



# MICROBIOLOGY

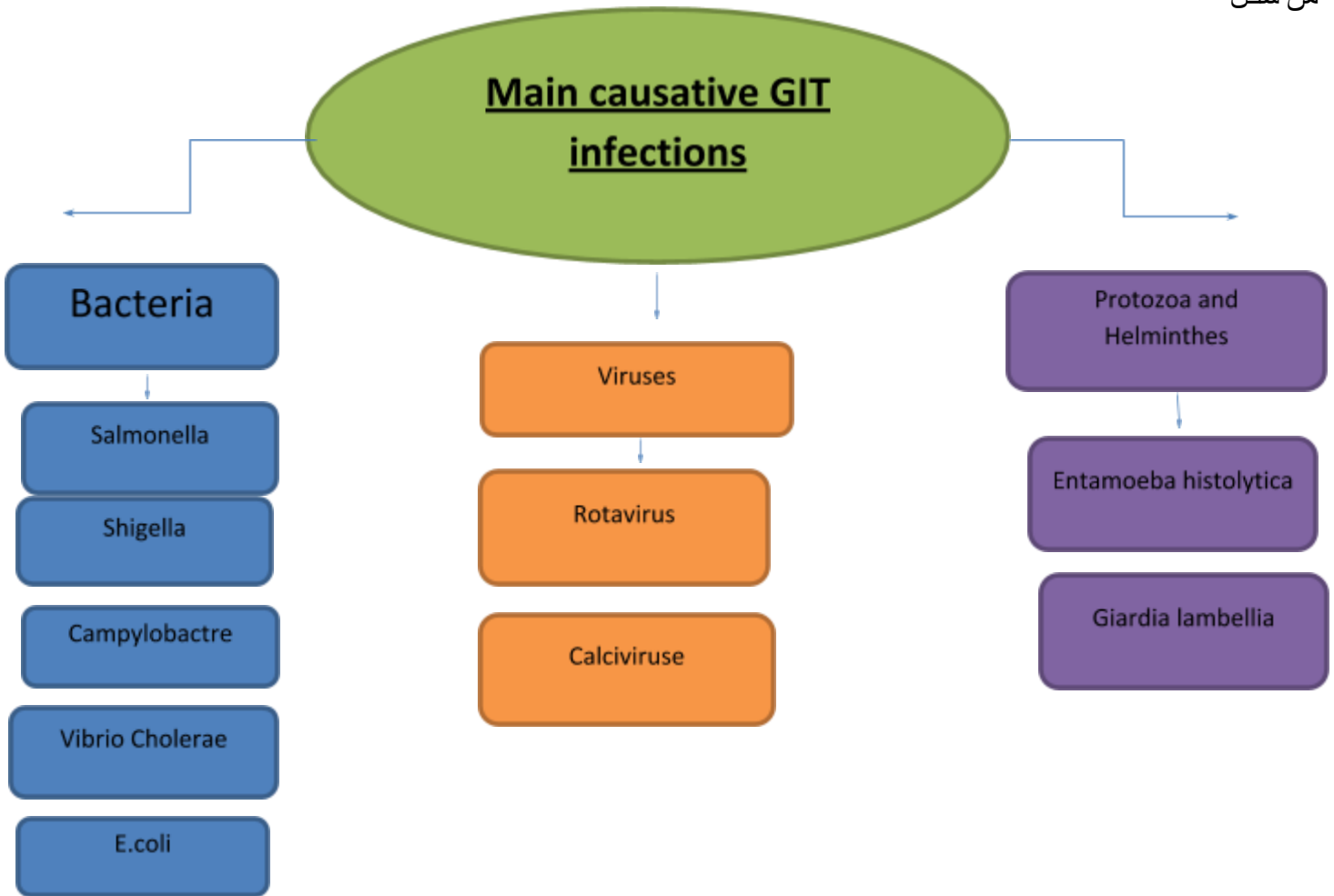
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Lecture 2

## Objectives for Today:

- 1- Understand the importance of **GIT infections**
- 2- Identify the main clinical syndromes and presentations associated with GIT infections  
Identify the main epidemiological aspects of GIT infections
- 3- Identify the main bacterial causes of GIT infections
- 4- Describe the epidemiology, general characteristics, clinical presentation, laboratory diagnosis and treatment of **Salmonella**, **Shigella**, and **Campylobacter**

