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Drug Utilisation Pattern of Antimicrobial Agents Prescribed for Urinary Tract Infection in Geriatric Patients at a Tertiary Care Hospital: A Retrospective Study

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ABSTRACT

Introduction: Drug utilisation studies may lead to several perspectives such as the correct usage of drugs and appropriateness of drug utilisation. Prescription indicators are used to assess the effectiveness of healthcare practitioners in several critical characteristics connected to drug usage. **Objectives:** 1. To determine the most commonly prescribed antimicrobial agents for treating UTI in Geriatric patients.2. To analyse prescriptions in comparison with WHO prescribing indicators. **Methods:** All the cases of UTI in geriatric patients with positive urine culture report in the past 6 months (Feb 2023 –July 2023) were included and it was a complete enumeration study. Discrete variables and Categorical variables were represented by percentage. Continuous variables were expressed in mean ± SD. **Result:** Total of 70 geriatric patients with UTIs were enrolled in the study. Of these male Patients were 31 (44.28%) and female Patients were 39 (55.71%). No of antibiotics per Prescription was 1.97± 1.43. Approximately 40.54% of medications were prescribed using their generic names. About 79.27% of medications were prescribed from the NLEM. 62.16% of drugs were prescribed by injection. systemic hypertension (67.74%) was observed in the majority of UTI patients. Piperacillin + Tazobactam were the most prescribed antibiotics. Duration of hospital stay was 10.22±6.71 days. **Conclusion:** By addressing these findings, we can enhance the pharmacological management of UTIs in geriatric populations, leading to improved patient outcomes and quality of care.

KEYWORDS: Urinary tract infection, Drug Utilisation Studies, Geriatric patient, Prescription, Antibiotics

INTRODUCTION

The World Health Organization (WHO) defines drug utilisation research as the study of the marketing, distribution, prescription, and use of drugs in society, with a focus on their medical, social, and economic consequences. [1] Geriatrics is a specialized field dedicated to maintaining the health and quality of life of older adults through comprehensive assessments and effective therapeutic strategies. [2] Among all age groups, geriatric patients—those aged 65 years and above—are prescribed the most medications, making them particularly susceptible to adverse drug reactions (ADRs) and polypharmacy. [3, 4]

Due to their weakened immune responses, older adults are more vulnerable to bacterial and viral infections, including urinary tract infections (UTIs), which are the second most common illness in this population. [5] A UTI is caused by microbial invasion of the urinary tract, from the renal cortex to the urethral opening, and is defined by a bacterial count of $\geq 10^5$ colony-forming units (CFU) per milliliter of urine. [6]

The geriatric population faces an elevated risk of UTIs due to factors such as dehydration, cognitive impairments, urinary and fecal incontinence, and reduced mobility. [7, 8] Additionally, conditions such as advanced age, diabetes mellitus, spinal cord injuries, catheterization, and poor overall health make diagnosing and treating UTIs in older adults more complex than in younger populations. [8]

Specific anatomical and physiological changes also contribute to this increased susceptibility. In women, pelvic organ prolapse, vaginal atrophy, and estrogen deficiency can predispose them to UTIs, while men are at risk due to prostate-related complications. Other risk factors include

poor perineal hygiene, immunosuppression, neurological illnesses, structural abnormalities, and invasive medical procedures. [8, 9]

Understanding the unique challenges of managing UTIs in the elderly is essential to optimizing treatment strategies and improving outcomes for this vulnerable group.

MATERIALS AND METHODS

Study Design: This retrospective study was conducted at Yenepoya Medical College and Hospital, a tertiary care center in Mangalore, Karnataka. It aimed to evaluate the prescribing patterns of antimicrobial agents used for treating urinary tract infections (UTIs) in geriatric inpatients.

Study Setting and Population: The study included all geriatric inpatients aged 65 years and above who had a positive urine culture report and were admitted to the hospital between February 2023 and July 2023. This complete enumeration study ensured that every eligible patient during the study period was analyzed.

