

ORIGINAL ARTICLE

ANTIMICROBIAL RESISTANCE PATTERNS IN COMMUNITY ACQUIRED URINARY TRACT INFECTIONS

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Background: Urinary tract infection (UTI) is the most frequent disease for which patients seek medical care. The antimicrobial agents causing UTI and their sensitivity patterns have remarkably changed throughout the world over the past few years. Hence, the present study was designed to explore the uropathogens and their susceptibility to various molecules in our region. **Methods:** This descriptive cross sectional study was conducted at Medical C Unit of Ayub Teaching Hospital, Abbottabad from January 2015 to January 2016. Patients with clinical features of UTI were evaluated using Urine R/E and Urine culture and sensitivity. Ten antibiotics were checked for susceptibility. Results were analysed using SPSS 17. **Results:** A total of 630 patients presented with urinary complaints. Of these, 236 patients had more than 8-10 pus cells on urine R/E. They were further evaluated using culture and sensitivity and positive culture was obtained in 75 patients. Of these 34 (45.3%) were males and 41 (54.7%) were females. E Coli was the predominant isolate being present in 49 (65.3%) patients. This was followed by Klebsiella in 9 (12%) patients. Tazobactam-piperacillin and cefoperazone-sulbactam were the most sensitive drugs having overall sensitivity of 96% and 93.3% respectively. The isolates were highly resistant to Fluoroquinolones 77.3% followed by Penicillins 72% and TMP-SMX 69.3%. **Conclusion:** Antibiotic sensitivity patterns have enormously changed over the past decade. Newer agents are quite efficacious but their use should be highly judicious to prevent the development of resistance to these molecules.

Keywords: Urinary tract infection; sensitivity; resistance; antimicrobials.

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INTRODUCTION

Urinary tract infection is the most frequently encountered infectious disease.¹ E Coli is the most significant pathogen encountered in 80–90% of community acquired and 30–50% of hospital acquired UTIs.² Some infections are also caused by other organisms from the Enterobacteriaceae family and by some Gram positive agents like *Staphylococcus saprophyticus* and *Enterococcus faecalis*. In the majority of infections, the etiologic agent is a single organism. However, multiple microbes may be responsible for the infection in some patients.³

These infections are usually treated empirically prior to microbiological tests or urine cultures. This approach is employed based on the fact that the spectrum of UTI causing organisms and their sensitivity to antimicrobial agents is considered quite predictable. But recently, it has been observed that the resistance to various antibiotics is found to be increasing among the common organisms causing UTI.⁴ Acute uncomplicated UTI have traditionally been treated primarily with trimethoprim-sulfamethoxazole. Owing to the increasing resistance to TMP-SMX, newer agents like fluoroquinolones and nitrofurantoin are increasingly being employed as first line treatment.⁵ Fluoroquinolones are quite

efficacious in treating a variety of bacterial infections including urinary tract infections with lower rates of resistance.⁶

Over the past years, the etiologic profile and the antibiotic sensitivity patterns are changing in both community acquired and hospital acquired urinary tract infections.^{7,8}

The present study was conducted with an aim to assess the sensitivity patterns of various antimicrobials to pathogens in patients with community acquired UTI so as to devise optimal options for empirical treatment of UTI.

MATERIAL AND METHODS

The descriptive cross sectional study was conducted at Medical C unit of Ayub Teaching Hospital Abbottabad from January to December 2015. Patients were recruited from medical ward and OPD. Patients with signs and symptoms of UTI were tested with Urine R/E and those having more than 8–10 pus cells were further evaluated using Urine Culture & Sensitivity from the same laboratory.

Growth of $\geq 10^5$ cfu/ml was considered as positive culture. Ten commonly used antibiotics were examined for susceptibility test. Data was collected using a structured *pro forma*. The results were collected and analysed using SPSS 17.

