

A STUDY OF CLINICO-MICROBIOLOGICAL PROFILE OF URINARY TRACT INFECTION IN A TERTIARY CARE HOSPITAL

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Abstract

Background: Urinary tract infection (UTI) is one of the most common infectious diseases seen in the community. It has been estimated that UTI account for 7 million hospital visits per year along with 1 million visits to the emergency department. The objectives are to isolate and characterize pathogens causing UTIs in patients admitted. To study the antimicrobial sensitivity pattern of the urinary isolates so as to provide a basic guideline in treating UTIs. To study the clinical profiles and risk factors associated with UTIs. **Materials and Methods:** It was prospective, observational, comparative study conducted at Kauvery medical centre and hospital, Trichy, Tamilnadu. Patients with clinical features suggestive of urinary tract infection admitted in hospital and had urinary tract infection confirmed by positive urine culture are the study population. Patients recruited for study from September 2017 to September 2019. **Result:** As per table 1 it was seen that out of the 100 patients who were culture positive, 41 were found to be males and 59 to be females. Among the total, 79 were complicated and only 21 were uncomplicated. As males were categorized as complicated cases, all 21 of the uncomplicated cases were female. Of the total complicated cases, female is to male ratio is 1: 1.08. Among the gram negative organisms, 31% (26/84) were sensitive to all antibiotics tested. 52.4% (44/84) were ESBL positive, 9.5% (8/84) were AMP-C positive and 7.1% (6/84) were MDR. Among the total, ESBL positive E. coli (47.6%) was the most common organism. **Conclusion:** Importance of obtaining proper culture specimens cannot be over emphasized as it is lifesaving. Hospitals need to evolve antibiotic recommendations based on independent studies.

INTRODUCTION

Urinary tract infection (UTI) is one of the most common infectious diseases seen in the community. It has been estimated that UTI account for 7 million hospital visits per year along with 1 million visits to the emergency department. By definition it means a bacterial/ non-bacterial invasion of the urinary tract that can occur anywhere between the urethra and the kidney.^[1] It encompasses a variety of clinical entities, including asymptomatic bacteriuria (ASB), cystitis, prostatitis, and pyelonephritis. Uncomplicated urinary tract infection refers to acute cystitis or pyelonephritis in a non-pregnant outpatient woman without anatomic abnormalities or instrumentation of the urinary tract.

The term complicated urinary tract infection encompasses all other types of urinary tract infection. Recurrent urinary tract infection is not necessarily complicated; individual episodes can be uncomplicated and treated as such.^[2] UTI can be caused by both Gram-negative and Gram-positive

bacteria, in addition to certain fungi. The major aetiological agent is Escherichia coli followed by Klebsiella pneumonia, Staphylococcus saprophyticus, Enterococcus faecalis, Group B Streptococcus, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus and Candida spp.^[3,4]

Empirical antibiotic therapy is usually applied here and for this, knowledge of the common uropathogens and their susceptibility to commonly used antibiotics is needed. Treatment becomes even more challenging in the presence of risk factors such as higher age, comorbidity, and immunosuppression. Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of resistance to many of these antibiotics. Various studies done worldwide have shown changing patterns in the etiology of UTIs.^[5,6] The aim of the present study was to record the common clinical presentation and risk factors for UTI. The distribution of bacterial strains isolated from complicated and uncomplicated UTIs occurring in the community and their resistance

pattern against commonly used antibiotics at our setting were also studied.

MATERIALS AND METHODS

It was prospective, observational, comparative study conducted at Kauvery medical centre and hospital, Trichy, Tamilnadu. Patients with clinical features suggestive of urinary tract infection admitted in hospital and had urinary tract infection confirmed by positive urine culture are the study population. Patients recruited for study from September 2017 to September 2019

Inclusion Criteria

Patients presenting with complaints suggestive of urinary tract infection like burning micturition, increased frequency, urgency, dysuria, suprapubic pain, hematuria, fever with chills, nausea, vomiting and loin pain.