Eligibility Criteria: Patients were included if they were diagnosed with UTIs confirmed by positive urine culture and had been prescribed at least one antimicrobial agent during hospitalization. Patients receiving antimicrobial agents for co-infections or surgical prophylaxis were excluded from the study.

Data Collection: Data were extracted retrospectively from urine culture registers maintained by the Microbiology Department. The corresponding case sheets were reviewed in the Medical Records Department to collect detailed information on demographic characteristics, prescribed antimicrobial agents, routes of administration, and comorbid conditions. All procedures were conducted following approval from the Institutional Ethics Committee.

Prescription Analysis: The prescribing patterns were assessed using the WHO prescribing indicators, which included the number of antimicrobial agents per prescription, the percentage of drugs prescribed by generic name, adherence to the National List of Essential Medicines (NLEM), and the proportion of injectable drugs prescribed. The following key patient details were noted:

- Demographic data.
- Names and classes of prescribed antimicrobial agents.
- Route of administration of prescribed medications.
- Presence of comorbid conditions.

Data Analysis: Data were organized in a Microsoft Excel sheet and analyzed using SPSS version 27. Categorical variables, such as the percentage of prescriptions adhering to NLEM and the proportion of injectable drugs, were presented as percentages. For the number of antibiotics per prescription, data were summarized using the median and interquartile range (IQR) to appropriately represent the discrete distribution. Comorbidities and demographic characteristics were also analyzed to identify trends within the study population.

RESULTS

A total of 70 geriatric patients with positive urine culture reports were enrolled in the study. Among these, 31 (44.28%) were male, and 39 (55.71%) were female, indicating a predominance of female patients. The highest number of patients was observed in the 65–70 age group, accounting for 26 (37.14%) cases, followed by 22 (31.42%) cases in the 71–75 age group. The detailed distribution of patient demographics is presented inTable 1.

WHO Prescribing Indicators: The study observed key prescribing indicators among the patient population, as shown inTable 2. The majority of prescriptions, accounting for 54.29%, included one antibiotic, followed by 31.43% of prescriptions with two antibiotics. The median number of antibiotics per prescription was 2 (IQR: 1–3). Of the total drugs prescribed, 45 (40.54%) were written using generic names, while 88 (79.27%) adhered to the National List of Essential Medicines (NLEM). Injectable drugs were commonly prescribed, with 69 (62.16%) prescriptions including at least one injectable antibiotic.

Comorbidities: The study population presented with various comorbidities, which are detailed in Table 3. Systemic hypertension was the most prevalent comorbidity, observed in 47 (67.74%) patients, followed by type 2 diabetes mellitus in 37 (52.85%) patients. Acute kidney injury (AKI) was present in 17 (24.28%) patients, while chronic kidney disease (CKD) and anaemia were recorded in 10 (14.28%) and 13 (18.57%) patients, respectively. Other notable conditions included benign prostatic hyperplasia in 9 (12.85%) patients and chronic obstructive pulmonary disease in 5 (7.14%) patients.

Antibiotic Usage: In terms of antibiotic usage, Piperacillin + Tazobactam was the most frequently prescribed antibiotic, used in 25 (22.52%) patients. This was followed by Meropenem, which was prescribed in 12 (10.81%) patients, and Doxycycline, used in 9 (8.10%) patients. Clindamycin was prescribed for 6 (5.40%) patients, while Vancomycin and Ceftriaxone were each used in 5 (4.50%) patients. Less commonly prescribed antibiotics included Cefuroxime, Cefotaxime, and Nitrofurantoin. A diverse group of other antibiotics accounted for 36 (32.43%) of prescriptions. The detailed breakdown of antibiotic usage is presented in Table 4.

