

Prevalence and Antibiotic Sensitivity Pattern of Enterococci Causing Urinary Tract Infection in a Tertiary Care Hospital of Bangladesh

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Abstract

Background: Enterococcus has emerged as one of the important causative agents of urinary tract infection (UTI) in recent years. Their resistance to many antimicrobials has increased in last few decades.

Objective: To find out the appropriate antibiotics to treat the patient caused by different species of enterococci.

Methods: This cross-sectional observational study was carried out in Armed Forces Institute of Pathology (AFIP) and Combined Military Hospital (CMH), Dhaka Cantonment, Dhaka during the period of December 2022 to May 2023. During this period, a total of 118 enterococci were isolated from urine specimen as a causative agent of UTI.

Results: 6130 urine specimens were cultured. 1056 specimens yielded growth of significant bacteria. 118 isolates were confirmed as enterococci (isolation rate 11.17%). The mean age was 25.9±8.5 years and female to male ratio was 1.8:1. Maximum resistance was seen against azithromycin (84.7%), followed by tetracycline (72.1%), doxycycline (61.86%), ciprofloxacin (55.1%) and carbapenems (45%). Most sensitive antibiotic was linezolid (resistance rate 0%), followed by vancomycin (resistance rate 4.23%), combination of amoxicillin and clavulanic acid (resistance rate 13.5%), nitrofurantoin (17.8%).

Conclusion: According to this study, linezolid was the most effective antibiotic followed by vancomycin, combination of amoxicillin-clavulanic acid and nitrofurantoin. In this study, sensitivity to nitrofurantoin and amoxicillin-clavulanic was quite promising (77.2% and 86.5% respectively). So these two drugs may be included as a first line treatment regime to treat enterococcal UTI.

Key-words: Enterococci, UTI, antibiotic sensitivity patterns.

Introduction

Urinary tract infection is one of the most common infectious conditions in clinical practice and an important cause of nosocomial infection.¹ Enterococci are Gram-positive cocci, facultative anaerobes and part of the normal intestinal flora

in humans.² In the last few years, Enterococcal infections have become frequent in hospital settings. Currently they are an important cause of nosocomial infections with increasingly common isolates that are resistant to multiple antibiotics.¹ Urinary tract infections constitute the most common type of disease produced by enterococci.³

The isolation rate of enterococci causing UTI varies in different studies in Bangladesh starting from 8.44% to 25.9%.^{4,5} In light of the increasing rate of enterococcal infections and due to limited clinical data in the medical literature, the purpose of this study was to isolate and identify different species of enterococcus as causative agents of UTIs and to find out their resistance pattern to different antibiotics. The present study aims at isolation and species identification of enterococcus as urinary pathogen from the suspected UTI patients reported to CMH Dhaka and AFIP and to determine antibiotic sensitivity patterns of the isolates.

Material and Methods

This cross-sectional observational study was carried out in Armed Forces Institute of Pathology and Combined Military Hospital, Dhaka Cantonment, Dhaka from December 2022 to May 2023. Urine specimens of patients who reported to Department of Microbiology, AFIP from CMH Dhaka for urine culture were taken.

Urine samples were collected by midstream clean-catch technique. Urine microscopy was done for pus cells and was cultured with semi-quantitative standard loop method. A loopful of urine which can contain 0.001 ml was inoculated aseptically on to Chromogenic UTI agar (Hi-Chrome modified UTI agar, Hi-Media), Blood agar and MacConkey agar media by using a calibrated wire loop. The plates were incubated aerobically at 37°C for 24 to 48 hours. Then colony count was done to see growth of significant number of colony.

Enterococci were identified by (1) colony morphology, (2) colour of colony in Chromogenic UTI agar (Hi-Chrome modified UTI agar, Hi-Media), (3) gram stain, (4) catalase test, (5) growth at 10°C and 45°C, (6) growth in 6.5% NaCl nutrient broth and (7) bile esculin hydrolysis.

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Identification of these isolates to species level was done by Analytical Profile Index (API) 20 Strep (bioMe'rieux). Then according to CLSI (Clinical and Laboratory Standards Institute) guidelines, antibiotic susceptibility test was done by Kirby-Bauer disc diffusion method.

Permission for this study was obtained from the Ethical Committee, Directorate General of Medical Services, Ministry of Defense. Patients and healthy participants were informed about the nature of the research and the confidentiality of the personal information that they provided. All relevant data of every isolates was systemically recorded in a pre-designed data sheet and were analyzed by SPSS v20.

