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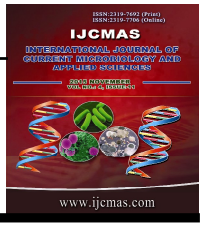

Original Research Article

Bacterial Pathogens in Urinary Tract Infection and Antibiotic Susceptibility Pattern from a Teaching Hospital, Bengaluru, India

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Keywords

Urinary Tract Infection, *E. coli*, Antibiotic Susceptibility

A B S T R A C T

Urinary tract infection (UTI) is one of the commonest infections encountered in clinical practice. Despite the widespread availability of antimicrobial agents UTI has become difficult to treat empirically because of appearance of pathogens with increasing resistance to antimicrobial agents. Objective of the study is to determine the bacterial pathogens causing UTIs and their antibiotic susceptibility pattern. This study was conducted in the department of microbiology, Raja Rajeswari Medical College & Hospital, Bengaluru, over a period of 1 year from September 2014 to October 2015. During this period around 4967 urine samples were received. Standard microbiological techniques were used to isolate and identify the organisms and to determine the antibiotic resistance pattern. 16.61% (825/4967) samples were culture positive, while 83.39% (4142/4967) were sterile. Gram negative organisms accounts for 80.36% and Gram positive organisms were 18.78%. Among gram negative bacilli, the predominant isolate was the *E. coli* (66.51%) followed by *K. Pneumonia* (14.32%), *K. oxytoca* (5.58%), *Pseudomonas spp.* (3.62%). Among Gram positive organisms, the predominant isolate was *CONS* (52.90%) followed by *Enterococcus spp* (35.48%) and *Staphylococcus aureus* (11.61%). *E. coli* is still the most widely prevalent organism causing UTI. Among oral antibiotics, nitrofurantion would be a better choice for the empiric treatment of UTI.

Introduction

Urinary tract infection (UTI) represents one of the most common diseases encountered in medical practice (Tambedkar *et al.*, 2006). This diseases affects people all age groups, being most common in women (Khan *et al.*, 2014).

The most common pathogens causing UTI are E. coli and other enterobacteriacae, which accounts for approximately 75% of the isolates (Beyene and Tsegaye, 2011). Other gram negative organisms like *P. aeruginosa* and gram positive organisms like *Enterococcus* spp. are the common organisms causing UTI in hospital settings (Minardi *et al.*, 2011).

In most cases of UTI, empirical antimicrobial therapy is initiated before culture and sensitivity results are available.

Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of increase in resistance to urinary isolates (Singhal *et al.,* 2014).

This study was carried out to determine the prevalent uropathogens in our hospital and their antibiotic sensitivity pattern to commonly used antibiotics. And also to formulate and develop an antibiotic guidelines for the empirical treatment of UTIs while awaiting the culture sensitivity.

Materials and Methods

The study was conducted in the department of microbiology, Raja Rajeswari Medical College & Hospital from September 2014 to October 2015, with objectives to determine the etiological Bacterial pathogens of the urinary tract infection (UTI) and to determine the antibiotic sensitivity pattern of pathogens isolated.

Clean catch, mid-stream urine samples were collected in sterile universal containers. Urine samples were processed within 2 hours of collection and in case delay, the samples were refrigerated at 2–8°C for up to 6 hours.

The samples were inoculated onto 5% sheep blood agar, MacConkeys agar and cysteine lactose electrolyte deficient (CLED) media by the semi-quantitative plating method using the calibrated loop delivering 0.001ml of urine. The plates were incubated at 37°C for 24–48 hours. Pure growth of an isolate in a count of ≥ 100000 colony forming unit (CFU) per millilitre of urine was considered as significant bacteriuria. A count of less than 100 CFU/ml was interpreted as negative. Growth of ≥ 3 isolates in a sample was considered as contamination, and a repeat sample was advised. Bacterial isolates were identified by using conventional biochemical tests (Forbes *et al.,* 2007).

