

Salmonella, Shigella, Yersinia

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Salmonella, Shigella

- Salmonella, Shigella causes of bacterial diarrhea
- Although they are classified in the same family and infect the same organ system
 - These organism differ
 - Microbiologic
 - Epidemiologic
 - Pathologic properties

Salmonella

- Salmonella species infect many animals and human body.
- Also extraintestinal invade of bacteria result with enteric fever
 - most severe of which is typhoid fever

Salmonella

- Biochemical characteristics :
- Do not ferment lactose or sucrose
- Produce acid and gas from glucose
 - *S. typhi* is gas negative
- Produce H₂S

Salmonella



Salmonella

- The **taxonomy** of the Salmonella very complicated
- Classification makes depends on the lipopolysaccharid O (somatic) and protein H (flagella) antigen

Salmonella

- Kauffmann-White scheme (>2200)
- Ewing and coworkers (1972-1983) (NSC)
 - *S. choleraesuis*
 - *S. Enteritidis*
 - *S. Typhi*
 - All other species/serotypes called serotypes of *S. enteritidis*

Salmonella

- Le minor scheme (Bergey et al. 1984):
Salmonella enterica
 - Salmonella subgroup 1: enterica
 - Salmonella subgroup 2: salamae
 - Salmonella subgroup 3a: arizonae
 - Salmonella subgroup 3b: diarizonae
 - Salmonella subgroup 4: houtenae
 - Salmonella subgroup 5: bongori

Salmonella

- CDC Salmonella classification 1989
 - Salmonella subgroup 1: typhi, cholerae, paratyphi A, gallinarum, pullorum
 - Salmonella subgroup 2: salamae
 - Salmonella subgroup 3a: arizonae
 - Salmonella subgroup 3b: diarizonae
 - Salmonella subgroup 4: houtenae
 - Salmonella subgroup 5: bongori
 - Salmonella subgroup 6: S. choleraesuis subsp indica

Salmonella

- ANTIGENIC STRUCTURE
- Somatic antigen (O antigen): All have O antigen
 - LPS
 - Designated by numbers
- Flagellar antigen (H antigen)
 - Protein
 - Diphasic
 - Phase 1 (Specific): a,b,c,d
 - Phase 2 (Non-specific): 1,2,3,4
- Capsular antigen
 - Vi antigen found in some salmonella types(S. Typhi, S. Paratyphi B/C, S.dublin)

Salmonella

- Pathogenesis
- Depend on the organism
 - The number and type of organisms
 - Virulence of the organisms
- Depend on the host
 - Local factors
 - Systemic factors

Salmonella

- The number of organisms :
 - 10^6 - 10^9 Salmonella
- Stomach
 - gastric acid, low Ph
- Small intestine
 - Asymptomatic (salmonella found in stool)
 - Symptomatic (Enterocolitis, enteric fever, bacteremia)

Salmonella

- Type of organisms
- Low virulence: *S. enteritidis* serotype Anatum
 - Asymptomatic intestinal infection
- High virulence: *S. choleraesuis*
 - Bacteremia
- Intermediate virulence: *S. enteritidis*
serotype Typhimurium
 - Sometimes invades bloodstream
 - Asymptomatic infection
 - Colitis

Salmonella

- Virulence of organisms
- Surface antigens:
 - O antigen , H antigen
 - Vi antigen: *S. typhi*
- Invasiveness: Penetrate epithelial and subepithelial lining of small bowel
- Endotoxin: (LPS) Bacteriemic stage of enteric fever
- Enterotoxin: Similar to LT and ST of *E. coli*
- Cytotoxin:
 - Cellular invasion
 - Cellular destruction

Salmonella

- Local Host factors
- Reduction of acidity in stomach or faster gastric emptying time
 - Using antacid drugs
 - Subtotal gastrectomy
 - Gastroenterostomy
 - Vagotomy
 - Achlorhydri
- Alteration of intestinal flora
 - Antibiotics using

