CLINICAL AND MICROBIOLOGICAL PROFILE OF URINARY TRACT INFECTION IN THE ELDERLY WITH SPECIAL REFERENCE TO ANTIBIOTIC SENSITIVITY AND RESISTANCE.

General Medicine

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ABSTRACT

Aims and objectives: The aim of the study focused on clinical features, risk factors, and microbiological profile of Urinary Tract Infection in elderly patients with special reference to antibiotic Sensitivity and Resistance. **Material and Methods:** In this study, a total of 140 elderly patients suffering from urinary tract infection were included from a tertiary care hospital, Kolkata for a period of 12 months from January 2017 to December 2017. Patients included in the study will be considered for sensitivity profile study. Every patient will be thoroughly evaluated with careful history taking, thorough clinical examinations, and necessary investigations. **Results:** UTI is an important cause of morbidity and sepsis in elderly patients having a spectrum varying from benign cystitis to potentially life-threatening pyelonephritis. We found that the Enterobacteriaceae groups of microorganism were the most common etiology with fungus being less common. The majority of the microorganisms were sensitive to fosfomycin, polymyxin B, and colistin. **Conclusion:** In conclusion, elderly populations with urinary tract infections require early diagnosis and focussed therapy to reduce the morbidity and mortality

KEYWORDS

Urinary Tract Infection, Antibiotic sensitivity,

INTRODUCTION

Urinary tract infections (UTIs) stand as a major public health problem in terms of morbidity as well as financial cost among urological diseases. It exceeds that of chronic renal failure even when renal dialysis and renal transplantation are included.¹ UTI estimates to 150 million per annum worldwide.² The main problem with current antibiotic therapies is the rapid emergence of resistance in hospitals and the community.³ Urinary tract infections (UTI) represent an important public health challenge and is a major cause of morbidity and hospital admissions especially in the elderly throughout the world.

MATERIALS AND METHODS

Study Population:

In this study, 140 total of 140 elderly patients suffering from urinary tract infection were admitted to the Department of General Medicine, in a tertiary care hospital in Kolkata for a period of 12 months from January 2017 to December 2017.

Study Design:

A prospective observational hospital-based study of 140 patients

Inclusion Criteria:

1. Age: 60 years and above
2. Patients with symptoms of urinary tract infection.
3. Those patients with colony count $\geq 10^5$ / ml of urine.

Exclusion Criteria:

1. History of urinary tract infection in the last 3 months
2. Growth of multiple species of bacteria in urine culture.

Patients included in the study will be considered for sensitivity profile study. Every patient will be thoroughly evaluated with careful history taking, thorough clinical examinations, and necessary investigations.

Methodology:

Demographics, clinical signs and symptoms, co-morbidities, and laboratory findings of patients coming with urinary tract infection.

Statistical Analysis:

Descriptive statistical analysis was performed to calculate the means with corresponding standard deviations (S.D.). Test of proportion was used to find the Standard Normal Deviate (Z) to compare the different proportions. Chi-square (χ^2) test was performed to find the associations between the variables. A corrected Chi-square (χ^2) test was performed to find the associations between the variables when one of the cell frequencies was less than zero. $p < 0.05$ was taken to be statistically significant.

RESULTS

Table 1: Distribution of age and gender of the patients

Age Group (in years)	Gender		Total
	Male (n=76)	Female (n=64)	
60 - 69	26	23	49
Row %	53.1	46.9	100.0
Col %	34.2	35.9	35.0

70 - 79	35	28	63
Row %	55.6	44.4	100.0
Col %	46.1	43.8	45.0
≥80	15	13	28
Row %	53.6	46.4	100.0
Col %	19.7	20.3	20.0
TOTAL	76	64	140
Row %	54.3	45.7	100.0
Col %	100.0	100.0	100.0
Mean±s.d.	72.38±7.16	73.04±7.10	
Median	71.5	73.5	
Range	60 - 90	60 - 89	

$\chi^2 = 0.07$; $p = 0.96$ NS- Not Significant

Corrected Chi-square (χ^2) test showed that there was no significant association between age and gender of the patients ($p=0.96$). Thus the prevalence of UTI was more or less equally distributed over the age of male and female patients. Though the mean age of females was higher than that of males, t-test showed that there was no significant difference in mean age of males and females ($t_{95}=0.54$; $p=0.27$).

