E-ISSN:2456-1487
P-ISSN:2456-9887
RNI:MPENG/2017/70771
Research Article
Bacterial

Tropical Journal of Pathology and Microbiology
2019 Volume 5 Number 7 July

Publisher
MEDRESEARCH
www.medresearch.in

A study on prevalence of bacterial isolates causing urinary tract infection at tertiary care hospital, Rajkot, Gujarat, India

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DOI: https://doi.org/10.17511/jopm.2019.i07.07

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Introduction: Urinary tract infection is most common bacterial infectious disease after respiratory tract infection disease in community practice. The introduction of antimicrobial therapy has contributed significantly to the management of UTIs. **Objective:** This study was conducted to identify bacterial isolates causing urinary tract infection & their prevalence in different age and gender. **Material & Methods:** 1000 Urine Samples received at Tertiary Care Hospital, Rajkot during year 2017 were tested for bacterial pathogen by Culture and Bio-chemical reaction. **Results:** Out of 1000 samples, 210 (21%) samples were found positive for UTI Isolates. Out of 210 positive cases, the prevalence of UTI was higher in female patients (56.19%) than in male patients (43.81%). The highest susceptible age group of patients to UTI was found in 21-40 years (33.33%). The highest prevalence of UTI in female patient was found in the age group of 21-40 years (44.92%) while in male patients the highest susceptible age group to UTI was above 60 years (35.87%). *E. coli* was the most common isolate (53.81%). **Conclusion:** Present study reported that *E. coli* isolate was the predominant pathogens causing UTI which mainly affected female. The study also allows comparison of the situation in Rajkot with other regions within and outside the state as well as in the country or outside the country. The knowledge of local prevalence of causative uropathogens and their respective antimicrobial sensitivity will help to reduce the incidence of resistance, empirical antibiotic selection in treatment of UTI.

Keywords: Antimicrobial agents, Bacterial isolates, E. coli, Urinary tract infections

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How to Cite this Article

Patel PK, Pattani MH. A study on prevalence of bacterial isolates causing urinary tract infection at tertiary care hospital, Rajkot, Gujarat, India. Trop J Pathol Microbiol. 2019;5(7):454-460.
Available From
https://pathology.medresearch.in/index.php/jopm/article/view/288

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Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2019-06-04	2019-06-14	2019-06-20		2019-06-25

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
No	Nil	Yes	6%	

Introduction

Urinary tract infection (UTI) is most common bacterial infectious disease after respiratory tract infection disease in community practice with a high rate of morbidity and financial cost. It has been estimated that 150 million people were infected with UTI per annum worldwide which costing global economy more than 6 billion US dollars. Although UTIs occur in all age groups including men and women, clinical studies suggest that the overall prevalence of UTI is higher in women.

An estimated 50% of women experience at least one episode of UTI at some point of their lifetime and between 20 to 40% of women can have recurrent episodes [1,2]. UTIs in men are uncommon but often associated with structural or functional abnormality. UTI is more common in females than in males as female urethra structurally found less effective for

Preventing the bacterial entry. It may be due to the proximity of the genital tract, urethra and adherence of urothelial mucosa to the mucopolysaccharide lining [3]. The other main factors which make females more prone to UTI are pregnancy and sexual activity [4]. In pregnancy, the physiological increase in plasma volume and decrease in urine concentration develop glycosuria in up to 70% women which ultimately leads to bacterial growth in urine [5]. Many different microorganisms can cause UTIs though the most common pathogens causing the simple ones in the community are *Escherichia coli* and other Enterobacteriaceae, which accounts for approximately 75% of the isolates.

Although *Escherichia coli* has been reported as the commonest isolate causing UTI, few authors have reported changing patterns in the prevalence of uropathogens [6, 7]. The introduction of antimicrobial therapy has contributed significantly to the management of UTIs. In almost all cases of community acquired UTI, empirical antimicrobial treatment is initiated before the laboratory results of urine culture are available; thus, resistance may increase in uropathogens due to frequent misuse of antimicrobials [8]. The prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide due to aberrant use of antibiotics in practise [9,10]. The distribution of antimicrobial susceptibility data of UTI causing microorganisms changes from time to time and from place to place [11].