Salmonella

- Systemic Host factors
- Age: <5 years, especially <1 years
- Impaired cellular and humoral immunity
 - HIV patients
 - Malnutrition
 - Malignancy: Leukemia, lymphoma
 - Corticosteroid or immunosuppressive therapy
 - Cirrhosis
- Sickle cell anemia
- Malaria
- Bartonellosis

Salmonella

- Clinical manifestations and pathogenesis
- Salmonella infections may present as any of four distinct clinical entities;
 - Gastroenteritis
 - Typhoid fever
 - Septicemia and Focal infections
 - Chronic carrier state

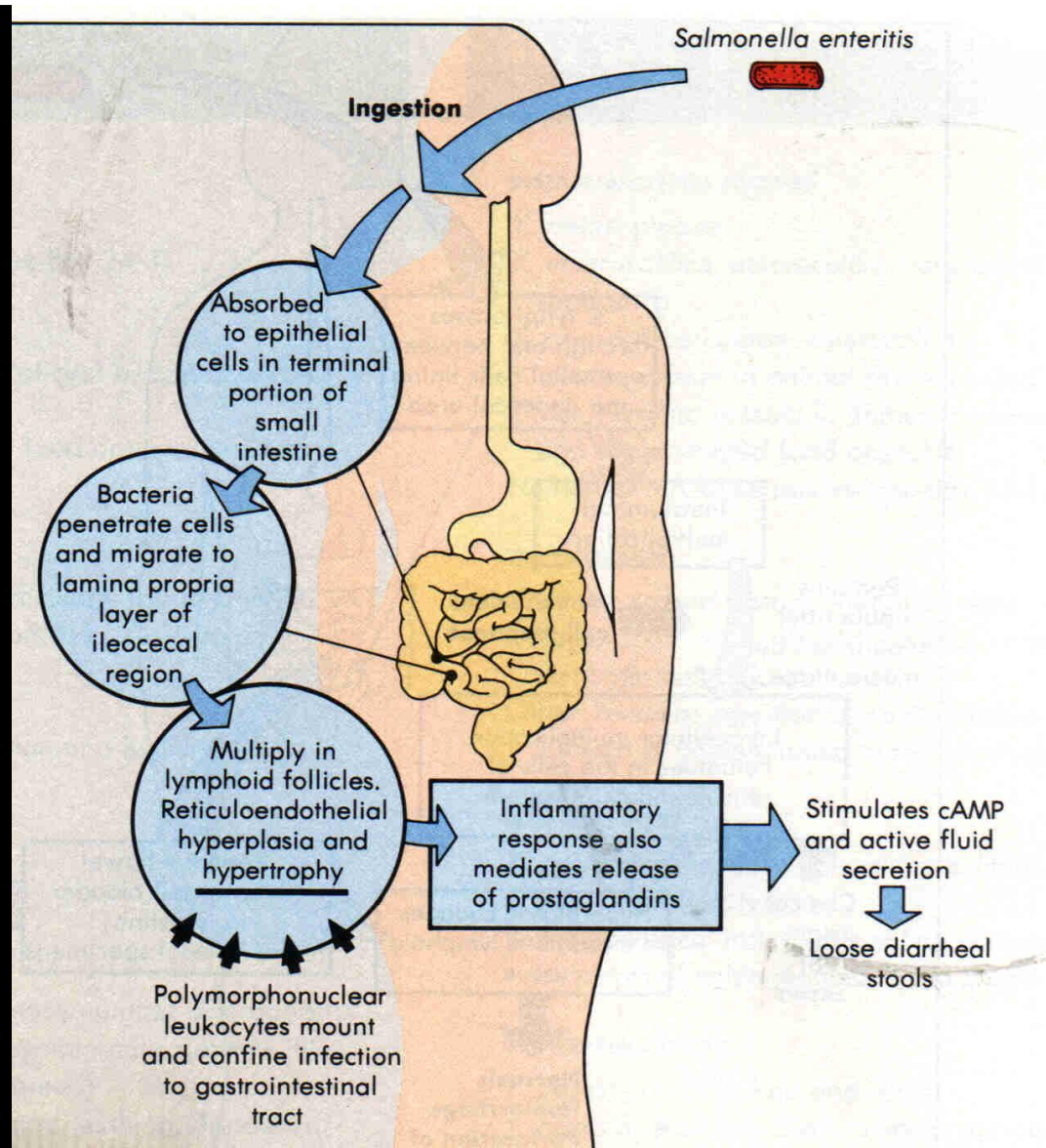
Salmonella

- Gastroenteritis:
 - 18-24 hours after ingestion of the organisms
 - Self-limited
 - Characterized nausea, vomiting, diarrhea, fever, abdominal pain
 - In most cases does not seek medical attention
 - Attributes the symptoms to “stomach flu”
 - Symptomatic treatment

Salmonella

- Gastroenteritis Etiology: Salmonella Typhimurium
 - A heat labile enterotoxin: Adenylate cyclase activated, cAMP increased, Na⁺ and H₂O absorption inhibited, resulting in outpouring of isotonic liquid and secretory diarrhea
 - Shiga-like toxin

Salmonella



Salmonella

- Gastroenteritis:
- Laboratory diagnosis:
 - Specimens : Stool, vomitus, contaminated food or drink
 - Direct examination: PMNL (stool)
 - Culture
- Treatment: Supportive and symptomatic therapy

Salmonella

- Typhoid fever (enteric fever) :
 - Salmonella typhi most common
 - S. Paratyphi a/b can also cause but symptoms milder and mortality is lower
 - Incubation period 8-14 days
 - When number of organisms ingested
 - FIRST WEEK patient symptoms lethargy, fever, malaise, general pains, constipations rather than diarrhea.
 - During this time organisms penetrating intestinal wall and infecting regional lymphatic system.
 - Some organisms also invade the bloodstream and infect other parts of RES.

