**LESSON 3.
Microbiology diagnosis of intestinal bacterial diseases (escherichiosis, salmonellosis, enteric fever)**

**LESSON PLAN:**

• Morpho-biological characteristics of intestinal bacteria. Antigen structure, serological classification and serotypes.

• Intestinal bacteria as a representative of the normal microflora of the human body and as a typical conditionally pathogenic bacteria

• Groups of enteropathogenic intestinal bacteria

• Pathogenesis and clinical manifestations of diseases caused by intestinal bacteria,

• Antibiotic-resistant forms of intestinal bacteria. Broad-spectrum beta-lactamase-resistant bacteria.

• Microbiological diagnosis of diseases caused by intestinal bacteria

• General characteristics of Salmonella, its intestinal and paratyphic agents, their morpho-biological characteristics. Antigen properties and classification.

• Pathogenesis of the abdominal cavity.

• Microbiological diagnostics of the abdominal cavity: bacteriological and serological (Vidal reaction and IFA). Determination of bacterial transportability

• Specific treatment and prevention of abdominal pain.

• Salmonella as a causative agent of food poisoning and nosocomial infections.

• Microbiological diagnosis of salmonellosis

***Enterobacteriaceae***

***ESCHERICHIA COLI***

**Trigger Words**

Gastroenteritis, EAEC, EIEC, EPEC, ETEC, STEC, neonatal meningitis, urinary tract infection

**Biology and Virulence**

Gram-negative, facultative anaerobic rods

Fermenter; oxidase negative

 Lipopolysaccharide consists of outer somatic O polysaccharide, core polysaccharide (common antigen), and lipid A (endotoxin)

**Epidemiology**

Most common aerobic gram-negative rods in the gastrointestinal tract

Most infections are endogenous (patient’s microbial flora), although strains causing gastroenteritis are generally acquired exogenously

**Diagnosis**

ᑏᑏOrganisms grow rapidly on most culture media

ᑏᑏ Enteric multiplex NAATs considered gold standard diagnostic

**Diseases**

At least five different pathogenic groups cause gastroenteritis: EAEC, EIEC, EPEC, ETEC, and STEC

Most cause diseases in developing countries, although STEC is an important cause of hemorrhagic colitis and hemolytic uremic syndrome

Extraintestinal disease includes bacteremia, neonatal meningitis, urinary tract infections, and intraabdominal infections

**Treatment, Prevention, and Control**

Enteric pathogens are treated symptomatically unless disseminated disease occurs

Antibiotic therapy is guided by in vitro susceptibility tests; increased resistance to penicillins and cephalosporins mediated by ESBLs

Appropriate infection-control practices are used to reduce the risk of nosocomial infections (e.g., restricting use of antibiotics, avoiding unnecessary use of urinary tract catheters)

Maintenance of high hygienic standards to reduce the risk of exposure to gastroenteritis strains

Proper cooking of beef products to reduce risk of STEC infections

***SALMONELLA***

**Trigger Words** Gastroenteritis, enteric fever, antibiotic treatment

**Biology and Virulence**

Gram-negative, facultative anaerobic rods

Fermenter; oxidase negative

Lipopolysaccharide consists of outer somatic O polysaccharide, core polysaccharide (common antigen), and lipid A (endotoxin)

More than 2500 O serotypes

Virulence: refer to Box 25.2; tolerant of acids in phagocytic vesicles

Can survive in macrophages and spread from the intestine to other body sites

**Epidemiology**

Most infections are acquired by eating contaminated food products (poultry, eggs, and dairy products are the most common sources of infection)

Direct fecal-oral spread in children

*Salmonella* Typhi and *Salmonella Paratyphi* are strict human pathogens (no other reservoirs); these infections are passed person to person; asymptomatic long-term colonization occurs commonly

Individuals at risk for infection include those who eat improperly cooked poultry or eggs, patients with reduced gastric acid levels, and immunocompromised patients