The susceptibility data provided by regional microbiology laboratories helps to choose the empirical choice of antimicrobials to treat UTI. To the best of our knowledge, less data regarding the bacterial resistance in UTIs from Saurashtra Region of Gujarat State, India, has been documented. Since most UTIs are treated empirically, the criteria for the selection of antimicrobial agents should be determined on the basis of the most likely pathogen and its expected resistance pattern in a geographic area. Therefore, there is a need for periodic monitoring of etiologic agents of UTI and their resistance pattern in the community. This study was undertaken in view of paucity of reports of UTIs in patients of Tertiary Care Hospital, Rajkot (Gujarat State), India. Thereby the study was undertaken to find out the most frequent causative organisms of UTI and sex wise, age group wise prevalence in order to facilitate better treatment and management of UTIs at Tertiary Care Hospital, Rajkot.

Material & Methods

Setting: The present study was conducted on urine samples received at Bacteriology laboratory, Department of Microbiology from patients of all age suspected of UTI of Tertiary care Hospital, Rajkot, Gujarat, India

Duration: 2017.

Sample size: 1000 Samples

Exclusion criteria: There were no exclusion criteria for this study.

Data collection procedure: All Urine samples were studied as per the Performa formulated. The Performa includes serial number, register number, Lab number, age, sex, ward, socio economic status and clinical features of patients, Type of urine sample. In the present study, Blood agar, Nutrient agar & MacConkey agar were used.

Ethical consideration & permission: Permission for this study was obtained from the ethical committee.

Sample collection: For collection of urine samples patients were advised to collect a clean catch midstream urine specimen in a sterile, wide mouthed leak proof container supplied by the laboratory and bring to the laboratory as early as possible. For catheterized patients, the catheter tubing was clamped off above the port to allow collection of freshly voided urine.

The catheter port or wall of the tubing was then cleaned vigorously with 70% ethanol, and urine sample was aspirated via a needle and syringe. Isolation and identification of bacterial pathogens was done by microscopy and culture methods.

Microscopy: The urine samples were mixed thoroughly, uncentrifuged and examined microscopically for wet mount preparation. This was followed by a Gram's stain.

Culture: A calibrated sterile Nicrome wire loop for the semi-quantitative method was used for the plating. It has a 1.3 mm diameter to deliver 0.001 ml. A loopful of the well mixed urine sample was inoculated on Blood and Mac – Conkey & Nutrient agar plates. The plates were then incubated at 37ºC aerobically for 24 hrs.

They were then examined for bacterial growth. A significant bacterial count was taken as any count equal to or in excess of 100,000CFU/ml. A less than 100 CFU/ ml were interpreted as negative. Bacterial isolates were identified using conventional biochemical tests.

Results

Out of the total number of 1000 urine samples included in this study, 210 (21%) urine samples were positive for UTI isolates shown in Table 1.

Table-1: Number of positive isolates.

Prevalence	No. of samples	Percentage (%)
No bacterial pathogen	790	79.00
Positive isolates	210	21.00
Total	1000	

In present study, the prevalence of UTI was higher in female patient (56.19%) than in male patient (43.81%) in 210 positive isolates. The gender wise prevalence of UTI is shown in Table 2.

Table-2: Gender-wise prevalence of UTI.

Gender	Total No. of samples (n=1000)	Samples for positive isolates in No. (n=210)	(%)
Male	486	92	43.81
Female	514	118	56.19

The highest susceptible age group of patients to UTI was found in 21- 40 years (33.33%) followed by 41-60 years (26.19%), Above 60 years (25.25 %), 0-10 years (13.81%) and 11-20 (1.43%). The highest prevalence of UTI in females was found in the age group of 21-40 years (44.92%); however, in males the highest susceptible age group to UTI was above 60 years (35.87%). The age wise and gender wise prevalence of UTI are shown in Table 3.

Table-3: Age groups and gender wise prevalence of UTI.

Years	Female		Male		Total	
Age Group	No. of Cases (n=118)	(%)	No. of Cases (n=92)	(%)	No. of Cases (n=210)	(%)
0-10	16	13.56	13	14.13	29	13.81
11-20	2	1.69	1	1.09	3	1.43
21-40	53	44.92	17	18.48	70	33.33
41-60	27	22.88	28	30.43	55	26.19
Above 60	20	16.95	33	35.87	53	25.24

Among total of 210 bacterial uropathogens, 207 (98.57%) were Gram negative isolates and 3 (1.43 8%) were Gram positive isolates. Table 4 shows the distribution of gram positive and gram-negative isolates.