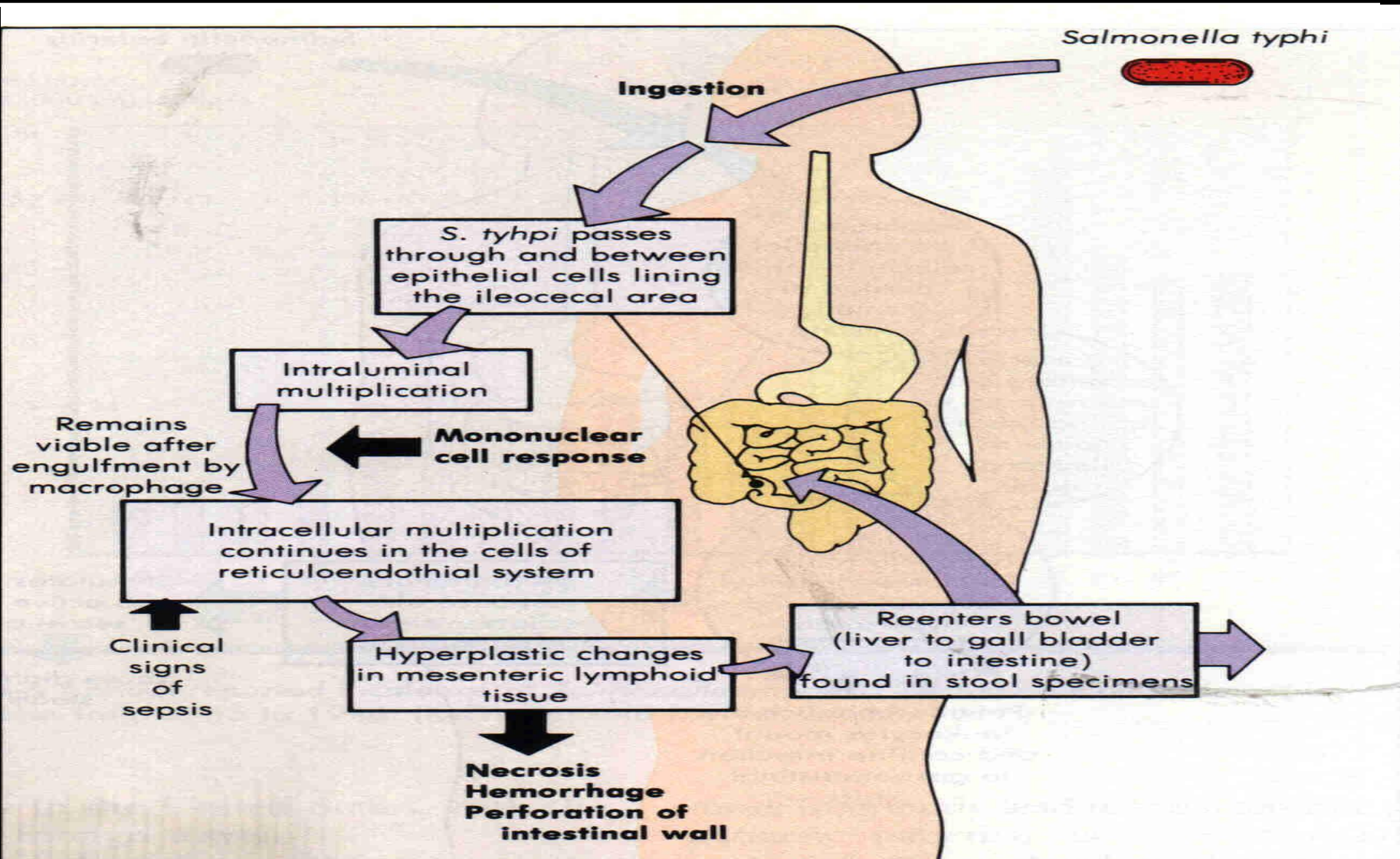
Salmonella

- Typhoid fever (enteric fever)
 - SECOND WEEK organisms reenter the bloodstream, causing a prolonged bacteremia
 - Patient severely ill, high fever, delirious, abdomen tenderness and typical rose-colored spots, diarrhea, necrosis of Peyer patches.

Salmonella

- Typhoid fever (enteric fever)
- THIRD WEEK complications are important
 - Intestinal perforation
 - Severe bleeding
 - Thromboflebitis
 - Cholecystitis
 - Pneumonia
 - Abscess formation

Salmonella



Salmonella

- Enteric fever :
- Laboratory diagnosis:
 - Specimen:
 - Blood, bone marrow (1st-2nd week)
 - Stool, urine (3rd-4th week)
 - Blood count: WBC /leukopenia
 - Peripheral blood smear : lack of eosinofilia
 - Culture
 - Serologic tests: Grubel-Widal test (agglutination)
- Treatment: Antibiotics

Salmonella

- Septicemia :
- Etiology: *S. choleraesuis*
- Signs and symptoms: Fever, chills, anorexia, weight loss
- Laboratory diagnosis:
 - Specimen: Blood, rarely stool
 - Culture
- Treatment: Antibiotics (Should be treated 10-14 days)

Salmonella

- Focal infections :
- Meningitis: Infants, neonates
- Pleuropulmonary disease: Lung abscesses
- Endocarditis: Natural or prosthetic valves
- Arteritis
- Osteomyelitis, arthritis
- Splenic abscess
- Hepatic abscess
- Soft tissue abscess

Salmonella

- Focal infections :
- Signs and symptoms: Fever, increase in PMNL
- Laboratory diagnosis:
 - Specimen: Blood, sputum, CSF...
 - Blood count: WBC
 - Culture
- Treatment:
 - Surgical drainage
 - Antibiotics ($\geq 4-6$ weeks in osteomyelitis and endocarditis)

Salmonella

Chronic carrier state :

Persons who continue to excrete organisms for more than a year after disease or after initial discovery of organisms in stool

- Incidence: Increases with age
 - 1-3% after typhoid fever
 - <1% after non-typhoidal infections
 - Higher incidence after biliary tract disease