Antimicrobial susceptibility testing was done on Mueller Hinton Agar by Kirby-Bauer disc diffusion method as per CLSI guidelines (CLSI, 2014), using the following antimicrobial drugs: ampicillin (30µg), amikacin (30µg) , amoxicillin/clavulanic acid (20/10µg), cephalexin (30µg), cefuroxime (30µg), cefotaxime (30µg), ceftazidime (30µg), cefepime (30µg), cefoxitin (30µg), gentamicin (10µg), tobramycin (10µg), norfloxacin (10µg), ciprofloxacin (5µg), ofloxacin (5µg), cotrimoxazole (1.25/23.75µg), nitrofurantoin (300µg), penicillin G (10), oxacillin (1µg), piperacillin-tazobactum (100/10µg), cefotaxime/clavulanic acid (30/20µg), aztreonam (30µg), tetracycline (30µg), meropenem (10µg), imipenem (10µg), vancomycin (30µg), linezoild (30µg), teicoplanin (30µg), novobiocin (15µg), colistin (10µg) and tigecycline (15µg).

Results and Discussion

A total of 4967 urine samples were received to the department of microbiology during the period from September 2014 to October 2015, out of which 16.61% (825/4967) samples were culture positive, while 83.39% (4142/4967) were sterile.

Culture positivity in male and female patients was 44.84% (370/825) and 55.15% (455/825) respectively.

The most common isolates in this study was Gram negative organisms which accounts for 80.36% (663/825) and Gram positive organisms were 18.78% (155/825). Among gram negative bacilli, the predominant isolate was the *E. Coli* (66.51%) followed by *K. Pneumonia* (14.32%), *K. oxytoca* (5.58%), *Pseudomonas spp.* (3.62%),*P. mirabilis* (3.01%) and *Non fermenting gram negative bacilli* (2.5%).

Among Gram positive organisms, the predominant isolate was coagulase negative *Staphylococcus* (52.90%) followed by *Enterococcus spp* (35.48%) and *Staphylococcus aureus* (11.61%).

The distributions of various urinary isolates are detailed in the table 1. The antibiotic susceptibility pattern of gram negative organisms and gram positive organisms are detailed in the table 2 and 3 respectively.

Worldwide, UTI is one of the most common infections encountered, which affects all age groups including men, women and children (Singhal *et al.,* 2014). The antimicrobial susceptibility patterns of organisms causing the UTI have changed over time, but the spectrum of agents causing UTI has remained relatively constant. Many studies reported *E. coli* as a most common organism causing UTI ranging from 44.96% to 70.96% (Khan *et al.,* 2014; Singhal *et al.,* 2014; Nerurkar *et al.,* 2012; Amin *et al.,* 2009; Dharmishtha *et al.,* 2012).

In our study, *E. coli* was the most common isolate 66.51% (441/663) among gram negative bacilli. Our study coincides with Khan *et al.* (2014) and Amin *et al.* (2009) studies which showed 61.3% and 59% *E. coli* respectively.

Second common gram negative organism was (14.32%) *K. pneumonia* followed by (5.58%) *K. oxytoca,* whereas the incidence of other enterobacteriaceae is low.

Nerurkar *et al.* (2012) and Amin *et al.* (2009) reported 14.72% and 11.6% cases *Klebsiella spp.* from urine sample in their studies, our study coincides with their studies. The isolation of *Pseudomonas spp* was (3.62%), which is similar to the other studies (Singhal *et al.,* 2014; Amin *et al.,* 2009).

The prevalence of Gram positive isolates (18.78%) was not high in our study; our study is similar to other studies in different countries (Zhanel *et al.,* 2005; Andrade *et al.,* 2006; Russell *et al.,* 2007).

Coagugalse negative *Staphylococcus* was the most common gram positive isolate in our study, accounted for 52.9% (82/155), as supported by other studies (Hussein NS). *Enterococcus spp* and *Staphylococcus aureus* were 35.48% and 11.61% respectively.

Candida spp. isolation was 7out of 4967 urine samples, of which 5 cases were *Candida albicans*, only 2 cases were *Candida non-albicans*.

Antibiotic susceptibility pattern of organisms:

Imipenem was the most sensitive antibiotic for gram negative organisms followed by meropenem, tetracycline, amikacin, piperacillin-tazobactum and nitrofurantoin. Gram negative organisms were least sensitive to ampicillin followed by cephalexin, amoxicillin/clavulanic acid and cefuroxime.

