more commonly seen in the stented group. More number of normal urinalysis were found in the non-stented group.

Both blood culture and urine culture were positive in the stented group. Blood culture positive acts as a strong indicator of patient requiring stenting.

TLC is one of the important parameters reflecting the severity of infection. Counts more than 20000/cubic mm were found to have early clinical failure after the treatment of pyelonephritis. In our study, persistently elevated TLC despite medical treatment indicated the need for DJ stenting for better outcome and prognosis. The falling trend of count was noted. It was observed that patients with Total counts responding to medical treatment settled with medications alone and patients with persistently high Total counts not responding to medical treatment were patients who required stenting for the same.

Thrombocytopenia turned out to be a poor prognostic factor. The patients with thrombocytopenia are clinically more toxic, requiring stenting for better outcome. These findings were like a study by Chung et al.[13]

The trend of serum creatinine rise, or fall was a marker of renal parameter. This trend was taken as a variable in our study. It was like a study by Wie et al.[14]

The role of DJ stenting in acute pyelonephritis with obstruction due to urolithiasis, necrosed papilla or pus flaked are straightforward.[4] Infection causes decreased ureteric mobility by two main mechanisms- bacteria producing products acting on ureteral peristalsis mechanism and toxins directly acting on the ureteric smooth muscle.[13] It is also accepted and recommended for DJ stenting in acute pyelonephritis even in absence of hydroureteronephrosis, due to ureteric dyskinesia.[4]

The highly significant factors in our study included persistent high grade fever >100.4°F despite medical treatment (p=0.001), persistent nausea or vomiting despite medications (-=0.045), persistent chills despite medications (-=0.004), persistent flank pain and tenderness (p=0.035), persistent lower urinary tract symptoms (p=0.009), gross pyuria or turbid urine (p=0.0001), thrombocytopenia (p=0.001), persistent hyponatremia (p=0.04) and Hba1c levels >9 (p=0.001). These factors were analyzed between both the groups. It concluded that presence of only one factor made medical treatment a viable option. The presence of 3 or more of the above-mentioned poor prognostic factors in a patient indicates the need for DJ stenting in acute pyelonephritis cases. In our study, majority of patients had more than 3 factors, carrying poorer outcome and thus responded to stenting.

Limitations

Being a tertiary health care center, most of the patients were referred to and underwent a trial of conservative treatment before referring to the patient. Many patients were admitted to a critical stage requiring early urological intervention. If the number of patients in each group was more, data interpretation would have much more relevance and significance. A study with a greater number of patients recruited in each group would give us better data that could convince the statistical analysis in a much better way.

CONCLUSION

Pyelonephritis is a severe infectious and inflammatory disease of renal parenchyma. A high index of suspicion, identification of the unfavorable prognostic markers and an early diagnosis and intervention are required to achieve a better response and outcome in such patients. The presence of poor prognostic factors like high temperature, persistent chills, persistent flank loin and tenderness, persistent tachycardia, gross pyuria or turbid urine, persistently high TLC, persistently high serum creatinine, thrombocytopenia, unexplained persistent hyponatremia, Hba1c of more than 9% and positive blood or urine cultures strongly suggest a need for a minimally invasive urological procedure. The presence of 3 or more of the above-mentioned poor prognostic factors in a patient indicates the need for DJ stenting in acute pyelonephritis cases.

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