Salmonella

- Chronic carrier state :
- Laboratory Diagnosis:
 - Specimen: Stool
 - Culture
 - Serology: Presence of antibody against Vi antigen
- Treatment:
 - Ampicillin + probenecid
 - Cholecystectomy in carriers with gall-bladder disease

Salmonella

- Epidemiology:
- Transmission :
 - Ingestion of contaminated food or drink
 - Direct fecal-oral spread (in children)
 - Administration of organisms by i.v. platelet transfusion
 - Inadequately sterilized fiberoptic instruments e.g. endoscopy
 - Airborne
 - Conjunctiva

Salmonella

- Reservoir:
 - Human carriers
 - Fowl (chickens, turkeys, ducks)
 - Mammals (cattle, sheep, swine, horses, dogs, cats, rodents)
 - Reptiles
 - Snakes
 - Lizards
 - Turtles
 - Insects

Shigella

- Shigella species are the major causes of bacillary dysentery
 - Severe abdominal cramps
 - Frequent, painful passage with low volume
 - Stool containing blood and mucus

Shigella

- Taxonomy /1986 by Ewing
 - *Shigella dysenteriae* (group A) 12 serotype
 - *Shigella flexneri* (group B) 6 serotype
 - *Shigella boydii* (group C) 18 serotype
 - *Shigella sonnei* (group D) 1 serotype

Shigella

- Group A-B-C are similar biochemical characteristics that way new classification made by CDC
- Taxonomy /1989 by CDC
 - Shigella A-B-C serogroups
 - Shigella sonnei

Shigella

- Shigella properties
 - Gram negative bacilli
 - 2-3 micrometer
 - Encapsulated
 - Nonmotile, there are no H antigens (flagella)
 - IMVIC; ++-- (Group A,B,C)
 - IMVIC; -+-- (group D)

Shigella

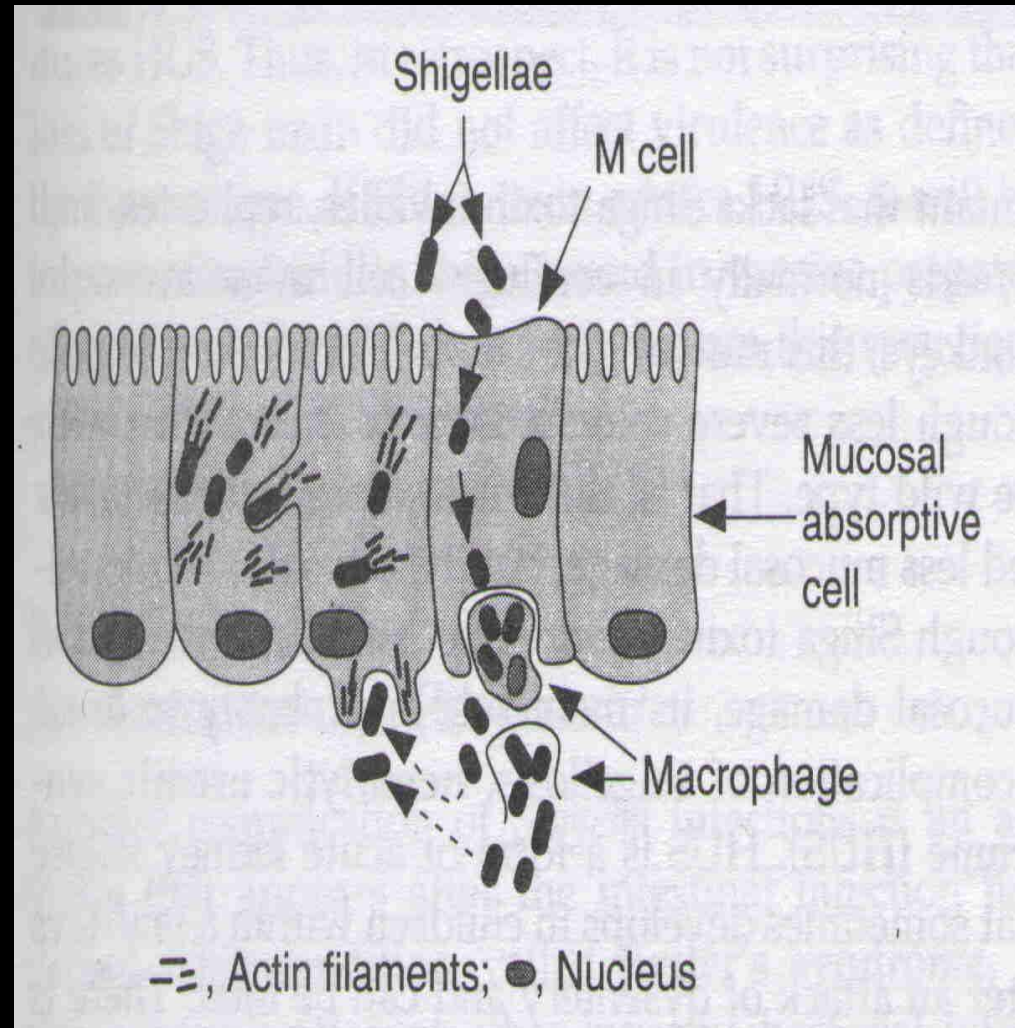
- Shigella properties:
- Non-lactose fermenting colonies
- Do not ferment lactose
- Non-motile
- Do not produce H₂S
- Do not produce gas from glucose
- (distinguish them from salmonella)
- S.flexneri 6,S.boydi 13/14,S.dysenteriea 3 can produce gas

