



Microbiology

Subject :

Lec no : 15

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وَقُلْ رَبِّ زِدْنِي عِلْمًا



Salmonella

- Salmonellae Gram negative
 - Typhi Typhoid fever / كونه حرارة معناها systematic ويتأثر ع كل الجسم / More sever infection
 - Non-Typhi: S enterica بتعمل abdominal pain and vomiting وهيك شغلات بسيطة
- Most strains are motile through the action of their flagella.
- **Salmonella Typhi has a surface polysaccharide called the Vi antigen,**

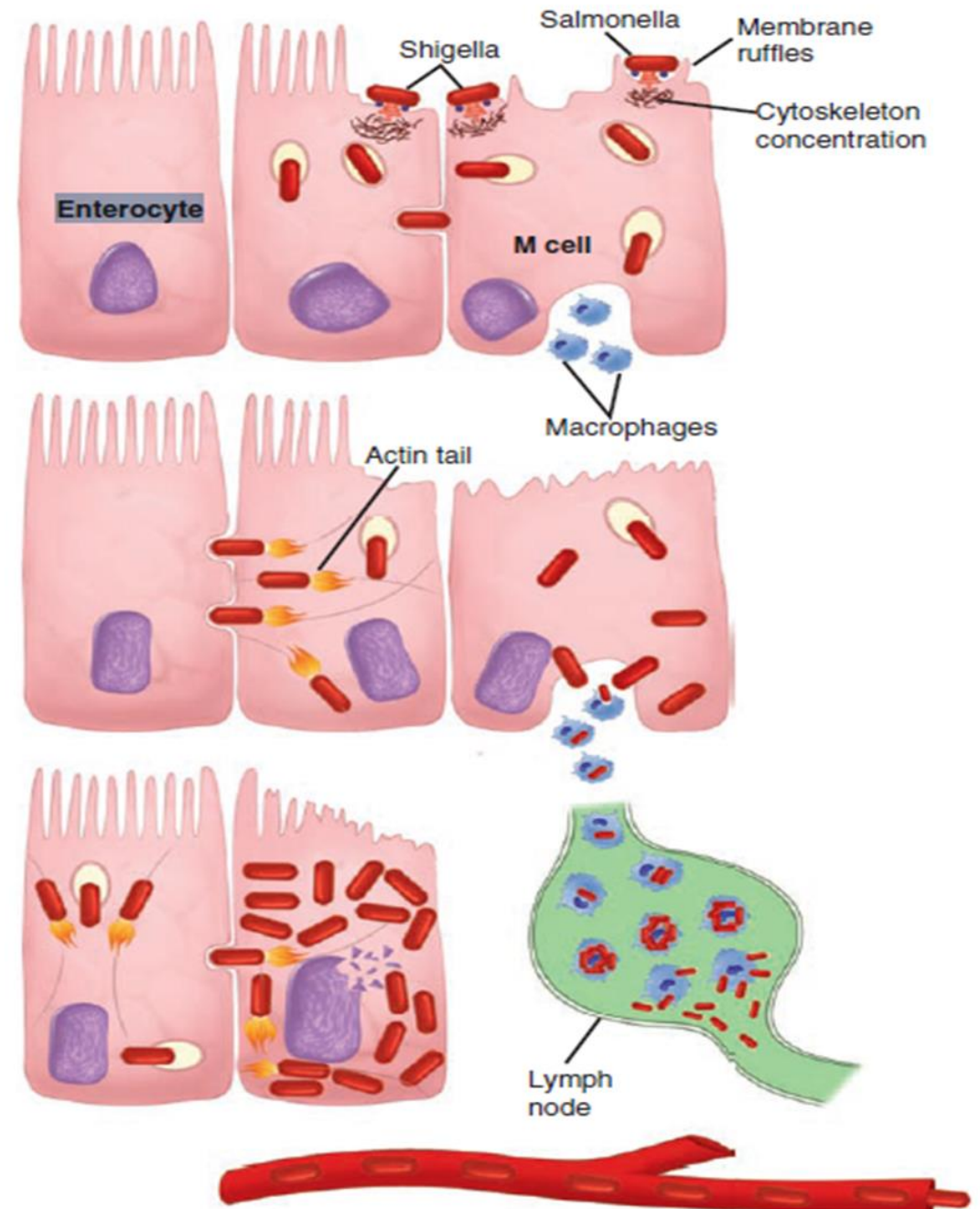
وجود ال Vi antigen هو الي بخليها اخطر ويتسبب infection اكثر

