Neisseria Meningitidis

Neisseria meningitidis, often called meningococcus, is a gram negative diplococci that can cause meningitis and life threatening sepsis. Neisseria are fastidious organisms that require nutrient supplementation to grow in laboratory cultures. Specifically, they grow on chocolate agar and can be isolated on Thayer-Martin media, sometimes called VPN agar. Thayer-Martin media is an agar plate containing vancomycin, polymyxin, and nystatin along with other nutrients that facilitate the growth of Neisseria species while inhibiting the growth of other organisms. Characteristically, Neisseria are oxidase positive and maltose-fermenting. N. meningitidis can be distinguished from N. gonorrhoeae because N. meningitidis ferments glucose in addition to maltose while N. gonorrhoeae only ferments glucose. These organisms exists as normal flora is the nasopharynx of 5-15% of adults and is spread through the exchange of saliva or other respiratory secretions. Virulence mechanisms include lipooligosaccharide (LOS) within the cell membrane of N. meningitidis, which acts as an endotoxin and can cause shock and destruction of red blood cells. Other virulence mechanisms include a polysaccharide capsule that is anti-phagocytic and aids in the evasion of the host immune response. Symptoms can rapidly progress from fatigue to meningitis with fever, headache, and neck stiffness. If toxic levels of the endotoxin reach the bloodstream, meningococcal sepsis can develop causing blood vessels to rupture and vital organs to rapidly shut down. Complications include Waterhouse-Friderichsen syndrome with adrenal insufficiency, organ failure, low blood pressure, disseminated intravascular coagulation with widespread petechial rash, and death. Treatment includes ceftriaxone and rifampin prophylaxis.

PLAY PICMONIC

Characteristics

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

Diplococci
Double-cockeyes
Diplococci are round-shaped bacteria that typically occur as two joined cells.

Chocolate Agar
Chocolate-bar
Neisseria are fastidious organisms that require nutrient supplementation to grow in laboratory cultures. Specifically, they grow on chocolate agar which is an enriched growth medium containing red blood cells that have been lysed, providing growth factors like NAD and hemin. The agar is named for the chocolate color of the medium and does not actually contain chocolate.

Thayer-Martin Media
Thief driving aston Martin car
Thayer-Martin media is an agar plate containing vancomycin, polymyxin, nystatin and specific nutrients that facilitate the growth of Neisseria species while inhibiting the growth of other organisms.

VPN
VPN on License Plate
Thayer-Martin media is also called VPN agar, standing for vancomycin, polymyxin, and nystatin. These antibiotics along with specific nutrients facilitate the growth of Neisseria species while inhibiting the growth of other organisms.

Oxidase-Positive
Ox-daisy
An oxidase test is used to determine if bacteria produce certain cytochrome c oxidases to help differentiate bacteria. Neisseria are oxidase-positive bacteria.

Maltose Fermentation
Malt-liquor Fern
Neisseria meningitidis can be distinguished from Neisseria gonorrhoeae because N. meningitidis ferments both glucose and maltose while N. gonorrhoeae only ferments glucose.

Glucose Fermentation
Glue-bottle Fern
Neisseria can be distinguished from other gram-negative bacteria because they are glucose-fermenting. Both Neisseria gonorrhoeae and Neisseria meningitidis are glucose fermenting.

Endotoxin
Unpopped-toxic-balloon
Virulence mechanisms include lipooligosaccharide (LOS), also known as endotoxin, within the cell membrane of N. meningitidis, which instigates a systemic inflammatory response with shock and destruction of red blood cells.

Lipooligosaccharide (LOS) in Membrane
Lips-sack Capsule in Membrane
LOS is a smaller form of the more common bacterial virulence factor lipopolysaccharide (LPS). LOS is found within the bacterial cell membrane and its function is to maintain membrane stability. LOS is highly antigenic and when released into the bloodstream it causes a systemic inflammatory response.

Polysaccharide Capsule
Polly-sack Capsule
N. meningitidis virulence mechanisms include a polysaccharide capsule that is anti-phagocytic and aids in the evasion of the host immune response.

IgA Protease
(IgA) Apple-goblin with Propeller-ace
An IgA protease is an enzyme that cleaves certain amino acid sequences of proteins including immunoglobulin A. Neisseria meningitidis releases IgA proteases which destroy IgA, leading to increased pathogenicity. Other IgA protease producers include Streptococcus pneumonia and Haemophilus influenzae type B.

Disease

Waterhouse Friderichsen Syndrome
Water-house
This syndrome is defined as adrenal failure due to massive hemorrhage into the adrenal glands caused by overwhelming meningococcemia and disseminated intravascular coagulation.

Adrenal Insufficiency
Damaged Adrenal gland
Sepsis caused by Neisseria meningitidis can lead to massive hemorrhage into one or both adrenal glands, causing rapidly developing adrenocortical insufficiency with loss of cortisol and aldosterone production. This is also called Waterhouse-Friderichsen syndrome.

Petechial Rash
Tiki-mask with a Rash
Petechia are small red or purple spots on the body caused by broken capillary blood vessels. A petechial rash is present in approximately 75% of meningococcal sepsis caused by widespread destruction of blood vessels.

Treatments

Ceftriaxone
Chef-tri-axes
Ceftriaxone is a third generation cephalosporine used in the treatment of N. meningitidis.

Rifampin Prophylaxis
Ref-amp Purple-axes
Rifampin is an antibiotic commonly used to treat tuberculosis. People who have had close contact with an individual who has meningococcal infection can be offered rifampin to eradicate the bacteria and prevent disease.