

## Original Research Article

# Vancomycin resistant Enterococci: an emerging threat

Changdeo S. Aher\*

Department of Microbiology, Dr. Vasantao Pawar Medical College and Hospital  
and Research Center, Adgoan, Nashik, Maharashtra, India

\*Corresponding author

## ABSTRACT

### Keywords

Antibiotics;  
clinical  
specimens;  
enterococci;  
vancomycin  
resistance.

Enterococci, although regarded as commensal of gastrointestinal tract has emerged as significant cause of health care associated infections. It exhibits both intrinsic and acquired resistance to antimicrobial agents. Vancomycin, a glycopeptide is an important class of antibiotic used for the treatment of severe enterococcal infections (Ghoshal *et al.*, 2006) but wide spread use of glycopeptides in health care setups has led to the emergence of vancomycin resistant enterococcus. The present study was conducted with an aim to identify the species of enterococci isolated from various clinical specimens and study their antibiotic susceptibility profile with special reference to vancomycin resistance. A total of 276 *Enterococcus* spp. were isolated from different clinical specimens. Maximum isolates were obtained from urine samples followed by pus and blood cultures. *E. faecalis* (49.3%) followed by *E. faecium* were the major isolates. Most of the isolates were resistant to routinely used antibiotics. Vancomycin resistance was noted in 55 (19.9%) isolates. Vancomycin resistance was detected in 25.5% of *E. faecalis* and 19.7% of *E. faecium* isolates. Vancomycin resistance was not in *E. raffinosus* and *E. gallinarum*. Judicious use of antimicrobial agents, a proper surveillance for VRE and strict implementation of infection control practices is very important to curb the problem of emergence and spread of multidrug resistant strains of enterococci.

## Introduction

Enterococci, although regarded as commensal of gastrointestinal tract has emerged as significant cause of health care associated infections (HCAIs) (Ghoshal *et al.*, 2006). They are Gram positive facultative anaerobic cocci. The most common HCAIs produced by enterococci include urinary tract infection, surgical site infections, bacteremia, endocarditis,

neonatal septicemia, intra-abdominal and pelvic infections. The enterococcal infections are usually associated with indwelling medical devices and antimicrobial administration (Murray, 1990).

*Enterococcus faecalis* followed by *E. faecium* are the most common cause of

infection (Marothi *et al.*, 2005). In recent years enterococci has gained increasing interest of Clinical Microbiologists not only for their ability to cause serious infections but also because of their increasing resistance to many antibiotics (Moellering, 1992).

Enterococci exhibits both intrinsic and acquired resistance to antimicrobial agents. Intrinsic or inherent resistance is species specific and thus present in all members of species and is chromosomally mediated (Marothi *et al.*, 2005). Acquired resistance is either due to DNA mutation or acquisition of new DNA (Marothi *et al.*, 2005).

Vancomycin, a glycopeptide is an important class of antibiotic used for the treatment of severe enterococcal infections (Ghoshal *et al.*, 2006) but wide spread use of glycopeptides in health care setups has led to the emergence of vancomycin resistant enterococcus (VRE). In spite of various reports of VRE from different parts of the world, there is paucity of information on this aspect from India (Mathur *et al.*, 2003; Ghoshal *et al.*, 2006). Therefore the present study was conducted with an aim to identify the species of enterococci isolated from various clinical specimens and study their antibiotic susceptibility profile with special reference to vancomycin resistance.

## Materials and Methods

The present study was conducted in the Department of Microbiology, Travancore Medical College, Kollam, Kerala. Enterococci isolated from various clinical specimens received in bacteriology section of the Department were included in the study.

The identification of enterococci was done on the basis of growth on bile-esculin medium, gram staining, catalase negative, growth in 6.5% NaCl, bacitracin resistance, acidification of ribose and positive Voges Proskauer test (Desai *et al.*, 2001).

The enterococci were identified upto species level by using conventional physiological tests devised by Faclam and Collins (Facklam and Collins, 1989).