DISCUSSION

Drug utilisation reviews (DURs) serve as aids in promoting rational drug utilisation and enables physicians to improve the suitability of their prescriptions. Retrospective studies offer opportunities to prevent future errors and furnish evidence supporting current clinical practices. Both the World

Age Group	Females (%)	Males (%)	Total (%)
65–70	17 (24.2%)	9 (12.8%)	26 (37.14%)
71–75	8 (11.42%)	14 (20%)	22 (31.42%)
76–80	6 (8.57%)	3 (4.28%)	9 (12.85%)
81–85	1 (1.42%)	5 (7.14%)	6 (8.57%)
86–90	-	-	-
>90	-	2 (2.85%)	2 (2.85%)

Table 1: Demographic Characteristics of Geriatric Patients with Positive Urine Culture Reports

Indicator	Result
No. of antibiotics per prescription	Median: 2 (IQR: 1–3)
Drugs prescribed by generic name	45 (40.54%)
Drugs prescribed from NLEM	88 (79.27%)
Drugs prescribed by injection	69 (62.16%)

Table 2: WHO Prescribing Indicators Observed Among Geriatric Patients Diagnosed with UTIs

Comorbidity	No. of Cases (%)
Acute Kidney Injury	17 (24.28%)
Type 2 Diabetes Mellitus	37 (52.85%)
Systemic Hypertension	47 (67.74%)
Chronic Kidney Disease	10 (14.28%)
AKI on CKD	8 (11.42%)
COPD	5 (7.14%)
Chronic Liver Disease	6 (8.57%)
Anaemia	13 (18.57%)
Benign Prostatic Hyperplasia	9 (12.85%)
Others	16 (22.85%)

COPD: Chronic Obstructive Pulmonary Disease, AKI on CKD: Acute Kidney Injury on Chronic Kidney Disease

Table 3: Distribution of Comorbidities in Geriatric Patients Diagnosed with UTIs

Antibiotic	No. of Patients (%)
Piperacillin + Tazobactam	25 (22.52%)
Meropenem	12 (10.81%)
Doxycycline	9 (8.10%)
Clindamycin	6 (5.40%)
Vancomycin	5 (4.50%)
Ceftriaxone	5 (4.50%)
Cefuroxime	3 (2.70%)
Cefotaxime	3 (2.70%)
Nitrofurantoin	4 (3.60%)
Others	36 (32.43%)

Table 4: Antibiotics Prescribed for the Management of UTIs in Geriatric Patients

Health Organization (WHO) and India's National Health Policy advocate for the application of essential medications, prescribed with generic names, for treating diseases. Examining prescription patterns forms a vital connection among prudent and rational drug utilisation, pharmacovigilance, evidence-based medicine, and Pharmacoeconomics. [10]

Urinary tract infections (UTIs) are prevalent across all age groups, particularly among older individuals, attributed to their weakened immune response and sedentary lifestyle. Women, regardless of age, experience UTIs more frequently than men, with the incidence rising with age. Every woman encounters at least one UTI during her reproductive years, with a notable surge of up to 60% post-menopause. Hormonal shifts, urinary tract abnormalities, compromised immunity, urinary incontinence, reduced functional capacity, nutritional deficiencies, and concurrent disorders are key risk factors for UTIs in the elderly.

Additionally, oestrogen depletion in older women disrupts vaginal flora, fostering periurethral colonisation due to reduced lactobacilli levels. Changes such as increased urine output, decreased bladder capacity, reduced voided volume, and diminished urinary tract defences contribute to heightened UTI vulnerability among older women. [11]

The current research indicates a significant disparity in UTI prevalence between women (55.71%) and men (44.28%) which is similar to study conducted by Chaudhary et al. who discovered a higher incidence of UTIs in women (62.5%) compared to men (37.5%). [12] Another study documented a UTI prevalence of 51.3% in women and 48.6% in men. [13]

