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Original Article

Antibiogram and Sensitivity Pattern of Bacteria in Urine Culture

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Abstract

Background: *Urinary tract infection is very common. Appropriate antibiotic is needed for effective treatment. The purpose of the study was to explore culture and sensitivity (Antibiogram) of common organism responsible for urinary tract infaction.*

Materials and methods: *It was a descriptive study. Secondary data were randomly collected from Microbiology Department of a tertiary care hospital. Study period was July-September 2023. Due to resource constraint only 153 data sheets were randomly selected. Data were manually managed. ANOVA and Z test were used for validation of results.*

Results: *A total of 153 reports were studied. Age range was 6months to 89 Years. Mean age 41 years and SD± 12. Highest frequency was 53(34%). It was among age group 15-45 years. Female preponderance was there 94(61%). Growth of organism was found is 72(47%) cases. Common organisms were Escherichia Coli 45(62%), Pseudomonas and Klebsiella were 08(11%) respectively. Staphylococcus aureus was 07(10%). For E. Coli, Nitrofurantoin, Meropenam and Amikacin were sensitive 42(93%) 40(89%) and 37(82%) respectively. Least sensitive were Cefixim and Cefuroxime. It was 08(18%) only. For Pseuodomonas Ceftazidime and Pipercillin were 07(88%) sensitive. Amikacin and Gentamycin were 05(63%) sensitive. Ciprofloxacin and Levofloxacin were 06(75%) sensitive. For Klebsiella Cotrimoxazole, Meropenam and Nitrofurantoin were 07(88%) sensitive. Least sensitive was Gentamycin 03(38%). For Staphylococcus Linezolid showed highest sensitivity 07(88%) and Ciprofloxacin and Cloxacillin showed 00% sensitive. For Enterococcus Amikacin and Gentamycin were 100% resistant. Others were 100% sensitive. Enterococcus showed 02(100%) sensitivity to Amoxyclav, Ciprofloxacin, Levofloxin, Linezolid, Meropenam, Nitrofurantoin and Vancomycine. Zero sensitivity shown to Amikacin, Gentomycin.*

Conclusion: *Only 47% samples yielded growth of organisms. Commonest organisms were E. Coli. Pseudomonas & Klebsiella ranked second position. Staphylococcus aureus was third. There is variation in sensitivity pattern. So, culture sensitivity should be done before starting antibiotic. However Nitrofurantoin and Meropenam could be started empirically.*

Key words: Culture and sensitivity; Organisms; Urinary tract infection.

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INTRODUCTION

Urinary Tract Infection (UTI) is the infection of urinary tract which extends from urethral meatus to kidney. It includes prostate also. UTI is a common problem and usually caused by bacteria. According to involvement of parts of urinary tract it may be urethritis, cystitis, pyelonephritis etc.[1] Clinical features varies according to location of involvement and consequence also varies if not properly treated. Common organisms are Escherichia Coli, Pseudomonas, klebsiella, Staphylococcus etc.

Among them Escherichia Coli is the commonest.[2] These organisms enter through urethra from skin of perianal region. Common clinical features are : Dysuria, Small frequent urination, Urethral discharge, Lower abdominal pain, Pain at kidney region, Constitutional sign symptoms, Sepsis, Delirium etc.[3]

In some cases urinary tract infection may be asymptomatic. Urinary tract infection

may be uncomplicated and complicated. Complicated UTI usually occurs due to structural anomaly of the urinary tract. However risk factors of UTI are.[4]

- **For Female:** Sexual intercourse, Diaphram and spermicide use, Unhealthy life style

Unhealthy menstrual hygiene, Antibiotic use.

- **For Male:** Benign prostatic hyperplasia, Urethral stricture, Indwelling catheter, Any structural anomaly, Congenital anomalies are common cause of frequent UTI among pediatric age group.

Diagnosis of UTI is usually done by[5]

Proper history taking, Clinical features, Urine analysis, Urine culture and sensitivity

Culture and sensitivity is not always done. If done it demonstrates presence or absence of organisms and its sensitivity pattern in urine.