Table 2: Distribution of Presenting Symptoms

Presenting Symptoms	Number (n=140)	%
Fever	84	60.0%
Chills and rigor	9	6.4%
Dysuria	78	55.7%
Frequency of micturation	113	80.7%
Diminished stream	34	24.3%
Incomplete emptying of urinary bladder	60	42.9%
Mental confusion	12	8.6%
Supra-pubic pain	66	47.1%
Pain in flanks	6	4.3%

Table 3: Distribution of Co-morbidities and Associated factors

Presenting Symptoms	Number (n=140)	%
Diabetes Mellitus	115	82.1%
B.P.H (n=76)	42	55.3%
Urinary Catheterisation	28	20.0%
Renal Disease	6	4.3%
Cardiac Disease	20	14.3%

Table 4: Distribution of Isolated Micro Organism of urine of the patients

Isolated Micro Organism	Number (n=140)	%
C.ALBI	13	9.3%
E. Coli	74	52.9%
ENTERO	15	10.7%
KLEB	16	11.4%
PSEU	22	15.7%
Total	140	100.0%

E. Coli (52.9%) was the most common among the Isolated Micro Organism which was significantly higher ($Z=5.54$; $p < 0.0001$).

Table 5: Distribution of resistance and sensitivity of antibacteria (n=127)

Antibacteria	Resistance		Sensitivity	
	Number	%	Number	%
Ceftazidime	57	44.9	68	53.5
Piperacillin-Tazobactam	23	19.6	94	80.3
Colistin	2	1.6	115	90.6
Polymyxin B	13	10.3	113	89.7
Imepinem-Cilastatin	15	19.8	101	80.2
Gentamicin	32	25.2	71	55.9
Ertapenem	37	30.3	85	69.6
Levofloxacin	79	62.7	47	37.3
Cotrimoxazole	40	40.4	59	59.6
Nitrofurantoin	40	37.7	66	62.3
Fosfomycin	18	14.8	104	85.2
Cefoperazone-Sulbactam	46	39.7	70	60.3

Resistance of Levofloxacin (62.7%) were found significantly higher ($Z=2.41$; $p=0.015$) than that of others.

Table 6: Distribution of resistance and sensitivity of Ceftazidime

Ceftazidime	C.ALBI	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	31	5	7	14	57
Row %	0.0	54.4	8.8	12.3	24.6	100.0
Col %	0.0	41.9	35.7	43.8	66.7	45.6
Sensitivity	0	43	9	9	7	68
Row %	0.0	63.2	13.2	13.2	10.3	100.0
Col %	0.0	58.1	64.3	56.3	33.3	54.4
TOTAL	0	74	14	16	21	125
Row %	0.0	59.2	11.2	12.8	16.8	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 7: Distribution of resistance and sensitivity of Piperacillin-Tazobactam

Piperacillin-Tazobactam	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	1	0	0	1	2
Row %	0.0	50.0	0.0	0.0	50.0	100.0
Col %	0.0	1.4	0.0	0.0	4.8	1.7
Sensitivity	0	73	6	16	20	115
Row %	0.0	63.5	5.2	13.9	17.4	100.0
Col %	0.0	98.6	100.0	100.0	95.2	98.3
TOTAL	0	74	6	16	21	117
Row %	0.0	63.2	5.1	13.7	17.9	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 8: Distribution of resistance and sensitivity of Colistin