- Salmonella gastroenteritis is predominantly a disease of **industrialized societies**
بالمناطق الي فيها صناعات غذائية
- improper food handling, which allows the transmission from the animal reservoir to humans.
ما في تعقيم وطبخ جيد للاكل فبتنتقل هاي البكتيريا
- The infecting dose of S enterica infection varies widely with the serotype (200-10⁶ bacteria), but is generally considerably **higher than Shigella**.

ال infection dose متوسطة بين ال E.coli and shigella، صعب تنتقل من شخص لشخص بدها وسط ناقل

بتكثر بالصيف لأنه ارتفاع درجة الحرارة بساعدها ع النمو وبتكثر بالمطاعم
موجودة عند الحيوانات ك normal flora

- Ingestedpass the stomach acid
....the intestinal mucous layer ... reach
the small bowel.
- the initial contact there is with M
cells, enterocytes, or
both.....mediated by pili.
- injection (type III) secretion systems,
the creation of membrane “ruffles”
dramatically alters the normal host
cell architecture within minutes



شخص اكل شغلة فيها salmonella نمت وتكاثرت بتمر بال stomach بتوصل لل small intestine الي فيها M cell
 ال salmonella عندها pili بتعمل التصاق بال M cell ، هاي ال salmonella فيها اشبي اسمه injection type
 secretion system بتطلع toxin ع الخلية مباشرة ، بتغير الستركشر بالخلية وبصير شكلها زي الوردة
 (بالسلايد تحت) بسميه ruffles بعدها بصير لل salmonella حويصلة وبتدخل لجوا وبتعمل infection