Infections occur worldwide, particularly in the warm months of the year

**Diseases**

Diseases: enteritis (fever, nausea, vomiting, bloody or nonbloody diarrhea, abdominal cramps); enteric fever (typhoid fever,

paratyphoid fever); bacteremia (most commonly seen with *Salmonella* serotype Typhi, *Salmonella* serotype Paratyphi, *Salmonella* serotype Choleraesuis); asymptomatic colonization (primarily with *Salmonella* Typhi and *Salmonella* Paratyphi)

**Clinical Diseases Induced by Salmonellae**

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**Diagnosis**

ᑏᑏ Isolation from stool specimens requires use of selective media

ᑏᑏ Enteric multiplex NAATs considered gold standard diagnostic

**Treatment, Prevention, and Control**

Antibiotic treatment not recommended for enteritis because this may prolong the duration of disease

Infections with *Salmonella* Typhi and *Salmonella* Paratyphi or disseminated infections with other organisms should be treated with an effective antibiotic (selected by in vitro susceptibility tests); fluoroquinolones (e.g., ciprofloxacin), chloramphenicol, trimethoprim sulfamethoxazole, or a broad-spectrum cephalosporin may be used

Most infections can be controlled by proper preparation of poultry and eggs (completely cooked) and avoidance of contamination of other foods with uncooked poultry products

Carriers of *Salmonella* Typhi and *Salmonella* Paratyphi should be identified and treated

Vaccination against *Salmonella* Typhi can reduce the risk of disease for travelers into endemic areas

*EAEC,* Enteroaggregative *E. coli*; *EIEC,* enteroinvasive *E. coli*; *EPEC,* enteropathogenic *E. coli*; ESBL, extended-spectrum \_-lactamase; *ETEC,* enterotoxigenic *E. coli*; *NAAT,* nucleic acid amplification test; *STEC,* Shiga toxin–producing *E. coli*.

Important Enterobacteriaceae

**Organism Historical Derivation**

*Escherichia coli - escherichia,* named after Escherich; *coli,* of the colon

*Salmonella enterica - salmonella,* named after Salmon; *enteron*, gut; pertaining to the gut

*Salmonella* Typhi - *typhi,* of typhoid; disease is typhoid fever

*Salmonella* Paratyphi - *paratyphi,* of a typhoid-like infection

*Salmonella* Choleraesuis - *cholera,* cholera; *sus,* hog; cholera of a hog

*Salmonella* Typhimurium - *typhi,* of typhoid; *murium,* of mice; *typhimurium,* typhoid of mice

*Salmonella* Enteritidis - *enteris,* gut; *idis,* inflammation

*Shigella dysenteriae - shigella,* named after Shiga; *dysenteriae,* dysentery

*S. flexneri - flexneri,* named after Flexner

*S. boydii - boydii,* named after Boyd

*S. sonnei - sonnei,* named after Sonne

*Yersinia pestis - yersinia,* named after Yersin; *pestis,* plague

*Y. enterocolitica - enterocolitica,* pertaining to the intestine and colon

*Y. pseudotuberculosis - tuberculum,* a small swelling; *pseudotuberculosis,* false swelling

**Common Medically Important Enterobacteriaceae**

*Citrobacter freundii, C. koseri*

*Enterobacter cloacae*

*Escherichia coli*

*Klebsiella pneumoniae, K. oxytoca*

*Morganella morganii*

*Proteus mirabilis*

*Salmonella serotype Typhi, Salmonella nontyphoidal serotypes*

*Serratia marcescens*

*Shigella sonnei, S. flexneri*

*Yersinia pestis, Y. enterocolitica, Y. Pseudotuberculosis*

**Common Virulence Factors Associated with Enterobacteriaceae**

Endotoxin

Capsule

Antigenic phase variation

Type III secretion systems

Sequestration of growth factors

Resistance to serum killing

Antimicrobial resistance

**Specialized Virulence Factors Associated with *Escherichia coli***



**Gastroenteritis Caused by *Escherichia coli***

