

# A Study of Microbiological Profile in patients with Acute Pyelonephritis in a Tertiary Care Hospital, Nandyal

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## Abstract

**Background :** Acute pyelonephritis is a bacterial infection that affects the renal parenchyma that can be life-threatening and often leads to renal scarring. It usually ascended from the lower urinary tract, and also reach the kidney via the bloodstream. Early diagnosis and management of acute pyelonephritis have a better impact on patient outcomes. Acute pyelonephritis is one of the severe conditions with high mortality and morbidity. It represents the most severe form of urinary tract infection. Acute pyelonephritis is the most common cause of community-onset bacteremia in elderly patients<sup>1</sup>.

**Aim:** To study the microbiological profile in patients with acute pyelonephritis admitted in a tertiary care hospital.

**Materials and Methods:** A Hospital-based Prospective study was conducted in the Department of Medicine, Santhiram medical college & general hospital for a 2 year period. Universal Sampling Technique was used for the selection of study subjects. The study population included patients admitted with fever, flank pain, and positive urine or blood cultures in the department of general medicine in Santhiram medical college and general hospital. The final sample size was 50 subjects.

**Results:** In the present study, 50 participants were selected as the study population. The mean age of the study population was  $57.48 \pm 11.21$ . The majority of participants (70%) were distributed in a 50 to 69-year age group. Majority of participants were females (60%) and males (40%). In the current study among participants, in the current study, urine culture was positive in 29 patients (58%) of the study population. In 29(58%) of the subjects who had a culture-positive infection, the most predominant infectious agent in the present study group was *Escherichia coli* and was reported in 22 (44%) of the study subjects. Other causative organisms include, *Klebsiella pneumonia* was reported in 2(4%) subjects. *Candida albicans*, *Citrobacter*, *Enterococcus faecalis*, and *Pseudomonas* were isolated in 1 (2%) subject each. One subject had a dual infection with *Escherichia coli* and *Candida*. In current study, among the 29 culture isolates, none of them were resistant to Cefoperazone plus Sulbactam or Piperacillin plus tazobactam. The highest proportion of resistance was reported for Ampicillin as 82.1% of isolates were resistant. Levofloxacin resistance was found in 67.9% of isolates. Gentamicin and

Amikacin resistance was found 17.86% and 3.6% of the isolates. Nitrofurantoin resistance was found in 2 (7.1%) of isolates.

**Conclusion:** The mean age of the study population was  $57.480 \pm 11.2072$  years in the study population, and there was a slight female preponderance in the occurrence of APN. The majority of participants (78%) were distributed in a 50 to 69-year age group. Diabetes, hypertension, ureteric calculus, and past history of UTI were the common risk factors identified in the study population. In. More than half (58%) of the study population had a culture-positive infection. The most common organism isolated in the study population was *E. Coli*, responsible for 44% of the cases. None of them were resistant to Cefoperazone plus Sulbactam or Piperacillin plus tazobactam. The other antimicrobials, which have not shown any resistance, were Meropenem and Colistin. The highest proportion of resistance was reported for Ampicillin in 82.1%, followed by Levofloxacin in 67.9% of isolates. ICU admission rate was higher in culture-positive cases (63.6%), as compared to culture-negative cases (36.4%) None of the study subjects had hospital mortality.

## INTRODUCTION

Acute pyelonephritis is a bacterial infection that affects the renal parenchyma that can be life-threatening and often leads to renal scarring. It usually ascended from the lower urinary tract, and also reaches the kidney via the bloodstream. Early diagnosis and management of acute pyelonephritis have a better impact on patient outcomes. Acute pyelonephritis is one of the severe conditions with high mortality and morbidity. It represents the most severe form of urinary tract infection. Acute pyelonephritis is the most common cause of community-onset bacteremia in elderly patients<sup>1</sup>.

## AIM AND OBJECTIVES:

To study the microbiological profile in patients with acute pyelonephritis admitted in a tertiary care hospital.

## MATERIALS AND METHODS:

A hospital-based prospective study was conducted in the Department of General Medicine, Santhiram Medical College, and General Hospital for a 2 year period after taking approval from the Hospital Ethics and Research Committee.