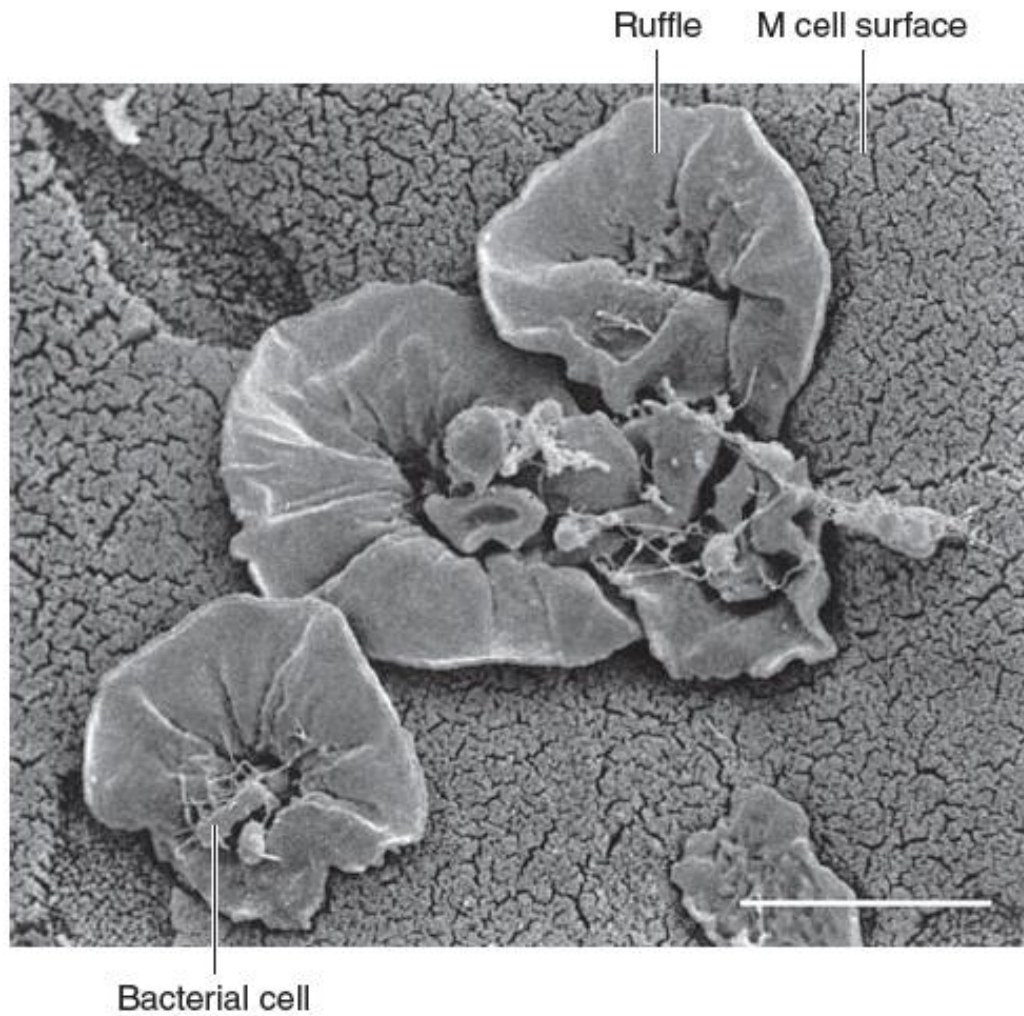
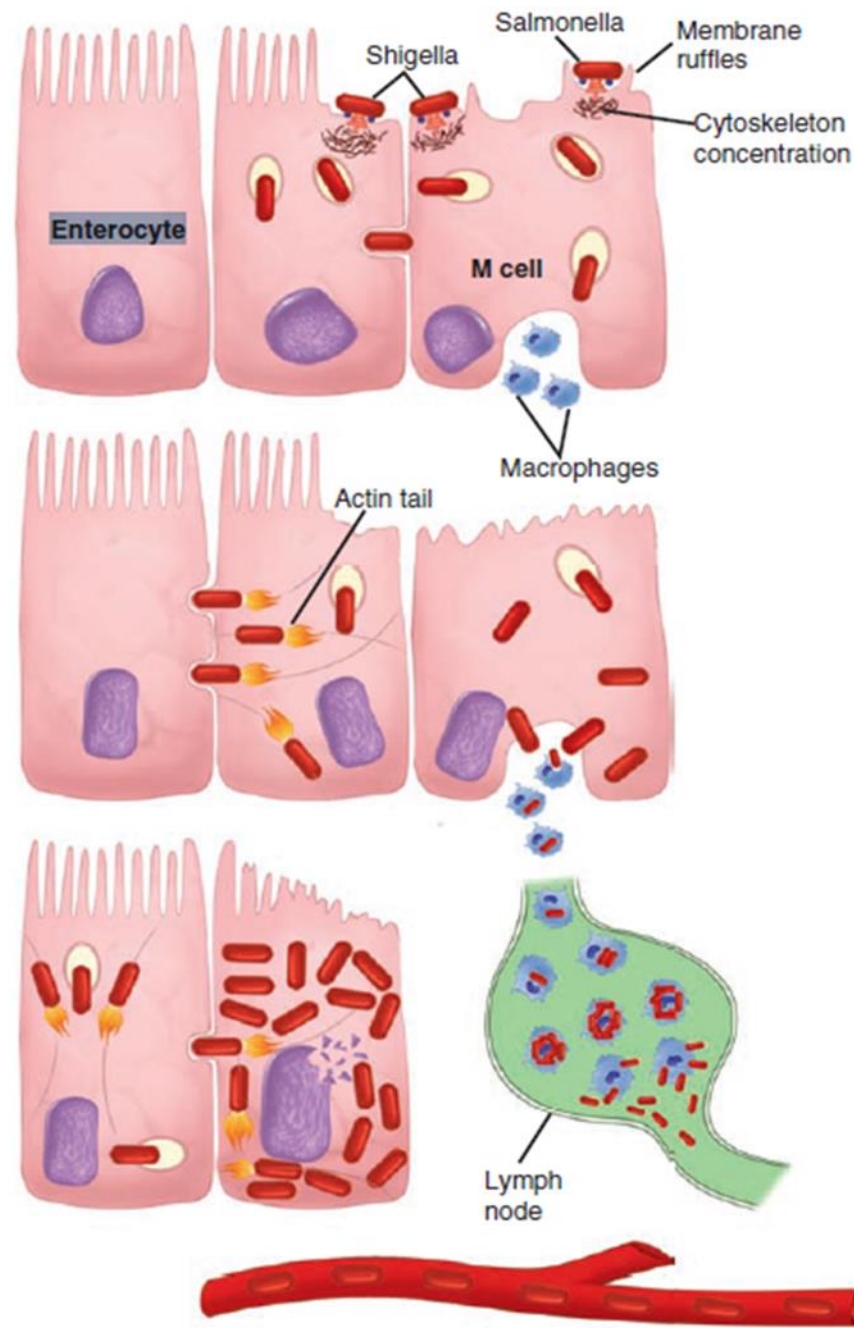