Colistin	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	1	0	0	1	2
Row %	0.0	50.0	0.0	0.0	50.0	100.0
Col %	0.0	1.4	0.0	0.0	4.8	1.7
Sensitivity	0	73	6	16	20	115
Row %	0.0	63.5	5.2	13.9	17.4	100.0
Col %	0.0	98.6	100.0	100.0	95.2	98.3
TOTAL	0	74	6	16	21	117
Row %	0.0	63.2	5.1	13.7	17.9	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 9: Distribution of resistance and sensitivity of Polymyxin B

Polymyxin B	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	0	0	0	1	1
Row %	0.0	0.0	0.0	0.0	100.0	100.0
Col %	0.0	0.0	0.0	0.0	4.5	0.8
Sensitivity	0	74	14	16	21	125
Row %	0.0	59.2	11.2	12.8	16.8	100.0
Col %	0.0	100.0	100.0	100.0	95.5	99.2
TOTAL	0	74	14	16	22	126
Row %	0.0	58.7	11.1	12.7	17.5	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 10: Distribution of resistance and sensitivity of Imipenem-Cilastatin

Imipenem-Cilastatin	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	23	3	7	13	46
Row %	0.0	50.0	6.5	15.2	28.3	100.0
Col %	0.0	31.1	21.4	43.8	59.1	36.5
Sensitivity	0	51	11	9	9	80
Row %	0.0	63.8	13.8	11.3	11.3	100.0
Col %	0.0	68.9	78.6	56.3	40.9	63.5
TOTAL	0	74	14	16	22	126
Row %	0.0	58.7	11.1	12.7	17.5	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 11: Distribution of resistance and sensitivity of Gentamicin

Gentamicin	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	14	5	8	5	32
Row %	0.0	43.8	15.6	25.0	15.6	100.0
Col %	0.0	19.4	62.5	50.0	71.4	31.1
Sensitivity	0	58	3	8	2	71
Row %	0.0	81.7	4.2	11.3	2.8	100.0
Col %	0.0	80.6	37.5	50.0	28.6	68.9
TOTAL	0	72	8	16	7	103
Row %	0.0	69.9	7.8	15.5	6.8	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 12: Distribution of resistance and sensitivity of Ertapenem

Ertapenem	C.ALBi	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	19	5	8	3	37
Row %	0.0	51.3	13.5	21.6	13.5	100.0
Col %	0.0	19.8	62.5	50.0	71.4	25.4
Sensitivity	0	72	3	8	2	85
Row %	0.0	84.7	3.5	9.4	2.4	100.0
Col %	0.0	80.2	37.5	50.0	28.6	69.6
TOTAL	0	91	8	16	7	122
Row %	0.0	69.9	7.8	15.5	6.8	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 13: Distribution of resistance and sensitivity of Levofloxacin

Levofloxacin	C.ALB	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	45	9	10	15	79
Row %	0.0	57.0	11.4	12.7	19.0	100.0
Col %	0.0	60.8	64.3	62.5	68.2	62.7
Sensitivity	0	29	5	6	7	47
Row %	0.0	61.7	10.6	12.8	14.9	100.0
Col %	0.0	39.2	35.7	37.5	31.8	37.3
TOTAL	0	74	14	16	22	126
Row %	0.0	58.7	11.1	12.7	17.5	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 14: Distribution of resistance and sensitivity of Cotrimoxazole

Cotrimoxazole	C.ALB	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	29	1	7	3	40
Row %	0.0	72.5	2.5	17.5	7.5	100.0
Col %	0.0	39.7	16.7	43.8	75.0	40.4
Sensitivity	0	44	5	9	1	59
Row %	0.0	74.6	8.5	15.3	1.7	100.0
Col %	0.0	60.3	83.3	56.3	25.0	59.6
TOTAL	0	73	6	16	4	99
Row %	0.0	73.7	6.1	16.2	4.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 15: Distribution of resistance and sensitivity of Nitrofurantoin