Exclusion Criteria

1. History of receiving antibiotics two weeks prior to culture
2. Patients on continuous indwelling catheter
3. Patients younger than 18 years
4. Patients who are HIV positive
5. Pregnant females

Methodology

A detailed history was taken after taking consent from the patient, in relation to Urinary tract infection like burning micturition, frequency, urgency, dysuria, suprapubic pain, hematuria and any symptoms suggestive of acute pyelonephritis like fever, chills, nausea, vomiting, diarrhea were noted. Past history of urinary tract instrumentation or catheterization were also asked. A detailed examination of all systems with special emphasis on temperature, pulse rate, blood pressure, suprapubic tenderness, costovertebral angle tenderness, tenderness/mass on deep abdominal palpation were carried out.

Midstream urine sample were collected in a wide mouthed universal container with a secure lid. Urine samples were sent to laboratory immediately for routine evaluation and for culture. For culture urine samples were incubated at 37C for 24 to 48 hrs in Blood / Chocolate agar and MacConkeys agar plate. Organisms identified were based on colony characteristics, lactose fermentation and biochemical test. In presence of any significant growth, antibiotic sensitivity was done by modified Kirby- Bauer disc diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Sensitivity to common antibiotics was done in all positive cultures.

Among gram negative organisms, screening for ESBL was done by testing the strain against ceftazidime (CA2) and ceftazidime / clavulanic acid (CA2- CLAV). A > 5 mm diameter of the zone of inhibition for ceftazidime / clavulanic acid in comparison to ceftazidime was considered indicative of ESBL production. Cefotaxime (CTX) vs

cefotaxime/clavulanic acid (CTX-CLAV) was also checked. In case of resistance to Cefoxitin along with betalactam – betalactam inhibitor combinations, but sensitive to Cefipime was considered as AMP-C. If resistance to more than 3 groups of antibiotics noted, it was considered as MDR (multi drug resistance). MDRs are resistant to carbapenams also and sensitive only to Colistin and Tigecycline.

Statistical Analysis: All data collected were entered into a porforma (annexure). Data was analysed using SPSS version 21.0.

RESULTS

As per [Table 1] it was seen that out of the 100 patients who were culture positive, 41 were found to be males and 59 to be females. Among the total, 79 were complicated and only 21 were uncomplicated. As males were categorized as complicated cases, all 21 of the uncomplicated cases were female. Of the total complicated cases, female is to male ratio is 1: 1.08. Majority of the patients were in the 6th decade. Second most common was in the 7th decade. Numbers of patients were less in both the extremes of age. In both complicated and uncomplicated cases, majority were seen in the elderly age group. Mean age was 62.13±13.81. Among the 100 patients, 8 were found to be obese out of which 6 were complicated female cases and 2 were pre obese. Majority of the patients, i.e., 37 were in the normal category. Mean BMI was 23.71±3.64. Calculations were based on the Asian criteria for BMI.

As per [Table 2] Fever (74%) was the most common presenting symptom followed by dysuria (45%). Vomiting (37%) and frequency (23%) were the other main presenting symptoms. A significant proportion of females with complicated UTI presented with suprapubic pain (28.9%) and loin pain (26.3%). Patients presenting with frank pyuria (4%) were very few in number especially in an uncomplicated case (0).

As per [Table 3] patients were examined for any renal angle tenderness or suprapubic tenderness. Only 19% of the patients had tenderness of which majority (18%) had a complicated UTI.

As per [Table 4] among the complicated cases, Diabetes mellitus was the most common risk factor both in males (61%) and in females (76.3%). Prostatomegaly (56.1%) and history of recent instrumentation (19.5%) were the other common factors which resulted in a complicated UTI in males. Among females, presence of renal calculi (18.4%) was the second commonest risk factor. Recurrent UTIs were present in 6 males (14.6%) and 10 females with complicated UTI (26.3%).

As per [Table 5] Anemia was taken as Hb<12g% in females and <13g% in males. In the study, 32 males (78%) and 44 females (74.6%) were found to be anemic. Among the females 76.3% of the complicated cases and 71.4% of the uncomplicated were anemic. WBC count of more than 11000 was

taken as leucocytosis. 39% of males, 47.4% of complicated females and 38.1% of uncomplicated females had leucocytosis. Creatinine levels of more than 1.4mg% were taken as abnormal. 53.75% of males, 26.3% of complicated females and 19% of uncomplicated females had elevated creatinine levels.

