

Lecture 2

Normal Flora & introduction of Infectious Diarrhea



Microbiology team 430

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Normal Flora

- **Def:** Normal flora is microorganisms that are frequently found in various body sites in normal, healthy individuals.
- Colon containing the largest number of normal flora (about 10^{10} org/gm), while the stomach contains the minimal number because of the presence of HCL (so pt on anti acidic drugs is more susceptible to get infection).
- NF could enter the blood (due to dental procedures) causing damage to the heart valve (endocarditis).
- It also could go to peritoneum (due to surgery or rupture of the bowl) causing peritonitis.

Definition of Diarrhea:

- Alteration in normal bowel movement with **decreased consistency** and **increased frequency**.
- Three times a day in less than 14 days.
- It is self limiting but sometimes it requires an early treatment.

Intestinal Pathogens

- **Invasive and cytotoxic strains** → causing **inflammation** which result in = [**Dysentery**] " WBCs, blood, mucous and pus are found in stool"
- **Enterotoxin** Strains = **watery diarrhea** and loss of fluids.

Enterotoxin: causes alteration in electrolytes, resulting in ↑ of cl in the intestinal lumen followed by ↑ in H₂O causing watery diarrhea.

❖ Etiology:

- ☐ **Viral:** very **serious in children** less than 3 years old. (**most common**)
- ☐ **Bacterial:** responsible for most cases of severe diarrhea, very common in adults.
- ☐ **Protozoan:** less than 10%.

❖ Classification:

- **Infectious diarrhea:** Viral (e.g. **Rota virus – most common**), Bacterial (e.g. **Campylobacter, Shigella, Salmonella, Yersinia, Vibrio cholerae, E.coli**)
- **Food poisoning:** **Staphylococcus aureus, Clostridium perfringes, Bacillus spp.**
- **Traveler diarrhea:** **Enterotoxogenic E.coli.**
- **Antibiotic associated diarrhea:** **Clostridium difficile.**

❖ Risk Factors

- Family member with gastrointestinal symptoms.
- Food from restaurant.
- Recent travel to developing countries.
- **Low stomach acidity or antacids drugs.**
- Abnormal peristalsis.
- Low Immunoglobulin IGA.
- **Antibiotics** = decrease the normal flora.

Clinical Presentation and Pathogenic

❖ Mechanism I:

- **Enterotoxin mediated** (watery diarrhea):
- **Clinical presentation:**
 - No pus in the stool (because of no invasion).
 - Lack of fever.
 - Vomiting non-bloody diarrhea, abdominal cramp.
 - **Rapid onset, Incubation period (IP) is 6 – 18 Hrs (short).**
- **Affects:** **Small intestine.**
- **Pathogens:** **Vibrio cholerae, Staphylococcus aureus, Clostridium perfringens and Bacillus cereus.**

- Toxins produced by organism are resistance to heat.

❖ Mechanism II :

- **Invasive** (dysentery):
- **Clinical presentation:**
 - Pus and blood in the stool.
 - Fever due to inflammation.
 - Extension of lymph nodes.
 - **Dysentery** syndrome- gross **blood** and **mucous**
 - **Incubation period 1-3 days (long)**
- **Affect:** **colonic mucosal surface of the bowel (large colon).**
- **Pathogens:**
 - **Shigella, Salmonella spp., Campylobacter**, some E.coli and Entameba histolytica
 - Entameoba histolytica 1-3 wk
 - **EHEC bloody diarrhea (EHEC: Entero Hemorrhagic E-Coli)**

Campylobacter

- **Family:** Campylobacteraceae.
- **Genus:** Archobacter.
- **Description:** Spiral Gram negative bacilli [Rods].
- **Common species:** C. jejuni, C. coli, C fetus.
- **Source:** dog, cat, birds, poultry [like chicken] → water, milk, meat, person to person can occur.

❖ Clinically:

- **IP 2-6 days.** (Or 1-3 days – because it is an invasive organism).
- **Very common and mild.**
- **Presentation:** Abdominal cramp, bloody diarrhea, nausea and vomiting are rare.
- **Self limiting.**
- **Guillain-Barre syndrome [GB] is the most common complication**

❖ **Laboratory diagnosis:**

- Transport media Cary Blair.
- CAMPYBAP media contain antibiotics.
- It needs Oxygen to grow → because of that, it's incubated in a media containing 5% O₂ 10% CO₂ 85% N at 42°C media except C.fetus 37°C. (called microaerophilic).
- **Gram stain** /Serology (for Identification)

CAMPYBAP: simply it is a blood agar containing antibiotics

❖ **Treatment:**

- **Erythromycin** [Macrolides].

E.coli

- There are five major categories of diarrheagenic E.coli:

Pathogen	Infection
- Enterotoxigenic E. coli (ETEC).	Traveler's diarrhea
- Enteropathogenic E. coli (EPEC).	Infantile diarrhea
- Enteroinvasive E. coli (EIEC).	Dysentery (blood & mucus)
- Enterohaemorrhagic E. coli (EHEC).	Bloody diarrhea (very severe)
- Enteroadherent E. coli (EAEC).	Pediatric diarrheal disease (same as EPEC)

All diarrhea caused by E.coli are **self limiting** (no treatment).

❖ **Enterotoxigenic E.coli :**

- Major cause of **traveler's diarrhea** in infant and adult in developing countries from contaminated food and water.
- It has high infective dose 10⁶-10¹⁰
- Produces **two types of toxins**: **heat labile toxin (LT)** and **heat stable toxin (ST)** both are A&B type.
- **Symptoms**: **watery diarrhea**, abdominal cramps and some time vomiting.
- **Diagnosis**: No routine diagnostic method.

