

URINARY TRACT INFECTION, ITS CAUSATIVE MICROORGANISMS AND ANTIMICROBIAL SUSCEPTIBILITY OF ENTEROBACTERIACEAE ISOLATES IN AND AROUND PARBHANI

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ABSTRACT

BACKGROUND

Urinary tract infection (UTI) remains a major public health problem and occurs in all populations and age groups. However, urinary tract infection is fourteen times more common in females than males, especially sexually active women. Among both outpatients and inpatients, *Escherichia coli* is the primary pathogen followed by *Staphylococcus saprophyticus*, *Klebsiella* species, *Proteus* species, *Enterococcus* species and *Enterobacter* species. Recurrent UTIs warrant the use of multiple courses of antibiotic therapy. Eventually, the risk of antibiotic-resistant organisms is increased. To provide appropriate antibiotic treatment, physicians need to know local patterns of antimicrobial susceptibility for proper drug selection.

Therefore, this study was done to determine the prevalent microorganisms causing UTI and their antimicrobial susceptibility patterns in and around Parbhani.

MATERIALS AND METHODS

The present retrospective descriptive study was carried out during July 2016 to December 2017. A total of 650 urine samples were collected for study. Patient's age, parity, history of urinary complaints, past history of diabetes and hypertension was documented. Mid-stream urine samples were collected in a sterile wide mouthed container. Microscopic and macroscopic examination of urine was done. Plating of urine sample was done using standard loop technique. After incubation, plates were examined for any growth and colony count measured. Bacterial identification and antimicrobial susceptibility was done using VITEK 2 compact 30.

RESULTS

Among 650 samples tested, 220 (20.73%) were positive for pathogenic organisms. *Escherichia coli* of 49.09% was the most common. This was followed by *Klebsiella* species 45 (20.45%) and *Pseudomonas* species 19 (8.63%). In the present study, burning micturition was the commonest (40.05%) complaint of UTI. *E. coli*, the most frequently isolated bacterium showed high resistance rates (> 80%) to Ampicillin and Nalidixic acid. Majority (96.3%) of *E. coli* isolates were susceptible to amikacin with resistance rate of 3.8%. *Klebsiella* species showed most resistance to Nalidixic acid (86.66%) followed by Ampicillin (84.44%), while Fosfomycin and amikacin (75.56 %) were most susceptible antimicrobials.

CONCLUSION

A continuous review of antibiograms is necessary to track changes in aetiological agents and antimicrobial patterns to help in empirical treatment.

KEYWORDS

UTI, *E. coli*.

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BACKGROUND

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.¹ It occurs in all populations and ages from the neonate to the geriatric age group. However, Urinary tract infection is fourteen times more common in females than males, especially sexually active women.

Women are more susceptible than men due to several factors including anatomic differences like short urethra, hormonal change, easy contamination of urinary tract with faecal flora and various other reasons such as obstruction either mechanical or functional. Obstruction leads to stasis of urine, which forms good culture medium for the organism.^{2,3} Among both outpatients and inpatients, *Escherichia coli* is the primary urinary tract pathogen accounting for 75 to 90% of uncomplicated urinary tract infection isolates. *Staphylococcus saprophyticus*, *Klebsiella* species, *Proteus* species, *Enterococcus* species and *Enterobacter* species are pathogens less commonly isolated from outpatients.⁴ Recurrent UTIs warrant the use of multiple courses of antibiotic therapy. Eventually, the risk of antibiotic-resistant organisms is increased. Therefore, choice of suitable antibiotics is a major determinant of appropriate therapy and prevention of chronic complications.⁵ To provide appropriate antibiotic treatment, physicians need to know local patterns of microbial susceptibility and cost effectiveness for proper

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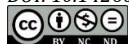
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drug selection. Therefore, the purpose of this study was to determine the prevalence of UTI and to identify the prevalent microorganisms and the recent trend of their antimicrobial susceptibility patterns in women patients attending Patil Hospital, Parbhani.

MATERIALS AND METHODS

Study Area

The present retrospective descriptive study was carried out in the clinical microbiology laboratory of a private hospital which is located in Parbhani district, Maharashtra, India and catering patients mostly from rural areas. The duration of the study was one and a half year period from July 2016 to December 2017.

A total of 650 urine samples were collected for study, from women attending clinic for complaint of symptoms (burning micturition, dysuria, increased frequency of urination) suggestive of Urinary tract infections during the study period. Subjects comprised of varying age from 12 to 55 years. Information regarding age, parity, history of urinary complaints, past history of diabetes and hypertension was documented.

Inclusion Criteria

Female patients in age group of 12-55 years with complaints of UTI.

Exclusion Criteria

Patients who were receiving any antibiotics.

