

Medical Flashcards: Clostridium tetani & Clostridium botulinum

Clostridium tetani

Introduction

- Tetanus: A serious infectious disease of the nervous system causing severe muscle contractions.
- The name 'tetanus' comes from the Greek word meaning taut (to stretch).
- Also called lockjaw.

History of Tetanus

- Discovered in 1884 by Carle and Rattone.
- In 1889, Kitasato isolated the organism from a human victim, proving its ability to produce disease.
- Passive immunization was first used during World War I.
- Tetanus toxoid was first widely used during World War II.

Microbiology

- Slender, gram-positive, anaerobic rod.
- Forms terminal spores, giving a 'drumstick' appearance.
- Spores are resistant to heat, antiseptics, and chemicals like phenol.
- Commonly found in soil, manure, and animal intestines.

Communicability

- Tetanus is not contagious from person to person.
- It is the only vaccine-preventable disease that is infectious but not contagious.

Mode of Transmission

- Primarily transmitted through contaminated wounds.
- Can occur after surgery, burns, deep punctures, animal bites, otitis media, or dental infections.

Toxins

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- C. tetani produces two exotoxins:
 1. Tetanolysin: Function is not well known.
 2. Tetanospasmin: Neurotoxin responsible for tetanus symptoms, one of the most potent toxins known.
- Minimum human lethal dose is 2.5 ng/kg of body weight.

Pathogenesis

- C. tetani enters through wounds, germinates in anaerobic conditions, and releases toxins.
- Toxin spreads through blood and lymph, reaching the motor neurons.
- Blocks release of inhibitory neurotransmitters (GABA), leading to continuous muscle contractions.
- Cleaves synaptobrevin, preventing neurotransmitter release in inhibitory interneurons.

Clinical Features

- Incubation period: 3-21 days (average 8 days).
- Forms of tetanus:
 1. Local Tetanus: Persistent muscle contraction near the injury site.
 2. Cephalic Tetanus: Rare, affects cranial nerves, leading to facial muscle spasms.
 3. Generalized Tetanus: Most common, begins with lockjaw and spreads to other muscles.
 4. Neonatal Tetanus: Occurs in newborns due to infection of the umbilical stump.

Complications

- Laryngospasm (spasm of vocal cords), causing breathing difficulties.
- Bone fractures due to severe spasms.
- Autonomic dysfunction: Hypertension, abnormal heart rhythm.
- High fatality rate in older adults and unvaccinated individuals.

Diagnosis

- Based on clinical presentation:
 - Muscle spasms starting in the face and spreading.
 - History of injury.

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- High blood pressure and irregular heartbeat.
- Laboratory tests are rarely used.

Treatment

- Goals: Eliminate bacteria, neutralize toxins, provide supportive care.
- Antibiotics: Metronidazole, Penicillin G.
- Antitoxin: Tetanus immune globulin (TIG).
- Wound care: Cleaning and debridement.
- Muscle relaxants: Diazepam for spasms.
- Ventilation support if respiratory muscles are affected.

Prevention

- Vaccination (DTaP for children, Td for adults).
- Proper wound care and hygiene.
- Immediate medical attention for contaminated wounds.

Case Study

- 4-year-old boy presented with lockjaw, dysphagia, and muscle spasms.
- History of toe injury.
- Diagnosed with generalized tetanus.
- Treated with anti-tetanus immunoglobulin, antibiotics, and mechanical ventilation.

Clostridium botulinum

Microbiology

- Gram-positive, rod-shaped, anaerobic, spore-forming bacterium.
- Found in soil, marine sediments, and contaminated food.

Toxins

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- Produces seven types of neurotoxins (A-G).
- Types A, B, E, and F affect humans.
- Most potent toxin known; even nanograms can cause disease.
- Blocks acetylcholine release, leading to flaccid paralysis.

Types of Botulism

- 1. Foodborne: Ingestion of contaminated food (home-canned foods, fermented fish, etc.).
- 2. Infant: Colonization of intestines in infants <1 year old, often linked to honey.
- 3. Wound: Infection of wounds leading to toxin production.
- 4. Adult Intestinal Toxemia: Rare, occurs in individuals with altered gut flora.

Symptoms

- Onset: 6 hours to 8 days after exposure.
- Early: Nausea, vomiting, dizziness.
- Late: Double vision, difficulty swallowing, muscle weakness.
- Severe cases: Respiratory failure due to paralysis.

Diagnosis

- Based on history (food intake, wounds) and symptoms.
- Laboratory confirmation via toxin detection in blood, stool, or food samples.

Treatment

- Botulinum antitoxin (A, B, E).
- Intensive care: Mechanical ventilation if necessary.
- Wound care: Surgical debridement.
- Supportive therapy: IV fluids, respiratory support.

Prevention

- Proper food preservation, heating, and hygiene.

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- Avoid giving honey to infants under 1 year.
- Immediate treatment of infected wounds.

Case Study

- 21-year-old woman developed blurry vision and difficulty swallowing after eating home-canned food.
- Diagnosed with botulism.
- Treated with antitoxin and mechanical ventilation.