Shigella

- Pathogenesis :
- 200 organisms can produce infection
- Small intestine (10^7 - 10^9 cells) multiplication
- Colon
(Attachment, penetration, multiplication)
leads to inflammation, epithelial cell death,
ulceration, impaired colonic fluid
absorption and discharge of blood and pus

Shigella

- Virulence:
- Invasiveness:
 - Penetrate epithelial cells of the colon
 - Virulent strains multiply intracellularly



Shigella

- Virulence :
- Toxin (Shiga toxin): Neurotoxic, cytotoxic, enterotoxigenic (S.flexneri type1)
 - S. dysenteriae, S. flexneri, S. sonnei
- O antigen: Responsible for the attachment of the bacteria to specific host cell receptors

Shigella

- Epidemiology ;
- Worldwide distribution
- 1-4 years old is common
- Transmission human to human with fecal-oral route
- Carriers can spread organisms
 - Fingers
 - Food
 - Feces
 - Carrier state usually lasts for 1 to 4 weeks

Shigella

- Epidemiology :
- Shigella can be isolated from
 - Clothing
 - Toilet
 - Contaminated water
 - Wash your hands for your health

Shigella

- Epidemiology :
- Outbreaks occur in closed groups
 - Families
 - Mental hospitals
 - Day care nurseries
 - Prisons
 - Cruise ships

Shigella

- Clinical findings;
- Incubation period: 36-72 hours
- Signs and symptoms:
 - Fever, abdominal tenderness and cramps, fecal urgency, tenesmus, watery diarrhea, vomiting
 - Diarrhea can be bloody and mucoid (dysentery), low volume but frequent
 - Peripheral neuritis, convulsion (*S. dysenteriae*)

Shigella

- Diagnosis ;
- Direct examination of stool:
 - Neutrophils and erythrocytes
- Culture: EMB, SS, Selenite F
 - Lactose negative colonies
- Biochemical reactions
- Serological typing

Shigella

- Treatment :
- Supportive therapy for dehydration
- Antimicrobial therapy
 - Ampicillin
 - Trimethoprim/sulfamethoxazole
 - Tetracycline

 - Quinolone (recent years)

Yersinia

- Members of enterobactericea
- Yersinia pestis (plague)
- Yersinia enterocolitica (entereokolitis)
- Y. pseudotuberculosis (mesenterik lenfadenitis)

