

LIVESAY EXPEDITIONS & ADVENTURES

Tetanus

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Infectious Agent

- *Clostridium tetani*, the tetanus bacillus, is a spore-forming, anaerobic gram-positive bacterium.
- Clinical disease is caused by a neurotoxin produced by anaerobic tetanus bacilli growing in contaminated wounds.

Mode of Transmission

- Tetanus is a global health problem because *C. tetani* spores are ubiquitous in the environment.
- Lesions that are considered “tetanus prone” are wounds contaminated with dirt, feces, or saliva, deep wounds, burns, crush injuries, or those with necrotic tissue.
- Tetanus has also been associated with apparently clean superficial wounds, surgical procedures, insect bites, dental infections, chronic sores and infections, and intravenous drug use.
- A reservoir of tetanus bacteria exists in the intestines of horses and other animals, including humans, in which the organism is a harmless normal inhabitant. Soil or fomites contaminated with animal and human feces propagate transmission.
- Tetanus has no direct person-to-person transmission.

Occurrence

- In 2006, an estimated 290,000 people worldwide died of tetanus, most of them in Asia, Africa, and South America.
- The disease occurs almost exclusively in persons who are inadequately immunized.
- Worldwide, the disease is more common in agricultural regions and in areas where contact with animal excreta is more likely and immunization is inadequate.
- In developing countries, tetanus in neonates born to unvaccinated mothers (neonatal tetanus) is the most common form of the disease.
- In 10% of reported cases in the United States, no antecedent wound was identified.

Risk for Travelers

Tetanus can occur anywhere in the world in inadequately vaccinated persons.

Clinical Presentation

- Acute manifestations of tetanus are characterized by muscle rigidity and painful spasms, often starting in the muscles of the jaw and neck. Severe tetanus can lead to respiratory failure and death.
- The incubation period is usually 3–21 days (average 10 days), although it may range from 1 day to several months, depending on the character, extent, and location of the wound. Most cases

occur within 14 days. In general, shorter incubation periods are associated with more heavily contaminated wounds, more severe disease, and a worse prognosis.

Clinical Syndromes

Generalized Tetanus

- Generalized tetanus is the most common form, accounting for more than 80% of cases.
- Neonatal tetanus is generalized tetanus in neonates, usually due to umbilical stump infections.
- The average incubation period from injury to symptom onset is 7–8 days (range 3 days–3 weeks).
- The most common initial sign is trismus (spasm of the muscles of mastication or “lockjaw”). Trismus may be followed by painful spasms in other muscle groups in the neck, trunk, and extremities and by generalized, tonic, seizure-like activity or frank convulsions in severe cases.
- Generalized tetanus can be accompanied by autonomic nervous system abnormalities, as well as a variety of complications related to severe spasm and prolonged hospitalization.
- The clinical course of generalized tetanus is variable and depends on the degree of prior immunity, the amount of toxin present, and the age and general health of the patient.
- Even with modern intensive care, generalized tetanus is associated with mortality rates of 10%–20%.

Localized Tetanus

- Localized tetanus is an unusual form of the disease consisting of spasm of muscles in a confined area close to the site of the injury.
- Although localized tetanus often occurs in persons with partial immunity and is usually mild, progression to generalized tetanus can occur.

Cephalic Tetanus

- The rarest form, cephalic tetanus, is associated with lesions of the head or face and has been described in association with ear infections (i.e., otitis media).
- The incubation period is short, usually 1–2 days.
- Unlike generalized and localized tetanus, cephalic tetanus results in flaccid cranial nerve palsies rather than spasm. Trismus may also be present. Like localized tetanus, cephalic tetanus can progress to the generalized form.

Diagnosis

- The diagnosis is almost always made clinically.
- The disease is characterized by painful muscular contractions, primarily of the masseter and neck muscles, secondarily of trunk muscles.
- A common first sign suggestive of tetanus in older children and adults is abdominal rigidity, though rigidity is sometimes confined to the region of injury.
- Generalized spasms occur, frequently induced by sensory stimuli; typical features of the tetanic spasm are the position of opisthotonos and the facial expression known as “risus sardonicus.”
- History of an injury or apparent portal of entry may be lacking.

- The organism is rarely recovered from the site of infection, and usually there is no detectable antibody response.

Treatment

- Tetanus is a medical emergency requiring hospitalization, immediate treatment with human tetanus immune globulin (TIG) (or equine antitoxin if human immune globulin is not available), a tetanus toxoid booster, agents to control muscle spasm, and, if indicated, aggressive wound care and antibiotics.
 - Specific treatment: TIG administered intramuscularly in doses of 3000–6000 IU. If immunoglobulin is not available, tetanus antitoxin (equine origin) in a single large dose should be given intravenously, following testing for hypersensitivity.
- Metronidazole is the most appropriate antibiotic. It is associated with the shortest recovery time and lowest case-fatality rate. It should be given for 7–14 days in large doses; this also allows for a reduction in the amount of muscle relaxants and sedatives required.
- The wound should be debrided widely and excised if possible. Wide debridement of the umbilical stump in neonates is not indicated.
- Depending on the severity of disease, mechanical ventilation and agents to control autonomic nervous system instability may be required.
- An adequate airway should be maintained, and sedation should be used as indicated; muscle relaxant drugs, together with tracheostomy or nasotracheal intubation and mechanically assisted respiration, may be lifesaving.
- Active immunization should be initiated concurrently with treatment.