About 29% (192/663) of gram negative isolates were ESBL positive, which were sensitive to imipenem, meropenem and piperacillin-tazobactum. Colistin and tigecyclin showed 100% sensitivity by all gram negative organisms, but these drugs are kept as reserve, should be used judicially. MRSA and MRCONS rate in our study was 2.5% (4/155) and 6.45% (10/155) respectively.

Table.1 Distribution of Gram negative, gram positive and yeast isolated from urine samples

Name of the isolate		Total No.	Percentage
Gram negative organisms (n=663)	*E. coli*	441	66.51%
	K. pneumonia	95	14.32%
	K. oxytoca	37	5.58%
	P. mirabilis	20	3.01%
	P. vulgaris	9	1.36%
	Enterobacter spp.	6	0.9%
	Citrobacter spp.	10	1.50%
	Morganellaspp	4	0.6%
	Providencia spp	2	0.3%
	Pseudomonas spp.	24	3.62%
	Non –fermenting GNB	17	2.50%
Gram positive organisms (n=155)	*Coagulase negative Staphylococcus*	82	52.90%
	S. aureus	18	11.61%
	Enterococcus spp	55	35.48%
Yeast (n=7)	*Candida albicans*	5	71.42%
	Candida non-albicans	2	28.57%

Table.2 Antibiotic resistance pattern of Gram negative isolates

Antibiotic Drug	**Percentage (n= 663)**
Ampicillin (30µg)	89%
Amikacin (30µg)	11.2%
Amoxicillin/clavulanic acid (20/10µg)	80.8%
Cephalexin (30µg)	82.8%
Cefuroxime (30µg)	77.6%
Cefotaxime (30µg)	72.4%
Cefotaxime/clavulanic acid (30/10µg)	28.95%
Ceftazidime (30µg)	66.2%
Cefepime (30µg)	46.2%
Piperacillin-tazobactum (100/10µg)	17.1%
Gentamicin (10µg)	40.2%
Norfloxacin (10µg)	65.8%
Ciprofloxacin (5µg)	62.6%
Ofloxacin (5µg)	30%
Cotrimoxazole (1.25/23.75µg)	55.3%
Nitrofurantoin (300µg)	20.3%
Aztreonam (30µg)	29.9%
Tetracycline (30µg)	10.8%
Meropenem (10µg)	7.9%
Imipenem (10µg)	6.2%
Colistin (10µg)	0.2%
Tigecycline (15µg)	0

Table.3 Antibiotic resistance pattern of Gram positive isolates

Antibiotic Drug	**Percentage (n=155)**
Penicillin G (10)	92.6%
Ampicillin (30µg)	89%
Amikacin (30µg)	6.2%
Amoxicillin/clavulanic acid (20/10µg)	65.7%
Cephalexin (30µg)	65.8%
Oxacillin (1µg)	15.5%
Cefoxitin (30µg)	15.7%
Nitrofurantoin (300µg)	08.3%
Norfloxacin (10µg)	65.8%
Ciprofloxacin (5µg)	62.6%
Vancomycin (30µg)	0
Linezoild (30µg)	0
Teicoplanin (30µg)	0

MRSA and MRCONS isolates were sensitive to vancomycin, linezolid and teicoplanin. Many other studies also reported all the staphylococcal isolates being sensitive to vancomycin and linezolid (Gupta et al., 2009). All *Enterococci spp.* (35.48%) were sensitive to Vancomycin.

Gram positive uropathogens showed more sensitivity to nitrofurantion followed by amikacin and were least sensitive topenicillin G followed by ampicillin, amoxicillin/clavulanicacid, cephalexin, norfloxacin and ciprofloxacin. All gram positive isolates were 100% sensitive to vancomycin and linezolid.

In conclusion, *E. coli* is still the most widely prevalent organism causing UTI followed by *Staphylococcus spp.* The most effective antimicrobial agents were carbapenems, amikacin, tetracycline and nitrofurantion against gram negative bacilli and also the most effective antibiotics against gram positive cocci were vancomycin, amikacin and nitrofurantion.

Nitrofurantion would be a better choice for the empiric treatment of UTI for both gram positive and gram negative organisms.

In addition the sensitivity patterns to other testing antibiotics have been decreasing due to uncontrolled abuse of the available drugs. A strong policy to avoid over counter sale of drugs and encouraging for multi centres periodic studies to win the battle against resistant uropathogens.

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