Yersinia Pestis (Black Plague)

Yersinia pestis is a gram negative coccobacillus that can cause pneumonia, septicemia, and the bubonic plague. This organism is widely believed to be responsible for the death of approximately one third of the European population between 1347 and 1353. Today, the reservoir for this organism is several species of rodents including the black-tailed prairie dog, commonly found in the Southwest region, and transmitted via the flea vector. There have been several incidents of human transmission in people exposed to these animals. Pathogenesis includes several factors that allow the bacteria to suppress and avoid the normal immune response including an anti-phagocytic polysaccharide capsule and anti-phagocytic F1 and VW antigens that inhibit macrophages. Yersinia pestis is known to proliferate inside lymph nodes, causing lymphadenopathy and buboes, most frequently involving the inguinal lymph nodes. The term buboes gave rise to the name the bubonic plague. The organism could also get into the lungs causing a severe pneumonia with symptoms of chest pain, dyspnea, and hemoptysis. If the organism gets into the bloodstream, it can cause septicemic plague with complications of disseminated intravascular coagulation (DIC). Widespread DIC causes destruction of the blood vessels and results in black cutaneous hemorrhagic lesions on the skin. Many historians believe these lesions gave rise to the name “Black Death.”



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Characteristics

Gram-Negative
Graham-cracker Negative-devil
This organism stains Gram-negative due to the relatively thin peptidoglycan layer in the cell wall.

Bacilli
Rod
These bacteria are small and can present as coccobacilli but are actually classified as rods.

Oxidase-Negative
Ox-daisy Negative
The oxidase test is used to determine if a bacterium produces certain cytochrome c-oxidases in order to use oxygen for energy production. Yersinia pestis is oxidase-negative meaning it does not use the electron transport chain to make energy.

Non-lactose Fermenting
Nun Milk-carton Ferns
Yersinia pestis is characterized as a non-lactose fermenter because it cannot utilize lactose sugars in a culture. The bacteria grows as white or colorless colonies on MacConkey agar, a medium used to test for lactose fermenting capability.

Prairie Dogs
Prairie Dog
Today, the reservoir for this organism is several species of rodents including the black-tailed prairie dog.

Fleas
Fleas
Yersinia Pestis-infected fleas residing on species of rodents and other mammals and can transmit the bacterium through their saliva/emesis into the host.

Polysaccharide Capsule
Polly-sack Capsule
Yersinia pestis has a polysaccharide capsule as a virulence factor, aiding in evasion of phagocytosis by macrophages and others.

Vw Antigen
VW-car with Ant-Gem
Vw antigen is an antiphagocytic virulence mechanism that aids in the pathogenesis of Yersinia pestis.

F1 Antigen
(F1) Formula 1 Car Ant-Gem
F1 antigen is an antiphagocytic virulence mechanism that aids in the pathogenesis of Yersinia pestis.

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Inhibits Macrophages

Inhibiting-chains on Mac-men

This bacterium has several antiphagocytic mechanisms, including a polysaccharide capsule, F1 antigen, and Vw antigen that inhibit phagocytosis by macrophages.

Southwest Region

Southwest scenery and cacti

The arid climate and environment of the American Southwest harbor the rodents typical of carrying fleas infected by Yersinia Pestis.

Signs and Symptoms

Lymphadenopathy

Lymph-lime-add (+)

Yersinia pestis is known to proliferate inside lymph nodes, causing lymphadenopathy.

Pneumonia

Nude-Mona

Yersinia pestis can lead to the development of pneumonia when infecting the respiratory tract/pulmonary system.

Black Cutaneous Hemorrhagic Lesions

Black Skin Lesions

In the case of septicemia (e.g. a blood infection), a further complication includes disseminated intravascular coagulation (DIC). Widespread DIC causes destruction of the blood vessels and result in developing black cutaneous hemorrhagic lesions of the skin. Many historians believe these lesions gave rise to the name “Black Death.”

Buboes

Blue-bow

Yersinia pestis is known to proliferate inside lymph nodes, resulting in the development of lymphadenopathy and buboes. A common region of developing lymphadenopathy and buboes is the inguinal region. The term buboes gave rise to the name the "bubonic" plague.

Diagnosis

Bipolar Giemsa Staining

Pole with Gems

When tested with giemsa staining,Yersinia pestis has a bipolar staining pattern. This is due to the ends of the bacterium taking up more stain than the center of the organism.

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