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A Study on The Clinical Profile of Patients with Acute Pyelonephritis Presenting as Acute Kidney Injury in A Tertiary Care Hospital in Jammu and Kashmir (Srinagar)

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Abstract

Introduction: Acute pyelonephritis (APN) is a common bacterial infection that can lead to acute kidney injury (AKI). Early diagnosis and treatment are crucial for preventing long-term renal damage. This study aimed to assess the incidence of AKI in patients with APN at a tertiary care hospital in Srinagar, Jammu and Kashmir.

Methods: A retrospective study was conducted on 30 patients with APN and AKI, hospitalized between September 1st and October 1st, 2024. Inclusion criteria were patients aged 18–70 years with radiologically confirmed APN. Exclusion criteria included chronic kidney disease, severe cardiopulmonary disease, and shock.

Results: Of the 30 patients, 22 (73.33%) were male, and the mean age was 46.56 ± 14.3 years. Risk factors for APN included diabetes mellitus (66.66%), hypertension (16.66%), and renal calculi (10%). Blood cultures were positive in 6 (20%) patients, with Escherichia coli being the most common pathogen. At presentation, the average serum creatinine was 4 mg/dL ± 2.3. Eight patients (26.66%) required hemodialysis during hospitalization. By discharge, the average serum creatinine decreased to 2.07 ± 1.48 mg/dL. The average length of stay was 7.2 ± 5.4 days. Age, initial serum creatinine, and diabetes were associated with unfavorable renal outcomes.

Conclusion: APN is a significant cause of AKI, particularly in patients with underlying conditions such

as diabetes. Early identification and aggressive treatment can lead to significant renal recovery, highlighting the importance of prompt intervention in preventing long-term renal impairment.

Keywords: Acute pyelonephritis, acute kidney injury, diabetes mellitus, serum creatinine, hemodialysis, renal recovery.

Introduction

Acute pyelonephritis is a bacterial infection causing renal inflammation and is one of the most common kidney diseases. Pyelonephritis generally occurs as a complication of an ascending urinary tract infection (UTI), which spreads from the bladder superiorly to the kidney, although the infection may also be spread hematogenously. Symptoms usually include fever, flank pain, chills, nausea, vomiting, anorexia, burning on urination, increased frequency, and urgency. The most common acute pyelonephritis symptoms are usually fever and flank pain[1]. Acute pyelonephritis can be divided into complicated and uncomplicated types. Complicated pyelonephritis includes pregnant patients, patients with uncontrolled diabetes, kidney transplants, acquired urinary anatomical abnormalities, acute or chronic kidney failure, as well as immunocompromised patients, and those with hospital-bacterial infections. It is essential to distinguish between complicated and uncomplicated pyelonephritis, as patient management and disposition depend on it. Chronic pyelonephritis refers to the disease process of pyogenic scarring and long-term inflammatory changes from persistent or recurrent renal infections, usually associated with vesicoureteral reflux or other significant urological anatomic abnormalities in children. In adults, it may describe the condition of an ongoing or intractable kidney infection associated with a major anatomical anomaly of the urinary tract, calculi, or an abnormal inflammatory response, such as in xanthogranulomatous pyelonephritis.

Objective

To study the incidence of acute kidney injury in patients with acute pyelonephritis in tertiary care hospital in Jammu and Kashmir Srinagar

Material and Methods

We retrospectively collected clinical, biochemical and radiological data of patients hospitalized in Medicine and Nephrology wards of our institute with a diagnosis of APN with AKI from September 1st 2024 to October 1st, 2024. We collected the records of 58 patients out of which 30 were selected for the evaluation as per our study criteria.

Inclusion Criteria

- Age > 18 -70 years of age
- All patients with acute pyelonephritis detected radiologically (USG, CT Scan)

Exclusion Criteria

- Patients with Known case of CKD
- Patients with severe cardiopulmonary disease, such as congestive heart failure, arrhythmia, or poorly controlled hypertension.
- Patients with shock.

