Original Article

A Clinical Audit Study On The Management Of Urinary Tract Infection In A Tertiary Care Hospital

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DOI: 10.47750/pnr.2022.13.S08.213

Abstract

This study aimed to clinically audit the antibiotic utilization pattern and the management of urinary tract infection (UTI) in a tertiary care hospital. This prospective observational study was conducted for four months in the General medicine ward of a tertiary care hospital management in patients diagnosed with UTI. Urine examination and urine culture sensitivity tests were used as the diagnostic tools. Of 120 patients, more women patients were affected with UTI with 62.5% compared to male patients (37.5%). One of the most prevalent microorganisms involved in UTI was Escherichia coli (31.7%). The most commonly used antibiotic for empirical therapy was found to be Injection Ceftriaxone (36.7%) and Nitrofurantoin (22.5%). Nitrofurantoin (7.5%) and Cefoperazone/Sulbactam (6.7%) were most commonly given as changes in the antibiotics after culture sensitivity reports. The results showed that E. Coli was more sensitive to Injection. Ceftriaxone (22.0%) and resistant to ciprofloxacin (19.0%) drug. The prescribing patterns of antibiotics were observed. The most common type of UTI in our study was found to be acute cystitis and acute pyelonephritis caused by E.coli. The majority of the prescriptions were adhering to the Hospital's Antibiotic prescribing guidelines.

INTRODUCTION

The most frequent non-intestinal infection caused globally is urinary tract infections (UTI). (August and de Rosa 2012) UTI are believed to be the cause and growth of microbes in the urinary tract, and they can affect the lower urinary tract or the whole urinary system. (Internet Scientific Publications n.d.) (Microbiology Testing Laboratory n.d.) UTI are categorized into two types: lower urinary tract infections that affect the bladder and urethra, and upper urinary tract infections that affect the kidney, pelvis, and ureter. (Parveen et al. 2011) The clinical manifestations of a urinary tract infection are determined by the region of the urinary system affected, the etiology, the extent of illness, and the patient's capability to build an immune response to it. (Sibi et al. 2011) Due to its rising prevalence, recurrence, and difficulty in eradication, UTI is a chronic illness in humans, posing a significant concern to health experts. Due to morphological and physiological causes, and because of its location, it is far more prevalent in females than in males. (Arjunan, Al-Salamah, and Amuthan 2010) Immune suppression, trauma, foreign bodies, broad-spectrum antibiotic treatment, infused bodily fluids such as urinary catheterization and saline irrigations are all major possible causes when infections are caused by these microorganisms. (Inoue et al. 2006) Bacteriuria, or the appearance of bacteria in the urine, and pyuria, or the appearance of WBC in the urine,

are virtually closely linked with a UTI. Bacteriuria can exist without pyuria, which could be caused by bacterial contamination or poor urine collecting methods. Pyuria, on the other hand, can exist without bacteriuria, indicating a urothelial inflammatory condition such as a urinary stone or cancer. (Campbell-Walsh Urology 10th Edition Review E-Boo - 9781455723171 | Elsevier Health n.d.) Antimicrobial sensitivity screening of the urinary pathogenic microbes is the basis for antibiotic treatment, and UTIs are commonly managed with various antibiotics. One with a narrow spectrum of activity may be suitable as a result of new issues regarding infection with resistant strains, and antibiotic therapy is based on antibiotic sensitivity examination of the urinary pathogenic organisms. However, with the rise in microbial resistance, regular resistance monitoring is needed to enhance empirical antibiotic therapy strategies. (Sabih and Leslie 2022) UTI, a common medical concern around the globe, has a major economic impact across every nation because it's also the most prevalent cause of hospitalization in geriatric patients and antibiotic prescriptions in general practice. Despite its high rate, the risk of relapse, and inappropriate management, as well as the awareness that resistance to antibiotics is on the rise across the world, clinicians do seem to have a difficult time detecting and treating upper and lower UTI. (Abou Heidar et al. 2019) Hence it is very important the establishment of an effective antibiotic management strategy for the treatment of UTI.

MATERIALS AND METHODS

Study Design

A prospective observational clinical audit was done in a multi-specialty tertiary care hospital for four months. The study protocol was approved by the institutional human ethics committee (1530/IEC/2018). The study was carried out under the Helsinki declaration and good clinical practice recommendations.

Inclusion exclusion criteria

The research enrolled both genders aged over 18 years with any type of Urinary Tract Infection and are willing to give consent. Patients visiting the outpatient department were excluded.