Table-4: Distribution of gram-positive and gram-negative isolates

Isolate	No. of positive isolates (n=100)	Percentage (%)
Gram negative	207	98.57
Gram positive	3	1.43
Total	210	100

Escherichia coli were found the dominant bacteria among all isolated uropathogens with the prevalence rate of 53.81%. The second most prevalent isolate was *Klebsiella pneumoniae* (32.58%) followed by *Pseudomonas aeruginosa* (5.71%), *Proteus mirabilis* (3.81%), *Acinetobacter baumannii* (1.90%), *Staphylococcus aureus* (1.43%), *Providencia spp.* (0.48%) and *Proteus vulgaris* (0.48%). Total positive isolates are shown in Table 5.

Table-5: Distribution of positive isolates.

Isolates	No. of positive samples (n=210)	(%)
Escherichia coli	113	53.81
Klebsiella pneumonia	68	32.38
Pseudomonas aeruginosa	12	5.71
Proteus mirabilis	8	3.81
Aceinetobacter baumannii	4	1.90
Staphylococci aureus	3	1.43
Providencia spp	1	0.48
Proteus vulgaris	1	0.48

Discussion

In present study, the prevalence of UTI was 21%. A Comparisons of UTI Prevalence with other similar studies are shown in Table 6.

All studies reported different prevalence rate and according various studies of UTI, the prevalence of UTI are varies periodically and geographically also.

Table-6: Comparison of overall prevalence of UTI with other studies.

Study	Year	Positive isolates (%)
Mohmmed Akram [12]	2007	10.86
Smita Sood, Ravi Gupta [13]	2012	17.16
Alka Nerurkar [14]	2012	60.00
Rezina Parveen [15]	2015	35.67
Nazreen Khan [16]	2016	36.64
Present Study	2017	21.00

Out of 210 Positive isolates, 118 positive isolates were found in female patient in present study (56.19%) and Comparisons of gender wise UTI prevalence distributions with other similar studies are shown in Table 7. all the above mentioned studies are comparable with present study for higher prevalence rate of UTI in female patient than male patient.

Table-7: Comparisons of gender wise prevalence of UTI with other studies.

Study	Year	(%) Isolates in female patient	(%) Isolates in male patient
Mohmmed Akram [12]	2007	66.66	33.34
Smita Sood, Ravi Gupta [13]	2012	62.42	37.58
Alka Nerurkar [14]	2012	57.74	42.26
Rezina Parveen [15]	2015	61.33	38.67
Nazreen Khan [16]	2016	68.67	31.33
Present Study	2017	56.19	43.81

In the present study, the highest prevalence of UTI (44.92%) in female patients was found in the age group of 21-40 years. However highest prevalence of UTI (35.87%) in male patient was found in elderly age group (Above 60 Years).

Similar results were observed in other studies and comparisons of studies are shown in table 8. Both studies mentioned in Table 8 are comparable with present study and found that more susceptible age group for UTI prevalence in female are 21-40 Years and susceptible age group for UTI in male patients are above 60 years.

Table-8: Comparison of age groups and genders wise UTI Prevalence with other studies

Study	Year	Age group in years	% prevalence
For female			
Smita Sood, Ravi Gupta [13]	2012	21-40	38.42
Nazreen Khan [16]	2016	21-40	46.49
Present Study	2017	21-40	44.92
For Male			
Smita Sood, Ravi Gupta [13]	2012	Above 60	46.92
Nazreen Khan [16]	2016	Above 60	23.07
Present Study	2017	Above 60	35.87

In present study, 207 (98.57%) were gram negative isolates and 3 (1.43%) were gram positive isolates among 210 Positive cases. All studies mentioned in table 9 had reported higher UTI prevalence rate (> 90%) in Gram negative isolates compared to gram positive isolates.