RESULTS

A total of 630 patients presented with urinary complaints. Of these, 236 patients had more than 8–10 pus cells on urine R/E. They were further evaluated using culture and sensitivity and positive culture was obtained in 75 patients. Of these, 34 (45.3%) were males and 41 (54.7%) were female patients. The mean age of the patients was 48.63 years with a range of 16–85 years. The majority of isolates were E Coli 49 (65.3%) followed by *Klebsiella* 9 (12%) and *streptococcus fecalis* 7 (9.3%). Other isolated organisms were *Pseudomonas* 6 (8%), *Proteus* 3(4%) and *Staphylococcus aureus* 1

(1.3%). Tazobactam-piperacillin was the most effective antibiotic having a sensitivity of 96% followed by cefoperazone-sulbactam with a sensitivity of 93.3%. Aminoglycosides demonstrated a sensitivity of 81.3%. Carbapenems and Nitrofurantoin had a sensitivity of 78.7% and 69.3% respectively. The isolates were highly resistant to Fluoroquinolones 77.3%, followed by Penicillins 72% and TMP-SMX 69.3%. Cephalosporins and Monobactams also demonstrated a high level of resistance being resistant to 62.7% and 50.7% of the isolates respectively (Table-1 & 2).

Table-1: Sensitivity of microorganisms to antibiotics

Microorganisms	Penicillins		Cephalosporins		Monobactams		Carbapenems		Nitrofurantoin	
	S	R	S	R	S	R	S	R	S	R
<i>E coli</i>	9 (18.4%)	40 (81.6%)	15 (30.6%)	34 (69.4%)	23 (46.9%)	26 (53.1%)	43 (87.8%)	6 (12.2%)	37 (75.5%)	12 (24.5%)
<i>Klebsiella</i>	3 (33.3%)	69 (66.7%)	3 (33.3%)	6 (66.7%)	3 (33.3%)	6 (66.7%)	7 (77.8%)	2 (22.2%)	4 (44.4%)	5 (55.6%)
<i>Staphylococcus aureus</i>	1 (100%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)
<i>Streptococcus fecalis</i>	6 (85.7%)	1 (14.3%)	6 (85.7%)	1 (14.3%)	5 (71.4%)	2 (28.6%)	5 (71.4%)	2 (28.6%)	7 (100%)	0 (0%)
<i>Pseudomonas</i>	1 (16.7%)	5 (83.3%)	2 (33.3%)	4 (66.7%)	4 (66.7%)	2 (33.3%)	1 (16.7%)	5 (83.3%)	3 (50%)	3 (50%)
<i>Proteus</i>	1 (33.3%)	2 (66.7%)	1 (33.3%)	2 (66.7%)	1 (33.3%)	2 (66.7%)	2 (66.7%)	1 (33.3%)	0 (0%)	3 (100%)
Total	21 (28%)	54 (72%)	28 (37.3%)	47 (62.7%)	37 (49.3%)	38 (50.7%)	59 (78.7%)	16 (21.3%)	52 (69.3%)	23 (30.7%)

Table-2: Sensitivity of microorganisms to antibiotics

Microorganisms	Aminoglycosides		Fluoroquinolones		Cefoperazone-Sulbactam		Tazobactam-piperacillin		TMP-SMX	
	S	R	S	R	S	R	S	R	S	R
<i>E coli</i>	42 (85.7%)	7 (14.3%)	13 (26.5%)	36 (73.5%)	47 (95.9%)	2 (4.1%)	48 (98%)	1 (2%)	18 (36.7%)	31 (63.3%)
<i>Klebsiella</i>	7 (77.8%)	2 (22.2%)	3 (33.3%)	6 (66.7%)	8 (88.9%)	1 (11.1%)	8 (88.9%)	1 (11.1%)	2 (22.2%)	7 (77.8%)
<i>Staphylococcus aureus</i>	1 (100%)	0 (0%)	0 (0%)	1 (100%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
<i>Streptococcus fecalis</i>	4 (57.1%)	3 (42.9%)	1 (14.3%)	6 (85.7%)	7 (100%)	0 (0%)	7 (100%)	0 (0%)	1 (14.3%)	6 (85.7%)
<i>Pseudomonas</i>	4 (66.7%)	2 (33.3%)	0 (0%)	6 (100%)	4 (66.7%)	2 (33.3%)	6 (100%)	0 (0%)	2 (33.3%)	4 (66.7%)
<i>Proteus</i>	3 (100%)	0 (0%)	0 (0%)	3 (100%)	3 (100%)	0 (0%)	2 (66.7%)	1 (33.3%)	0 (0%)	3 (100%)
Total	61 (81.3%)	14 (18.7%)	17 (22.7%)	58 (77.3%)	70 (93.3%)	5 (6.7%)	72 (96%)	3 (4%)	23 (30.7%)	52 (69.3%)