Study Method

The study involved 120 UTI patients who were screened based on outcome measures. The UTI management was observed and analyzed. This research was done in the department of general medicine in tertiary care multispecialty hospital for 4 months in patients diagnosed with UTI. The clinical information, culture data, and sensitivity reports from a patient with urinary tract infection were reviewed with the treatment plan to confirm that prescribing pattern strictly adhered to the management guidelines for appropriate therapy.

Measurement Tools

Urine examination and urine culture sensitivity tests were used as diagnostic tools. Antibiotic susceptibility patterns were identified. As per therapeutic recommendations for the therapy of urinary tract infection, the culture report and the patient's medical case records were checked for the right antibiotic treatment or a modification in the antibiotic treatment. After the patient's discharge, a comparative evaluation of the Microbiology lab report and patient medical chart was observed in the medical case files of the patients kept in the various wards and the medical data storage department. Compliance with correct antibiotic prescriptions and strict patient compliance for treatment of urinary tract infections were assessed, and the results were recorded and analyzed.

Statistical analysis

Graphpad prism software was used to analyze the data. The T-test was used to examine the collected data. The calculated P-values were considered statistically significant when compared at $P<0.05$. The data were expressed in terms of % and mean ± SD changes.

RESULTS

In our study, 120 subjects with UTIs were screened based on standard criteria and were included in the study. It was found that the female patients were predominantly affected by urinary tract infection compared to male

patients (62.5 vs. 37.5%), respectively. Around 47.5% of UTI patients had a history of type II diabetes mellitus, 3.3% of patients had renal calculi, 0.8% of patients had vaginal candidiasis, 0.8% of patients had an enteric fever and 0.8% of patients had chronic kidney disease**.** It was found that 80.8% of patients had community-acquired UTI, whereas 19.2% of patients had a nosocomial infection. It was found that 31.7% of the patients had UTI caused by E.Coli organism. 2.5% Of patients had normal flora, 3.3% of patients had UTI caused by Staphylococcus aureus, 10.8% of patients exhibited urethral commensals and 0.8 and 1.7% of patients exhibited Salmonella typhi and Enterococcus infections, respectively. Demographic details of the study population have been depicted in Tables 1 & 2. The primary outcomes such as the description of antibiotics usage patterns and antibiotic sensitivity were measured. The observations regarding the pattern of antibiotic usage are summarized in **Table 3** in the order of their administration.

TABLE 1: DEMOGRAPHIC DETAILS OF STUDY POPUATION

Characteristics	**Change in antibiotics Frequency (Percentage) (n = 33)**	**No change in antibiotics Frequency (Percentage) (n = 87)**	**P value**
Male	14(42.4)	31(35.6)	0.49
Female	19(57.6)	56(64.4)	
HTN	17(51.5)	9(10.3)	0.001
Veg	26(7.8)	73(83.9)	73(83.9)
NonVeg	7(21.2)	14(16.1)	0.51
Community acquired	21(63.6)	76(87.4)	0
Nosocomial	12(36.4)	11(12.6)	0.003
Catheter use	7(21.2)	4(4.6)	0.005

*Statistical significance difference was found at P<0.05

TABLE 2: CHARACTERISTICS OF THE STUDY POPULATION

Characteristics	**Change in Antibiotics Mean ± SD Changes (n = 33)**	**No Change in Antibiotics Mean ± SD Changes (n = 87)**	**P value**
Age	54.90 ± 16.43	45.34 ± 13.76	0.602
Length of Hospital Stay	8.87 ± 3.71	45.34 ± 2.69	0.0001
Duration of first antibiotic	3.5 ± 2.00	3.87 ± 2.06	0.48
Duration of second antibiotic	4.09 ± 1.98	4 ± 1.511	0.90