Average length of hospital stay was 10.22 $\pm$ 6.71 days, analogous to the findings of Faryabi et al., who reported an average hospitalisation length of 10.72 $\pm$ 5.2 days. [14] The average quantity of antibiotics prescribed per patient was 1.97 $\pm$ 1.43, demonstrating a similarity to the research

conducted by Shareef J et al., where the mean number of antibiotics per patient was reported as 1.94 ± 0.94. [15]

Diabetes mellitus (52.85%) and hypertension (67.14%) emerge as the predominant comorbidities within the study. In older adults, diabetes mellitus affects the immune system through autonomic neuropathy, resulting in incomplete bladder emptying and suboptimal metabolic regulation, collectively elevating the susceptibility to UTIs among elderly diabetic patients. [16] Pargavi et al. [17], Yadav et al. [18], and Sewify et al. [19] found comparable rates of UTIs among diabetic individuals, with prevalence figures of 37%, 38%, and 35%, respectively.

Research conducted in rural South India demonstrated a notable prevalence of hypertension among the elderly. [20] Findings suggest that physicians should closely monitor UTI patients who were at risk of acute kidney injury. [21] Studies have indicated that benign prostatic hyperplasia (BPH) is the primary cause of lower urinary tract obstruction in male patients, and bladder outlet obstruction resulting from BPH can predispose men to UTIs. [22]

Our research findings indicate that 62.16% of prescribed medications are administered via injection, while 36.03% are taken orally. Studies have emphasised the significance of ensuring sufficient intravenous (IV) access to administer life-saving antimicrobial drugs to elderly patients. Although oral administration may lead to decreased bioavailability due to changes in absorption kinetics in the elderly, it may be preferred over IV administration in certain situations. However, considering the risks of infection and phlebitis associated with IV lines, as well as the higher cost of IV antimicrobial formulations compared to oral ones, transitioning to oral formulations as soon as clinically indicated is recommended. [23] Our research reveals that 79.27% of prescribed drugs are sourced from the National List of Essential Medicines (NLEM), a figure that closely aligns with the findings of Jyothsna et al., who reported a rate of 73.07%. [24]

The quality of a prescription is contingent upon the use of generic drugs. The WHO advocates for the use of International Nonproprietary Names (INNs), commonly known as generic names, to ensure clear identification and safe prescription of medicines. Similarly, the NMC's "Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002" advises physicians to prescribe drugs using generic names to enhance prescription quality and patient safety. [25] Our research indicates that 40.54% of medications were prescribed using generic names, a proportion that closely resembles the findings of Joshi R et al. [26] Another study in the United Arab Emirates reported that all prescribed medications were identified by their generic names. [15]

In our study, the antibiotics most frequently prescribed for urinary tract infection (UTIs) were Piperacillin + Tazobactam (18.9%), followed by meropenem (5.4%) and vancomycin (4.5%). Studies suggest that Piperacillin and tazobactam could serve as a viable alternative to carbapenems in treating Extended Spectrum Beta Lactamase (ESBL) that produces pyelonephritis. [27]

CONCLUSION

In conclusion, our drug utilisation studies in geriatric patients with UTI reveal several key findings. Firstly, there is a high prevalence of UTIs among the elderly population, particularly among women and those with comorbidities such as diabetes mellitus and hypertension. Secondly, antibiotics are commonly prescribed for UTI management, with Piperacillin + Tazobactam emerging as the most commonly prescribed medication.Additionally, our research underscores the importance of ensuring adequate intravenous access for administering antimicrobial medications, while also highlighting the potential benefits of prescribing medications by their generic names. Efforts to increase the use of generic medications, as recommended by WHO guidelines, are essential to improve cost-effectiveness and accessibility. Furthermore, our findings suggest that Piperacillin and Tazobactam may offer a promising alternative to carbapenems in treating UTIs caused by ESBL-producing bacteria, potentially mitigating the risk of antibiotic resistance. Overall, these insights contribute to enhancing the appropriateness and effectiveness of UTI management strategies in geriatric patients, ultimately improving patient outcomes and optimising healthcare delivery in this vulnerable population.

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