بداية ليش كثير مهم ندرس عن GIT infections لانه فيه اسباب كثيرة ممكن تسببه وممكن يطلع ال infection على اكثر من شكل



## Pathology:

- 1- **Gastritis** : is inflammation of the lining of the stomach
- 2- **Enteritis**: is inflammation of the small intestine
- 3- **colitis** : inflammation of the inner lining of the colon

## we have to main routs of transmission GIT infections:

1. Fecal-oral rout (through food)
2. Person-to-person contact ( like shake hands )

### **Importance of GIT infections:**

1-Acute infections of the gastrointestinal tract are among the most frequent of all illnesses, exceeded only by respiratory tract infections such as the common cold

أشهر وأكثر الأمراض حدوثا وتكررا بحياتنا العملية كأطباء حتكون RTI وبعدها فورا ال GIT infection لهيك بنعطيه اهتمام كبير عشان كثير بنشوفه وجزء كبير من المرضى اللي حنشوفهم بعياداتنا رح يكون عندهم أما RTI أو GIT infection (تقريبا حوالي 50% من المرضى) لهيك ضروري جدا نفهمهم ونحفظهم

2- Diarrhea is the most common manifestation of these infections; however, because it is usually self-limiting within hours or days, patients do not seek medical care

أول سؤال بسأله للمريض اذا شكيت انه عنده GIT infection هو هل عندك diarrhea؟ و ايش خصائصها؟ وطبعنا بدنا نخلي ببالنا انه فيه جزء من GIT infection بيجي mild and self limiting فهاي النسبة من المرضى على الاغلب ما رح تيجي للمستشفى فعلى الرغم من انه 50% من المرضى اللي رح اشوفهم بالعيادة حيكون عندهم RTI أو GIT infection لسا فيه غيرهم جزء كبير ما بيوصلنا عشان الاعراض عندهم خفيفه

3-In the western countries ( **developed countries** ) , gastrointestinal infection remains one of the three most common syndromes seen by physicians

4-Worldwide, diarrheal disease remains one of the most important causes of morbidity and mortality among infants and children Importance of GIT -infections

ما زال جزء كبير من المرضى they will be affected morbidity and mortality يعني ممكن المريض يقعد بالمستشفى اسبوع اسبوعين وممكن يدخل ب complication زي ال renal failure وجزء كبير من الاطفال والرضع ممكن يتوفوا بسببها رح يصير معهم

### **Diarrhea □ dehydration □ shock (among hours) □ death**

5- It has been estimated that in Asia, Africa, and Latin America, depending on socioeconomic and nutritional factors, a child's chance of dying of a diarrheal illness before the age of 7 years can be as high as 50%

هاي الدول عندها ال socioeconomic level and quality of care are low لهيك نسبة الاطفال اللي عمرهم اقل من 7 سنين اللي بموتوا بسبب ال GIT infection =50%

6-In developed countries, mortality is very much lower, but it is still significant

because socioeconomic level and financial situation and general health and quality of life and quality of medical care is so better than developing country

### Clinical Classification: (فيه جدول تحت بشملهم كلهم)

Gastrointestinal infections can be classified into three major syndromes:

#### 1. Watery Diarrhea :

The most common form of gastrointestinal infection is the rapid development of frequent intestinal evacuations of a more or less fluid character known as diarrhea

فيه عندي 3 تعاريف diarrhea

1- التعريف العام لل diarrhea :

Is (bowel movements)\_loose stools three or more times in one day or

2- التعريف الثاني :

increase frequency more than normal Bowel habits

ال normal Bowel habits بتختلف من شخص لثاني ممكن واحد يخرج كل 3 أيام مرة وممكن شخص ثاني عنده كل يوم او شخص غيرهم عنده مره كل اسبوع

فأذا الشخص مثلا ال normal Bowel habits عنده مرة كل ثلاث أيام وصار فجأة يخرج مرة كل يوم هذا يعتبر عنده diarrhea

3- التعريف الثالث :

the rapid development of frequent intestinal evacuations of a more or less fluid character

الاعراض اللي بترافق ال watery diarrhea :

1-Nausea 2- vomiting 3-fever 4- abdominal pain may also be present

but the dominant feature is intestinal fluid loss.