Duration of third antibiotic	4.75 ± 1.488	Nil	_

*Statistical significance difference was found at P<0.05

TABLE 3: DSTRIBUTION BASED ON EMPIRICAL ANTIBIOTIC THERAPY

FIRST CHOICE		
Antibiotics	**No. of patients (n=120)**	**Percentage (%)**
INJECTION. Ceftriaxone	44	36.7
Nitrofurantoin	27	22.5
Norfloxacin	12	10.0
Amoxicillin/Clavulanate	11	9.2
Cefaperazone/Sulbactam	8	6.7
Ciprofloxacin	7	5.8
Fluconazole	2	1.7
Cefixime	2	1.7
Cefotaxime	2	1.7
Amoxicillin	1	0.8
Doxycycline	1	0.8
Amikacin	1	0.8
SECOND CHOICE		
Antibiotics	**No. of patients (n=120)**	**Percentage (%)**
Nitrofurantoin	9	7.5
Cefaperazone/Sulbactam	8	6.7
Norfloxacin	7	5.8
Amoxicillin/Clavulanate	5	4.2
Ciprofloxacin	4	3.3
Linezolid	2	1.7
Fluconazole	2	1.7
Doxycycline	2	1.7
Amikacin	1	0.8
Injection. Ceftriaxone	1	0.8
Cefotaxime	1	0.8
THIRD CHOICE		
Antibiotics	**No. of patients (n=120)**	**Percentage (%)**
Cefaperazone/Sulbactam	3	2.5
Nitrofurantoin	3	2.5
Injection. Ceftriaxone	1	0.8

Doxycycline	1	0.8

Injection. Ceftriaxone was predominantly given as the first-choice antibiotic followed by nitrofurantoin and cefoperazone/sulbactam. The characteristics of the study population with and without change in antibiotics were also assessed and it was observed that age, length of hospital stay, presence of hypertension, type 2 diabetes mellitus, and catheter use were significantly higher among patients with a change in antibiotics compared to patients without a change in antibiotics. There was only a 27.5% change in antibiotics observed among the study population who had antibiotic resistance.

The antibiotic sensitivity pattern of the common causative microorganism E. coli was assessed by considering the antibiotic sensitivity test for the microorganism taken for some of the study patients. The results showed that the microorganism was more sensitive to Injection. Ceftriaxone is followed by Nitrofurantoin and Cefoperazone/Sulbactam**. Table 4**

The secondary outcomes were the length of stay in the hospital and treatment outcomes. The length of stay in the hospital was assessed by observing the number of days admitted to the hospital. It was found that among the study population, the shortest length of time spent in the hospital was 2 days while the highest number of days of hospital admission was 16 days and the mean number of days of hospital admission was found to be 5.94 days. The treatment outcome was evaluated based on the patient's condition at discharge. Our study observed that majority of the patients involved in the study showed significant improvement at the time of discharge.

TABLE 4: ANTIBIOTIC SENSITIVITY OF COMMONLY REPORTED ORGANISM (E.coli)

Antibiotics	**No. of patients (n=120)**	**Percentage (%)**
Cefaperazone/Sulbactam	3	2.5
Nitrofurantoin	3	2.5
Injection. Ceftriaxone	1	0.8
Doxycycline	1	0.8
OUTCOMES		
Condition	**No. of patients (n = 120)**	**Percentage (%)**
Improved	120	100
Not improved	0	0

DISCUSSION

This is observational research was studied on 120 patients, who were infected with UTI in a tertiary care hospital. In our study, the female patients (62.5%) were more prevalent to UTI infection when compared to male patients (37.5%). This observation was similar to study conducted by Kuch et al. 2018 (Kuch et al. 2018)

Most of the patients had a history of diabetes mellitus (47.5%) followed by renal calculi (3.3%) and vaginal candidiasis (0.8%). The majority of the patients were presented with a history of diabetes mellitus and it is reported that the risk of developing UTI is greater in diabetic patients than in non-diabetic patients. Similar results were conveyed in study conducted by Motzer et al. 2015 (Motzer et al. 2015) where the risk of developing UTI was higher in diabetic patients than in non-diabetic patients.

Patients with female gender and diabetes mellitus are prone to developing catheter-associated UTI but in our study population, most of the patients were not associated with catheter use (90%), the patients who were associated with catheter were found to be (10%). These findings were contradict to the results conveyed in study conducted by Machado et al. 2017 (Machado et al. 2017) where there are higher risks of developing catheter-associated UTI in female patients and in patients with diabetes mellitus.

In our study, most of the cases of UTIs are caused by E.coli (31.7%) and was the most repeated organism isolated in the patients with both nosocomial and community-acquired infection. These findings were similar to results conveyed by Stefaniuk, Oleszczuk et al., 2016 (Stefaniuk, Oleszczuk, and Ok 2016) where it is reported that E.coli was most of the most common causative organisms of community-acquired and nosocomial UTI.