**Sampling Technique and Sample Size:** Universal Sampling Technique was used for the selection of study subjects. All the

patients coming to the medicine department during the study period and fulfilling the inclusion criteria were taken for study after taking prior informed consent. The patients included in the study were from both ICU and wards. The final sample size came to be 50 subjects.

#### Inclusion Criteria

1. Age > 18 years with written informed consent.
2. Patients presenting with features of acute pyelonephritis (fever with flank pain, positive urine culture, imaging suggestive of acute pyelonephritis).

#### Exclusion criteria

1. Age < 18 years.
2. Pregnant and lactating mothers.
3. Patients without informed written consent.

#### Data Analysis

All patient profiles were recorded in proforma, and findings were tabulated, SPSS24 was used for the analysis of the data.

#### RESULTS:

The proportion of the male and female population was 40% and 60%, respectively in the study population.

**Table 1:** Descriptive analysis of Gender in the study population (N=50).

SEX			
		Frequency	Percent
SEX	MALE	20	40.0
	FEMALE	30	60.0
	Total	50	100.0

Among the study population, 29 (58%) of the subjects had a culture-positive infection.

**Table 2:** Descriptive analysis of culture status in the study population (N=50).

CULTURE STATUS			
		Frequency	Percent
CULTURE STATUS	YES	29	58.0
	NO	21	42.0
	Total	50	100.0

E. coli was the most common organism isolated in culture, in 22 (44%) of the study subjects. Klebsiella pneumoniae was isolated in 2(4%) subjects. Candida Albicans, Citrobacter, Enterococcus Faecalis, and Pseudomonas were isolated in 1 (2%) subject each. One subject had a dual infection with E. coli and Candida.

**Table 3:** Descriptive analysis of urine culture in the study group (N=50)

URINE CULTURE ORGANISM			
		Frequency	Percent
URINE CULTURE ORGANISM	STERILE	21	42.0
	E.COLI	22	44.0
	KLEBSIELLA PNEUMONIAE	2	4.0
	CANDIDA ALBICANS	1	2.0
	CITROBACTER	1	2.0
	E.COLI, CANDIDA GROWTH	1	2.0
	ENTEROCOCCUS FAECALIS	1	2.0
	PSEUDOMONAS AERUGINOSA	1	2.0
	Total	50	100.0

Among the 29 culture isolates, none of them were resistant to Cefoperazone plus Sulbactam or Piperacillin plus tazobactam. The other antimicrobials, which have not shown any resistance, were Meropenem and Colistin. The highest proportion of resistance was reported for Ampicillin as 82.1% of isolates were resistant. Levofloxacin resistance was found in 67.9% of isolates. Gentamicin and Amikacin resistance was found 17.86% and 3.6% of the isolates. Nitrofurantoin resistance was found in 2 (7.1%) of isolates.

**Table 4:** Descriptive analysis of Antibiotic sensitivity pattern in culture-positive cases (N=29)

ANTIBIOTIC SENSITIVITY PATTERN IN CULTURE POSITIVE CASES				
ANTIBIOTIC	SENSITIVE	%	RESISTANT	%
CEFOPERAZONE + SULBACTAM	29	100	0	0
PIPERACILLIN + TAZOBACTAM	29	100	0	0
MEROPENEM	29	100	0	0
COLISTIN	29	100	0	0
AMIKACIN	28	96.4	1	3.6
NITROFURANTOIN	27	92.9	2	7.1
GENTAMICIN	24	82.14	5	17.86
LEVOFLOXACIN	9	32.1	19	67.9
AMPICILLIN	5	17.9	23	82.1
Total				

**Discussion:**

Acute pyelonephritis is an infection that affects renal parenchyma and renal pelvis. Acute pyelonephritis is considered uncomplicated if the infection is caused by a typical pathogen in an immunocompetent patient who has normal urinary tract anatomy and renal function. The condition is not generally associated with high levels of mortality, but patients can become acutely ill and experience severe pain. It can lead to sepsis, renal abscesses, and chronic pyelonephritis and also cause secondary hypertension, renal failure, and death if misdiagnosed. Acute pyelonephritis is a major complication of pregnancy that may result in significant maternal and fetal morbidity.<sup>2</sup>The risk of APN is also increased in diabetics. Even though APN have good treatment options, developing countries like India, where there is poor access to good health services and also a high load of diabetes, make APN more complicated.<sup>3,4</sup>

Females are prone to develop acute pyelonephritis because urinary tract infections are more common in females due to shorter urethra, hormonal changes, and close distant to the anus.