#### **Mechanism :**

Diarrhea is produced by pathogenic mechanisms that attack the proximal small intestine where fluid absorption occurs

لهيك هي بتمنع انه يصير fluid absorption

## Microorganisms that cause watery diarrhea:

Vibrio cholera/ Enterotoxigenic Escherichia coli/ Rotaviruses/G. lamblia

## 2. Dysentery

Rapid onset of frequent intestinal evacuations

, طيب زي ال Diarrhea؟ لا لانه فيه فروقات أهمها :

1-the stools are of smaller volume than in watery diarrhea and 2- contain blood and pus (اهم اشئ )

: بالكتب الطبية هيك بحكوا

If watery diarrhea is the “runs” dysentery is the “squirt” بتكون الخراج قليل فبض المريض بالحمام لفترة طويلة لكنه بيخرج كمية قليلة

الاعراض اللي بترافق ال Dysentery:

1-Fever 2-abdominal pain 3-cramps 4-tenesmus are frequent complaints. 5-Vomiting occurs less often

بنلاحظ انه فيه تشابه بين الاعراض المرافقة لل Diarrhea و ” Dysentery لهيك التفريق الرئيسي بينهم عن طريق ال characteristic of the stool

### Mechanism :

Organisms causing dysentery can produce inflammatory and/or destructive changes in the colonic mucosa either by direct invasion or by production of cytotoxins.

bleeding + pus in stool لهيك هذا الاشئ بسبب Inflammation or destructive changes

This damage produces the pus and blood seen in the stools but does not result in substantial fluid loss because the absorptive and secretory capacity of the colon is much less than that of the small bowel.

### Microorganism causes dysentery :

Salmonella, Shigella, Campylobacter

## 3-Enteric fever (Typhoid fever)

سميها enteric لانها بتصير بال intestine و fever عشان الحمى هو العرض الاهم والشائع فيها وبهاي الحالة بداية المرض بتكون بال GIT لكن سرعان ما تنتقل للدم وتصير systemic infection فبتعمل حمى

Enteric fever is a systemic infection, the origin and focus of which are the gastrointestinal tract .The most prominent features are **fever and abdominal pain**, which develop gradually over a few days. Diarrhea is usually present but may be mild and not appear until later in the course of the illness

**Mechanism :**

It generally involves penetration by the organism of the cells of the distal small **bowel with subsequent spread outside the bowel to the biliary tract, liver, mesentery, or reticuloendothelial organs**

Bacteremia is common, occasionally causing metastatic infection in other organs.

**Microorganisms that cause enteric fever:**

Typhoid fever caused by **Salmonella enterica** serotype **Typhi** is the only infection for which these events have been well studied

Syndrome	Watery Diarrhea	Dysentery	Enteric fever (Typhoid fever)
Clinical presentation	loose stools three or more times in one day or increase frequency more than normal Bowel habits /the rapid development of frequent intestinal evacuations of a more or less fluid character	Rapid onset of frequent intestinal evacuations, but the stools are of <b>smaller volume than in watery diarrhea</b> and <b>contain blood and pus</b>	fever and abdominal pain, which develop gradually over a few days
Associated symptoms	1-Nausea 2- vomiting 3-fever 4- abdominal pain may also be present. 5-but the dominant feature is <b>intestinal fluid loss.</b>	1-Fever 2-abdominal pain 3-cramps 4-tenesmus are frequent complaints. 5-Vomiting occurs less often	fever and abdominal pain, which develop gradually over a few days Diarrhea is usually present but may be mild and not appear until

			later in the course of the illness
Mechanism	Diarrhea is produced by pathogenic mechanisms that attack the proximal small intestine where fluid absorption occurs	Organisms causing dysentery can produce inflammatory and/or destructive changes in the colonic mucosa either by direct invasion or by production of cytotoxins. This damage produces the pus and blood seen in the stools but does not result in substantial fluid loss because the absorptive and secretory capacity of the colon is much less than that of the small bow	It generally involves penetration by the organism of the cells of the distal small bowel with subsequent spread outside the bowel to the biliary tract, liver, mesentery, or reticuloendothelial organ <b>Bacteremia is common,</b>
Main microorganism	1-Vibrio cholera 2-Enterotoxigenic Escherichia coli 3-Rotaviruses 4-G. lambelia	1-Salmonella 2-Shigella 3-Campylobacter	Salmonella enterica serotype Typhi
Site of infection	Proximal small intestine	colonic mucosa	a systemic infection, the origin and focus of which are the gastrointestinal tract