Yersinia

YERSINIA PESTIS



SECTOR ALPHA

Yersinia



Yersinia

- Coccobacilli, 1.5-2 mikrometer
- Gram (-) bacilli
- Bipolar staining
- Non-motile at 37 C, motile at 25 C (except Y. Pestis)
- Non-spore forming, facultative anaerob
- Capsulated , mucoid layer
- Blood agar, MC agar, Deoksiolat agar, CIN agar (Cefsulotin-Irgason-Novobiosin)
- Optimal growth 25-37 C

Yersinia



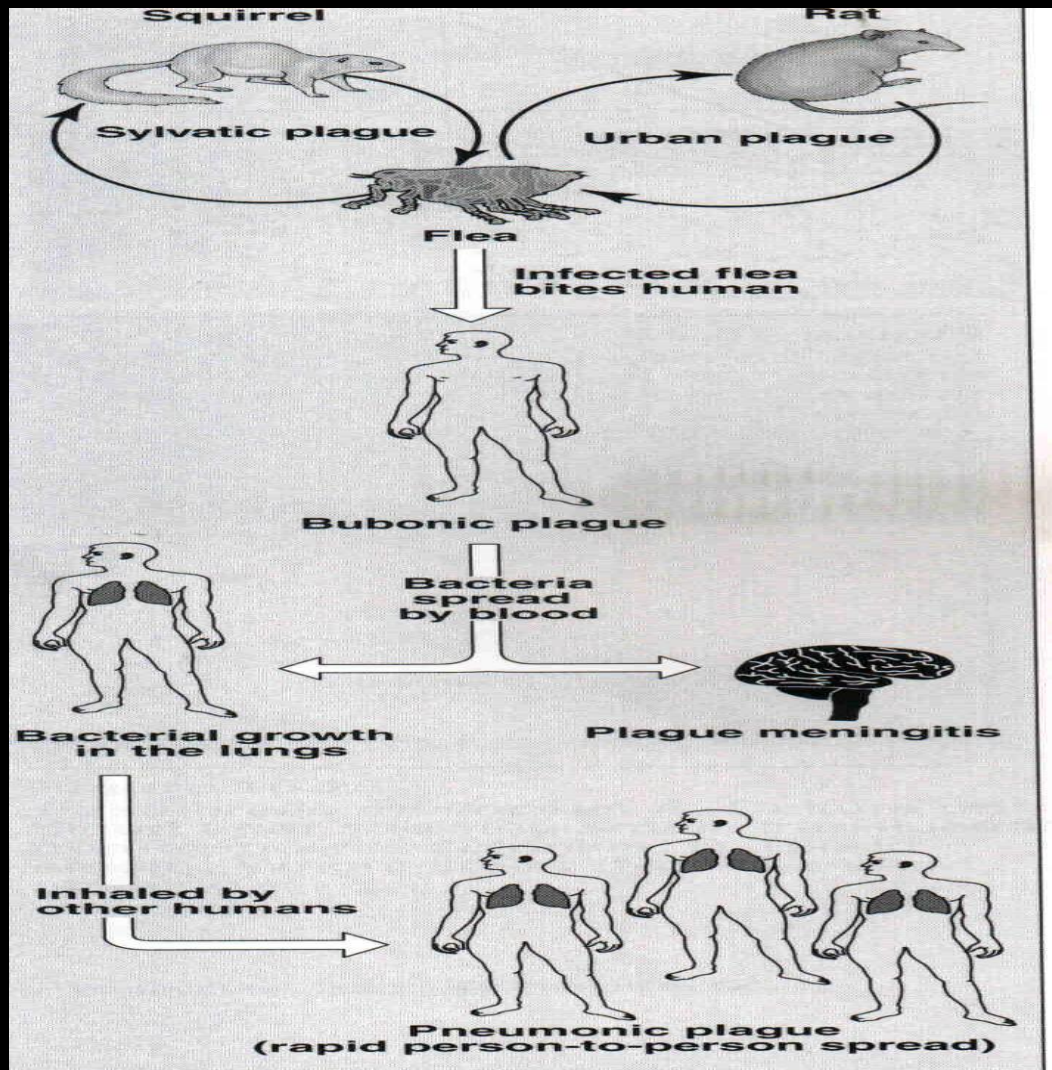
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Yersinia