Preventive Measures for Travelers

- Travelers should ensure they have adequate immunity to tetanus.
 - Active immunity is induced by tetanus toxoid and persists for at least 10 years after full immunization; transient passive immunity follows injection of TIG or tetanus antitoxin (equine origin).
 - Infants of actively immunized mothers acquire passive immunity that protects them from neonatal tetanus.
 - Recovery from tetanus may not result in immunity; second attacks can occur, and primary immunization is indicated after recovery.
- Wounded travelers who received their most recent tetanus toxoid-containing vaccine more than 5 years previously or who have not received at least three doses of tetanus toxoid-containing vaccines may require a dose of tetanus toxoid-containing vaccine (Tdap, Td, or DTaP), depending on the nature of the wound.
- Human tetanus immune globulin (TIG) is indicated in travelers with tetanus-prone wounds who have an unknown or incomplete history of primary tetanus vaccination.

General Preventive Measures

- Universal active immunization with adsorbed tetanus toxoid, gives durable protection for at least 10 years; after the initial basic series has been completed, single booster doses elicit high levels of immunity.
- In children <7 years of age, the toxoid is generally administered together with diphtheria toxoid and pertussis vaccine as a triple (DTP or DTaP) antigen, or as a double (DT) antigen when

contraindications to pertussis vaccine exist.

- Td is used for children >7 years of age.
- For adolescents 11–12 years of age, a single dose of Tdap is recommended for routine booster, and for adolescents and adults 13–64 years of age, a single dose of Tdap is recommended to replace the next decennial Td booster or when indicated as part of wound prophylaxis.
- In countries with incomplete immunization programs for children, all pregnant women should receive two doses of tetanus toxoid in the first pregnancy, with an interval of at least 1 month, and with the second dose at least 2 weeks prior to childbirth.
- Vaccine-induced maternal immunity is important in preventing maternal and neonatal tetanus. Active protection should be maintained by administering booster doses of Td every 10 years, preferably before or between pregnancies.
- For children and adults who are severely immunocompromised or infected with HIV, tetanus toxoid is indicated in the same schedule and dose as for immunocompetent persons even though the immune response may be suboptimal.
- Minor local reactions following tetanus toxoid injections are relatively frequent; severe local and systemic reactions are infrequent but do occur, particularly after excessive numbers of prior doses have been given.

Prophylaxis in Wound Management (see Table 2-21)

- Tetanus prophylaxis in patients with wounds is based on careful assessment of whether the wound is clean or contaminated, the immunization status of the patient, proper use of tetanus toxoid and/or TIG, wound cleaning and, where required, surgical debridement and the proper use of antibiotics.
- Those who have been completely immunized and who sustain minor and uncontaminated wounds require a booster dose of toxoid only if more than 10 years have elapsed since the last dose was given. For major or contaminated wounds, a single booster injection of tetanus toxoid (preferably as Td or Tdap) should be administered promptly on the day of injury if the patient has not received tetanus toxoid within the preceding 5 years.
- Persons who have not completed a full primary series of tetanus toxoid require a dose of toxoid as soon as possible following the wound and may require passive immunization with human TIG if the wound is major or if it is contaminated with soil containing animal excreta. DTP/DTaP, DT, or Td, as determined by the age of the patient and previous immunization history, should be used at the time of the wound and ultimately to complete the primary series.
- Passive immunization with at least 250 IU of TIG intramuscularly (or 1,500 to 5,000 IU of antitoxin of animal origin, if globulin is not available), regardless of the patient's age, is indicated for patients with other than clean, minor wounds and a history of no, unknown, or fewer than three previous tetanus toxoid doses. When tetanus toxoid and TIG or antitoxin are given concurrently, separate syringes and separate sites must be used.

Table 2-21. Summary guide to tetanus prophylaxis in routine wound management¹

History of Tetanus Immunization (Doses)	Clean, Minor Wounds		All Other Wounds	
	Td ²	TIG	Td ²	TIG
Uncertain or <3 doses	Yes	No	Yes	Yes
3 or more doses	No ³	No	No ⁴	No

¹Important details in the text.

²For children <7 years old, DTaP or DTP (DT, if pertussis vaccine contraindicated) preferred to tetanus toxoid alone. For children ≥7 years of age, Td preferred to tetanus toxoid alone. For adolescents and adults to age 64, tetanus toxoid as Tdap is preferred, if the patient has not previously been vaccinated with Tdap.

³Yes, if more than 10 years since last dose.

⁴Yes, if more than 5 years since last dose. More frequent boosters are not needed and can accentuate side effects.

References

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