



ENTEROCOCCUS

17.1 INTRODUCTION

Enterococcus is a genus of lactic acid bacteria. Enterococci are catalase negative Gram-positive cocci that often occur in pairs (diplococci) or short chains, and are difficult to distinguish from streptococci on physical characteristics alone.



OBJECTIVES

After reading this lesson, you will be able to:

- describe Enterococci
- identify Enterococci in the laboratory
- explain the pathogenesis
- discuss the antibiotic resistance

17.2 ENTEROCOCCI

Enterococci are facultative anaerobic organisms, i.e., they are capable of cellular respiration in both oxygen-rich and oxygen-poor environments. Though they are not capable of forming spores, enterococci are tolerant of a wide range of environmental conditions: extreme temperature (10-45°C), pH (4.5-10.0) and high sodium chloride concentrations. They are part of the normal enteric flora. Two species are common agents causing infection among humans: *E. faecalis* (90-95%) and *E. faecium* (5-10%). Rare clusters of infections occur with other species, including *E. casseliflavus*, *E. gallinarum*, and *E. raffinosus*. The enterococci were previously classified as group D streptococci.

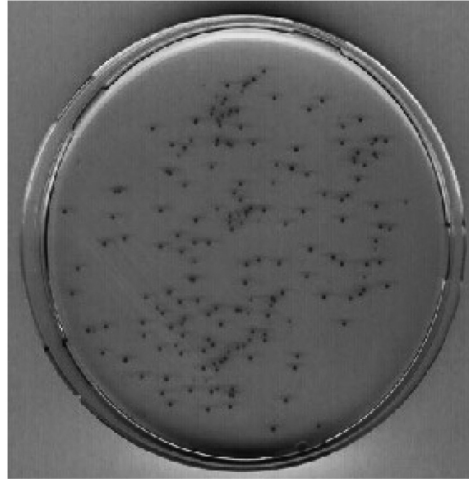


Fig. 17.1

Enterococci can exhibit beta/gamma-haemolysis on sheep's blood agar.

Identification: Because the group D cell wall specific antigen is a teichoic acid, it is not an antigenically good marker; enterococci are usually identified by characteristics other than immunologic reaction with group-specific antisera.

- They are usually non-haemolytic, but occasionally α -haemolytic.
- The enterococci are gram positive cocci, occurring in singles, pairs, and short chains.
- Cells are sometimes coccobacillary when gram stains are prepared from agar plate growth. Cells are more oval and in chains when gram stains are prepared from thioglycolate broth.
- The enterococci are facultative anaerobe and optimum growth occurs at 35°C.
- They grow well at between 10°C and 45°C whereas streptococci generally grow at a much narrower temperature range.
- All strains grow in broth containing 6.5% NaCl and hydrolyze esculin in the presence of 40% bile salts (bile-esculin medium).
- Enterococci hydrolyze pyrrolidonyl- β -naphthylamide (PYR), the exceptions to this are *E. cecorum*, *E. columbae*, and *E. saccharolyticus*.
- Most strains produce leucine aminopeptidase (LAP). Some strains belonging to Group I enterococci give negative LAP tests.
- They are more resistant to penicillin G than the streptococci, and rare isolates have plasmids that encode for β -lactamase.
- Many isolates may be vancomycin-resistant.



Notes



Notes

- Presumptive identification of a catalase negative gram positive cocci as an *Enterococcus* can be accomplished by demonstrating that the unknown strain is PYR and LAP positive, and grows in 6.5% NaCl and at 45°C.



INTEXT QUESTION 17.1

1. Enterococci are cocci
2. Culturally Enterococci are anaerobes
3. Enterococci most frequently cause Infection
4. is highly antibiotic resistance

17.3 SPECIES IDENTIFICATION

Once established that the unknown catalase-negative gram-positive coccus is an *Enterococcus* the tests can be used to identify the species. The species are divided into 5 Groups based on the reactions in acid formation in mannitol, sorbitol, and sorbose broths and hydrolysis of arginine.

The pigmentation test aids in the identification of *E. casseliflavus*, *E. mundtii*, *E. pullins*, *E. gilvus* and *E. sulfureus*. These enterococci produce a yellow pigment that can be detected on several different media.

The pyruvate utilization test aids in the differentiation of *E. faecalis* and *E. faecium*. This test is also used to help differentiate between *E. faecalis* variant strains and *E. hirae*.

The tellurite tolerance test aids in the differentiation of *E. faecalis* and *E. faecium*.

E. haemoperoxidus is variable in the mannitol reaction and may be in group II or III.

Diseases caused: There are at least 12 species of enterococci. *Enterococcus faecalis* is the most common and causes 85–90% of enterococcal infections, while *Enterococcus faecium* causes 5–10%, while *E. faecalis* remains the predominant species in clinical infection, *E. faecium* isolates are increasing in proportion. The trend is particularly true for blood isolates.

The enterococci are among the most frequent causes of nosocomial infections, particularly in intensive care units, and are selected by therapy with cephalosporins and other antibiotics to which they are resistant.

Enterococcus

Enterococci are transmitted from one patient to another primarily on the hands of hospital personnel, some of whom may carry the enterococci in their gastrointestinal tracts. Enterococci occasionally are transmitted on medical devices.

In patients, the most common sites of infection are the urinary tract, wounds, biliary tract, and blood. Enterococci may cause meningitis and bacteraemia in neonates. In adults, enterococci can cause endocarditis.

However, in intra-abdominal, wound, urine, and other infections, enterococci usually are cultured along with other species of bacteria, and it is difficult to define the pathogenic role of the enterococci.

Antibiotic Resistance

A major problem with the enterococci is that they can be very resistant to antibiotics. *E faecium* is usually much more antibiotic-resistant than *E faecalis*.

Intrinsic Resistance

Enterococci are intrinsically resistant to cephalosporins, penicillinase-resistant penicillins, and monobactams. They have intrinsic low-level resistance to many aminoglycosides, are of intermediate susceptibility or resistant to fluoroquinolones, and are less susceptible than streptococci (10- to 1000-fold) to penicillin and ampicillin. Enterococci are inhibited by β -lactams (eg, ampicillin) but generally are not killed by them.

Vancomycin Resistance

The glycopeptide vancomycin is the primary alternative drug to penicillin (plus an aminoglycoside) for treating enterococcal infections. Enterococci that are resistant to vancomycin have increased in frequency. Vancomycin resistance has been most common in *E faecium*, but vancomycin-resistant strains of *E faecalis* also occur.



INTEXT QUESTIONS 17.2

1. Bile aesculin positive Gram positive coccus is
2. Vancomycin resistant catalase negative gram positive cocci can be
3. Two important species of Enterococci are &
4. Most common route of transmission of Enterococci from one to another is by

MODULE

Microbiology



Notes

**Notes****WHAT YOU HAVE LEARNT**

- Enterococci are catalase negative Gram-positive cocci
- Enterococci can exhibit beta/gamma-haemolysis on sheep's blood agar
- They grow well at between 10°C and 45°C
- All strains grow in presence of 6.5% NaCl and are bile-aesculin test positive
- Most strains are PYR and LAP positive
- They can be very much resistant to antibiotics

**TERMINAL QUESTIONS**

1. Define genus enterococci?
2. What are the diseases caused by enterococci?
3. How will you identify Enterococcus in laboratory?

**ANSWERS TO INTEXT QUESTIONS****17.1**

1. Gram positive
2. Facultative anaerobes
3. Nosocomial
4. E. Faecium

17.2

1. Enterococcus
2. Enterococcus
3. E. faecalis and E. Faecium
4. Contaminated hands