Collection of Urine Sample

Mid-stream urine samples were collected in a sterile wide mouthed container. Urine specimens were transported to microbiology laboratory and processed within two hours.

Examination of Urine

1. **Macroscopic Examination:** Urine was observed for altered colour, presence of any turbidity and the findings were recorded.
2. **Microscopic Examination:**
 - A. **Wet Mount Examination:** About 10 mL of urine was taken into a conical tube and centrifuged at 1500 rpm for 5 minutes. One drop of sediment was examined microscopically by using 40x. Motility of organism, Pus cells, Red cells, various Casts and Crystals were observed.
 - B. **Gram Stain:** The smear of uncentrifuged urine was heat fixed and stained by Gram’s stain. Presence of at least one organism per field was considered as significant.
3. **Plating of Urine Sample:** Plating of urine sample was done prior to the other tests.

Standard Loop Technique: Plating of urine was done by Standard loop technique. Internal diameter of 4 mm to deliver 0.01 mL of urine on Blood agar and MacConkey’s agar was as follows-

Method⁶:

1. Urine was mixed thoroughly.
2. The sterile calibrated loop was vertically inserted into the urine.
3. The loopful of urine was spread across all the four quadrants of plate.

4. Plates were incubated at 37°C for 24 hours in an incubator.
5. Colonies were counted on each plate.
6. Significant bacteriuria was confirmed by colony count (Multiplying 100 to total number of colonies formed).

4. Bacterial Identification and Antimicrobial Susceptibility on VITEK 2 Compact 30:

Gram stain was observed. Depending on gram stain ID cards for identification of organism were run. For antimicrobial testing AST cards for gram positive (p628) and gram negative (N235) were used.

RESULTS

Among 650 samples tested, 220 (20.73%) were positive for pathogenic organisms. The types of organisms isolated are shown in Chart and Table No. 1. Escherichia coli was isolated in 108 (49.09%) of the positive samples. This was followed by Klebsiella species 45 (20.45%) and Pseudomonas species 19 (8.63%) and Staphylococcus aureus 17 (7.72%), Enterococcus species 16 (7.27%), Candida species 11 (5%) and Proteus species 4 (1.81%). In our study, majority of growth positive cases were in the age group of 21-30 years followed by children up to 10 years. The present study shows that burning micturition was found in 40.05% cases, which was the commonest complaint of UTI followed by increased frequency of urination (31.16%) and flank pain (10.6%) cases (Chart No. 2). E. coli, the most frequently isolated bacterium showed high resistance rates (> 80%) to Ampicillin and Nalidixic acid. Majority (96.3%) of E. coli isolates were susceptible to with resistance rate of 3.8%. Klebsiella species showed most resistance to Nalidixic acid (86.66%) followed by Ampicillin (84.44%), while Fosfomycin and amikacin (75.56 %) were most sensitive antimicrobials (Table No. 3).

Total Urine Isolates

220.

Isolate	No.	Percentage
E. coli	108	49.09
Klebsiella species	45	20.45
Pseudomonas aeruginosa	19	8.63
Staphylococcus aureus	17	7.72
Enterococcus species	16	7.27
Candida species	15	6.81