Treatment of UTI usually with antibiotic for 7-14 days. Urine should be cultured during and after treatment[6] and occasionally surgery is needed.[7] UTI is mostly preventable through personal hygiene, sexual hygiene, adequate hydration, proper urination and correction of anomalies.[8]

--E Coli to be the most common pathogen in UTI with very high antibiotic resistance. This warrants careful selection of antibiotics.[9]

--Escherichia Coli was the most frequent urinary tract infection causing bacteria followed Klebsiella, Pseudomonas, Staphylo aureus, Enterococcus etc. Ampicillin, Cefepime, moxifloxacine were not effective.[10]

Various gram-positive, as well as gram-negative, organisms are culprits in urinary tract infection but the most common cause of urinary tract infection is a gram-negative, facultative uropathogenic anaerobe known as Escherichia coli.[11] E. coli is considered to be the cause in more than 80% of female urinary tract infection cases between 18and 39 years of age. A less commonly involved organism is Staphylococcus and is thought to be involved in 15%-20% of the cases. Other less common organisms involved in urinary tract infectionare Enterococci, Enterobacter, Pseudomonas, Proteus and Klebsiella. The purpose of the study was to explore culture and sensitivity (Antibiogram) of common organism responsible for urinary tract infaction.

MATERIALS AND METHODS

It was a hospital based descriptive study conducted at National Hospital, Chattogram during the period July to September 2023. All age groups & both sexes registered after study start. Sampling technique: Random Sampling. A sampling frame was made with code numbers of 500 reports. 153 samples were selected randomly. Data were collected with semi structured questionnaire and were manually managed.

Laboratory Methods

Urine cultured by a semi-quantitative methodon Hi-chrome media and isolation of yeast on ChromeAgar. Using calibrated inoculating loop 0.001 M1 ofuncentrifuged, uniformly mixed, midstream urine samples were aseptically inoculated on to Hi-chrome agar[12] Afterovernight incubation at 37°C for 24-48h, colonies were counted to check significant growth. Identification of bacteria was done using standard microbiological procedures. The samples were cultured on Chromeagar. All positiveurine cultures with significant bacteriuria were furtheridentified by their colony characteristics, Gram-stain and pattern of biochemical profiles using standard procedures. Antimicrobial susceptibility testing was done by the modified Kirby Bauer disc diffusion method and Vitek according to the Clinical Laboratory Standards Institute guidelines. An attempt was made tostudy ESBL production and multiple drugs resistant in isolates.[13]

Antimicrobial Susceptibility Testing

Antibiotic susceptibility test was carried out on eachisolated bacteria using Kirby Bauer disc diffusion methodaccording to the CLSI: M100-S22 guidelines. Bacterial suspensions were prepared by emulsifying 3-5 purecolonies in nutrient broth and adjusted to 0.5 McFarland standards. A sterile cotton swab was then dipped into thesuspension and swabbed on surface of Mueller-Hinton agarplate. Standard antibiotic discs were placed aseptically and the inoculated Mueller Hinton agar plates were incubated at 37°C for 24h. The diameters of the zones of complete inhibition were measured using mm of calipers. The isolatezone of inhibition was reported based on CLSI M100-S22 standard as Susceptible, Intermediate and Resistant.[14] The following antibiotic discs were tested for the isolates: Amoxicillin-Clavulanic acid (10 µg) Ceftazidime (30 µg) Ceftriaxone (30 µg) Gentamicin (10 µg) Nitrofurantoin (300 µg) Cefotaxime (30 µg) Trimethoprim Sulphamethoxazole (1.25 µg) Ciprofloxacin (5µg) levofloxacine, Amikacin (30 µg) and Vancomycin (30 µg).

Species identifications and Antibiotics Susceptibility

Species identification of Gram-positive bacteria and Gram Negative Bacteria (GNB) and antibiotics susceptibility testing was determined with VITEK 2 compact system (bioMéricux, France) using GN, GP, AST-235, AST-280 and AST-281 cards. The investigated antibioticsby VITEK 2 cards were the following: Piperacillin, Piperacillin/Tazobactam (PIT) ceftazidime, cefepime, aztreonam, imipenem, meropenem,

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amikacin, gentamicin, ciprofloxacin, levofloxacin, trimethoprim/sulfamethoxazol, nitrofurantoin, linezolid and vancomycin. Isolates with resistance orintermediate susceptibility were considered non-susceptible to the antibiotic agent. The results were interpreted according to the 2015 CLSI criteria.[15]

Quality control: Sterility and performance of culturemedia were tested before using the culture media. Standard reference strains of Escherichia coli (ATCC 25922) and Staphylococcus aureus (ATCC 25923) were used as controlfor culture and sensitivity testing.[15]

RESULTS

A total of 153 patients were studied. The patients age range was 6m to 89 years. Mean age 41 years SD ±12. Maximum patients were in reproductive age group i.e. 15-45 years. It was 53(34%), next were 60-80 age group 33(22%) and 45-60 age group 28(18%).