The antibiotic susceptibility testing of enterococcal isolates was performed on Mueller Hinton agar by Kirby –Bauer disc diffusion method based on Clinical Laboratory Standards Institute (CLSI, formerly National Committee for Clinical Laboratory Standards (NCCLS)) guidelines. The antibiotic discs used were ampicillin (10µg), ciprofloxacin (5 µg), erythromycin (15 µg), gentamycin (120 µg) nitrofurantoin (300 µg), tetracycline (30 µg) and vancomycin (30 µg). *E. faecalis* ATCC 29212 and *E. faecalis* ATCC 51299 were used as quality control strains.

## Results and Discussion

A total of 276 *Enterococcus* spp. were isolated from different clinical specimens. Figure 1 shows the sample wise distribution of the isolates. Maximum isolates were obtained from urine samples (34.7%) followed by pus (26.8%) and blood cultures (19.2%).

The species wise distribution of enterococcus isolates is shown in Figure 2. *E. faecalis* (49.3%) followed by *E. faecium* (25.7%) were the major isolates. *E. gallinarum* was isolated from 5 (1.8%) clinical specimens.

Table.1 shows the antibiotic profile of enterococcal isolates. Most of the isolates were resistant to ampicillin (80.7%), nitrofurantoin (78.2%), erythromycin (77.1%) and gentamycin (71.3%). Vancomycin resistance was noted in 55 (19.9%) isolates.

Figure.3 shows vancomycin resistance in different species of enterococci. Vancomycin resistance was detected in 25.5% of *E. faecalis* and 19.7% of *E. faecium* isolates. Vancomycin resistance was not in *E. raffinosus* and *E. gallinarum*.

Alarming rise in the antibiotic resistance both in health care setups and community is published in various national and international medical journals (Kanungo, 2010). Multi-antibiotic-resistant Gram positive (methicillin resistant *Staphylococcus aureus* (MRSA), VRE) and Gram negative (extended spectrum beta lactamase (ESBL) and AmpC) bacteria are clinical problem in hospitals (Bhattacharya, 2011).

In last two decades infections due to enterococci have increased (Murdoch, 2002). Now, it is among the leading causes of bacteremia and UTI (Kafil *et al.*, 2013). Enterococci is the second most common cause of surgical infections and the third most frequently reported cause of HCAs (Murdoch *et al.*, 2002). Gastrointestinal colonization, length of stay in hospital, ICU stay, older age, neutropenia, hematological malignancies and transplantation are risk factors identified for enterococcal colonization and infection (Marothi *et al.*, 2005).

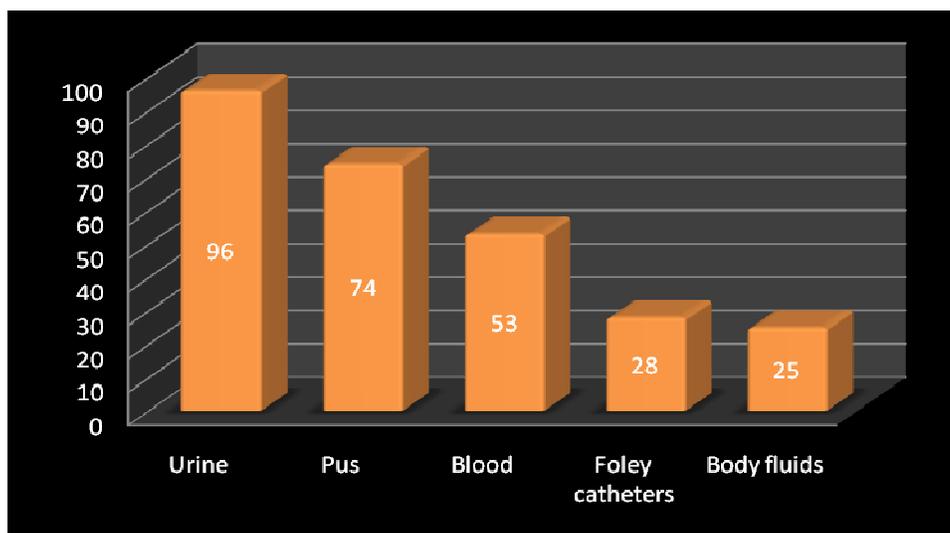
In our study, majority of isolates were obtained from urine samples, pus and blood cultures. Our observation is similar to that of Ghosal *et al* (Ghosal *et al.*, 2005). Presence of enterococci in urine is

well documented to be the cause of urinary catheterization or instrumentation (Morrison and Wenzel, 1986). Shales and Levy reported high mortality rate with enterococcal bacteremia (Shales and Levy, 1981).