Results

Of the 30 patients, 8 (26.66%) were female and 22 (73.33%) were male. The patients average age was 46.56 ± 14.3 years. Diabetes mellitus, obstructive uropathy, renal calculi, hypertension and renal transplant were risk factors for pyelonephritis that were present in20 (66.66%), 1 (3.33%), 3 (10%), 5 (16.66%) and 1 (3.33%) of the cases, respectively. None of the patients had emphysematous pyelonephritis. Two patients (30%) had positive blood cultures, and six patients (60%) had diabetes. One patient exhibited right-sided pyonephrosis and bilateral renal calculi. Because both patients had a

history of recurrent UTIs, they were evaluated for vesico-ureteric reflux (VUR). VUR was absent from all of them. The symptoms persisted for 13.2 ± 7 days on average. Ninety-seven had a fever. The average number of leucocytes per microliter of blood was 18321 ± 5678.

The patient's serum creatinine level was 4 mg/dl ± 2.3 mg/dl at arrival. Hemodialysis was needed for one or more sessions in 8 patients at the time of discharge, the average serum creatinine was 2.07 ± 1.0.48.At the time of discharge, 8% of patients had serum creatinine levels below 2.0 mg/dl. Every patient was discharged with their renal function having improved. 10 (33.33%) had positive urine cultures; the isolates were E. Coli 5 (16.66%), Klebsiella 2 (6.66%), and Pseudomonas 3 (10%). 6 individuals (20%) had a positive blood culture result. 50% of the 3 patients had diabetes. The hospital stay lasted 7.2 ± 5.4 days on average. Patient age, S. Creatinine at presentation, and diabetes were highly correlated with unfavorable outcomes in terms of elevated serum creatinine levels during hospital stay.

Table 1: Baseline characteristics of the patients

Male : Female	22:8 (73.33%: 26.66%)
Age (in years)	46.56± 14.8
Diabetics	20 (66.66%)
Hypertension	5 (16.66%)
Renal Calculi	3 (10%)
Obstructive Uropathy	1 (3.33%)
Bilateral pyelonephritis	1 (3.33%)

Table 2: Clinical and laboratory parameters

Fever (in degrees)	27 (90%)
Leucocyte count (per micro L)	18321
S. Creatinine at admission (mg/dl)	4 ± 2
S. Creatinine at discharge(mg/dl)	2.20 ± 1.0
Days of hospitalization	7 ± 4
Duration of symptoms	13.2 ± 7

Positive urine culture	24 (80%)
Positive blood culture	2 (6.66%)

Table 3: Urine Culture

Sterile	20 (66.66%)
E. Coli	5 (16.6%)
Klebsiella	2 (6.66%)
Pseudomonas	3 (10.0%)

Discussion

One potentially treatable cause of renal failure is acute pyelonephritis. Renal failure in APN is caused by a variety of factors. Bilateral renal involvement and related bilateral urinary tract blockage may be the cause. AKI may result from the use of nephrotoxic medications, such as aminoglycosides, non-steroidal anti-inflammatory drugs (NSAIDs), or alternative forms of medication, as well as septicaemia or shock due to sepsis from unilateral acute pyelonephritis. Few case reports of patients with APN with AKI exist. A case series with 223 pyelonephritis patients was presented by Rollino et al. 9.4%, or 21 individuals, suffered AKI.[2] Yadla et al examined the clinical profiles of 25 patients with acute kidney injury and acute pyelonephritis in individuals with type 2 diabetes mellitus and came to the conclusion that bilateral acute pyelonephritis should be taken into account when evaluating the patients with type 2 Diabetes mellitus with acute renal damage.[3] In a few number of Indian studies, sepsis has been identified as the primary cause while examining the aetiology of AKI. However, all of these studies – aside from one where urosepsis was the primary cause in 34% of the patients—did not go into detail about the underlying cause of sepsis.[4,5] Urinary tract infections (UTIs) continue to be the most frequent source of infection in people receiving kidney transplants. Urinary bladder infections (UTIs) following kidney transplantation are most second.[6,7] Most UTIs happen within the first three months. Although