Results

During this period, 6130 urine specimens were cultured and 1056 specimens yielded growth of significant bacteria. Among these, 118 isolates were confirmed as enterococci. The isolation rate of enterococci among positive specimens was 11.17%. Among the 118 isolates, 97(82.2%) were *Enterococcus faecalis* and 21(17.8%) were *Enterococcus faecium* (Table-I). Among the one hundred and eighteen isolates, 42(35.6%) were isolated from male and 76(64.4%) were isolated from female patients (Figure-1). The maximum number of patients 46(47.3%) were found in the age group of 21-40 years, followed by 30(25.4%) and 23(19.5%) in the age group of 0-20 years and 41-60 years respectively (Table-II). Maximum resistance was seen against azithromycin (84.7%), followed by tetracycline (72.1%). Most sensitive antibiotic was linezolid (resistance rate 0%) followed by vancomycin (resistance rate 4.23%), combination of amoxicillin and clavulanic acid (resistance rate 13.5%) and nitrofurantoin (17.8%) (Table-III). Highest resistance was observed against erythromycins (84.7%) followed by tetracyclines (66.9%), quinolones (61.8%) and aminoglycosides (50.8%) (Table-IV).

Table-I: Species of enterococci isolates (n=118)

Name of species	Frequency	Percentage
<i>Enterococcus faecalis</i>	97	82.2
<i>Enterococcus faecium</i>	21	17.8
Total	118	100.0

Table-II: Age and sex distribution of the study population (n=118)

Age group in years	Sex of the respondent		Total
	male	female	
0-20	18	12	30(25.4%)
21-40	9	37	46(39.0%)
41-60	5	18	23(19.5%)
61-80	9	8	17(14.4%)
81-100	1	1	2(1.7%)
Total	42(35.6%)	76(64.4%)	118

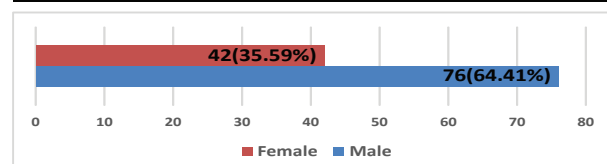


Figure-1: Distribution of patients according to sex.

Table-III: Antibiotic resistance pattern of different species of enterococci isolates.

Name of antibiotic	Resistant isolates (n=118)		Total	P value
	<i>Enterococcus faecalis</i> (97)	<i>Enterococcus faecium</i> (21)		
Penicillin G	37(38.1%)	14(66.6%)	51(43.2%)	0.017a
Ampicillin	44(45.3%)	10(47.6%)	54(45.7%)	0.851b
Amoxicillin-Clavulanic Acid	12(12.3%)	4(19.04%)	16(13.5%)	0.418 b
Tetracycline	72(74.2%)	13(61.9%)	85(72.03%)	0.254 b
Doxycycline	61(62.9%)	12(57.1%)	73(61.86%)	0.623 b
Azithromycin	82(84.5%)	18(85.7%)	100(84.7%)	0.892 b
Nitrofurantoin	16(16.5%)	5(23.8%)	21(17.8%)	0.427
Ciprofloxacin	49(50.5%)	16(76.2%)	65(55.1%)	0.032 a
Levofloxacin	47(48.5%)	16(76.2%)	63(53.4%)	0.021 a
Imipenem	43(44.3%)	11(52.3%)	54(45.7%)	0.721 b
Mereopenem	42(43.2%)	10(47.6%)	52(44.06%)	0.585 b
Vancomycin	2(2.06%)	3(14.2%)	5(4.23%)	0.012 a
Linezolid	0(0%)	0(0%)	0(0%)	-

a= Significant, (P value <0.05); b=Not significant (P value >0.05)

Table-IV: Resistance pattern against different classes of antibiotics

Antibiotic Class	Name of antibiotic	Resistance (%)
Beta-Lactam	Penicillin G	38.4%
	Ampicillin	
Tetracyclines	Tetracycline	66.9%
	Doxycycline	
Amxycillin-Clavulanic Acid		13.5%
Erythromycins	Azithromycin	84.7%
Urinary antiseptics	Nitrofurantoin	22.8%
Quinolones	Ciprofloxacin	61.8%
	Levofloxacin	
Carbapenems	Imipenem	44.8%
	Mereopenem	
Glycopeptides	Vancomycin	4.23%
Oxazolidinones	Linezolid	0%

Discussion

Enterococci have become important nosocomial pathogens worldwide and are associated with a high mortality rate. *Enterococcus faecalis* is the most commonly (80-90%) isolated species, followed by *Enterococcus faecium* (5-10%).⁶ In this study, a total of 118 enterococci were isolated from urine specimen as a causative agent of UTI. The prevalence of urinary tract infection (UTI) caused by enterococci was 11.17%. A study in Bangladesh revealed that the isolation rate of enterococcus spp from culture positive urine specimen was 11.56%.⁷

