

Gram negative bacilli

Escherichia coli:

E. coli is part of the normal flora of the colon in human and other animals, but can be pathogenic both within and outside of the GIT. Has fimbria or pili that are important for adherence to host mucosal surface.

Structural and physiology:

E. coli share many properties with the other Enterobacteriaceae, they are all facultative anaerobes. They all ferment glucose, and they all can generate energy by aerobic or anaerobic respiratory, they are oxidase negative.

Clinical significance: Intestinal disease

Transmission of Intestinal disease is commonly by fecal – oral route, food and water serving as vehicles for transmission

At least five types of intestinal infections that differ in pathogenic mechanisms have been identified

1. Enterotoxigenic *E. coli* (ETEC): Is a common cause of traveler's diarrhea colonizes the small intestine mucosa (pili facilitate the binding of the organism to the mucosa). ETEC cause
2. Enteropathogenic *E. coli* (EPEC): Are important cause of diarrhea in infants. The EPEC attach to mucosal cells in the small intestine by use of bundle – forming pili (BFpA).
3. Enterohemorrhagic *E. coli* (EHEC): Bind to the cells of large intestine, similar to EPEC produces characteristic lesions. EHEC produce one of two exotoxin (shiga-like toxin 1 or 2), resulting in sever form of bloody diarrhea. Serotype O157:H7 is the most common strain of *E. coli* that produce shigalike toxin. The primary reservoir of this bacterium is cattle. Therefore the possibility of infection can be greatly decreased by thoroughly cooking ground beef and pasteurizing milk.
4. Enteroinvasive *E. coli* (EIEC): cause dysentery like syndrome with fever and bloody stools. Plasmid encoded virulence factors are nearly identical to those of *Shigella* species in addition EIEC strains produce a hemolysin (HlyA).

5. Enteroaggregative *E. coli* (EAEC): Is also cause Traveler's diarrhea and persistence diarrhea in young children. Adherence to small intestine. EAEC produce a heat – stable toxin that is plasmid encoded.

Clinical significance: Extraintestinal disease

The source of infection is frequently the patient own flora

1. Urinary tract infection (UTI)
2. Neonatal meningitis
3. Nosocomial (hospital- acquired) infections these include sepsis / bacteremia – endotoxic shock, and pneumonia.

Gram positive cocci

1. Staphylococcus genus

Staphylococcus is a Gram-positive bacteria, they appear round (cocci), and form in grape-like clusters. Produces catalase which is one feature that distinguishes them from catalase negative *Streptococcus*.

Most are harmless and reside normally on the skin and mucous membranes of humans. Found worldwide, they are a small component of soil microbial flora. are facultative anaerobes (capable of growth both aerobically and anaerobically). All species grow in the presence of bile salts. The most virulence species is *S. aureus*, almost all isolates of which secrete coagulase, an enzyme that causes citrated plasma to clot.

A-Epidemiology: IS frequently carried by healthy individuals on the skin and mucous membrane carriers serve as a source of infection to them.

B- Pathogenesis : Virulence factors are the genetic , biochemical , or structural features that enable an organism to produce disease .Staphylococcus aureus expresses many potential virulence factors

1- Coagulase: Activity results in localized clotting, which restricts access by polymorphonuclear neutrophils (PMNS) and other immune defenses.

2- Cell wall virulence factors :

a-Capsule: Most clinical isolates express a polysaccharide "microcapsule" its very thin, but has been associated with increased resistance to phagocytosis.

b-Protein A: Is a major component of the *S. aureus* cell wall. It act as anti-phagocytic factor.

c-Fibronectin – binding protein: Its one of surface proteins promote binding to mucosal cells.

3- Cytolytic exotoxins: α , β , γ , attack mammalian cell (including RBC) membranes, and often referred to as hemolysis .

Clinical significance:

- 1- Localized skin infections are small, superficial abscesses involving hair follicles (folliculitis).
- 2- Acute endocarditis: is caused by injection of contaminated preparations or by needles contaminated with *S. aureus*.
- 3- Pneumonia: *S. aureus* is a cause of sever pneumonia.
- 4- Nosocomial infections: *S. aureus* is one of the most common causes of hospital-associated with catheters.
- 5- Toxinoses: These are diseases caused by the action of a toxin, Staphylococcal gastroenteritis caused by ingestion of food contaminated with enterotoxin-producing *S. aureus*.

2. Streptococci genus

Are G+, non-motile, and catalase negative. Clinically important genera include Streptococcus and Enterococcus. They are ovoid to spherical in shape, occur as pairs or chains. Blood enriched medium is generally used for their isolation.

Classification of streptococcus: We can classify Streptococci according to

- 1- Hemolytic properties on blood agar
 - α - hemolytic Streptococcus: appearance of green pigment ring around the colony.
 - β - hemolysis Streptococci: lysis of red blood cells form clear ring around the colony.
 - γ - hemolytic streptococci: cause no color change or lysis of the RBCs.
- 2- Serologic grouping, the clinically most important groups of β - hemolytic Streptococci is types A and B.

Group A β - hemolytic Streptococci

S. pyogenes: The most clinically important member of this group, *S. pyogenes* is usually spread person to person by skin contact and via the respiratory tract.

A. Structure and physiology

It is appear as individual cocci, pairs, or clusters of cells in gram stains. The structural features involved:

- 1- Capsule: Hyaluronic acid, identical to that found in human connective tissue, form outer most layer of the cell. This capsule is not recognized as foreign by the body, and therefore, is nonimmunogenic. The capsule also antiphagocytic.
- 2- The cell wall: The cell wall contains a number of clinically important components.
 - a- M protein: *S. pyogenes* is not infectious in the absence of M protein. M-protein is antiphagocytic.
 - b- Protein F (Fibronectin-binding protein): mediates attachment to fibronectin in the pharyngeal epithelium.

B. Clinical significance:

- 1- Acute pharyngitis or pharyngotonsillitis: It is the most common type of *S. pyogenes* infection. This type pharyngitis called "Strep throat" the syndrome is designated scarlet fever.
- 2- Impetigo: Typically affecting children, it can cause severe and extensive lesion on the face and limbs.
- 3- Streptococcal toxic shock syndrome: The syndrome is mediated by the production of streptococcal pyogenic exotoxin that function as super antigen causing massive , nonspecific T-cell activation cytokine release.
- 4- Acute rheumatic fever: this autoimmune disease occurs 2 to 3 weeks after initiation of pharyngitis , It happens when the body's immune system overreacts to a strep throat or scarlet fever infection that hasn't been fully treated.