As per [Table 6] pH of urine was found to be acidic in all the samples. WBC cells $\geq 10/\text{mm}^3$ was taken as significant pyuria. 82.9% of the males, 81.6% of females with complicated UTI and 85.7% of females with uncomplicated UTI had significant pyuria. 24.4% of male patients, 31.6% of females with complicated UTI and 19% of females with uncomplicated UTI had significant RBCs on urine analysis (i.e., $>3\text{-RBCs}/\text{mm}^3$). Only 9 patients had presence of casts in urine analysis out of which 4 were males and rest females.

As per [Table 7] ultrasonography revealed a normal study in 55% of the cases. Prostatomegaly was the most common finding among males (56.1%). Among

complicated female cases, bilateral MRD and renal calculi came out to be the most common ultrasonogram findings (18.4% each)

As per [Table 8] Escherichia coli was the most frequent isolate (64%) in all groups. It was followed by Klebsiella (11%) and Pseudomonas (8%). Gram negative bacteria represented 84% of the isolate, gram positive and fungal constituted 7% and 9% respectively. Enterococcus was the only gram positive pathogen and it was associated with male gender. Fungal infections were associated with complicated cases of UTI.

As per [Table 9] among the gram negative organisms, 31% (26/84) were sensitive to all antibiotics tested. 52.4% (44/84) were ESBL positive, 9.5% (8/84) were AMP-C positive and 7.1% (6/84) were MDR. Among the total, ESBL positive E. coli (47.6%) was the most common organism. Out of the total 7 gram positive bacteria isolated (all of which were Enterococcus), 2 were Vancomycin resistant Enterococcus (28.6%) and others were vancomycin sensitive (71.4%).

Table 1: Age Sex and BMI distribution

Gender	Complicated UTI	Uncomplicated UTI	Total
Male	41	0	41
Female	38	21	59
Total	79	21	100

Table 2: Symptom distribution

Symptoms	Male	Complicated female	Uncomplicated female	Total
Fever	29	29	16	74
Vomiting	10	20	7	37
Dysuria	19	15	11	45
Frequency	13	4	6	23
Urgency	6	2	2	10
Hematuria	7	5	0	12
Pyuria	3	1	0	4
Suprapubic pain	5	11	5	21
Loin pain	5	10	1	16

Table 3: Examination findings

	Male	Complicated female	Uncomplicated female	Total
Renal angle tenderness	3	8	0	11
Suprapubic tenderness	3	4	1	8

Table 4: Risk factors

	Males	Females
Diabetes mellitus	25	29
Renal calculi	3	7
Prostatomegaly/Pelvic obstruction	23	5
Recent instrumentation	8	3
Post renal transplant	1	2
Congenital anomalies	0	1
Recurrent UTIs	6	10
Malignancy	1	2

Table 5: Blood investigations

	Males	Complicated female	Uncomplicated female
Anemia (Hb $<13\text{g}\%$ in males, $<12\text{g}\%$ in females)	32	29	15
Leucocytosis(WBC $>11000/\text{mm}^3$)	16	18	8
Creatininine($>1.4\text{mg}\%$)	22	10	4

Table 6: Urine microscopy

	Male	Complicated female	Uncomplicated female
Pyuria	34	31	18
Microscopic hematuria	10	12	4

Casts	4	4	1
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Table 7: Ultrasound findings

	Male	Complicated female	Uncomplicated female
Normal study	22	23	10
Prostatomegaly	23	-	-
Cystitis	12	4	3
Pyelonephritis	7	4	4
Bilateral Medical renal disease	10	7	4
Renal calculi	3	7	-

Table 8: Frequency distribution of uropathogens

	Male	Complicated female	Uncomplicated female	Total
E. coli	24	23	17	64
Klebsiella	4	5	2	11
Pseudomonas	3	4	1	8
Enterococcus	5	1	1	7
Proteus	0	1	0	1
Candida	5	4	0	9

Table 9: Antibiotic resistance pattern in gram negative organisms

	Sensitive	ESBL	AMP-C	MDR
E.coli	16	40	6	2
Klebsiella	4	3	2	2
Pseudomonas	6	0	0	2
Proteus	0	1	0	0
Total	26	44	8	6