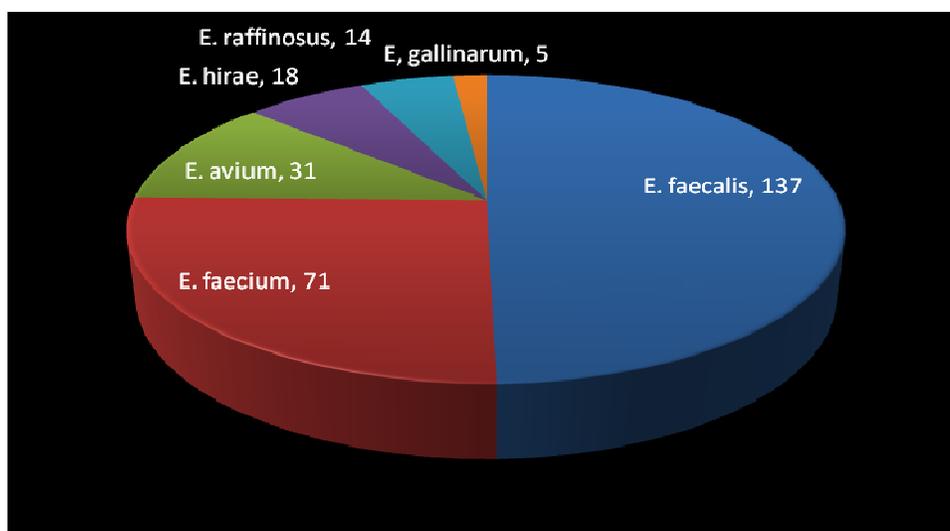
*E. faecalis* followed by *E. faecium* were the major isolates from *Enterococcus* spp in the present study. *E. faecalis* is one of the major etiologies of HCAs. It is often isolated from biofilms on the surfaces of various indwelling medical devices associated with chronic infection (Donlan, 2001). *E. faecalis* and *E. faecium* are long known to be significantly associated with the clinical disease hence their isolation is a cause of serious concern (Murray, 1990). In our study enterococcal isolates demonstrated high resistance to routinely used antibiotics which is similar to the observation of Vinodkumar *et al* (Vinodkumar *et al.*, 2011). Enterococci demonstrate intrinsic resistance to semisynthetic penicillinase-resistant penicillins, cephalosporins, and a low level of clindamycin. Acquired resistance includes resistance to chloramphenicol, erythromycin, a high level of aminoglycosides, penicillin, fluoroquinolones, and vancomycin (Murray, 1990).

In the present study vancomycin resistance was detected in 19.9% of enterococcal isolates. Vancomycin resistance was seen *E. faecalis*, *E. faecium*, *E. avium* and *E. hirae*. Vancomycin resistance in enterococci was first described in 1988 by Uttley *et al*. Antibiotic selective pressure exerted by widespread use of third generation cephalosporins and drugs with potent activity against anaerobes are important among factors responsible for VRE colonization and infections (Ghosal *et al* 2006).

**Figure.1** Clinical specimens wise distribution of Enterococcus.



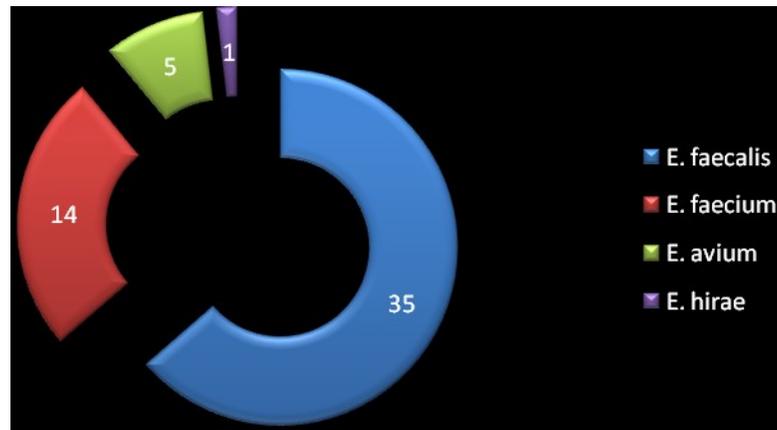
**Figure.2** Species wise distribution of enterococci.