- *Yersinia pestis* ;
- Zoonosis
- Rezervuar: Domestic rodents (rats, mice, rabbits, pets (dog,cat))
- Inhalation: (respiratory plague pneumoniae)
human to human
- Skin:Flea (direct contact with infected person)
- GIS: ingestion of contaminated food, water
- 25-30 C humidity and hot

Yersinia



Yersinia

- Yersinia pestis :
- Clinical manifestations
- Bubonic plague:
- Pneumonic plague:
- Septicemic form

Yersinia

- Yersinia pestis :
- Bubonic plague:
 - % 75 of cases
 - 2-10 day incubation period
 - Pustule on skin,organism travels to lymph nodes through lymph channels and painfull bubo (groin, axilla)
 - Fever, chills, fatigue,somnolans,ajitation,delirium,
 - Tachicardia, facial edema, hemorajic lesions, hipotansion, hepatosplenomegly
 - Died if not well treated ,(black dead)

Yersinia



Yersinia



Yersinia

- *Yersinia pestis* :
- Pneumonic plague:
- 2-3 days incubation period
 - Fever, malaise, cough, dyspnea, cyanosis, mucoid and bloody sputum
- Transmission by inhalation or hematogenous way from bubonic plague
- X-Ray : Bronchopneumonic infiltrations
- Mortality rate is very high

Yersinia

- *Yersinia pestis* :
- Septicemic form:
- Source from Bubonic plague or pneumonic plague
- Multi organ failure
- Mortality rate very high

Yersinia

- Yersinia pestis diagnosis:
- Leukocytosis, neutrophil
- Lack of eozinofilia in blood smear
- Bipolar staining
- Positive hemoculture
- Culture media incubated 37 C and 25 C
- Hemaglutinasyon, ELISA, DFA helpful for identification

Yersinia

- Yersinia pestis treatment :
- Streptomycin 30mg/kg/day IM. 10 days
- Tetracycline 2-4 gr/day 4x1 10 days
- Ciprofloxacin 500 mg 2x1 10 days
- Doksisiklin 100 mg
 - First day 2x200 mg over dose
 - Other days 2x100 mg/day , 10 day

Yersinia

- *Yersinia pseudotuberculosis*, *enterocolitica*
- General characteristics:
 - Motile at 22°C with peritrichious flagella
 - Urease positive
- Epidemiology:
 - Wild and domestic mammals, birds, invertebrates
 - Humans (Northern Europe, Scandinavia, France, Germany)

Yersinia

- *Yersinia pseudotuberculosis*, *enterocolitica*
- Transmission:
 - Ingestion of contaminated food products (fecal-oral spread)
 - Infusion of contaminated blood products

Yersinia

Yersinia pseudotuberculosis, enterocolitica

Clinical manifestations

(Prodromal period: 1 day)

- Enterocolitis (diarrhoea, fever and abdominal pain)
terminal ileum---- enlarges the lymph nodes, mimic appendicitis
- Septicemia
- Arthritis
- Intraabdominal abscess
- Hepatitis
- Osteomyelitis

Yersinia

Yersinia pseudotuberculosis, enterocolitica:

Laboratory diagnosis

Specimen: Mezenteric lymph nodes, feces, blood, effusions from serous cavities, organ specimens

CULTURE : Blood agar

Specific medium(CIN agar)

Don't forget



Diarrhoea and sickness
Norovirus
stop the spread

Wash your hands
Stay at home if you are ill
Symptoms may begin suddenly and include:
Nausea | vomiting | tiredness | fever |
diarrhoea | muscle ache |
stomach cramps | headaches
Stay away from hospital until you are
symptom-free for at least 48 hours

NHS Direct is available free 24 hours a day to help you decide which service would be best for you

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