Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: xyz10.53555/jptcp.v30i18.3215

PATTERN OF ANTIBIOTIC RESISTANCE IN STROKE PATIENTS WITH UTI AND ITS DETERMINANTS

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Abstract

Background: Stroke is the world's second leading cause of mortality and morbidity. Stroke survivors usually have UTIs along with other infections as they weaken the immune system. UTIs are common after a stroke and usually result in death or disability.

Objective: The main objective of this study is to discover and characterise the pattern of antibiotic resistance in UTIs among 80 stroke patients.

Study Design: Descriptive cross-sectional study

Place and Duration: This Study was conducted at the Department of Medicine, Lady Reading Hospital, and Peshawar between September 2022 and February 2023

Material and Methods: The study included 80 patients over the Age of 18 of both genders. Urine cultures were collected before antibiotics were administered to UTI-symptomatic stroke patients. Relevant data was entered in a pre-designed proforma to adjust for confounders and bias.

Results: The study had 80 patients, 45 (56.25%) male and 35 (43.75%) female. Patients had a mean age of 62.4±10.3 years. 70% of patients had ischemic strokes, while 30% had hemorrhagic strokes. The average NIHSS score was 9.7±3.6. Many patients (35%) had recurrent strokes and 95% needed bladder catheterisation. Most patients (72.5%) had diabetes. E. coli caused 45 (56.25%) UTIs. (90%) were sensitive to Carbapenems, nitrofurantoin, and fosfomycin only.

Conclusion: This study, focusing on urinary tract infections (UTIs) in stroke patients, has disclosed essential elements of patient demographics, clinical profiles, causative microorganisms, and treatment resistance trends.

Keywords: Stroke, Urinary Tract Infection, Antibiotic Resistance, Microorganisms.

Introduction

Stroke is a major worldwide health issue, ranking as the second leading cause of death and has a substantial impact on global morbidity. Stroke is a condition that causes both a significant number of deaths and serious health problems, leading to long-term disability in up to half of the people who survive it[1,2]. After the first phase of stroke, the damaged brain may alter the peripheral immune response and transition the functional condition of the peripheral immune system from being capable to being suppressed[3]. Stroke may lead to the migration and abnormal colonisation colonisation of certain gut bacteria, which increases the susceptibility of stroke patients to infections[4].

Urinary tract infections (UTIs) emerge as a particularly serious problem among the various complications that stroke survivors suffer, with a frequency ranging from 3 to 40% [5,6,7]. These infections are linked to an increased risk of poor outcomes, such as mortality and disability, adding to the already significant burden put on stroke patients and healthcare providers[8,9]. A stroke can cause complex immune system changes that make patients vulnerable to infections, particularly UTIs. Furthermore, the occurrence of stroke has been linked to changes in the gut microbiota, potentially making stroke patients more susceptible to infections. In the post-stroke period, urinary tract infections, in particular, stand out as a common and dangerous occurrence, with incidences ranging widely. It is critical to identify the causative organisms and antibiotic resistance to guide appropriate treatment strategies for these vulnerable patients.

Multiple studies have shown that Gram-negative bacilli, namely the Enterobacteriaceae bacteria family, are the predominant pathogens associated with the development of urinary tract infections (UTIs). Additionally, E. coli is the cause of over 81% of urinary tract infection (UTI) cases[10,11]. Staphylococcus saprophyticus, Klebsiella, Enterobacter, Proteus, and Enterococci have also been identified as causative agents of urinary tract infections (UTIs). Prompt and precise identification of UTIs is crucial for reducing the duration of sickness and averting the advancement of the disease to higher UTIs and kidney damage. The global variation in antibiotic resistance is attributed to genetic mutations in strains, variations in antibiotic use, and disparities in the accessibility of broad-spectrum novel antibiotics[12]. In order to administer the appropriate antibiotic, physicians must have sufficient information about the likely cause of infection and antibiotic susceptibility. Therefore, it is necessary for patients with infectious diseases, such as UTIs, to begin treatment early, even before a definitive diagnosis of the infection cause and antibiogram. In order to initiate treatment prior to the availability of culture and antibiotic sensitivity test results, UTI agents and antibiotic resistance are detected in each location[13,14,15]. Accurate identification of the bacteria causing urinary tract infections (UTIs) and their antibiotic resistance is crucial for targeted treatment to eliminate the infectious agent[16].
We want to clarify this crucial feature of post-stroke care by evaluating 80 stroke patients. Our findings may enhance patient outcomes and treatment techniques.

