

Original Research Article

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## Susceptibility Pattern of Enterococcal Isolates in a Tertiary Care Hospital against Tigecycline, Linezolid and Teicoplanin

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### ABSTRACT

#### Keywords

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There has been an upsurge in the emergence of Enterococci as a nosocomial pathogen in the recent years. The emergence of vancomycin-resistant enterococci (VRE) is a cause of concern, and is very difficult to control. A study on the speciation and antimicrobial susceptibility pattern of Linezolid, Teicoplanin and Tigecycline isolated of from clinical specimens from patients in the Department of Microbiology, MGUMST was carried out in the period of January 2018 to December 2018. A total of 172 enterococcal isolates obtained from various clinical samples were included in the study. Identification and antimicrobial susceptibility testing was done on Vitek-2 Compact (bioMérieux) *E. faecalis* (54.97%) was the predominant enterococcal species isolated followed by *E. faecium* (39.76%). The isolates were shown to have 5.84% resistance to Linezolid, 13.45% resistance to Teicoplanin and 100% sensitivity to Tigecycline. This study was performed to seek an alternative option like Linezolid, Tigecycline and Teicoplanin as vancomycin is reportedly being noted resistant in many clinical cases.

### Introduction

Formerly known as Group D Streptococci, Enterococci are gram-positive bacteria that inhabit the gut of mainly immunocompromised hosts. They can grow in extreme conditions. Resistance to environmental conditions like heat ensures prolonged survival. Improper hand hygiene practices by healthcare workers results in rapid transmission of drug resistant nosocomial Enterococcal outbreaks. Most common infections caused by Enterococci are

surgical wound infections, nosocomial urinary tract infections, bacteremia, septicemia and pelvic infections. Enterococcal strains have progressively acquired resistance to essentially most of the antimicrobial agents over the past few years, largely due to their resistance to many antimicrobial agents, including  $\beta$ -lactam antibiotics, glycopeptides, and aminoglycosides. Enterococci have become resistant to first line drugs i.e. aminoglycosides and penicillin so the alternative treatment options are Linezolid, Teicoplanin and Tigecycline (1, 2)

Trimethoprim-sulfamethoxazole has also been proven to be ineffective in treating enterococcal infections. Both strains of Enterococci, *E. faecalis* and *E. faecium* are clinically resistant to Aminoglycosides. Intrinsic resistance to the  $\beta$ -lactam class of antibiotics is associated with the presence of a species-specific chromosomal gene, *pbp5*. Intrinsic resistance to cephalosporins has also been noted in the Enterococcal species, but the molecular basis is unknown. Glycopeptide resistance is attributable to a cluster of van genes. VanA gene confers resistance to both Vancomycin and Teicoplanin. Out of the two strains, *E. faecalis* is globally more prevalent in clinical cases while *E. faecium* is intrinsically more resistant to antimicrobial agents. (3) Resistance to Vancomycin traces back to 1986 when the first case of Vancomycin resistant Enterococci was documented in Europe. Resistance in Enterococci is mediated by a cluster of Van genes. Van A and Van B genes are isolated in majority of the cases. Other genotypes are Van C, Van G and Van E. Colonization precedes infection in Vancomycin Resistant Enterococci, hence proper contact precaution and hand hygiene practices should be maintained by healthcare personnels. For alternative treatment to Vancomycin resistant Enterococci, linezolid, daptomycin, quinupristin/ dalfopristin, and tigecycline is recommended. Because of this drug resistance emerging pattern, this study was undertaken to know the effectiveness of other antibiotics like Linezolid, Teicoplanin and Tigecycline.

### **Materials and Methods**

Enterococcal isolates obtained during a period of one year from January 2018 to December 2018 were speciated and analyzed for antibiotic susceptibility and their patterns were assessed. A total of 172 sample were collected (Table 2), out of which 86 (50%) were isolated from urine, 41 (23.83%) were

isolated from blood, 17 (9.88%) were isolated from semen, 13 (7.55%) from swabs, 5 (2.9%) from tissue and other body sites (5.84%). Clinical specimens received in the Microbiology laboratory including Ascitic fluid, Urine, Blood, Drain, ET Secretion, Pleural fluid, Pus, Swab, Semen, Sputum and Tissue were processed as per the standard protocols. Specimens were inoculated on to solid media such as Blood agar, MacConkey agar, and also to liquid broth. All media were incubated at 37°C. After 24 hrs of incubation, growth was observed on solid media. The primary identification was made with basic microbiological methods using colony morphology, Gram staining and catalase test. Growth of enterococci on solid media was as follows:

On blood agar plate, enterococci produced small, round, smooth, transparent colonies and some colonies showed hemolysis alpha ( $\alpha$ ) or beta ( $\beta$ ) and some were non-hemolytic.

Gram staining was done on the colonies which morphologically resembled enterococci which showed gram positive cocci which were spherical, arranged mostly in pairs or in short chains. Catalase test was performed which was negative. *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, and *Enterococcus faecalis* ATCC 29212 were used for quality control.

The final identification and antibiotic susceptibility testing of the bacteria isolated from clinical specimens were obtained using an auto-analyzer system (bioMérieux, VITEK 2 Compact).

### **Results and Discussion**

A total of 172 Enterococcal isolates were processed over the period of one year, out of which *E. faecalis* (54.97%) was the predominant enterococcal species isolated in

the study followed by *E. faecium* (39.76%). *Enterococcus avium* was also isolated in 2 samples (1.16%).