In the study of Shin et al.(2012), the proportion of females (98.3%) was higher than males.<sup>5</sup>In the study of Chung, V. Y.(2014) also study population consists 70.6% of females and 29.4% of males.<sup>6</sup> In Leelavathi Venkatesh et al.(2017), study, the most common co morbid condition was diabetes mellitus(69%). This study concluded that diabetes mellitus patients are at high risk of developing pyelonephritis. When diagnosed early, the majority of patients respond to antibiotics.<sup>7</sup>

In L Umesha et al. study, urine culture was positive in 48 percent of cases. Culture negativity in the study group attributed to prior usage of antibiotics in outside hospitals or due to the late collection of urine samples. This study group concluded that culture negativity groups are at lesser risk in developing complications such as renal abscess, renal failure, multi-organ dysfunction, and death. Escherichia coli is the most common pathogen in emphysematous pyelonephritis and nonemphysematous pyelonephritis groups, followed by Klebsiella pneumonia in this study group. In this study, there is a difference in antibiotic sensitivity patterns in inpatient in wards and intensive care patients though the prevalence of organisms was the same in both groups. Local antibiogram pattern is important to prevent resistances in organisms.<sup>8</sup>

In the study of Shin et al., seven hundred nineteen patients (56.8%) had positive culture results, and 211 of them (29.3%) also had positive blood cultures. The etiologic agents of the acute pyelonephritis in the study population, Escherichia coli was overwhelmingly the most common pathogen (661/719, 91.9%). Klebsiella pneumoniae (15/719, 2.1%), Streptococcus species (7/719, 1.0%), and Enterococcus species (11/719, 1.6%) were also identified. This study concluded that

Fluoroquinolone treatment of uncomplicated acute pyelonephritis caused by Fluoroquinolone resistant Escherichia coli has lesser cure rates and prolonged hospital stay.<sup>5</sup>In the study of Chung, V. Y. et al. the yields of blood culture were positive in 57.4% of the patients, with Escherichia coli being the commonest causative organism (38.2%) followed by Klebsiella pneumoniae, Proteus mirabilis, and Acinetobacter species. 75% of patients in this study group had urinary obstruction. Factors attributed to mortality are old age (more than 65 years), males, renal failure, and disseminated intravascular coagulation. This study concluded there was a high prevalence of septic shock and bacteraemia in patients with severe acute pyelonephritis.<sup>6</sup>

**Conclusion:**

These are the following findings from this study;

- The mean age of the study population was 57.480 ± 11.2072 years in the study population, and there was a slight female preponderance in the occurrence of APN. The majority of participants (78%) were distributed in a 50 to 69-year age group.
- Diabetes, hypertension, ureteric calculus, and past history of UTI were the common risk factors identified in the study population.
- In the present study, the classical triad of pyelonephritis is present in 34 percent of patients. Fever was a predominant symptom in 84% of patients, flank pain in 78% of patients, and burning micturition in 58% of patients.
- More than half (58%) of the study population had a culture-positive infection
- The most common radiological findings were renal calculus, ureteric calculus, hydronephrosis, and bulky kidneys.
- The most common organism isolated in the study population was E.Coli, responsible for 44% of the cases.
- None of them were resistant to Cefoperazone plus Sulbactam or Piperacillin plus tazobactam. The other antimicrobials, which have not shown any resistance, were Meropenem and Colistin.
- The highest proportion of resistance was reported for Ampicillin in 82.1%, followed by Levofloxacin in 67.9% of isolates.
- ICU admission rate was higher in culture-positive cases (63.6%), as compared to culture-negative cases (36.4%)
- None of the study subjects had hospital mortality.

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