lower UTI does not appear to impair transplant function, in 20% of instances.[8,9] Few studies have reported AKI associated with APN according to the RIFLE classification[10,11] and these studies did not explore incidence, risk factors, and clinical outcomes of AKI. One study used clinical presentation and one study used outcome as only one category in the clinical characteristics of ipsilateral and bilateral APN: they reported incidences of 32.2% and 21%, respectively. A recent study explored risk factors for the development of AKI in patients with urinary tract infections (UTIs)[8] it reported a 12.3% incidence of AKI and concluded that risk factors associated with AKI included old age, DM, upper UTI, and underlying CKD. Its lower reported AKI incidence may have resulted from the enrolment of lower UTI patients (67%) and application of different AKI criteria. AKI was diagnosed by a decrease in GFR more than 50% or doubling of serum creatinine compared to that at baseline according to the RIFLE GFR criteria in that study[8]. AKI is a common complication of sepsis and septic shock. UTI is a common cause of sepsis, may decrease renal function. Sepsis is known to be an important risk factor of AKI in several infectious diseases[9,12,13]. Previous studies have shown that hypovolaemia, hypotension, shock, the use of nephrotoxic drugs, and urinary tract obstruction are important AKI risk factors in UTI patients[14,15]. A recent study also found that older age, diabetes, upper UTI, and CKD were independent associated risk factors for developing AKI in patients with UTI[8]. One report also showed that severe inflammation was correlated with the occurrence of AKI in patients with APN[16]. Severe leukocytosis and higher CRP, as well as lower albumin levels, were common in AKI patients compared with non-AKI patients. CKD is considered an important risk factor for the development of AKI in several infectious diseases[17,18]. The frequency and severity of AKI according to the RIFLE classification were significantly greater in patients with CKD compared to patients without CKD. CKD was also associated with increased mortality in patients with AKI. We also found that more frequent and severe AKI, and higher mortality, were common in patients with CKD and AKI in spite of few enrolments of CKD patients. Another concern of AKI prognosis without underlying CKD is progression to CKD and aggravation of CKD after AKI. According to some studies, rates to new onset of CKD after AKI range from 7 to 20% over a follow-up of 1–3 years[19,20]. Flank pain is almost universal in patients with APN; its absence may support an alternative diagnosis and require another diagnostic tool, leading to late diagnosis and treatment and a poor prognosis. Older patients may not present with this symptom for several reasons including hypoesthesia, mental deterioration, and poor communication with medical staff. Older age and the absence of flank pain were risk factors of AKI in our study, although the latter was not significant in multivariate analysis. The absence of flank pain may be associated with late diagnosis and treatment, leading to an unfavorable prognosis. Previous studies have reported that patients with even mild AKI experience significantly higher mortality than those without AKI[21]. According to one report, total mortality was 1.7% in patients with bilateral APN[19]. According to another report, overall mortality rate was 0.38% in 790 UTI patients[21]. However, these two studies did not describe the relationship between mortality and AKI. According to one report, total mortality was 1.7% in patients with bilateral APN[19]. According to another report, overall mortality rate was 0.38% in 790 UTI patients[21]. However, these two studies did not describe the relationship between mortality and AKI. In our study

urine culture was positive in around 33%% of the patients probably due to early presentation of the patients with no prior antibiotic therapy. Urine culture positivity was comparable with other studies. Blood culture was positive in 6 patients (20%).

All patients had pyuria. We didn't encounter any fungal pyelonephritis in our study which may be due to small sample size or having only one renal transplant recipient. Fungal pyelonephritis is an important cause especially in immunocompromised patients. All patients were treated empirically with intravenous antibiotics as per the Infectious Diseases Society of America (IDSA) guidelines or later as per culture sensitivity reports.

Outcome: 10 patients were discharged with a normal serum Creatinine and they had normal serum Creatinine till last follow-up. Of the remaining 20 patients with higher serum Creatinine at discharge, serum Creatinine settled to baseline in 3 patients while remaining patients had abnormal 5 values in their last follow-up. Out of these 15 patients had received HD during hospitalization. These groups of patients will require longer follow up to know the renal outcome.

Conclusion

If APN is not treated early, it continues to be a major cause of AKI with high morbidity. Patients with fever and other symptoms together with unexplained renal failure need to be treated with extreme caution. The majority of patients can significantly restore their renal function with aggressive and early therapy that reverses the course of the disease.

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