**Table.1** Antibiotic susceptibility profile of Enterococci

Sr.No	Antibiotic	No. of resistant isolates	Percentage
1	Ampicillin	223	80.7%
2	Ciprofloxacin	169	61.2%
3	Erythromycin	213	77.1%
4	Gentamycin	197	71.3%
5	Nitrofuratoin	216	78.2%
6	Vancomycin	55	19.9%

**Figure.3** Vancomycin resistance in *Enterococcus* spp.



Enterococci were once considered as commensal and hence its isolation was often neglected in diagnostic microbiological services. In recent years, enterococci have emerged as an important cause of HCAs. It is capable of causing variety of infections and shows resistance to antibiotics of routine use. Judicious use of antimicrobial agents, a proper surveillance for VRE and strict implementation of infection control practices is very important to curb the problem of emergence and spread of multidrug resistant strains of enterococci.

### References

- Bhattacharya, S. 2011. Is screening patients for antibiotic-resistant bacteria justified in Indian context? Indian J Med Microbiol. 2011. 29:213-217.
- Desai, P., Pandit, D., Mathur, M., and Gogate, A. 2001. Prevalence, identification and distribution of various species of enterococci isolated from clinical specimens with special reference to urinary tract infection in catheterized patients. 19:132-137.
- Donlan, R.2001. Biofilm formation: A clinically relevant microbiological process. Clin Infect Dis. 33:1387-1392.
- Facklam, R., and Carey, R. 1989. The Streptococci and aerococci. In Lennette, E., Ballows, A., Hausler, W., and Shadomy, H. (ed.). Manual of clinical Microbiology, 4<sup>th</sup> ed. American Society for Microbiology, Washington.D.C; p.154-157.
- Ghosal, U., Garg, A., Tiwari, D., and Ayyagari,A.2006. Emerging vancomycin resistance in enterococci in India. Indian J Pathol Microbiol. 49:620-622.
- Kafil, H., Mobarez, A., and Moghadam, M.2013. Adhesion and virulence factor properties of Enterococci isolated from clinical samples in Iran. Indian J Pathol microbiol. 56: 238-242.
- Kanungo, R., 2011. Antimicrobial resistance: Action by laboratories for a cure tomorrow. 29:205-206.
- Marothi, Y., Agnihotri, H., and Dubey, D.2005. Enterococcal resistance – An overview. Indian J Med Microbiol. 23:214-219.
- Mathur, P., Kapil, A., Chandra, R.,

- Sharma, P., and Das, B. 2003. Antimicrobial resistance in *Enterococcus faecalis* at a tertiary care center of northern India. *Indian J Med Res.* 118:25-28.
- Moellering, R., 1992. Emergence of enterococci as a significant pathogen. *Clin Infect Dis.* 14:1173-1178.
- Morrison, A., and Wenzel, R. 1986. Nosocomial Urinary tract infection due to enterococcus: ten year experience at university teaching hospital. *Arch Intern Med.* 141:1549-1551.
- Murdoch, D., Mirrett, S., Harrell, L., Monahan, J., and Reller, L. 2002. Sequential emergence of antibiotic resistance in enterococcal bloodstream isolates over 25 years. *Antimicrob agents chemother.* 46: 3676-3678.
- Murray, B. 1990. The life and times of the *Enterococcus*. *Clin Microbiol rev.* 3:46-65.
- Shales, D., and Levy, J. 1981. Enterococci bacteremia without endocarditis. *Arch Intern Med.* 141:578-581.
- Uttey, A., Collins, C., Naidoo, J., and Geogre, R. 1988. Vancomycin resistant enterococci. *Lancet.* 1:57-58.
- Vinodkumar, C., Srinivasa, H., Basavarajappa, K., Geethalakshmi, S., and Bandekar, N. 2011. Isolation of bacteriophages to multi-drug resistant *Enterococci* obtained from diabetic foot: A novel antimicrobial agent waiting in the shelf? *Indian J Pathol Microbiol.*