Gender of respondents were : Female 94(61%), Male 59(39%). Majority of the patients were inhabitant of Chittagong city area 90(59%) and outside city area were 63(41%).

About education status: 66(43%) did not cross class V. V-X class were 46(30%) and 41(27%) crossed SSC.Most of the patients were Muslims 144(94%) and remaining 09(06%) were Non Muslims. About occupation 58(43%) of the patients were home maker. Next occupation groups were: Student 25(19%) and service holder 17(12%).

Regarding washing practice after Urination: Majority 124(81%) washed genitalia with water, only tissue used by 08(5%) and both water and tissue by 05(03%). No washing by 16(11%) respondents. During sample collection 71(46%) patients answered that they were not using antibiotic and 68(44%) answered that they were using antibiotic. Used antibiotics were: Ciprofloxacin 16(24%), Cefixim 08(12%), Moxaclav and Meropenam were 07(10%) respectively. 15(22%) patients could not recall name of antibiotic.

All samples were cultured. No growth was 81(53%) and 72(47%) yielded growth of different organisms. Commonest organisms were Escherichia Coli 45(62%). Pseudomonas and Klebsiella were 08(11%) respectively. Staphylococcus and Coliform were 02(03%) respectively.

Escherichia Coli showed sensitivity to Nitrofurantoin. It was 42(93%). Next were Meropenam 40(89%) and Amikacin 37(82%). Least sensitivity showed to Cefixime and Cefuroxime. It was 08(18%) only. Pseudomonas showed maximum sensitivity to Ceftazidime and Imipenam 07(88%). Next were Ciprofloxacin and Levofloxacin 06(75%), Amikacin and Gentamycin showed 05(63%) sensitivity respectively. Klebsiella showed maximum sensitivity to Cotrimoxazole, Meropenam and Nitrofurantoin 07(88%). Ciprofloxacin and Amikacin showed 06(75%) sensitivity. Next group were Ceftazidime, Cefixime, Ceftriaxone and Levofloxacin. It was 05(63%) respectively. Least sensitive was Gentamycin 03(38%). Staphylococcus aureus showed maximum sensitivity to Linezolid 07(88%). Next antibiotics were Amikacin, Doxycycline, Nitrofurantoin and Vancomycine. Sensitivity was 06(75%). Cotrimoxazole was 05((63%) sensitive. No sensitivity shown to Ciprofloxacine. Enterococcus showed 02(100%) sensitivity to Amoxyclav, Ciprofloxacin, Levofloxacin, Linezolid, Meropenam, Nitrofurantoin and Vancomycin. Zero sensitivity shown to Amikacin, Gentamycine. Coliform showed 02(100%) sensitivity to Levofloxacin and Pipercillin. Amikacin, Amoxyclav, Ceftazidime, Ciprofloxacin, Meropenam showed 1(50%) sensitivity. Cefixim, Cefuroxime, Ceftriaxone and Gentamycin showed no sensitivity. All samples were cultured. No growth was 81(53%) and 72(47%) yielded growth of different organisms.

Table I Cultured Organisms

Name of Organism	Frequency
Escherichia Coli	45 (62%)
Pseudomonas	08 (11%)
Klebsiella	08(11%)
Staphylococcus aureus	07(10%)
Enterococcus	02(03%)
Coliform	02(03%)
Total	72(100%)

Source: Hospital Records 2023.

Commonest organisms were Escherichia Coli 45(62%). Pseudomonas and Klebsiella were 08(11%) respectively. Staphylococcus and Coliform were 02(03%) respectively.

Table II Urine antibiogram of suspected urinary tract infection patients and sensitivity pattern

Antibiotics	Eschericia Coli	Pseudo-monas	Klebsiella	Staph. Aureus	Entero-coccus	Coliform
Amikacin	82%	63%	75%	75%	00%	50%
Amoxyclav	47%		50%	50%	100%	50%
Aztreonam		50%				
Cefixime	18%		63%			00%
Cefuroxime	18%		50%	38%		00%
Ceftazidime	27%	88%	63%			50%
Ceftriaxone	24%		63%			00%
Ciprofloxacine	44%	75%	75%	00%	100%	50%
Cotrimoxazole	53%		88%	63%		
Cefepime		50%				
Cloxacillin				00%		
Doxycyclime				75%		
Gentamycine	42%	63%	38%	25%	00%	00%
Imipenam		50%				
Levofloxacin	51%	75%	63%	13%	100%	100%
Linezolid				88%	100%	
Meropenam	89%		88%	50%	100%	50%
Nitrofurantoin	93%		88%	75%	100%	
Pipercillin		88%				100%
Vancomycime				79%	100%	