DISCUSSION

In the present study, the majority of isolates were from the female patients (54.7%). This aspect has been widely reported that female patients have a higher incidence of UTI, keeping in view the anatomic and physical reasons.^{9,10} The Study for Monitoring Antimicrobial Resistance Trends (SMART) in the year 2009 reported results from 1762 isolates of patients from 38 hospitals. Among these, *Enterobacteriaceae* group constituted the major proportion of organisms (86%). Of these, the commonest organisms were E coli (56.5%) and *Klebsiella* (13.8%)¹¹. Similar results were obtained in our study as well where E Coli comprised 65.3% and *Klebsiella* 12% of the isolates. In the SMART study, Amikacin was found to be the most sensitive antibiotic (91.7%). Sensitivity rates for ertapenem, imipenem and piperacillin-tazobactam were 86.9%, 86.6% and 84.9% respectively.¹¹ In the present study, tazobactam-piperacillin had the highest sensitivity 96%. Aminoglycosides also were quite sensitive with rates of 81.3%. The susceptibility rates varied from

50.3–74.2% for third and fourth generation cephalosporins.¹¹ In comparison, the sensitivity of cephalosporins was found to be 37.3% in this study. In our study, E coli showed a poor response to cephalosporins and fluoroquinolones having sensitivity rates of 30.6% and 26.5% respectively. In contrast, a study from Africa showed 92–99% susceptibility rates of cefotaxime and 68–91% sensitivity of ciprofloxacin against E Coli.¹²

E coli and *Klebsiella* strains in our study were highly resistant to penicillins having resistance of 81.6% and 66.7% respectively. Both the strains were also resistant to TMP-SMX (63.3% and 77.8%) respectively. Similar results were obtained from a study conducted in India where E coli and *Klebsiella* demonstrated a resistance of 76% and 75% respectively to ampicillin and 75% and 53% respectively to co trimoxazole.¹³ Nitrofurantoin was found to be quite sensitive to a wide range of isolates with an overall sensitivity of 69.3%. Similar observation was made in another study in Bangladesh where majority of isolates were sensitive to

Nitrofurantoin except *Klebsiella* and *Proteus* with a resistance of 63.64% and 66.67% respectively.¹⁴

In our study, overall the most sensitive antibiotics were tazobactam-piperacillin and cefoperazone-sulbactam followed by aminoglycosides and carbapenems. Identical results are reported in a study from Punjab, Pakistan where carbapenems, cefoperazone and tazobactam were found to be most efficacious. However, contrary to our study aminoglycosides had higher resistance rates.¹⁵ The resistance of microbes to Fluoroquinolones is much higher in our study (overall 77.3%). Reports from studies at Pennsylvania Health System show a resistance of 55.6% in enterococcal UTI and 15.6% for gram negative UTI.^{16,17}

CONCLUSION

The uropathogens are showing an ever increasing level of resistance to previously efficacious drugs all over the world in general and the developing world in particular. This can be attributed to the injudicious use of antibiotics, suboptimal concentrations and poor quality of the drugs and self-medication in the developing countries. The present study is indicative of increasing antibiotic resistance in our area that necessitates need for culture and sensitivity testing prior to initiating antibiotic therapy. Aminoglycosides and nitrofurantoin still appear to be quite sensitive against urinary microbes. The newer agent's tazobactam-piperacillin, cefoperazone-sulbactam and carbapenems are presently the promising agents for effectively treating UTI. However, their injudicious use should be avoided to prevent the development of resistance to these molecules.

AUTHOR'S CONTRIBUTION

SYH: Principle author, collected data, literature search, manuscript writing. SRA, SB: Data analysis, literature search. NA: Designed and supervised the whole study.

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