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Research Article

Assessment of Risk Factors and Cost-Effective Analysis of Antibiotics in Urinary Tract Infections

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ABSTRACT

Objectives: Using an analysis test that is cost-efficient, determining which antibiotic therapy is most effective among several antibiotics. And to deliver superior care at a lower cost, to evaluate the risk factor that causes UTIs the most frequently, to determine efficacy of antibiotics used in UTIs, and to know the prescribing patterns involved in UTI patients in tertiary care hospital. **Materials and Methods:** The study was conducted prospective observational study using medical records and direct medical cost of UTI patients. The records of 200 patients met the inclusion criteria. Data processing and decision-making were carried out using descriptive and inferential statistical analysis, Average Cost-Effectiveness (ACER) calculation, and a cost-effectiveness grid. The outcome parameter used in a cost-effectiveness analysis was the percentage of effectiveness of antibiotics. **Results:** With an ACER of 821, ofloxacin IV is clearly the most economical choice. Additionally, it has a 100% efficacy rate. Despite having a high efficacy rate of 97.36%, Meropenem IV has the highest ACER (7294), making it the least cost-effective of the mentioned options. The ACER values of Doxycycline IV and Niftas P/O are in the middle. Piptaz IV's ACER is modest, and its effectiveness rate is quite low at 69.23%. **Conclusion:** Using the cost-effectiveness grid, Ofloxacin is more effective therapy, therefore treatment of UTIs using Ofloxacin is more cost beneficial.

Keywords: Antibiotic therapy, Prescribing patterns, Average Cost-Effectiveness (ACER) calculation, Ofloxacin and cost-effectiveness.

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INTRODUCTION

The urinary system, comprising kidneys, ureters, bladder, and urethra, filters blood by removing waste and excess water. It regulates blood volume, pressure, and ion and solute concentrations. Urinary Tract Infections (UTIs) affect 150 million people annually, causing high morbidity and medical costs. They can occur in the kidney, bladder, or urethra. UTIs impact patients' social and personal relationships, reducing quality of life. Community-acquired and hospital-acquired infections are caused by bacteria affecting the urinary system. Functional and structural defects are common causes of infection.[1]

CLASSIFICATION OF URINARY TRACT INFECTIONS

UTIs can be classified by the part of the urinary tract infected, predisposing conditions, and nature of events.

UTI includes upper and lower UTI

- UPPER UTI- Pyelonephritis and ureteritis.
- LOWER UTI- Urethritis and cystitis.

Part of the urinary tract infected

UTI type depends on which part is infected:

- **Urethritis:** An infection of the urethra, which drains urine from bladder.
- **Cystitis:** A bacterial infection of the bladder.
- **Pyelonephritis:** An infection of the kidneys.

PREDISPOSING CONDITIONS

Clinically, UTIs are categorized as uncomplicated or complicated. Uncomplicated UTIs typically affect individuals who are otherwise healthy and have no structural or neurological urinary

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tract abnormalities these infections are differentiated into lower UTIs (cystitis) and upper UTIs (pyelonephritis). Several risk factors are associated with cystitis, including female gender, a prior UTI, sexual activity, vaginal infection, diabetes, obesity and genetic susceptibility.[2] Complicated UTIs are defined as UTIs associated with factors that compromise the urinary tract or host defence, including urinary obstruction, urinary retention caused by neurological disease, immunosuppression, renal failure, renal transplantation, pregnancy and the presence of foreign bodies such as calculi, indwelling catheters or other drainage devices. In the United States, 70-80% of complicated UTIs are attributable to indwelling catheters, accounting for 1 million cases per year. Catheter-associated UTIs (CAUTIs) are associated with increased morbidity and mortality and are collectively the most common cause of secondary bloodstream infections. Risk factors for developing a CAUTI include prolonged catheterization, female gender, older age and diabetes.[3]

UTIs are caused by both Gram-negative and Gram-positive bacteria, as well as by certain fungi.[4] The most common causative agent for both uncomplicated and complicated UTIs is Uropathogenic*Escherichia coli* (UPEC). For the agents involved in uncomplicated UTIs, UPEC is followed in prevalence by Klebsiella pneumoniae,Staphylococcussaprophyticus,Enterococcusfaecalis, group B Streptococcus (GBS),*Proteus mirabilis*,*Pseudomonas aeruginosa*,*Staphylococcus aureus* and*Candida* spp. For complicated UTIs, the order of prevalence for causative agents, following UPEC as most common, is*Enterococcus* spp.,*K. pneumoniae*,*Candida* spp.,*S. aureus*,*P. mirabilis*,*P. aeruginosa* and GBS.

