Salmonella Overview

Salmonella spp. is a gram negative bacilli. It is a non-lactose fermenter and produces white colonies on MacConkey agar. It is oxidase negative and produces hydrogen sulfide. Its flagella provides motility to facilitate invasion of Peyer's patches within the ileum. Some of the clinical conditions it causes include gastroenteritis, osteomyelitis in sickle cell patients, and reactive arthritis. Antibiotics are not routinely recommended for treatment of mild disease.



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Pathophysiology

Gram-Negative Rod
Graham-cracker Negative-devil with Rod
These bacilli bacteria lack the thick peptidoglycan layer of gram positives that normally retain crystal violet dye; when dyed with a Gram counterstain their thin peptidoglycan layer appears pink on microscopy.

Oxidase Negative
Wilting Ox-daisy
An oxidase test is used to determine if bacteria produce certain cytochrome c oxidases to help differentiate similar bacteria.

Non Lactose Fermenter
Nun with Milk Fern
MacConkey agar is a lactose-containing selective medium which inhibits the growth of gram positive bacteria and promotes gram negative bacteria growth. Salmonella cannot ferment the lactose in the medium, so the colonies that grow appear white.

White on Macconkey Agar
White Monkey Petri-dish
When non-lactose fermenting bacteria grow on MacConkey agar, they must use peptones as their energy source; when processing peptones, they form basic ammonia, raising the pH of the agar, and forming white colonies.

H2S Producing
H-shaped Sulfur-match with H2S-fart
These bacteria can oxidize organic compounds for energy while reducing sulfate (SO4-) to hydrogen sulfide (H2S) as a paired redox reaction. This characteristic helps distinguish Salmonella from Shigella, which is non-hydrogen sulfide producing.

Flagella
Flag
Flagella are long tails made of proteins like flagellin with an internal proton pump motor that facilitates bacterial motility.

Invades GI Tract
GI Tract
Salmonella bacteria spread via the fecal-oral route; once ingested they colonize the small intestine and invade the body through Peyer’s patches located in the terminal ileum. A large amount of Salmonella bacteria must be ingested because stomach acid normally destroys the bacteria.

Peyer's Patches
Pirate Patch
Peyer’s patches are aggregates of lymphoid tissue in the terminal ileum of the small intestine. Peyer’s patches are lined by M cells, which are specialized epithelial cells that endocytose antigens and then present them to other immune cells like T-cell lymphocytes.

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Considerations

Osteomyelitis in Sickle Cell Patients

Skeleton-on-fire with Sickle

Due to its encapsulated trait that requires a functional spleen to properly destroy, Salmonella infection is classically associated with osteomyelitis in patients with sickle cell anemia who often have nonfunctional spleens.

Reactive Arthritis

Reaction King-Arthur

Some patients develop reactive arthritis after a Salmonella infection. Reactive arthritis consists of the classic triad: uveitis, urethritis, and arthritis. Its clinical manifestations can be remembered by the saying “Can’t see, can’t pee, can’t climb a tree.”

Antibiotics Prolong Fecal Excretion

ABX-guy causing Prolonged Feces

The use of antibiotics to treat salmonellosis is debated, as antibiotic treatment has been associated with a prolonged carrier state and symptoms. Supportive care is recommended and most infections are self-limiting without antimicrobial use.

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