### Epidemiological Classification:

#### 1- Endemic Infections:

Occur sporadically in the usual living circumstances of the patient. Examples are **rotaviruses**, **caliciviruses**, **Campylobacter**, **Salmonella**, and **Shigella**

يعني الا ما اشوف حالات تيجيني عالعيادة لانه المرض مستوطن زي ال rotaviruses بالشتوية

**2-Epidemic Infections :** Spread beyond the family unit to cause epidemics involving regional, national, and even international populations. Examples are **typhoid fever**, **cholera**, and **shigellosis** متوسع بشكل كبير بتكون منطقة كاملة بتكون منتشر فيها هذا المرض

**3-Traveler's Diarrhea:** From 20% to 50% of travelers from developed countries who go to less developed countries experience a diarrheal illness in the first week that is usually brief but can be serious

المسافرين من دول متطورة لدول أقل تطورا عادة بأول اسبوع لانه يكون انتقل من مكان فيه ال hygiene عالي وجهازه المناعي كان بعده مش مستقبل عدد كبير من ال infections ولما يروح على دولة مش متطورة يكون فيها low hygiene system فبتعرض ل large dose of infections فبصير عنده diarrheal فلها مرات بنعطي المسافرين من دول متطورة لدول أقل تطورا prophylactic antibiotic عشان نتجنب ال diarrheal و infections اللي ممكن تصيبه لانها مرات بتكون خطيرة وممكن تأدي للوفاة

#### **4-Food Poisoning:**

Gastrointestinal infection where a single meal can be incriminated as the source, usually with multiple cases develop at the same time with persons who shared the same meal

بتكون وجبة وكل اللي بيؤكلوا منها بصيهم المرض أو infection

**5-Hospital Associated Diarrhea:** Occurs in hospital due to infected employee or contaminated food from outside the hospital.

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هسا بدنا نبليش بال 3 microorganisms:

#### **1 Salmonella 2-Shigella 3-Campylobacter**

رح نحكي عنهم الثلاث بالتفصيل ورح اعلمهم تلخيص بجدول بالنهاية

#### **1- Salmonella**

##### **General Characteristics**

Coliform bacilli (enteric rods )/ Motile gram-negative facultative anaerobes/Non-lactose fermenting/Resistant to bile salts



## Virulence attributable to:

1- Invasiveness 2-Intracellular survival & multiplication

3-Endotoxin(lipid A)

وهاد بخلي ال Clinical presentation أصعب

4-Exotoxins: enterotoxins, cytotoxin

وال cytotoxin بساعدها انه تعمل invasion

## Mechanism :

1- Hold on epithelial cell lining intestinal tract

2-enter an epithelial cell

3-multiply within vesicles inside the cell

4-salmonella multiply in mucosal cells cause inflation result in diarrhea ,bacteria cross the epithelial cell membrane (vertical invasion )and enter blood stream and lymph nodes result in systemic manifestation

## Clinical Presentations:

بتصير على مراحل وممكن الشخص يمر بكل المراحل أو يمر بمرحلة ويختفي والمراحل هي :

### **1- Enteritis (acute gastroenteritis): acute inflammation in small intestine**

Most common form of salmonellosis with major foodborne outbreaks and sporadic disease

\*High infectious dose = 10<sup>8</sup> CFU

\*Poultry, eggs, etc. are sources of infection

\*6-48h incubation period

\* Nausea, vomiting, nonbloody diarrhea (intestine لانه البكتيريا بعدها بال), fever, cramps, myalgia and headache common

### **2-Enteric fever**

هون يكون البكتيريا انتقلت من ال intestine وراحت للدم وللأعضاء الثانية

)prototype is typhoid fever and less severe paratyphoid fever(

S. typhi causes typhoid fever, S. paratyphi A, B and C cause milder form of enteric fever

\*Infectious dose = 10<sup>6</sup> CFU(high)

\*Fecal-oral route of transmission

\* Person-to-person spread by chronic carrier

\*Fecally-contaminated food or water

\*10-14 day incubation period

\*Initially signs of sepsis/bacteremia with sustained fever (delirium) for > one week before abdominal pain and gastrointestinal symptoms