Nature of event

UTIs can be primary or recurrent

Recurrent: Three or more uncomplicated UTIs within 12 months or two or more infections within six months.

Causes

Urinary tract infections may arise from a plethora of bacterial and fungal organisms, with Uropathogenic *Escherichia coli* (UPEC) identified as the predominant etiological agent. Additional prevalent pathogens encompass Klebsiella pneumoniae, *Staphylococcus saprophyticus, Enterococcus faecalis*, Group B Streptococcus (GBS), *Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus*, and *Candida*.

MATERIALS AND METHODS

Design

The study was conducted using description and analytical research design at territory care hospital, Khammam, Telangana, India. The study was conducted prospective observational study using medical records and direct medical cost of UTI patients. The sample in this study was UTI patients over six months who met inclusion criteria. Inclusion criteria include Patients who stayed at least 5 days in hospital, Individuals of both sexes, and Individual who provides consent. Data processing and decision-making were carried out using descriptive and inferential statistical analysis, average cost-effectiveness (ACER) calculation, and a cost-effectiveness grid.[5-7]

Assessment

The percentage of therapeutic effectiveness used as an outcome parameter for cost-effectiveness analysis was total percentage of patients treated and given antibiotics for maximum of five days. The data of the results of the analysis were presented quantitatively in the form of tables supported by textual narratives. A thorough summary of the direct medical expenses related to utilizing different antibiotics for a 5-day course of treatment (except for Niftas p/o, which lasts for 7 days) is provided in the table below. The lowest medical cost is ofloxacin with a total direct medical cost of 82130, while the highest is meropenem, with a total direct medical cost of 710120 for five days.[8,9]

With an ACER of 821, ofloxacin IV is clearly the most economical choice. Additionally, it has a 100% efficacy rate. Despite having a high efficacy rate of 97.36%, Meropenem IV has the highest ACER (7294), making it the least cost-effective of the mentioned options. The ACER values of Doxycycline IV and Niftas P/O are in the middle. Piptaz IV's ACER is modest and its effectiveness rate is quite low at 69.23%.

RESULTS

The number of patients with UTI diagnosis over six months period in 2024 at territory care hospital, Khammam, Telangana, India. Of these only 200 patients met the inclusion criteria. Patient's characteristics show in Table 1. Results showed that majority of patients were female are more (71%). Based on age characteristics, most of the patients (21.50%) were in age range of 51-60 years. About 90% of people are married, compared to only 10% who are single. This study also showed that there were more UTI patients with comorbidities than patients without comorbidities; most UTI patients had one comorbidity diabetes (17%). Of the 142 female patients in our study, approximately 45.70% are active menstruators. The effectiveness of therapy was measured using the parameter of the duration of hospitalization (Table 2).

The percentage of effectiveness of ofloxacin is higher (100%) when compared to other antibiotics (Table 3). ACER value of total ofloxacin cost (82,130 per percentage effectiveness) has lower value compared to other antibiotics (Table 3). Using cost-effectiveness grid, ofloxacin was more effective.

DISCUSSION

The study was carried out in the 500-bed urology department of a multispecialty hospital. The protocol was developed and filed once the general health care department of the study hospital confirmed the study's scope.

After alerting the study's participants or any onlookers to its necessity, 200 occurrences of urinary tract infections were discovered. The gender distribution of UTI patients differs around the world. Both 58 (29%) and 142 (71%) of the patients were male and satisfied the inclusion criteria. The work from the trial's first six months was examined. Women were more likely than men to get urinary tract infections. According to research on female anatomy, the primary causes of urinary tract infections in women were menstrual hygiene, pregnancy, and menopause. Six of the 142 female patients in our study are pregnant, and 83.30% of them are primigravida, while 16.60% are multigravida.[10-12]

A study on the risk factors for urinary tract infections during pregnancy was conducted in 2010 by Gulfareen Haider *et al.*, 108 out of 232 women with urinary symptoms had pregnancy-induced alterations in their urinary systems, according to the study. The study's main grouping element is age; the highest incidence was observed in the 51-60 age range, followed by the 21-40 age range. A study on risk factors for UTIs in hospitalized patients was conducted in 2019 by Hadiati Setyorini *et al.* According to a study, being elderly and immobile are risk factors for urinary tract infections. A study on *Escherichia coli* urinary tract infections: host age-related variations in bacterial virulence factors and antibiotic sensitivity was conducted by Wei-Hung Lin *et al.*, in 2021.

Table 1: Patient Characteristics based on the Risk Factors.