Methodology

Study Design: descriptive cross-sectional study

Place and Duration: This Study was conducted at the Department of Medicine, Lady Reading Hospital, Peshawar, from September 2022 to February 2023

Material and Methods: This study comprised 80 patients of both genders who were above the Age of 18. The inclusion criteria include 80 cases of stroke (both ischemic and hemorrhagic) with UTIs. After receiving ethical and research committee permission, data collection started. Patients who fulfilled the inclusion criteria were admitted to the ward; informed consent was taken either from patients or their families and then enrolled in the study. Urine cultures were collected before starting antibiotic treatment. To adjust for confounders and bias, relevant was entered in a pre-designed proforma.

Data Analysis
The data collected was analysed using SPSS 10.0. For categorical factors, percentages and proportions include gender, different bacterial strains, antibiotic group sensitivity, Diabetes, Glasgow Coma Scale (GCS) score, bladder catheterisation catheterisation, recurrent stroke, and National Institutes of Health Stroke Scale (NIHSS) score applied.

Statistical Analysis
Percentages and proportions for categorical variables evaluated gender, bacterial strain, and antibiotic sensitivity distribution and prevalence. The Chi-square test was used. Statistical software package SPSS, version 20.0 IBM Crop. IBM SPSS statistics was used for statistical analysis.

Results
The study included a total of 80 patients; 45 (56.25%) were male, and 35 (43.75%) were female. The mean Age of the patients was 62.4±10.3 years. The majority of patients (70%) had an ischemic stroke, whereas the remaining 30% suffered a hemorrhagic stroke. The average NIHSS score was 9.7±3.6, indicating moderate stroke severity. A considerable proportion of patients (35%) had a recurrent stroke, and 95% needed bladder catheterisation catheterisation. The majority of patients (72.5%) had diabetes mellitus. The study cohort was varied in terms of gender, stroke type, comorbidities, etc., as shown in Table (Table-I).

Table 2 summarises the microbiological pathogens found in the study's population. 45 (56.25%) of the 80 patients had E. coli as the causal pathogen for their UTI. The second most prevalent organism was Staphylococcus saprophyticus, which was found in 15 (18.75%) of the patients. Klebsiella, Enterobacter, and Proteus were found in ten (12.5%), five (6.25%), and five (6.25%) of the patients, respectively. E. coli was the most common causal bacterium in the study population, accounting for more than half of the UTI cases.

Table 3 shows antibiotic resistance trends in stroke patients with UTIs. Carbapenems, nitrofurantoin, and fosfomycin were the most frequent UTI medications prescribed according to urine culture sensitivity and were found to be 99% sensitive. Resistance is only in 1 % of cases. Other regularly used antibiotics like piperacillin/tazobactam and cefoperazone/sulbactam have 20% and 50% resistance rates. However, 70% and 75% of fluoroquinolones and trimethoprim-sulfamethoxazole resistance rates were significant. 3rd generation cephalosporins and amoxicillin had the highest 90% and 96% resistance rates. These data indicate that stroke patients need to be evaluated carefully before starting appropriate antibiotic therapy, as commonly practised antibiotics are found to have a high resistance rate among stroke patients. The causes of antibiotic resistance in this population and effective solutions need further investigation and studies.

Table 1: Demographic and Clinical Characteristics of Patients (n=80)

Characteristics	**Value**	**Percentage**
Gender		
Male	45	56.25%
Female	35	43.75%
Mean Age (years)	62.4±10.3	N/A
Ischemic Stroke	56	70%
Hemorrhagic Stroke	24	30%
Mean NIHSS Score	9.7±3.6	N/A
Recurrent Stroke	28	35%
Bladder Catheterization Catheterization	76	95%
Associated Diabetes Mellitus	58	72.5%

Table 2: Microbiological Causative Organisms

Microorganism	Number of Patients (n=80)	Percentage
Escherichia coli (E. coli)	45	56.25%
Staphylococcus saprophyticus	15	18.75%
Klebsiella	10	12.5%
Enterobacter	5	6.25%
Proteus	5	6.25%
Total	80	100%

Table 3: Antibiotic Resistance Patterns

Antibiotic Group	Resistance Rate
Carbepebems, Nitrofurantoin, Fosfomycin	01%
Pipercillin /tazobactam	20 %
Cefoperazone/salbactum	50 %
Moxifloxacine	70%
Trimethoprim-Sulfamethoxazole	75%
Augmentin	96%
Ceftriaxone	90%