Table 1. Distribution of Urinary Isolates

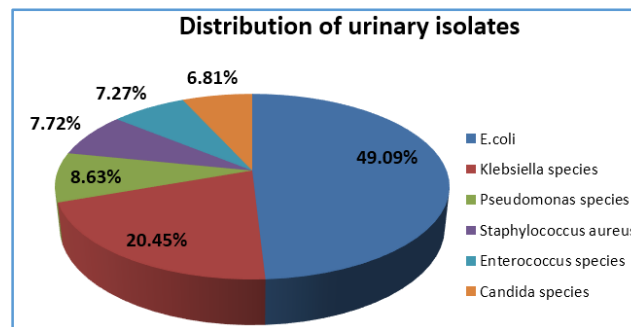


Chart 1. Distribution of Urinary Isolates

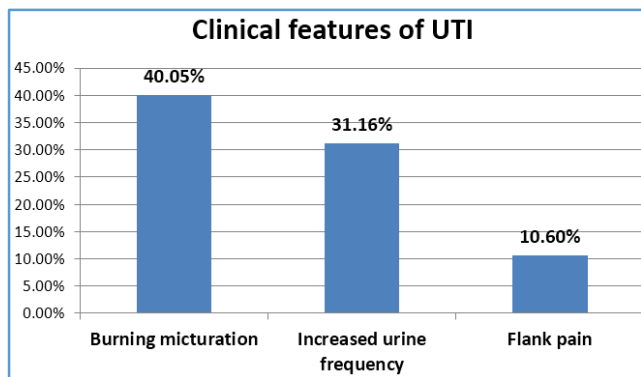


Chart 2. Clinical Features of UTI

Resistance and susceptibility pattern for E. coli and Klebsiella species

Antimicrobial	E. coli % Resistance	E. coli % Susceptibility	Klebsiella % Resistance	Klebsiella % Susceptibility
Ampicillin	80.55	19.45	84.44	15.56
Amoxicillin-clavulanic acid	30.55	69.45	62.22	37.78
Amikacin	3.70	96.3	24.44	75.56
Gentamicin	36.11	63.89	57.77	42.23
Cephalothin	74.07	25.93	71.11	28.89
Cefixime	74.07	25.93	74.07	25.93
Ciprofloxacin	75.92	24.08	66.66	33.34
Norfloxacin	67.59	32.41	67.59	32.41
Ofloxacin	68.51	31.49	67.59	32.41
Nalidixic acid	90.74	9.26	86.66	13.34
Ceftriaxone	75.92	24.08	80.00	20
Ertapenem	10.18	89.82	37.77	62.23
Fosfomycin	4.62	95.38	24.44	75.56
Cefoxitin	27.77	72.23	51.11	48.89
Nitrofurantoin	12.96	87.04	37.77	62.23
Cotrimoxazole	60.18	39.82	42.22	57.78

Table 2. Antimicrobial susceptibility of Enterobacteriaceae Isolates

DISCUSSION

This study provides valuable laboratory data to monitor the status of antimicrobial resistance among uropathogens and to improve treatment recommendations in a specific geographical region. The study also allows comparison of the situation in Parbhani with other regions within and outside the Maharashtra state.

Among 650 samples tested, 220 (20.73%) were positive for pathogenic organisms. The types of organisms isolated are shown in Figure 1. Escherichia coli was isolated in 108 (49.09%) of the positive samples. This was followed by Klebsiella species 45 (20.45%) and Pseudomonas species 19 (8.63%) and Staphylococcus aureus 17 (7.72%), Enterococcus species 16 (7.27%), Candida species 11 (5%) and Proteus species 4 (1.81%). Our findings are matching to following previous studies done by Chatterjee N et al⁵ Yasmeen et al² and Mulugeta Kibret et al.⁷

In our study majority of growth positive cases were in the age group of 21-30 years followed by children up to 10 years.

Age group 21-30 is mostly sexually active group, so most of the patients were from that group.

The present study shows that burning micturition was found in 40.05% cases, which was the commonest complaint of UTI followed by increased frequency of urination (31.16%) and flank pain (10.6%) cases. RA Hussain et al (1994)⁸ reported burning micturition was the commonest presentation of UTI followed by increased frequency. Sushma S Thakre et al (2012)⁹ also found that commonest complaint of UTI was burning micturition (55.2%) followed by increased frequency of micturition (51.7%), fever with chills (24.1%), dysuria (17.2%) and loin pain (10.3%).

E. coli, the most frequently isolated bacterium showed high resistance rates (> 80%) to Ampicillin and Nalidixic acid. Majority (96.3%) of E. coli isolates were susceptible to with resistance rate of 3.8%. Klebsiella species showed most resistance to Nalidixic acid (86.66%) followed by Ampicillin (84.44%), while Fosfomycin and amikacin (75.56%) were most sensitive antimicrobials. Our findings correlate with findings published by Awoke Derby et al (A study from Ethiopia),¹⁰ Yasmeen et al,² Mulugeta Kibret et al⁷ and Kotgire Santosh et al.¹¹ Inappropriate use of antimicrobials without proper culture and susceptibility report is the main contributing factor for emergence of resistance.

CONCLUSION

Management of UTI is often empirical without urine culture and susceptibility testing. A continuous review of antibiograms is necessary to track changes in aetiological agents and antimicrobial patterns to help in empirical treatment. Overuse of antibiotics and improper use of higher groups seems to be the main factor in the expansion of drug resistance and emergence of 'superbugs.' The current status of sensitivity of common organisms, rests mainly on fosfomycin, nitrofurantoin, levofloxacin, cefoperazone-sulbactam and aminoglycosides. In this miserable scenario, it seems awareness and prevention of UTI would be a better policy than finding newer drugs for cure. International guidelines are no longer applicable for treating community acquired UTIs in rural settings of India and development of specific guidelines based on local susceptibility patterns are necessary. Periodic surveillance of antimicrobial resistance of uropathogens, re-evaluation of empirical therapy, pre-therapy counseling for delayed antibiotic initiation and short-course antibiotic therapy with sensitive antibiotics are vital in an era of emerging antimicrobial resistance. Our study also highlights increasing antibiotic resistance trends in UTI to most commonly used Fluoroquinolones, Cotrimoxazole, Penicillin and alarming resistance was seen with third generation Cephalosporins thus warranting judicious use.

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