**3-Septicemia** (particularly S. choleraesuis, S. typhi, and S. paratyphi)

**4-Asymptomatic carriage** (gall bladder is the reservoir for Salmonella typhi)

تذكروا انها can survive in bile salt ' لهيك بتعيش بأريحيتها بال gall bladder طيب كيف بدى اعرف انه المريض لسا حامل للبكتيريا بكون بيخرج مع ال stool ال (Salmonella typhi) وما بكون عنجه اي عرض

\*\*Chronic carriage in 1-5% of cases following S. typhi or S. paratyphi infection

Chronic carriage with other Salmonella spp. occurs in <<1% of cases and does not play a role in human disease transmission

## Laboratory Diagnosis

**1-Full blood count (CBC):** usually decrease number of neutrophils (neutropenia )

قاعدة عامة : ال bacterial infections بتزيد عند المريض ال neutrophils فبصير عنده neutrophilia , أما بال viral infections بزيد عندي ال lymphocytes فبصير معه lymphocytosis , ولو كان parasite بزيد عندي ال .other cells like basophil

طيب ليش صار عندي neutropenia على الرغم من انه ال salmonella بكتيريا ؟ لانها عندها القدرة انه تحطم ال neutrophils بدرجة اسرع من انتاج الجسم لل neutrophils

**2- Stool analysis**

**3-Microscopic examination** نادرا ما اشوفها

#### 4-Culture - selective media)S-S agar (salmonella –shiglla agar ))

non lactose ferment salmonella بتكون وطبعا ال Macconkey agar استخدم ال ممكن برضو

#### 5-Biochemical tests

بجيب Ab لل salmonella و Ab لل shiglla عشان اشوف اي وحدة فيهم هي

#### 6-Antigen and antibody detection

#### 7- Widal test :serological test for enteric fever.

بقيس عدد ال Ab لل salmonella لكن هذا الاختبار مش مهم وأغلب الكتب صارت تشيله وتحكي يفضل عدم طلبه لانه لحتى اخذ عينة blood من المريض وأدور على anti-salmonella Ab هاي بتوخذ اسبوع لأسبوعيين وكمان ال sensitivity and specificity low يعني

**\*\*برضو ممكن ال blood culture لل salmonella تساعدني و بحالة يطلع عندي ال culture postive يكون Enteric fever 100% لانه بتكون طلعت من small intestine ووصلت للدم.**

#### Treatment and Prevention:

##### Enteritis:

1- Self- limiting and antibiotics not recommended for enteritis because prolong duration

2-Control by proper preparation of poultry & eggs

##### Enteric fever:

\*Antibiotics (chloramphenicol, ceftriaxone)

Chloramphenicol \*\* بطلنا نستخدمه عشان لانه اله serious side effect لكن ال ceftriaxone منيح كثير بهاي الحالة وبنعطيه IV واذا بدني اعطيه دواء Orally بعطيه Ciprofloxacin

\*\*Antibiotics should avoid carrier state identify & treat carriers of S. typhi & S. paratyphi

\*\*Vaccination can reduce risk of disease for travelers in endemic areas

Vaccination يكون effective بنسبة 60% لمدة سنتين وبعطيه قبل السفر باسبوع اسبوعين عشان احمي المسافرين -

## 2-Shigella

### General Characteristics:

- 1-Coliform bacilli (enteric rods)
- 2-gram-negative facultative anaerobes
- 3-Non-lactose fermenting
- 4-Resistant to bile salts

وهذول الخصائص كلهم شبه ال salmonella

بتختلف عن ال salmonella بالخاصية الخامسة

- 5- Non- motile

وكونها بتختلف عن ال salmonella فبقدر من خلالها اميز بينهم لانه بال s-s agar ما بميز بينهم فبقدر من خلال خاصية ال motility أعرف هاي salmonella أو Shigella

### Four species

**Shigella sonnei** (most common in industrial world)

**Shigella flexneri** (most common in developing countries)

**Shigella boydii**

**Shigella dysenteriae**

### Pathogenesis

#### Two-stage disease:

- **Early stage:** **Watery diarrhea** attributed to the enterotoxic activity of Shiga toxin, fever attributed to neurotoxic activity of toxin
- **Second stage:** Adherence to and tissue invasion of large intestine with typical symptoms **of dysentery**

#### Virulence factors:

- Invasiveness

هون بكون horizontal invasion يعني بتدمر خلايا ال intestine ونادرا ما تكون vertical invasion وتنتقل للدم

- Attachment and internalization
- Large virulence plasmid
- Exotoxin (Shiga toxin)
- Intracellular survival & multiplication