FIGURE 33-9. Salmonella ruffles. *S* serotype Typhimurium is shown inducing wave-like ruffles on an intestinal M cell. This leads to induction of uptake of the bacteria by the M cell. (Reproduced with permission from Nester EW: *Microbiology: A Human Perspective*, 6th edition, 2009.)

plasma membrane sites of filamentous actin cytoskeletal rearrangement normally induced by physiologic molecules such as growth factors.

- The ruffles..... engulf the organism in an endocytotic vacuole
.....transcytose from the apical surface to the basolateral membrane.
- Once in the cell, *S enterica* multiplies in a vacuole and continues on through the cell and entering the lamina propria.



watery diarrhea و Abdominal pain و Fever ⇒ اغلب الـ
Non Typhi
بوقفوا لهون
↓
ممکن يكون معها شويته blood and mucus
لأنها بتتعل شويته damage cell

- induce a profound inflammatory response
- phagocytosed by neutrophils and macrophages.
- Persistence in the lamina propria = Non Typhi بتوقف لهون وما بتدخل
اکثر
- remains localized to the mucosa and submucosa with most S enterica strains,

بتدخل البكتيريا هاجب لل Macrophag ونريد عددها
وبتستخدم ال Macrophag (حويصلات) للانتقال

Enteric (Typhoid) Fever

(Salmoella Typhi)

← كونا عندها P (Pili)

بيطبل جرحها ز المناعة يقدر عليها

موجودة فقط بالانسان



- Typhoid fever is a strictly human disease.
- **Chronic carriers** of serotype Typhi are the primary reservoir.
- Some patients become chronic carriers for years (hence the infamous “Typhoid Mary” Mallon), usually because of chronic infection of the biliary tract when gallstones are present..
- Mary Mallon, known commonly as Typhoid Mary, was an Irish-born American cook believed to have infected between 51 and 122 people with typhoid fever



- All cases can and should be traced back to their human source.
 - fecal-oral route.

اقل fever من ال Typhi بس بشكل عام الهم نفس الخصائص.

- Three serotypes called Paratyphi (A, B, C) have features similar to S Typhi, including the production of an enteric fever syndrome.

Pathogenesis

- The invasion and killing of intestinal M cells and macrophages are presumed to follow the same pattern as that of *S. enterica*.
- Two differences are the Vi surface polysaccharide and the extended multiplication of Typhi in macrophages.

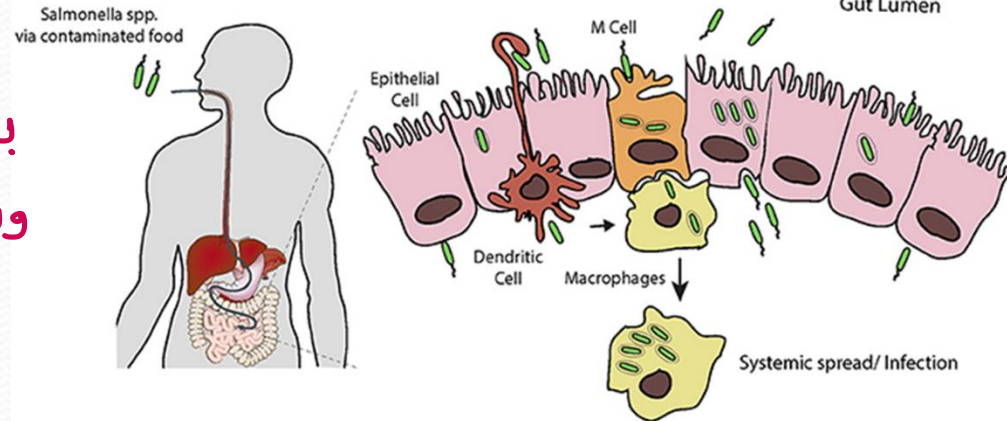
دخلة البكتيريا ومشيت لوصولت لعدد Small intestine