In this study, the predominant species isolated was *E. faecalis* 97(82.2%) and rest 21(17.8%) were *E. faecium*. Two other studies from Bangladesh reported isolation rates of *E. faecalis* as 62.5% by Islam⁸ and 71.18% by Akhter⁴ that were almost similar to this study. Saleh et al (in Bangladesh) showed that the frequency of enterococci isolated from UTI patients reported to Bangabandhu Sheikh Mujib Medical University (BSMMU) had increased significantly in 5 years (11.38% and 13.29% in 2003 and 2008 respectively).⁹

In current study, age distribution of the study population is 02 months to 98 years (Mean±SD=35.2±22.7 years). These results are in line with studies of Srivastava et al (2012).¹⁰ In the present study, enterococci causing UTI are more common in females (64.4%) compared to males (35.6%).

This is comparable with study of Bose et al¹¹, Venkatesan et al.¹² The prevalence of resistance among different species of enterococci to various antibiotics by disc diffusion methods was investigated in the current study.

In this study, maximum resistance was seen against azithromycin (84.7%), followed by tetracycline (72.1%), doxycycline (61.86%), ciprofloxacin (55.1%), carbapenems (45%). Most sensitive antibiotic was linezolid (resistance rate 0%), followed by vancomycin (resistance rate 4.23%), combination of amoxicillin and clavulanic acid (resistance rate 13.5%) and nitrofurantoin (17.8%).

Among the β -lactam antibiotics, resistance rate against penicillin G, ampicillin was 43.2%, 45.7% respectively and against penicillin G, it was observed 49.7% by Venkatesan et al¹² and 48.6% by Sreeja et al.¹³ Another two studies reported 21.7% and 62.86% resistance rate against ampicillin.^{12,14}

In this study, resistance rate against combination of amoxicillin and clavulanic acid was found 13.5%, 8% and 17.2% resistance rate were seen by different studies.^{11,15} Resistance rate against tetracyclines was seen more than 60% (tetracycline 72.03%, doxycycline 61.9%) in present study. It was comparable with Goel et al study.¹⁶ 84.7% of the isolates were resistant to azithromycin in present study. More than 90% resistance rate was seen by Islam et al.⁸ In the present study, susceptibility pattern of enterococci against nitrofurantoin is very promising. Resistance to nitrofurantoin is 17.8% in this study. In two Bangladesh study, Haque et al found 21.74%⁷ and Bobby et al found 11.43%¹⁴ resistance against nitrofurantoin. Almost similar resistance was observed by Ali et al from Pakistan (19%)¹⁵ and Venkatesan et al from India (13.1%).¹² More than 50% resistance was seen against fluoroquinolones (ciprofloxacin 55.1%, levofloxacin 53.4%). Higher resistance was seen in two other Bangladesh studies (73.3% by Bobby et al¹⁴, 87.5% by Islam et al⁸). Resistance to imipenem and meropenem was observed 45.07% and 44.01% respectively. Lower resistance was seen by Bobby et al (15.24%) and Islam et al (35%).^{8,14} Frequent indiscriminate use of carbapenems seems to be the reason of increased resistance.

Vancomycin resistant enterococci have been increasingly reported from all parts of the world. 5 enterococci (4.23%) showed vancomycin resistance in this study by disc diffusion method. But it could not be confirmed due to non-availability of confirmatory methods in our laboratory. In previous Bangladesh studies, no vancomycin resistance was seen (100% sensitivity).^{8,14} In India, vancomycin resistance was seen 5.7% by Venkatesan et al.¹² An antimicrobial which has given increasingly encouraging results is linezolid, as all the isolates (100%) remained susceptible to this antimicrobial. It was comparable with other Bangladesh studies.^{8,14}

Conclusion

From the results of this study, it was concluded that, the prevalence rate of enterococci as a cause of UTI was 11.17%. Among them, 82.2% were *E. faecalis* and 17.8% were *E. faecium*. According to antibiotic sensitivity result of the study, linezolid was the most effective antibiotic, followed by vancomycin, combination of amoxicillin-clavulanic acid and nitrofurantoin. In contrast, azithromycin, tetracyclines, ciprofloxacin and carbapenems were the most drugs to which the isolates developed resistance. This study has provided base line data on the prevalence and drug sensitivity of enterococci causing UTI and is, therefore, of clinical and epidemiological significance.

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