Gender	Frequency	Percentage
Male	58	29%
Female	142	71%
Total	200	100%

Age (in years)	Male	Female	Percentage
0-20	4	16	10%
21-30	7	17	12%
31-40	11	29	20%
41-50	9	12	10.50%
51-60	12	31	21.50%
61-70	5	24	14.50%
71-80	9	12	10.50%
81-90	1	1	1%
91-100	0	0	0%
Total	58	142	100%

Marital status	Frequency	Percentage
Married	180	90%
Unmarried	20	10%
Total	200	100%

Comorbidities	Frequency	Percentage
Diabetes	34	17%
Hypertension	29	14.5%
CKD	3	1.5%
Hypothyroidism	3	1.5%

Menstrual history	Frequency	Percentage
Active menstruation	65	45.70%
Menopause	60	42.20%
Hysterectomy	15	10.50%
Amenorrhea	2	1.40%
Total	142	99.8%

The lifetime prevalence of UTIs in adult women is between 50% and 60%. The distribution of 907 E. coli isolates by host age and gender was examined by researchers, who discovered that older people were more resistant to antimicrobial treatments and less virulent. The menstrual history is one of the most important elements to take into account when assessing the risk factors for UTIs. About 45.70% of the 142 female patients in our study are active menstruators, meaning that they use two pads per day on average. Menopausal women make up the next largest group, at 42.20%.

Approximately 90% of the population in our study is married, while only 10% is single, making marital status another risk factor for UTIs. Active sexual activity has been linked to an increased risk of UTIs, according to numerous research. We can identify the comorbid conditions that the UTI patients were managing by looking at the collected data. Diabetes mellitus accounts for approximately 17% of the high prevalence of comorbid illnesses in our sample. Hypertension (14.5%), chronic kidney disease (1.5%), and hypothyroidism (1.5%) follow.

Geerlings *et al.*, conducted research on risk factors for symptomatic UTIs in diabetic women in 2021. 34 women with type 1 diabetes participated in the study, which identified risk factors for UTIs, such as sexual activity prior to study enrolment for women with type 1 diabetes and ASB for women with type 2 diabetes. Of the 636 women, 589 had follow-up data available.

Both severe and uncomplicated UTIs have diverse treatment options, with differences in therapy length and cost. 51 (25.50%) of the cases in our study are complicated, while 149 (74.50%) are simple UTIs. The cost of services, examinations, activations, accommodations, supporting medications, and antibiotics are among the direct medical costs required for the cost-effectiveness study. Appropriate laboratory testing should be done to guarantee that the treatment for UTI is effective.

Complete blood picture 197 (98.50%), culture sensitivity 26 (13%), and complete urine test 196 (98%), are the primary laboratory tests that are part of our study. By identifying organisms and antibiotic sensitivity, a culture sensitivity test is the most accurate method for diagnosing UTIs; it reduces the need for medicines and offers efficient treatment. Only 26 of the 200 patients are subjected to culture sensitivity testing; the most frequently isolated organisms in these tests are *E. coli* (73.00%), Pseudomonas (11.5%), and Klebsiella (15.38%).

In our analysis, the most often utilized antibiotics for empirical therapy were Niftas in oral form, piperacillin-tazobactam in IV form, meropenem, ofloxacin, and doxycycline. Most importantly, medications are broad-spectrum antibiotics that are used to treat a wide range of organisms, including both gram-positive and gram-negative bacteria. Ofloxacin in intravenous form, doxycycline, meropenem, piperacillin-tazobactam, and Niftas in oral form are the most prescribed antibiotics for 200 individuals.

The average hospital stay for the population in our survey is five days, except for Niftas. Ofloxacin is more cost-effective than other antibiotics, according to our examination of the cost-effectiveness of those medications. The duration of hospitalization is a significant measure of medical care. According to the estimates, patients who received ofloxacin paid 172 rupees per unit and had a lower overall cost than those who received alternative antibiotics that were 100% effective in treating their conditions.

Despite its 97.36% efficacy, meropenem is expensive, costing 1067 rupees per unit. Doxycycline costs 500 rupees per unit and has an effective rate of 94.44%. Niftas has an effectiveness of 90.19% and costs 12 rupees per unit. Piptaz, which costs 280 rupees per unit, has the lowest efficacy (69.23%) in our study. We discovered

Table 2: Direct Medical Cost Distribution between the Five Treatment Groups.

Parameters	Service cost	Supporting examination	Activation cost	Accommodation cost	Cost of supporting drugs	Antibiotic cost	Hospital stays in days	Unit cost	Dose	Total cost	*p*-Value Significance
Doxycycline IV	10800	14400	7200	54000	14520	90000	5	500	200mg	190920	>0.0001, Yes
Piptaz IV	78000	11600	5200	39000	15340	36400	5	280	4.5gm	185540	
Meropenem IV	114000	30800	7600	57000	20790	202730	5	1067	1gm	710120	
Ofloxacin IV	33000	4400	2200	16500	16570	9460	5	172	200mg	82130	
Niftas P/O	214200	28800	10200	107100	30156	59976	7	12	100mg	449832	

Table 3: ACER Calculation for each Antibiotic Group.