Source: Hospital Records 2023

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DISCUSSION

Present study is a single centre hospital based study. Both outdoor and indoor patients were included here. So it is a bit different from general population from whole country. However some similarities are there with different studies of home and abroad. All age groups and both sexes are included here. Rural and urban patients were there. So it varies with group specific studies. Highest age group was 15-45 years 53(34%). Kaushik et al. shows 42%. Female preponderant 61% in present study and Kaushik showed 72% Out of 153 reports uropathogens were found in 72(42%) cases.[16] Study conducted by Muzammil et al. found 53(44%) cases.[9] The difference wasnot significant (Z=0.49, p=0.624). However study conducted by Kaushik et al. showed growth of organism among 242(26%) samples.[16]

Present study isolated organisms were E. Coli 45(62%) Pseudomonas and klebsiella 08(11%) each. Staphylococcus aureus was 07(10%). Study conducted by Kaushik et al. showed E. Coli 45%, Klebsiella 16%, Pseudomonas 10% respectively.[16] He also detected mixed organisms in 8(3%) cases. Study conducted by Mozammil et al. showed. E. coli 21(40%), Pseudomonas 7(13%) and Klebsiella 01(2%) cases. Staphylococcus aureus was 03(6%).[9]

Table III Isolated organisms in different studies (F=2.21, p=0.152)

Pathogen	Present study p=153	Muzammil et al. n=120	Kaushik et al. n=949
E.coli	45(62%)	21(40%)	109(45%)
Pseudomonas	08(11%)	07(13%)	24(10%)
Klebsiella	08(11%)	01(02%)	39(16%)
Staphy-aureus	07(10%)	03(06%)	07(03%)
Enterococcus	02(03%)	18(40%)	27(11%)

Source: Hospital Records 2023.

Table IV Sensitivity pattern of Escherichia coli in different studies

Antibiotic	Present study n=153	Muzammil et al.[9] n=120	Remarks*
Amikacin	82%	86%	p=0.371
Amoxyclav	47%	27%	p=.0007
Ciprofloxacin	44%	24%	p=.0006
Ceftriaxone	24%	29%	p=0.351
Cefuroxime	18%	24%	p=0.224
Gentamycine	42%	66%	p=.0001
Meropenam	89%	62%	p=.0001

Source: Hospital Records 2023. *Here is a comparison between present study and previous study to assess proximity of findings. Z test was used here.

Table V Sensitivity pattern of Enterococci in different studies

Antibiotic	Present study n=153	Muzammil et al.[9] n=949	Kaushik et al.[16] n=120
Amoxyclav	100%	72%	NA
Ciprofloxacin	100%	28%	50%
Levofloxacime	100%	NA	50%
Linezoid	100%	83%	86%
Meropenam	100%	NA	NA
Nitrofurontoin	100%	NA	NA
Vancomycine	100%	18(100%)	90%

Source: Hospital Records 2023. (F=3.21, p=.076).

Common antibiotics were tested in different studies but some antibiotics were not tested in all studies. For that reason we could not compare among that antibiotics. Some antibiotics were found 100% resistant against some antibiotics. It also varies among the studies. Staphylococcus aureus was found 100% resistant to Ciprofloxacine and cloxacillin in present study. Enterococcus also found 100% resistant to Amikacine and Gentamycine.

LIMITATION

Single centre study and small sample size.

CONCLUSION

Urinary tract infection is a common problem and there is a female preponderance, but sometimes it may be fatal and may cause grave consequences like urosepsis, multi organ failure and death. These grave consequences are due to resistant bacteria causing urinary tract infection. So, isolation of specific bacteria and their sensitivity pattern is a dire need for a medical practitioner and empirical treatment should not be where facility of culture sensitivity is available.. The study explored common causative agents of urinary tract infection in Chittagong region. Sensitivity pattern also been explored. The massage should be disseminated among the clinicians for effective management of urinary tract infection.

RECOMMENDATION

Periodic, large scale multicenter study is hereby recommended for country data base development which would be helpful for effective management of urinary tract infection.

DISCLOSURE

All the authors declared no competing interest.

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