Nitrofurantoin	C.ALB	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	16	6	14	4	40
Row %	0.0	40.0	15.0	35.0	10.0	100.0
Col %	0.0	22.2	50.0	87.5	66.7	37.7
Sensitivity	0	56	6	2	2	66
Row %	0.0	84.8	9.1	3.0	3.0	100.0
Col %	0.0	77.8	50.0	12.5	33.3	62.3
TOTAL	0	72	12	16	6	106
Row %	0.0	67.9	11.3	15.1	5.7	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 16: Distribution of resistance and sensitivity of Fosfomycin

Fosfomycin	C.ALB	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	0	0	1	1	2
Row %	0.0	0.0	0.0	50.0	50.0	100.0
Col %	0.0	0.0	0.0	6.7	4.5	1.6
Sensitivity	0	74	11	14	21	120
Row %	0.0	61.7	9.2	11.7	17.5	100.0
Col %	0.0	100.0	100.0	93.3	95.5	98.4
TOTAL	0	74	11	15	22	122
Row %	0.0	60.7	9.0	12.3	18.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 17: Distribution of resistance and sensitivity of Cefoperazone-Sulbactam

Cefoperazone-Sulbactam	C.ALB	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Resistance	0	21	3	8	14	46
Row %	0.0	45.7	6.5	17.4	30.4	100.0
Col %	0.0	28.4	50.0	50.0	70.0	39.7
Sensitivity	0	53	3	8	6	70
Row %	0.0	75.7	4.3	11.4	8.6	100.0
Col %	0.0	71.6	50.0	50.0	30.0	60.3
TOTAL	0	74	6	16	20	116
Row %	0.0	63.8	5.2	13.8	17.2	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

Table 18: Distribution of resistance and sensitivity of Antifungals (n=13)

Antifungals	Resistance		Sensitivity	
	Number	%	Number	%
Fluconazole	0	0.0	13	100.0
Voriconazole	0	0.0	13	100.0
Caspofungin	0	0.0	13	100.0
Micafungin	0	0.0	13	100.0
Amphotericin B	0	0.0	13	100.0
Flucytosine	0	0.0	13	100.0

Table 19: Distribution of resistance and sensitivity of Antifungals

Antifungals	C.ALBI	E.Coli	ENTERO	KLEB	PSEU	TOTAL
Sensitivity	13	0	0	0	0	13
Row %	100.0	0.0	0.0	0.0	0.0	100.0
Col %	100.0	0.0	0.0	0.0	0.0	100.0
TOTAL	13	0	0	0	0	13
Row %	100.0	0.0	0.0	0.0	0.0	100.0
Col %	100.0	100.0	100.0	100.0	100.0	100.0

100% of *Candida albicans* isolated were sensitive to Fluconazole, Voriconazole, Caspofungin, Micafungin, Amphotericin B, Flucytosine

DISCUSSION

UTI is an important cause of morbidity and sepsis in elderly patients having a spectrum varying from benign cystitis to potentially life-threatening pyelonephritis. In the series, a total of 140 (n=140) elderly inpatients were selected from Peerless hospital and B.K. Research center for an observational study of the clinical and microbiological profile of urinary tract infection.

There were several studies done before to study the clinical and microbiological profile of urinary tract infection in the elderly. A very few of them were however done in this part of the country.

Comparison with similar studies is given below

S. No.	Series	Year	Total Patients
1	Mahesh et al. ⁴	2011	194
2	Eshwarappa et al. ⁵	2011	510
3	Sood and Gupta ⁶	2012	346
4	Kakde et al. ⁷	2017	95
5	Present Study	2017	140

In our study, 140 elderly patients were selected, in a study by Sood & Gupta total 346 patients were selected and out of them 108 were elderly and in a study done by Eshwarappa et al. 510 patients were selected out of which 234 were elderly, however in the study by Kakde et al. and Mahesh et al. 95 and 194 patients were selected respectively, all the patients selected were elderly.

