Clostridium perfringens

Clostridium perfringens is a species of the clostridia genus, a group of gram-positive, spore-forming bacteria. C. perfringens is a non motile bacillus that prefers to grow in an anaerobic environment and is capable of forming spores when in an unfavorable environment. It is known for its quick onset of disease, as it can multiply in less than a day and causes disease in skin and soft tissue, or the GI tract. This bacteria produces hydrogen and carbon dioxide as a byproduct of its replication, which results in the characteristic gas formation in tissues. C. perfringens is also known for its ability to produce multiple exotoxins. The most clinically important toxin is alpha toxin, which contains a phospholipase that is capable of destroying phospholipids. In particular, the phospholipid lecithin, which is in cell walls of RBCs, WBCs, and muscle cells, can be damaged. This produces the characteristic hemolysis and myonecrosis. The myonecrosis with accompanying gas formation is known as gas gangrene. C. perfringens produces multiple other pathogenic toxins, including heat-labile enterotoxin which causes clostridial food poisoning manifested by abdominal pain and diarrhea. The typical scenario involves meat that is kept warm for long periods of time, allowing spores to germinate and produce bacteria in a vegetative state that produce the enterotoxin. Clostridial food poisoning is rarely fatal, but gas gangrene can be rapidly lethal and lead to shock unless treated. Placement of the patient in a hyperbaric oxygen chamber can increase the oxygen content of tissues, and slow the rate of growth of bacteria. Debridement of dead tissue is essential. Antibiotics may also be useful.

PLAY PICMONIC

Characteristics

Gram-Positive

Graham-cracker Positive-angel

This bacteria stains gram-positive, which means that it retains large amounts of the Gram stain due to its high peptidoglycan content in the cell wall.

Bacillus

Rod

C. perfringens is a blunt-ended rod-shaped bacteria.

Anaerobe

Ant-robe

This bacteria prefers to grow in an anaerobic environment.

Spore-Forming

Spores

This bacteria is capable of forming spores when in an unfavorable state. It can quickly germinate and produce bacteria in its vegetative state when in preferable conditions.

Alpha Toxin Lecithinase

Afro Lace-thin

This is the most clinically significant exotoxin produced by C. perfringens. The alpha-toxin contains phospholipase, which is a toxin capable of destroying phospholipids, in particular lecithin found in the cell membranes of RBCs, WBCs, and muscle cells.

Phospholipase

Phospholipid-bilayer

The alpha-toxin contains a phospholipase capable of destroying phospholipid present in the cell membrane.

Heat Labile Enterotoxin

Heat-lamp melted canister

C. perfringens produces a heat-labile enterotoxin that causes loss of cellular fluid and can lead to dehydration.

Signs and Symptoms

Myonecrosis

Muscle-necrosis-crow

This bacteria causes myonecrosis through its phospholipase activity in the alpha toxin, which can destroy the cell membrane of muscle cells.

Gas Gangrene

Gas from Gang-of-green girls

C. perfringens produces hydrogen and carbon dioxide during replication, which results in gas formation in tissues. The resulting hemolysis and necrosis from alpha-toxin activity creates gas gangrene.

Food Poisoning and Diarrhea

Food-with-toilet

C. perfringens causes clostridial food poisoning through its enterotoxin, resulting in abdominal pain and diarrhea.

Treatment

Hyperbaric O2 Chamber

Oxygen-mask

This can be a useful treatment for gas gangrene, as the hyperbaric oxygen chamber increases the oxygen content in tissues and slows or prevents bacterial growth since C. perfringens prefers an anaerobic environment.