	Doxycycline IV	Piptaz IV	Meropenem IV	Ofloxacin IV	Niftas P/O
Cost (C)	190920	185540	710120	82130	449823
Effectiveness (E)	94.44%	69.23%	97.36%	100%	90.19%
ACER (C/E)	2022	2680	7294	821	4988

significance in our data with a p-value <0.0001 after running a one-way ANOVA on the corresponding data. Ofloxacin IV is unquestionably the most cost-effective option, with an ACER of 821.

It also has an effective rate of 100%. Meropenem IV is the least economical of the choices listed, even if it has a high effectiveness rate of 97.36%. Its highest ACER is 7294. Doxycycline IV and Niftas P/O have ACER values that fall somewhere in the centre. With an efficacy rate of only 69.23%, Piptaz IV has a moderate ACER value.

CONCLUSION

The most frequent risk factors for UTIs are female gender, women between the ages of 24-60, pregnancy (especially primigravida), exposure to pads for long periods of time, and menopause. The average ACER value of the ofloxacin is lower than the other antibiotic therapy; however, there is no significant difference in hospital stay except Niftas. The average cost of those five antibiotics showed the significant difference.

Compared to ofloxacin, the average cost of meropenem treatment is greater. But because Nifas p/o is less effective and causes longer hospital admissions, it has a low unit cost; hence, it is probably not the best medication for UTIs. Another inexpensive medication with a low ACER value and great efficacy is ofloxacin. Ofloxacin is the best medication for UTIs, according to research, when compared to all other antibiotics.

It can be inferred that the usage of ofloxacin is more effective in treating UTIs at tertiary care hospitals because it is the most advantageous option when interpreted using the cost-effectiveness grid.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Giuseppe Mancuso, Angelina Midiri, Elisabetta Grace, Maria Marra, Sabastiana Zummo and Carmelo Biondo: Urinary tract infection: The current scenario and future prospects, Pathogens.2023; 12(4): 623.
2. Iman Abu Aleinein, Elie Salem Sokhn: Knowledge and prevalence of urinary tract infection among pregnant women in Lebanon, 2024; 10(17): e37277
3. G. Chan, F. Davidovic, J. Gani, Role of videourodynamics, imaging, and cystoscopy in patients with recurrent urinary tract infections: Should we throw in the kitchen sink?, Continence Reports, 2024; 12: 100073, ISSN 2772-9745,
4. Petra Tielen, Maike Narten, Nathalie Rosin, Ilona Biegler, Isam Haddad, Michael Hogardt, *et al*, Genotypic and phenotypic characterization of *Pseudomonas aeruginosa* isolates from urinary tract infections, International Journal of Medical Microbiology, 2011; 301(4): 282-92, ISSN 1438-4221,
5. Martha Medina1,Edgardo Castillo-Pino, An introduction to the epidemiology and burden of urinary tract infections.
6. Jacob E Simmering, Linnea A Polgreen, Joseph E Cavanaugh, Bradley A Erickson, Manish Suneja, Philip M Polgreen: Warmer Weather and the risk for urinary tract infection in women, Published in final edition form as: J Urol.2020.
7. Kaiping Zhang, Xiang Fang, Yin Zhang, Min Chao, A retrospective study of uropathogen and its antibiotic resistance among children with urinary tract infection from a single center in China, Heliyon, 2024; 10(11): e31902, ISSN 2405-8440,
8. Dimitri M. Drekonja, Urinary Tract Infection in Male Patients: Challenges in Management, Infectious Disease Clinics of North America, 2024; 38(2): 311-23, ISSN 0891-5520, ISBN 9780443246531.
9. Zelalem Asmare, Mulat Erkihun, Wagaw Abebe, Agenagnew Ashagre, Tadesse Misganaw, Sefineh Fenta Feleke, Catheter-associated urinary tract infections in Africa: Systematic review and meta-analysis, Infection, Disease and Health, 2024; 29(3): 172-9, ISSN 2468-0451,
10. Rajanbir Kaur, Rajinder Kaur: Symptoms, risk factors, diagnosis and treatment of urinary tract infection, Postgraduate Medical Journal, 2021; 97(1154): 803-12.
11. Catherine M. Bettcher, MD, Lead, Elizabeth Campbell, MD, Lindsay A. Petty, MD, Karl T. Rew, MD, Jennifer C. Zelnik, MD, and Giulia I. Lane, MD, consultant. A book of urinary tract infection from national library of medicine.

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