Sex wise distribution of UTI

Author	Sex	
	Male	Female
Mahesh et al. (2011) ⁴	116 (59.79%)	78 (40.20%)
Eshwarappa M et al. (2011) ⁵	140 (59.82%)	94 (40.17%)
Sood and Gupta (2012) ⁶	61 (56.48%)	47 (43.51%)
Kakde et al. (2017) ⁷	53 (55.78%)	42 (44.21%)
Present study (2017)	76 (54.3%)	64 (45.7%)

The male preponderance over females may be due to the fact that with the advancing age prostatic enlargement, neurogenic bladder, decreased prostatic sections and prostatic microcalculi which can harbor bacteria and become a nidus for infection increases the prevalence of UTI in elderly males.

Age wise distribution of UTI

In a study by Mahesh E et al. (2011), they reported that 58.8%, 33.0%, 7.7%, and 0.5% of the patients were in the age groups of 65–74, 75–84, 85–94, and 95 years and above respectively. Eshwarappa M. et al. (2011) reported that 20.2% of the patients were in the age group of 60–69 years, 17.8% in the 70–79 age group, and only 6.3% and 1.6% in the age group 80–89 and 90–99 respectively. In another study by Sood and Gupta (2012), they reported that 15.61% of patients were in the age group of 61–70 years, 10.69% in the 71–80 age groups, and only 0.49% in 81–90 age groups. In the present study, it was found that 35% of patients were in the age group 60–69 years, 45% patients in the age

group 70–79 years, and 20% patients more than 80 years of age.

Symptomatology

Classic signs and symptoms of UTI include increased urinary frequency, urinary urgency, dysuria, and suprapubic discomfort. Pyelonephritis usually presents with costovertebral angle tenderness, fever, and variable lower urinary tract symptoms. suprapubic discomfort. Pyelonephritis usually presents with costovertebral angle tenderness, fever, and variable lower urinary tract symptoms.

Symptoms	Mahesh E et al. (2011) ⁴	Eshwarappa M. et al. (2011) ⁵	Kakde et al. (2017) ⁷	Present Study (2017)
Fever	29.4%	30.6%	45.26%	60%
Dysuria	26.8%	32.4%	62.10%	55.7%
Frequency of micturition	13.9%	16.3%	65.26%	80.7%
Pain in abdomen	10.3%	8.5%	34.73%	51.4%

A prospective study done specifically in elderly population by Mahesh E et al. (2011) observed that fever was the most common symptom while Eshwarappa et al. found dysuria to be the most common symptom but in our present study similar to a study done by Kakde et al. the most symptom observed was increased frequency of micturition.

Risk Factors:

Risk Factors	Mahesh E et al. (2011) ⁴	Eshwarappa M. et al. (2011) ⁵	Kakde et al. (2017) ⁷	Present Study (2017)
Diabetes Mellitus	50.0%	42.6%	46.31%	82.1%
Prostatic Hypertrophy	—	—	41.50%	55.3%
Urinary Catheterisation	14.9%	11.4%	14.73%	20%
Female Genital Prolapse	—	—	30.95%	21.8%

Studies, similar to the present study, done by Mahesh et al., Eshwarappa M et al. and Kakde et al. found that diabetes mellitus was the most common risk factor for acquiring UTI in the elderly.

Microorganisms isolated from Urine Culture

Author	Microorganisms				
	E. coli	Klebsiella	Pseudomonas	Enterococcus	C. aureus
Mahesh et al. (2011) ⁴	71.1%	13.4%	8.3%	2.6%	—
Eshwarappa M et al. (2011) ⁵	66.9%	15.5%	10.2%	1.6%	—
Sood and Gupta (2012) ⁶	61.84%	6.64%	4.62%	9.24%	—
Kakde et al. (2017) ⁷	47.36%	18.94%	14.73%	5%	—
Present study (2017)	52.9%	11.4%	15.7%	10.7%	9.3%

In a study done by Mahesh et al., *E. coli* was isolated from urine cultures of 71.1 % of patients, *Klebsiella* from 13.4 % of patients, *Pseudomonas* from 8.3% of patients, and *Enterococcus* from 2.6% of patients.