A total of 172 sample were collected, out of which 86 (50%) were isolated from urine, 41 (23.83%) were isolated from blood, 17 (9.88%) were isolated from semen, 13 (7.55%) from swabs, 5 (2.9%) from tissue and other body sites (5.84%) (Table 3).

Clinical specimens received in the Microbiology laboratory including Ascitic

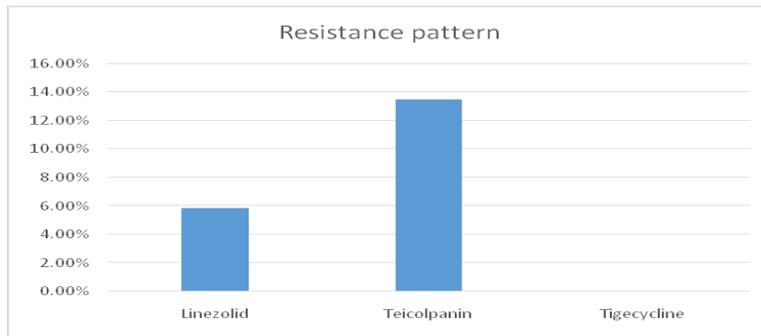
fluid, Urine, Blood, Drain, ET Secretion, Pleural fluid, Pus, Swab, Semen, Sputum and Tissue were processed as per the standard protocols. The results of antimicrobial susceptibility are as follows:

All Enterococcal isolates were 100% susceptible to Tigecycline. Teicoplanin resistance was observed in 13.45% cases and Linezolid resistance was noted in 5.84% of the isolates (Table 1).

Statistical data of the results are as follows:

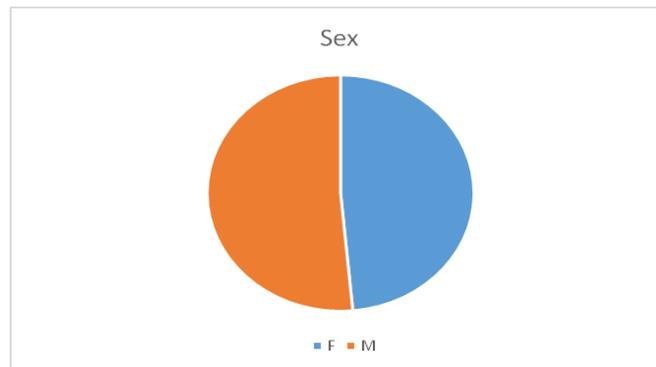
**Table.1 Resistance pattern**

Antibiotic	Resistance
Teicolpanin	13.45%
Linezolid	5.84%
Tigecycline	0%



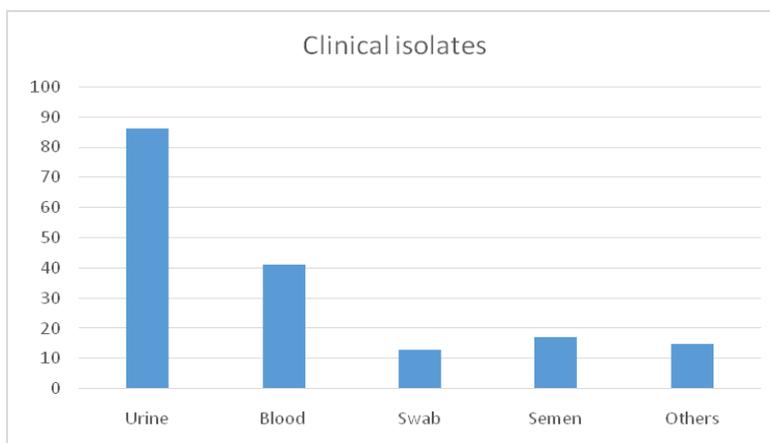
**Table.2 sex wise distribution**

Sex	Count
F	83
M	88



**Table.3** Clinical sample wise distribution

Sample	Count
Urine	86
Blood	41
Swab	13
Semen	17
Others	15



Latest studies show that Enterococcal strains are the third most isolated species in hospital acquired infections. (5) In our study the predominant species isolated was *Enterococcus faecalis* (54.97%) which was followed by *Enterococcus faecium* (39.76%) In our study, the prevalence of urinary tract infections caused by Enterococcal strains was 50% (86/172) The rationale behind may be by the transmission of the bacteria by hands of the healthcare workers while placement of the urinary catheters. (6)

Tigecycline has shown to be promising against VRE infections. (7) Tigecycline became available for clinical use in 2005. Being a broad spectrum tetracycline derivative, this novel antimicrobial agent has activity against both Gram positive and Gram negative bacteria including both aerobic and anaerobic bacteria. (8) Linezolid, belonging in the Oxazolidinone group was the first in its group to have activity against *E. faecalis* and *E. faecium*. It has the added advantage that it can be given orally. (9)

Our study shows that there is an emergence of resistance to Teicoplanin (13.4%) which further reduces therapeutic options.

In conclusion, most of the enterococcal isolates from immunocompromised patients were resistant to Vancomycin. There was 100% sensitivity to Tigecycline, followed by Linezolid and Teicoplanin. So, the empirical therapy should be started with Linezolid or Tigecycline by clinicians

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