### **Mechanism :**

1- Hold on epithelial cell lining intestinal tract

2-enter an epithelial cell

3-multiply inside the cell

4-shiglla invade neighboring epithelial cells **avoiding immune defenses**

4- abscess forms as epithelial cells killed by infection .the bacteria rarely spread in blood

### **Clinical Presentation**

#### **Mainly enteritis**

\*Low infectious dose (10<sup>2</sup>-10<sup>4</sup> CFU)

\* Humans are only reservoir

\* Transmission by fecal-oral route

\*Incubation period = 1-3 days

قريبة جدا لل salmonella

\* Watery diarrhea with fever; changing to dysentery

\* Major cause of bacillary dysentery (severe 2nd stage) in pediatric age group (1-10 yrs) via fecal-oral route

\*Outbreaks in daycare centers, nurseries, institutions

\* Estimated 15% of pediatric diarrhea in U.S. Leading cause of infant diarrhea and mortality (death) in developing countries

## Laboratory Diagnosis

### 1- Full blood count:

بصير عنده neutrophilia

### 2- Stool analysis

بشوفها وبتكون non motile لكن هذا احتمال ضعيف

### 3- Microscopic examination

### 4- Culture - selective media

1- S-S agar (salmonella –shiglla agar ) positive

2 -non lactose ferment Macconkey agar وطبعا ال shiglla بتكون

3 بستخدم معها Ab test أو motility test عشان اميز بينها وبين ال salmonella

## 🧪 Biochemical tests

## Treatment and Prevention

\*Antibiotics (trimethoprim-sulfonamide) help in shortening the period of illness

Bactrim (هذا الدواء عبارة عن trimethoprim-sulfonamide) combination

وال national company التي عملته سمته Balkatrin

\* Symptomatic treatment and fluid replacement

\* Prevention by proper food cooking and handling ,hand washing and sanitary measures

انتبه انه ما فيه vaccine لل shiglla

## 3-Campylobacter

### General Characteristics

من نفس عيلة ال h.polari وكمان هي ظهرت بعد أن قل ظهور ال salmonella and shiglla

- \* Small, thin, helical (spiral or curved) cells with typical gram-negative cell wall
- \*Tendency to form coccoid & elongated forms on prolonged culture or when exposed to O<sub>2</sub>
- \* Distinctive rapid motility
- \* Long sheathed polar flagellum at one (polar) or both (bipolar) ends of the cell
- \* Microaerophilic, capnophilic, thermophilic (42-43°C)  
Microaerophilic تحتاج كمية قليلة من ال capnophilic , O<sub>2</sub> كمية قليلة م CO<sub>2</sub> )
- \* The most important and common infective species is *C. jejuni*

## Epidemiology

- \*Campylobacter enteritis was not recognized until the mid-1970s when selective isolation media were developed
- \*Most common form of acute infectious diarrhea in **developed countries**; Higher incidence than Salmonella & Shigella combined
- \* Zoonotic infections in many animals particularly avian (bird) reservoirs
- \*Humans acquire via ingestion of contaminated food (particularly poultry), unpasteurized milk, or improperly treated water

## Clinical Presentation

- \*\* Illness begun 1-7 days after ingestion
- \*\* Starts with fever and severe abdominal pain followed by dysentery with pus and blood

## Diagnosis

by culture and growth on selective media under microphilic conditions

## Treatment and Prevention

- \* Self-limiting
- \*Replace fluids and electrolytes

في حال كان فيه Dehydration بعمل Replace fluids and electrolytes وهاي قاعدة بكل GIT خاصة الاطفال

\*\*Antibiotic treatment can shorten the excretion period, erythromycin is drug of choice for severe or complicated enteritis & bacteremia, fluoroquinolones Like Ciprofloxacin are also highly active

\*\*Control should be directed at domestic animal reservoirs and interrupting transmission to humans

بالنهاية عندي نقطتين رئيسيات لازم اتذكرهم :

- اذا اجاني طفل بدي اسأل حالي هل الطفل صار عنده اعراض ال Dehydration أول خطوة بعملها قبل ما أبلىش أ  
علاج اعوض fluids and electrolyte
- فيه ناس بتستخف بال GIT infections لكن هذا الاشي أكبر غلط لانه اله نسبة morbidity and mortality عالية

Thank you hope 