Eshwarappa M et al. in their study found that the most predominant microorganism grown in urine culture of their selected patients was *E. coli*, present in 66.9% of patients followed by *Klebsiella* present in 15.5% of patients, *Pseudomonas* present in 10.2 % of patients, and *Enterococcus* present in 1.6% of patients.

Sood and Gupta found that *E. coli* was grown in 61.84% of urine cultures of their selected patients, *Klebsiella* in 6.64 % of urine cultures, *Pseudomonas* in 4.62 % of urine cultures, and *Enterococcus* in 9.24 % of patients.

In a similar study done by Kakde et al., it was seen that *E. coli* was isolated from 47.36% samples, *Klebsiella* from 18.94% samples, *Pseudomonas* from 14.73 % samples, and *Enterococcus* from 5% samples.

In the present study, among the organisms isolated from urine cultured from elderly patients with UTI, *E. coli* was most predominant being present in 52.9% of patients, *Pseudomonas* was isolated from 15.7% of the patients, *Klebsiella* was grown in 11.4% of the culture, *Enterococcus* and *C. aureus* were grown in 10.7% and 9.3% of urine culture respectively. The findings of the present study nearly correlate with most of the studies mentioned above.

Sensitivity and Resistance Pattern of Organisms

In the present study all, the organisms isolated from urine culture of elderly UTI show maximum sensitivity to colistin. Uropathogens showed the least resistance to colistin followed by polymyxin B and Fosfomycin. This variation in the sensitivity and resistance pattern among different antibiotics was possible due to the antibacterial coverage of these antibiotics and also as colistin and polymyxin B were used less frequently they showed the least resistance. Similarly, quinolones being the most commonly used antibiotics for any kind of infection hence they developed maximum resistance.

Candida albicans was sensitive to all the commonly used antifungals, like fluconazole, voriconazole, caspofungin, micafungin, amphotericin B, flucytosine.

Mahesh E et al (2011) reported that 79.9% of the uropathogens were resistant to fluoroquinolones i.e. for ciprofloxacin and norfloxacin each and only 3.16% were resistant to imipenem.

Eshwarappa M. et al (2011) found the least resistance rate for imipenem (3.9%), whereas quinolones i.e. both ciprofloxacin and norfloxacin recorded the highest rate of resistance (74.1%).

In a study by Sood and Gupta (2012), the resistance rates for norfloxacin, ciprofloxacin, and piperacillin/tazobactam were 77%, 74%, and 6.19% respectively.

Kakde et al found that the microorganisms isolated were least resistant to Imipenem (86.31% sensitivity) followed by Meropenem (80% sensitive) and Piperacillin-Tazobactam (70.52% sensitive). Organisms were least susceptible to cefotaxime (10.52% susceptible) followed by ceftriaxone (16.84% susceptible).

Many factors may be responsible for the high level of resistance such as the frequent use of antibiotics for therapy and prophylaxis, the ease of procurement of antibiotics in developing country and other socio-economic factors. Last but not least poor patient compliance is also responsible for an increase in antimicrobial resistance.

CONCLUSION

Urinary tract infection (UTI) represents an important public health challenge and is a major cause of morbidity and hospital admissions especially in the elderly throughout the world. Our series focuses on clinical features, risk factors, and microbiological profile with special reference to antibiotic susceptibility and resistance. We found that the Enterobacteriaceae groups of microorganism were the most common etiology with fungus being less common. The majority of the microorganisms were sensitive to fosfomycin, polymyxin B, and colistin. We found that diabetes mellitus along with dementia, urogenital instrumentation, and benign prostatic hyperplasia; specifically in male patients were major risk factors for acquiring urinary tract infection. In conclusion, elderly populations with urinary tract infections require early diagnosis and focussed therapy to reduce the morbidity and mortality.

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