عملت زي ما علية ال Non Typhi (ruffls)

و صارت جوا الخلية وكونه عندها ال Antigen Vi

بخليةها تقدر يقبل جوا ال Macrophages

وبزاد عددها وبتنقل مع ال Macrophages



بزداد عددھا

- Vi+ phenotype favors **intracellular multiplication**. Like other serotypes of Salmonella, Typhi remains within a membrane-bound vacuole, but unlike them, rather than killing the macrophage, it enters a stage of **extended replication**. *بتضلل عابثة جوا ال Macrophages وبنقل خلال ال lymphatic circulation*
- The primary difference between Typhi and the other serotypes is the **prolonged intracellular survival in macrophages**.
 - ability to inhibit the oxidative metabolic burst and continue to multiply.
 - **lymphatic circulation** *ممکن توصل للدم وتعمل bacterimia وممكن توصل الى ال lymph node بتوصل بالبوابت ال*
 - **mesenteric nodes**, **spleen**, **liver**, and **bone marrow**, all elements of the reticuloendothelial system (RES).
 - 1
 - 2
 - 3

بعض اوقات بiliary System

- This sometimes results in metastatic infection of other organs including the **urinary tract and the biliary tree**.
- The latter causes reinfection of the bowel. This cycle beginning and ending in the small intestine takes approximately 2 weeks to complete.

Manifestation

- The clinical patterns of salmonellosis can be divided into
 - Gastroenteritis,
 - Bacteremia with and without focal extraintestinal infection, اذا وصلت للدّم
 - Enteric fever (**multiorgan**)
 - The asymptomatic carrier state.

Enteric Fever (Typhoid)

← راحتے علی ال lymphatic system وبعدها علی الدم وای مکان بتوصلہ بتعمل infection

- Enteric fever is a **multiorgan**
- prolonged fever, ^{بقل ال heart rate} sustained bacteremia, and profound involvement of the mesenteric lymph nodes, liver, and spleen.

- The mean incubation period is **13 days**,
- the first sign of disease is fever associated with a headache.
The fever rises in a stepwise fashion over the next 72 hours.
- A relatively **slow pulse** is characteristic and out of character with the elevated temperature. ↑ Temperature ↓ heart rate
- A faint rash (rose spots) appears during the first few days on the abdomen and chest.



- Many patients are **constipated**, although perhaps one-third of patients have a mild **diarrhea**.
يكون بالبداية **constipated** بعدها **diarrhea**
- chronic infection of the bloodstream is serious, and the effects of endotoxin can lead to **myocarditis**, **encephalopathy**, or **intravascular coagulation**. Moreover, the persistent bacteremia can lead to infection at other sites.

- 
- Of particular importance is the **biliary tree**, with reinfection of the intestinal tract and diarrhea late in the disease.

بصير ثقوب

- the most important complication of typhoid fever is **hemorrhage** from perforations through the wall of the terminal ileum or proximal colon at the site of necrotic Peyer patches. These occur in patients whose disease has been progressing for 2 weeks or more.



Diagnosis

Stool sample

blood sample ممكن نؤخذ Typhoid Fever واذا شاكين

- **Culture of Salmonella** from the blood or feces is the primary diagnostic method. media culture = Macconkey Agar (gram negative تستخدم لـ)

- Early blood is far more likely to give a positive culture result than culture from any other site. كيف بدي اميز بين E -coli و Salmonella و Shigella ← عن طريق الـ lactase fermentation

- **Failure to ferment lactose** and the production of **hydrogen sulfides** H_2S from sulfur-containing amino acids are characteristic features used to identify suspect colonies on the selective isolation media. لونها اسود

- the use of antimicrobial agents in S enterica gastroenteritis is restricted to those with severe infections or underlying risk factors, particularly children.



- Antimicrobial therapy is clearly indicated in typhoid fever.



