Comparative Prevalence of Antimicrobial Resistance in Community-Acquired Urinary Tract Infection Cases from Representative States of Northern and Southern India

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ABSTRACT

Context: Urinary tract infections (UTIs) are amongst the most common infections described in outpatient settings. Increased antimicrobial resistance (AMR) of urinary tract pathogens is a matter of global public health concern. Treatment of UTI depends on both prevalence and antimicrobial resistance (AMR) of causative bacteria at any specific geographical location.

Aim: This study was undertaken to compare the prevalence of uropathogens and their AMR profile in two different geographical parts of India.

Methods and Materials: Clean-catch mid-stream urine samples were collected from adult patients, bacterial flora isolated from human urine was evaluated for antimicrobial susceptibility profile using Kirby Bauer’s disc diffusion method among patients from Hyderabad (Southern India), Rajasthan and Punjab (Northern India). The data were analysed using Chi-square (χ²) test, confidence interval (CI), odds ratio (OR) analysis and p-value using SPSS 16 software.

Results: Escherichia coli (55.1%) were the most prevalent isolates followed by Enterococcus faecalis (15.8%). Amikacin was the most active antimicrobial agents which showed low resistance rate of 14%. The present study revealed the geographical difference in prevalence of uropathogens with Klebsiella pneumoniae being the second most common uropathogen followed by E. faecalis in the states from northern India while no K. pneumoniae was seen in samples from southern India but E. faecalis was the second most prevalent organism.

Conclusion: Therefore, development of regional surveillance programs is highly recommended for implementation of national CA-UTI guidelines in Indian settings.

Keywords: Antimicrobial Resistance, Bacteriuria and antibiotics, Community-acquired urinary tract infections, Uropathogens

INTRODUCTION

Urinary tract infection (UTI) is the most common infectious disease after respiratory tract infection in community practice. It remains a major public health problem in terms of morbidity and financial cost with an estimated 150 million cases per annum worldwide, costing global economy in excess of six billion US dollars [1,2]. UTI is defined as bacteriuria along with urinary symptoms [3]. It may involve only the lower urinary tract or may involve both the upper and lower tract. Malnutrition, poor hygiene, low socio-economic status is important factors associated with UTIs [4].

The most episodes of UTI are caused by Escherichia coli (E.coli) and Enterococcus faecalis (E. faecalis), while Klebsiella pneumoniae (K. pneumoniae) accounts for most of the remaining infections [5]. Although E.coli has been reported as the commonest isolate causing UTI, recent reports suggest a changing pattern in the prevalence of uropathogens [6,7]. The introduction of antimicrobial therapy has contributed significantly to the management of UTIs along with other infectious diseases. In almost all cases of community-acquired UTI (CA-UTI), empirical antimicrobial treatment is initiated before the laboratory results for urine culture are available; contributing significantly to antimicrobial resistance (AMR) in uropathogens due to frequent and sometimes repeated misuse of antimicrobials [8]. The resistance pattern of community acquired uropathogens has not been extensively studied in the Indian subcontinent [9,10]. It is important to realize that there may be marked differences between various geographical areas. Since most UTIs are treated empirically the selection of antimicrobial agent should be determined not only by the most likely pathogen but also by its confirmed susceptibility pattern. Therefore, periodic monitoring of aetiological agents of UTI, and their resistance pattern in the community is essential for prudent empirical antibiotic therapy to control the menace of increasing AMR so as to maintain efficacy of available antibiotics. It was against this backdrop that the current study was undertaken to assess and compare the most frequent pathogens responsible for UTIs in outpatients and their AMR pattern in Southern and Northern Indian states. Additionally, the study also aimed at identifying the possible resistance trends.

MATERIALS AND METHODS

Study area and study population
A retrospective study of all pathogens isolated from urine specimens of patients (both male and female; age 14-72 y) who attended the outpatient departments (OPDs) during the period January 2010 to June 2011 in Birla Sarvajanik hospital, Pilani (Rajasthan) and local diagnostic laboratorieis in Bathinda (Punjab) and Hyderabad (Andhra Pradesh). Patients were informed by the doctor about the test prior to collection of samples and the test for culture and sensitivity was conducted (based on prescription and doctor’s advice). UTI was confirmed by positive urine culture reports. All patients who had significant bacteriuria (>105 cfu/ml) were included for further microbiological analysis in the present study. Only one specimen per patient was included.

Sample collection and processing
Discrete colonies obtained after culturing the urine sample on Luria’s Broth (LB) agar plates were selected and these isolates were
used to grow new colonies on the same media to ensure purity of isolated bacterial strains. Bacterial inocula were then prepared by suspending the freshly-grown bacterial colonies in 10 mL sterile LB and incubated at 37oC; which were then inoculated in both HiChrome UTI agar and MacConkey agar plates followed by incubation at 37oC for 24-48 h for bacterial identification based on specific metabolism of chromogenic substrates. Susceptibility of the isolated UTI causing bacteria to commonly used antimicrobial agents was then examined.

### Antibiotic sensitivity testing

All antibiotic discs (Ampicillin 10μg; Gentamicin 30μg; Cefuroxime 30μg; Amikacin 30μg; Ciprofloxacin 5μg) and media used were obtained from Himedia Labs; India. The isolates were tested for antimicrobial susceptibility testing by the standard Kirby-Bauer disc diffusion method [11]. LB agar plates were incubated for 24 h after inoculation with organisms and placement of discs. After 24 h the inhibition zones were measured. Results were interpreted based on the diameter of the observed zone of inhibition. Following the Clinical and Laboratory Standards Institute Guidelines; the obtained results were categorized into three groups namely Sensitive (S); Intermediate (I); Resistant (R) and results were interpreted accordingly [12].

### STATISTICAL ANALYSIS

The data were analyzed using Chi-square (χ²) test, confidence interval (CI), odds ratio (OR) analysis and p-value using SPSS 16 software. Statistical significance was defined when p-value was <0.05.

### RESULTS

A total of 830 urine samples from clinically suspected patients were analysed for CA-UTI. Of these, 292 (35.1%) samples (192 from northern India and 100 from Southern India) were found to be culture positive showing significant bacteriuria and the remaining 538 (64.9%) samples showed either non-significant bacteriuria or were sterile. The incidence of the bacteria implicated in UTI in women was found higher than men [Table/Fig-1]. The total incidence of infection in women and men was 54% and 46% respectively, same pattern was observed in both the geographical regions.

[Table/Fig-2]: Distribution of microbiological flora causing urinary tract infections in CPD patients (Percentages given in parentheses)

### DISCUSSION

This study provides valuable laboratory data to monitor the status of AMR among uropathogens and to improve treatment.
CONCLUSIONS
The worldwide trend of empirically treating CA-UTI may worsen the debacle of growing AMR and certainly does not apply for specific geographical regions, where decreased susceptibility rates are documented for common uropathogens. Therefore, development of regional surveillance programs is necessary for implementation of CA-UTI guidelines.

ACKNOWLEDGEMENTS
1. Birla Sarvajanik hospital, Pilani (Rajasthan) and local diagnostic laboratories in Punjab and Hyderabad (Andhra Pradesh) for providing the urine samples.

2. NPMASS-DRDO for the financial Support provided.

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