DISCUSSION

UTIs are considered to be the most common bacterial infection. Approximately 10% of humans will have an episode of UTI at some point during their lives.^[7] Women are significantly more likely to experience UTI than men. Almost half of all women will experience at least one UTI during lifetime. 20- 30% of adult women will have recurrence within 3 – 4 months after an initial UTI. Specific subpopulations at increased risk of UTI include infants, pregnant women, the elderly, patients with spinal cord injuries and/ or catheters, patients with Diabetes mellitus or multiple sclerosis, patients with acquired immunodeficiency disease syndrome/ human immunodeficiency virus and patients with underlying urologic abnormalities.^[1] Of the 100 culture positive patients taken for study, 41 were males and rest was females. Of the 59 females, 38 had complicated UTI. It was found that incidence of UTI increases with age and elderly were particularly at risk. Maximum incidence was found in the 6th decade. Studies done by Foxman¹ and Sheerin^{NS8} have postulated the increased incidence of UTI in elderly population in their respective studies.

In the study done by Huppert^{JS et al}, dysuria was the most common presenting symptom followed by urgency and frequency.^[9] Fever and dysuria were the most common clinical presentation of patients in a study conducted by Eshwarappa^{M et al}.^[10] Increased frequency was the most common symptom among acute uncomplicated UTI in a study done by Little^{et al}.^[11]

The laboratory diagnosis of urinary tract infection involves macroscopy, microscopy and quantitative culture methods. Quantification of bacteria is useful

especially in case of asymptomatic UTI. In our study, pyuria was present in 82.9% of the males, 81.6% of females with complicated UTI and 85.7% of females with uncomplicated UTI. 24.4% of male patients, 31.6% of females with complicated UTI and 19% of females with uncomplicated UTI had significant RBCs on urine analysis. Cast on urine analysis was present in only 9% of patients. It should be noted that pyuria only indicates inflammation and does not always mean infection.^[12,13] However some studies showed pyuria to be a poor predictor of infection.^[14] In our study, Escherichia coli was the most common uropathogen isolated followed by Klebsiella and Pseudomonas in that order. This was comparable to studies by Sonovane^{et al},^[15] However study done by Tambeker^{et al} reported Pseudomonas as the second major pathogen next to E.coli in their study.^[16] Contradicting findings have been reported regarding the uropathogens profile and their antibiotic sensitivity patterns in the presence of diabetes. Kader^{et al}. reported 8.9% ESBL-positive cases in a hospital-based study in Saudi Arabia.^[17] Bean^{et al}. reported a community-based ESBL prevalence to be 5.7% in London.^[18] ESBL producers do not respond to the usually prescribed empirical therapy. Also, there is an increased risk of associated morbidity and mortality, and cost of therapy when these patients are put on the standard empirical therapy.^[19] Both ESBL and AMP-C producers are typically resistant to some or all cephalosporins, but they exhibit some differences like – ESBLs are inhibited by beta lactam inhibitors and do not hydrolyse cephamycins, while AMP-C enzymes are inhibited by classic beta lactam inhibitors and confer resistance to cephamycins but do not effectively hydrolyse cefipime.^[20]

The oral options available for the treatment of complicated UTI caused by ESBL or AmpC-producing bacteria are limited; particularly if susceptibility testing indicates concurrent resistance to trimethoprim and quinolones.^[21]

CONCLUSION

Clinical presentation plays a minor role in establishing diagnosis in UTI. Diabetes was the major risk factor for UTI. E.coli is still the most widely prevalent organism causing UTI in the community; only the alarming rate of resistant ESBL and AMP-C species should draw our attention. The resistance pattern, almost identical to that from the rest of the world is ever increasing due to irrational use of antibiotics.

Importance of knowing the common bacteria and the resistance pattern in each geographic area assumes great importance when patients present with very severe life threatening urosepsis. Pending culture results, the clinician has to choose appropriate antibiotics to cover all possible organisms and also obtain relevant culture and imaging and then to deescalate antibiotics based on culture reports. Importance of obtaining proper culture specimens cannot be over emphasized as it is life saving. Hospitals need to evolve antibiotic recommendations based on independent studies.

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