When we compared change of antibiotic therapy in patient with and without type 2 diabetes mellitus, there were significant difference found between the patients with or without type 2 diabetes mellitus with p Value = 0.017. It was observed that Patients with type 2 diabetes mellitus had a change in antibiotics compared to patients without type 2 diabetes mellitus. This is similar to the results conveyed by Sun et al. 2016 (Sun et al. 2016) where diabetes patients profoundly had a change in antibiotics.

The percentage of community-acquired and nosocomial UTI among the study population was found to be 80.8% and 19.2% respectively. This is similar to results of research that was done by Chan et al. 2015 (Chan et al. 2015) where 73.5% of the patients had a community-acquired infection and 26.5% had a nosocomial infection.

Our study results demonstrated that Injection. Ceftriaxone (36.7) was the most preferred first-choice antibiotic followed by nitrofurantoin (22.5) and norfloxacin (10.0) and this correlates with the study conducted by Worku et al. 2017 (Worku et al. 2017) who had observed that cephalosporins were the most common antimicrobial used in UTI.

In our study, Nitrofurantoin (7.5) was predominantly given as second line antibiotics, followed by Cefapeazone/Sulbactam(6.7) and norfloxacin (5.8) and this is in concordance with research conducted by Gupta et al. 2007 (Gupta et al. 2007) showing that nitrofurantoin is a well-tolerated antibiotic and has good efficacy when administered twice in a day for 5 days.

E. Coli is found to be the common causative organism isolated in the urine culture report which was done for some patients, it showed more sensitivity towards Nitrofurantoin (n= 22) and Cefoperazone/Sulbactam (n= 20). Resistance by the organism was more towards

Ciprofloxacin (n= 19).A similar result was observed by Naik et al. 1318 (Naik et al. 1318) where E.coli being the most frequent causative organism of UTI and was more sensitive to Nitrofurantoin and more resistant to ciprofloxacin.

Our study found that the average length of hospital stay was 5.94 days. A similar study conducted by Azeez et al. 2020 (Azeez et al. 2020) in which they have concluded that the length of hospital stay was 5.82 days proving that the administration of suitable antibiotics for these types of patients minimizes the length of their stay in the hospital.

Our study found that, the average length of hospital stay was 5.94 days. Similar results are correlated with a study conducted by (Spoorenberg et al. 2013) who concluded that the length of hospital stay was 5.82 days proving that appropriate antibiotic use for the patients with urinary tract infection reduces length of hospital stay.

Our results illustrate that there was improvement in the condition of all patients in study (100%) at the time of discharge. The results are in correlation with a study conducted by Veroniek Spoorenberg et al., 2013 (Spoorenberg et al. 2013) where patient treatment outcome was favoured by appropriate antibiotic use.

In our study, our results suggest that the antibiotic prescription pattern was more in compliance with SRM hospital antimicrobial prescribing guidelines compared to the ICMR guidelines. Treatment given according to SRM prescribing guidelines was more effective with 100% treatment outcomes.

CONCLUSION

In our study wide range of antibiotics were given initially and later switched to other antibiotics for better therapeutic outcomes and it was also observed that the change in antibiotics were more significant in patients with

co-morbidities like hypertension and type II diabetes mellitus, use of catheters, and also due to length of hospital stay. An empirical therapeutic approach has been initiated as there was delay in getting the urine culture report. The most common type of UTI in our study was found to be acute cystitis caused by E.coli hence the common empiric therapy was Nitrofurantoin 100 mg twice a day.

ACKNOWLEDGEMENT

I'd like to show my gratitude and appreciation to everyone who helped me accomplish this article. I also take this opportunity to thank **SRM College of Pharmacy** for giving me the chance to do this project.

CONFLICT OF INTEREST

There are no competing interests declared by the authors.

AUTHOR CONTRIBUTIONS

Conceptual model & Supervision: Dr. S Sarumathy & Dr. Nanda Kumar R.

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Writing: original draft preparation: Dr. Sarumathy S.

All authors have reviewed and approved the final version of the article. The corresponding author or report guarantor had full access to all of the study's data and is solely responsible for its integrity and authenticity.

STATEMENTS OF CLARITY

The principal writers Ajith R, Nweke Collins Ozioma, Prathyusha VT, Yagnam Pranavi, Bharathi Karuppusamy, Nandakumar R and Sarumathy S, certify that this paper is an honest, accurate, and fair explanation of the study being provided; that no important part of the inquiry has been left out; and that any differences from the study as planned have been adequately explained.

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