A&B type: means that the toxin has two parts: A part → which is an infectious part & B part → which is a carrier

❖ **Enteroinvasive E.coli:**

- Produce **dysentery** (Penetration, invasion and distraction)
- Infective dose 10⁶
- It produces **Shigella-like toxin**.
- Fecal oral route
- **Symptoms**: Fever, severe abdominal cramp, malaise and watery diarrhea
- **Diagnosis**: Sereny test and DNA probes.

❖ **Enteropathogenic E.coli:**

- **Infantile diarrhea [Infants]**
- Outbreak in **hospital nurseries** and day- care centers.
- Low grade fever, malaise, vomiting and diarrhea
- **Mucous in stool but no blood.**

❖ *Entero-hemorrhagic E.coli:*

- Serotype: 0157:H7 → Hemorrhagic diarrhea, colitis and hemolytic uremic syndrome, hemolytic anemia and kidney failure.
- **Symptoms:** Bloody diarrhea, low grade fever and stool have no leucocytes.
- **Source:** Undercooked hamburgers, unpasteurized dairy products, apple cider, cookie dough → This bacteria lives in cows' intestine
- **Diagnosis:** by culture, MUG test, immunological test or PCR
- Produces two types of Cytotoxin = Verotoxin I and Verotoxin II similar to (shiga-toxin I & II)
- Fatal disease in young and elderly persons in nursing homes.
- *Very dangerous in children because its presentation is mild then it progress to bloody diarrhea.*

❖ *Entero-adherent E.coli:*

- **Pediatric diarrheal Disease.**
- Adhering to the surface of the intestinal mucosa and can cause UTI.
- Watery diarrhea, vomiting, dehydration and abdominal pain for 2 or more weeks

Yersinia enterocolitica

- Mesenteric lymphadenitis in children and septicemia in immunocompromised hosts.
- Chitterlings [intestine of pigs] are the most common site.
- It's rare in the middle-east but very common in North America.
- Survive cold temperatures and associated with transfusion of packed red blood cells.
- Presented with enteritis, arthritis and erythema nodosum.
- Generalize infection in adult and children 1-5 yrs, usually mild but in old children adult mimic appendicitis.

Clostridium difficile

- Antibiotic associated diarrhea.
- Transmit from person to person via fecal-oral route.
- Have been cultured from inanimate hospital surfaces.
- Disruption of the indigenous bacterial flora of the colon.
- Produces A&B type of toxin.
- **Clinical Presentation:** fever, leukocytosis, abdominal pain and diarrhea.
- Pseudomembrane can result (neutrophils, fibrin, and cellular debris in the colonic mucosa) and toxic megacolon.
- **Diagnosis:** toxin detection by enzyme immunoassay (EIA).
- Treatment Metronidazole ± Vancomycin and supportive treatment.

Summary:

- Diarrhea is defined as Alteration in normal bowel movement characterized by decreased consistency and increased frequency.

- There are two types of strains that cause diarrhea:
 1. **Invasive strains** = **dysentery** (due to **inflammation**) contains **WBCs (pus)**, **blood** and **mucous**.
 2. **Enterotoxin Strains** = **watery diarrhea** and **loss of fluids**.
- **Causes of infectious diarrhea are:** Viral (**most common especially rota**), bacterial [**Campylobacter**, **Yersinia**, **Vibrio cholerae**, **E.coli**] or protozoal infections.
 - Bacteria that cause Food poisoning are: ***Clostridium perfringens***, ***S. Aureus*** and ***Bacillus cereus***.
- **Antibiotic associated diarrhea** is caused by **Clostridium difficile**
- The most important risk factors of acute diarrhea are: **low stomach acidity**, **Antibiotics** and **decreased food and personal hygiene**.
- **Enterotoxin mediated** mechanism is **very rapid**; **IP** is **6 – 18 Hrs** and takes place in the **small intestine** and causes **watery diarrhea**.
- **Invasive** mechanism is **slower**; **IP** is **1 – 3 days**, takes place in the **colon** and causes **Dysentery**.
- **Campylobacter:**
 - **Spiral Gram –ve** bacilli.
 - Most common species is **C.jejuni**.
 - Most common source is **Poultry** [Chicken].
 - **Self-limiting, microaerophilic** [requiring oxygen for growth but at lower concentration than is present in the atmosphere]
 - Complication: **Guillain-Barré syndrome**.
 - Diagnosis: **Gram stain**.
 - Treatment: **Erythromycin “Macrolides”**

○ **E.coli:**

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- Serotype **O157:H7** of **EHEC** will cause **hemorrhagic diarrhea**, **colitis**, **hemolytic uremic syndrome (HUS)**, **hemolytic anemia** and **kidney failure**
- **EHEC** Produces **verotoxin 1 & 2**, which is similar to (**shiga toxin 1&2**)
- **ETEC** produces **heat labile toxin (LT)** and **heat stable toxin (ST)**.
- **Yersinia enterocolitica**: most commonly found in **Chitterlings** [intestine of pigs], causes:
- **Mesenteric lymphadenitis**.
- **Clostridium difficile**: It causes **Antibiotic associated diarrhea**, **Pseudomembranous colitis** and treated by **Metronidazole**.
- **Listeria monocytogenes** has the **longest IP** (2-6 weeks) and found in **cheese (dairy products)** and it causes **Gastroenteritis** and **meningitis**.
 - **Clostridium botulinum** causes **paralysis** and **blurred vision**.

Good Luck 😊