

Botulinum Toxin

Source

- *Clostridium botulinum*, a large gram-positive, spore-forming, anaerobic bacillus

Characteristics

- Grows anaerobically on Blood Agar and egg yolk plates

Pathogenesis

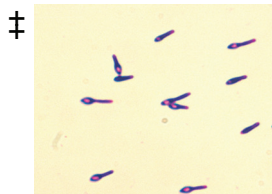
- Toxin enters nerve terminals and blocks release of acetylcholine, blocking neuro-transmission and resulting in muscle paralysis

Toxicity

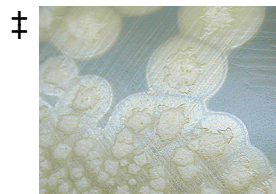
- Most lethal of all toxic natural substances
- Groups A, B, E (rarely F) cause illness in humans

Symptoms

- 24-36 h (up to 3 d for wound botulism)
- Progressive skeletal muscle weakness
- Symmetrical descending flaccid paralysis
- Can be confused with stroke, Guillain-Barre syndrome or myasthenia gravis



Gram stain



Lipase on egg yolk plates

Ricin Toxin

Source

- *Ricinus communis* seeds commonly called castor beans

Characteristics

- Toxin can be disseminated in the form of a liquid, powder or mist

Pathogenesis

- A-chain inactivates ribosomes, interrupting protein synthesis
- B-chain binds to carbohydrate receptors on the cell surface and allows toxin complex to enter cell

Toxicity

- Highly toxic by inhalation, ingestion and injection
- Less toxic by ingestion due to digestive activity and poor absorption
- Low dermal toxicity

Symptoms

- 18-24 h post exposure
- Fever, cough, chest tightness, dyspnea, cyanosis, gastroenteritis and necrosis; death in ~72 h



Ricin plant



Castor beans

Staph Enterotoxin B

Source

- *Staphylococcus aureus*, a gram-positive cocci

Characteristics

- Appears as grape-like clusters on Gram stain or as small off-white colonies on Blood Agar
- Toxin-producing and non-toxigenic strains of *S. aureus* will appear morphologically identical

Pathogenesis

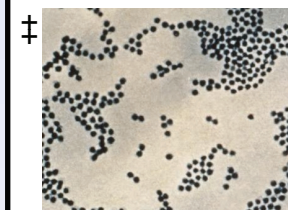
- *Staphylococcus* Enterotoxin B (SEB) is a superantigen. Toxin binds to human class II MHC molecules causing cytokine release and system-wide inflammation

Toxicity

- Toxic by inhalation or ingestion

Symptoms

- 4-10 h post-ingestion, 3-12 h post-inhalation
- Flu-like symptoms, fever, chills, headache, myalgia
- Nausea, vomiting, and diarrhea
- Nonproductive cough, chest pain, and dyspnea
- SEB can cause toxic shock syndrome



S. aureus Gram stain



Growth on Blood Agar

Botulinum Toxin

Transmission

- Aerosol release
- Food contamination
- Wound contamination
- Toxin not transmitted person to person

Clinical Specimens

- Serum: > 5 ml (10 ml preferred)
- Feces and gastric contents: >10 g
- Clinical swab specimens: Place swabs in an anaerobic transport media
- Autopsy: contents from small and large intestines
- Storage: Refrigerate, preferably in plastic containers

Environmental Samples

- All environmental samples: 100 ml or 2 g
- Food, drinks: Send entire item
- Storage: Refrigerate, preferably in plastic containers

Detection

- Mouse neutralization assay
- Enzyme-linked immunosorbent assays (ELISA)
- PCR

Ricin Toxin

Transmission

- Aerosol release
- Food contamination
- Injection
- Toxin not transmitted person to person

Clinical Specimens

- Serum to test for circulating antibody (>5ml) (Tested at CDC)
- Urine: >5 ml (10 ml preferred)
- Storage: Room temperature, in plastic containers (do not use glass)
- Note: Ricin toxin can be denatured by freezing or excess heat

Environmental Samples

- All environmental samples: 100 ml or 2 g
- Food, drinks: Send entire item
- Storage: Room temperature, in plastic containers (do not use glass)
- Note: Ricin toxin can be denatured by freezing or excess heat

Detection

- Time-resolved fluorescence (TRF)
- PCR
- Ricinine detection by chemical analysis

Staph Enterotoxin B

Transmission

- Aerosol release
- Food contamination
- Toxin not transmitted person to person

Clinical Specimens

- 5-10 ml blood in EDTA
- Urine: > 5 ml (10 ml preferred)
- Respiratory secretions, or nasal swabs
- Bacterial isolates
- Storage: Refrigerate

Environmental Samples

- All environmental samples: 100 ml or 2 g
- Food, drinks: Send entire item
- Storage: Refrigerate

Detection

- Time-resolved fluorescence (TRF)
- Gel diffusion assay
- Latex agglutination test
- PCR