Shigella

Shigella

- Closely related to E coli. *Enteroinvasive E. coli* *Enterohemorrhagic E. coli* بتشابه ال E-coli وخصوصاً
- lack flagella and thus H antigens.
- All Shigella species are nonmotile.
- The genus is divided into four species,

- Shigella dysenteriae (serogroup A), *The most common*
- *Shigella flexneri* (serogroup B),
- *Shigella boydii* (serogroup C),
- *Shigella sonnei* (serogroup D).

يعني بتعمل damage cell

- Shigella is the prototype invasive bacterial pathogen.
- Shigella dysenteriae type A₁, the Shiga bacillus, is the most potent producer of Stx.
- Other Shigella species produce various molecular forms and quantities of Stx.

inflammation

Abdominal pain

diarrhea with blood and mucus

(small amount)

Shiga toxin

خطورتها لما يوصل للدم

- تكسر ب RBCs

- تكسر بالمفكاح

تذكير →

enzymatic Activity

binding بين الـ A هي الي فيها enzymatic Activity

الـ B يتعمل binding بين الـ A هي الي فيها enzymatic Activity

بتتكون من A و B unit

هون بتعمل block to protein synthesis

5-Shiga toxin (Stx) Shigella infection سميت بسبخ الح العالم الي اكتشف

- The B unit directs binding to a specific glycolipid receptor (Gb₃)
- internalized in an endocytotic vacuole.
- enzymatically modifies the ribosome site (28S-RNA of 60S subunit) where amino acyl tRNA binds.
- This alteration blocks protein synthesis, leading to cell death.

الـ B يتعمل binding مع reseptore (Gb₃) ويخل لما يصير حوا الـ cell الـ A بتعمل block to protein synthesis

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Epidemiology

- Shigellosis is a strictly **human disease** with **no animal reservoirs**.
- Worldwide, it is consistently one of the most common causes of infectious diarrhea
- Shigella disease remains important in both developed and developing countries.

- The fecal–oral route.
 - person-to-person contact is **so effective** . يعني اذا مصافت شخص مصاب فيها تنتقل اللى .
 - the infecting dose is extremely low, as few as 10 organisms in some studies.
- The secondary attack rates among family members are as high as 40%.
- Shigella is also spread by food or water contaminated by humans.

Pathogenesis

(Large intestine)

بتوصيل للامعاء
colon and intestine

- **Acid-resistant** and survives passage through the stomach to reach the intestine **invasion** and destruction of the human **colonic mucosa**.
- This triggers an intense acute **inflammatory** response with mucosal **ulceration** and **abscess** formation.
- Pili → Attachment

- The diarrhea created by this process is almost purely inflammatory, consisting of small-volume stools containing **WBCs**, **RBCs**, bacteria, and little else. This is classic dysentery.
- The disease remains localized to the colonic mucosa. Spread to the bloodstream is uncommon.

- Some Shigella also produce Stx, which is not essential for disease, but does contribute to the severity of the illness.
 - The original and most potent producer of Stx, S dysenteriae type 1,
 - significant mortality rate in previously healthy individuals.
 - systemic effects of the toxin and HUS.

Manifestation

- acute inflammatory colitis and bloody diarrhea, which in the most characteristic state presents as a **dysentery syndrome**—a clinical triad consisting of

1. **cramps**
2. painful straining to pass stools (**tenesmus**),
3. a frequent, **small-volume, bloody, mucoid fecal discharge**.

Low amount of stool / بتكون مصاحبة لـ WBC and RBC
Abdominal Pain / عبارة عن
↓
كونه بتروح ع القولون ويتعمل infection و inflammation

To diagnosis

بنوخذ عينة من ال stool بنستخدم ال macconkey agar بنفرق بينها وبين salmonella عن طريق ال motility انه ال shigella no motile وانها بتطلع غاز

Treatment

بتروح لحالها عادة

- Usually self-limiting, the beneficial effect of treatment is in shortening the duration of the illness and the period of excretion of organisms.

مش حفظ

- Ciprofloxacin, ceftriaxone, and azithromycin have been used depending on susceptibility testing.
- Antispasmodic agents may aggravate the condition and are contraindicated in shigellosis and other invasive diarrheas.



عندما يتملك

الإعجاب

عندما يتملك

تذكر لي إذا بدأت

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