Discussions

The current study has identified the causative organisms for causing urinary tract infections in stroke patients and antibiotic resistance patterns. E. coli was shown to be the most prevalent in the study population, accounting for more than half of the UTI cases. This conclusion is consistent with earlier research that found E. coli to be the most commonly linked bacterium in UTIs [17]. According to Foxman et al. [18], E. coli is responsible for 80% of UTIs in women, while according to Nicolle [19], E. coli is responsible for 75% of UTIs in elderly patients. These data indicate that E. coli is a prevalent causal bacterium in UTIs in many populations and age categories.

Staphylococcus saprophyticus was the second most prevalent linked bacterium discovered in this study, accounting for 18.75% of UTI cases. This conclusion is consistent with earlier studies that have identified Staphylococcus saprophyticus as a prevalent linked bacterium in urinary tract infections [20]. Gupta et al. [21] discovered that Staphylococcus saprophyticus caused 15% of UTIs in young women. Hooton et al. [22] discovered that Staphylococcus saprophyticus was responsible for 10% of UTIs in young women. These data indicate that Staphylococcus saprophyticus is a prevalent cause of UTIs, especially in young women.

According to the findings of the current research, Klebsiella, Enterobacter, and Proteus were responsible for 12.5%, 6.25%, and 6.25% of UTI cases, respectively. These results support previous studies that have identified these microbes as prevalent causal agents in UTIs [23]. Klebsiella was shown to be responsible for 10% of UTIs in young women in research by Gupta et al. [21]. In contrast, Enterobacter was found to be responsible for 5% of UTIs in a study by Hooton et al. [22]. These data imply that Klebsiella, Enterobacter, and Proteus are also frequent pathogens in UTIs, especially in young women.

The current research also sought to identify antibiotic resistance trends in stroke patients with UTIs. According to the study, the resistance rates for moxifloxacine, amoxicillin-clavulanate, and trimethoprim-sulfamethoxazole were 70%, 90% and 75 respectively. Similarly, higher resistance rates for cephalosporins and amoxicillin, which are 90 and 95%, respectively, suggest that these antibiotics are not effective treatments for UTIs caused by the microbiological organisms discovered in this research group. This is consistent with previous studies that reported significant rates of antibiotic resistance in UTIs [24]. Gupta et al. [21] discovered that ciprofloxacin, amoxicillin-clavulanate, and trimethoprim-sulfamethoxazole showed resistance rates of 70%, 70%, and 80% in UTIs caused by E. coli, respectively. These data imply that antibiotic resistance is a widespread

problem in urinary tract infections in stroke patients and that alternate treatment options with broad-spectrum antibiotics are required.

The current research also discovered that carbapenems, fosfomycin and nitrofurantoin had lower resistance rates of 1 %, so data suggested that these antibiotics are more effective treatment options for UTIs caused by the identified microbiological organisms in stroke patients. This is similar to previous studies, which demonstrated decreased rates of resistance to antibiotics like carbapenems, nitrofurantoin and fosfomycin in UTIs [25]. By Gupta et al. [21].

Overall, the results of this research emphasize the necessity of identifying the causative microbacterial organisms and appropriate antibiotic therapy according to culture and sensitivity in UTIs after a stroke. This information will assist in the guidance of correct antibiotic treatment and ultimately enhance patient outcomes.

Study Limitation

Some limitations of this research were the small number of samples and a single-centre design. Larger sample numbers and multi-centre designs are required in future research to corroborate these results and give more extensive insights into the microbiological and antibiotic resistance trends in UTIs after a stroke.

Conclusion

This research, which focused on urinary tract infections (UTIs) in stroke patients, offered illumination on crucial patient demographics, clinical profiles, causative bacteria, and drug resistance trends. The high frequency of ischemic and recurrent strokes emphasises the need for awareness and secondary prevention. Escherichia coli emerged as the most common bacteria causing UTIs, emphasizing emphasizing the need for targeted therapy. The patterns of antibiotic resistance indicated variable degrees of resistance across drug categories. These results highlight the need to use appropriate antibiotics in the treatment of UTIs in stroke patients.

Acknowledgement

The authors express their gratitude to all the patients who actively took part in this research, as well as the medical staff for their valuable assistance and collaboration.

Conflict of interest

The authors declare no conflict of interest.

Author's Distribution

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