Table-9: Comparisons of distribution of gram-positive and gram-negative isolates with other studies

Study	Year	Gram-negative isolates (%)	Gram- positive Isolates (%)
Mohmmed Akram [12]	2007	93.00	7.00
Atul Kothari, Vishal Sagar [17]	2008	95.00	5.00
Shalini [18]	2011	93.70	6.29
Devanand Prakash [19]	2013	90.30	9.68
R Shyamala [20]	2013	98.10	1.92
Rezina Parveen [15]	2015	94.40	6.61
Present Study	2017	98.60	1.43

In present study, *Escherichia coli* were found most common bacteria among all isolated uropathogens with the prevalence rate of 53.81% followed *Klebsiella pneumoniae* (32.58%), *Pseudomonasaeruginosa* (5.71%), *Proteus mirabilis* (3.81%), *Acinetobacter baumannii* (1.90%), *Staphylococcus aureus* (1.43%), *Providencia spp* (0.48%) and *Proteus vulgaris* (0.48%). Comparisons of Results with the similar studies are shown in Table 10. All the studies have reported that *Escherichia coli* were the predominant isolates among the uropethgens causing UTI in the range of 34% to 68%.

Table-10: Comparison of positive isolates causing UTI with other studies

Study	Mohmmed Akram [12]	Atul Kothari, Vishal Sagar [17]	Shalini [18]	Alka Nerurkar [14]	Smita Sood, Ravi Gupta [13]	Sanjida Setu [21]	R Shyamala [20]	Devanand Prakash [19]	Rezina Parveen [15]	Nazreen Khan [16]	Present Study
Year	2007	2008	2011	2012	2012	2013	2013	2013	2015	2016	2017
Escherichia coli	61.00	68.00	64.30	34.50	61.80	54.00	61.50	42.60	64.50	49.40	53.80
Klebsiella pneumonia	22.00	17.00	20.30	11.30	6.64	14.40	17.30	18.70	11.20	7.83	32.40
Proteus Spp	-	5.50	-	5.35	1.44	1.13	13.50	9.03	3.74	1.20	4.29
Providencia spp	-	-	-	-	-	-	-	-	-	-	0.48
Pseudomonas aeruginosa	4.00	-	9.10	2.38	4.62	4.72	5.77	21.90	9.35	3.61	5.71
Acinetobacter baumannii	3.00	-	-	-	-	-	-	-	-	1.80	1.90
Staphylococci aureus	7.00	-	6.30	21.40	5.49	0.43	1.92	9.86	-	9.63	1.43
Enterobacter	-	5.30	-	13.70	-	4.46	-	7.10	2.80	19.30	-
Enterococci	-	1.50	-	-	9.24	2.01	-	-	5.61	-	-
Citrobacter	-	-	-	9.52	2.31	1.48	-	-	-	2.40	-

The second common bacteria after *Escherichia coli* was *Klebsiella pneumoniae* (32.58%) in the present study. R Shyamala [20], Rezina Parveen [15], Atul Kothari, Vishal Sagar [17], Mohmmed Akram [12], Sanjida Setu [21] & Shalini [18] had also reported *Klebsiella pneumoniae* as second most common bacteria after *Escherichia coli* with prevalence rate of 17.30%, 11.20%, 17.00%, 22.00%, 14.40% & 20.30 % respectively.

These studies are comparable and similar to present study where *Klebsiella pneumoniae* was second most common bacteria after *Escherichia coli.* Prevalence of other isolates likes Pseudomonas aeruginosa, *Proteus Spp. Acinetobacter baumannii*, *Staphylococcus aureus* & *Providencia spp.* were low in present study.

Conclusion

Against the background of paucity of reports of UTI in Rajkot (Gujarat), India, this study conducted to determine the prevalence of UTI, the effect of gender and age on its prevalence in community of Rajkot city at Tertiary Care Hospital. In the present study, as expected, the prevalence of UTI was found higher in female patients than male patients. The culture positive rate for UTI uropathogens was also highest in adult female patients with Age group (21-40 years) while in male patients, the highest UTI prevalence was found elderly age group (Above 60 Years).

The gram-negative bacilli (Enterobacteriaceae) were responsible for majority of Urinary tract infections. *Escherichia coli* were found to be the most common isolated bacteria causing urinary tract infection.

What this study adds to existing knowledge?

This study will help to improve treatment recommen-dations in a specific geographical region. The study also allows comparison of the situation in Rajkot with other regions within and outside the state as well as in the country or outside the country.

Author's contribution

- **Priyanka K. Patel:** Concept, Design, Preparation & editing of manuscript, Data Collection, Data Compiling, Literature Review, Sample Testing and Result Analysis, Final Approval.
- **Dr. Manish H. Pattani:** Manuscript editing, Literature Review, Final Approval.

Acknowledgement

Authors would like to thank all clinicians for providing clinical details of all patients & to laboratory staff for their support for the study.

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