

Tetanus

Lockjaw

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Tetanus is infection of the nervous system with the potentially deadly bacteria *Clostridium tetani* (*C. tetani*).

Causes, incidence, and risk factors

[Spores](#) of the bacteria *C. tetani* live in the soil and are found around the world. In the spore form, *C. tetani* may remain inactive in the soil, but it can remain infectious for more than 40 years.

Infection begins when the spores enter the body through an injury or [wound](#). The spores release bacteria that spread and make a poison called tetanospasmin. This poison blocks nerve signals from the spinal cord to the muscles, causing severe muscle spasms. The spasms can be so powerful that they tear the muscles or cause [fractures](#) of the spine.

The time between infection and the first sign of symptoms is typically 7 to 21 days. Most cases of tetanus in the United States occur in those who have not been properly vaccinated against the disease.

Symptoms

Tetanus often begins with mild spasms in the jaw muscles (lockjaw). The spasms can also affect the chest, neck, back, and [abdominal muscles](#). Back muscle spasms often cause arching, called [opisthotonos](#).

Sometimes the spasms affect muscles that help with breathing, which can lead to breathing problems.

Prolonged muscular action causes sudden, powerful, and painful contractions of muscle groups. This is called tetany. These episodes can cause fractures and muscle tears.

Other symptoms include:

- [Drooling](#)
- Excessive sweating
- [Fever](#)
- [Hand or foot spasms](#)
- Irritability
- Swallowing difficulty
- Uncontrolled urination or defecation

Signs and tests

Your doctor will perform a physical exam and ask questions about your medical history. No specific lab test is available to determine the diagnosis of tetanus.

Other tests may be used to rule out [meningitis](#), [rabies](#), strychnine poisoning, and other diseases with similar symptoms.

Treatment

Treatment may include:

- Antibiotics, including penicillin, [clindamycin](#), [erythromycin](#), or metronidazole (metronidazole has been most successful)
- Bedrest with a nonstimulating environment (dim light, reduced noise, and stable temperature)
- Medicine to reverse the poison (tetanus immune globulin)
- Muscle relaxers such as [diazepam](#)
- Sedatives
- Surgery to clean the wound and remove the source of the poison (debridement)

Breathing support with oxygen, a breathing tube, and a breathing machine may be necessary.

Expectations (prognosis)

Without treatment, one out of four infected people die. The death rate for newborns with untreated tetanus is even higher. With proper treatment, less than 10% of infected patients die.

Wounds on the head or face seem to be more dangerous than those on other parts of the body. If the person survives the [acute](#) illness, recovery is generally complete. Uncorrected episodes of [hypoxia](#) (lack of oxygen) caused by muscle spasms in the throat may lead to irreversible brain damage.

Complications

- [Airway obstruction](#)
- [Respiratory arrest](#)
- [Heart failure](#)
- [Pneumonia](#)
- Fractures
- Brain damage due to lack of oxygen during spasms

Calling your health care provider

Call your health care provider if you have an [open wound](#), particularly if:

- You are injured outdoors.
- The wound has been in contact with soil.

- You have not received a tetanus booster (vaccine) within 5 years or you are not sure of your vaccination status.

Call for an appointment with your health care provider if you have never been immunized against tetanus as an adult or child, if your children have not been immunized, or if you are unsure of your tetanus immunization (vaccine) status.

Prevention

Tetanus is completely preventable by active tetanus immunization. Immunization is thought to provide protection for 10 years. Studies of soldiers suggest that good protection persists up to 12 years after the last immunization.

In the United States, immunizations begin in infancy with the [DTaP](#) series of shots. The DTaP vaccine is a "3-in-1" vaccine that protects against [diphtheria](#), [pertussis](#), and tetanus. It is a safer version of an older vaccine known as DTP, which is no longer used in the U.S.

[Td vaccine](#) or Tdap vaccine is used to maintain immunity in those age 11 and older. Tdap vaccine should be given once, prior to age 65, as a substitute for Td for those who have not had Tdap. Td boosters are recommended every 10 years starting at age 19.

Older teenagers and adults who have sustained injuries, especially puncture-type wounds, should receive booster immunization for tetanus if more than 10 years have passed since the last booster.

Thorough cleaning of all injuries and wounds and the removal of dead or severely injured tissue (debridement), when appropriate, may reduce the risk of developing tetanus. If you have been injured outside or in any way that makes contact with soil likely, contact your health care provider regarding the possible risk for tetanus.

Many people believe injuries caused by rusty nails are the most dangerous. This is true only if the nail is dirty as well as rusty, as is usually the case. It is the dirt on the nail, not the rust, that carries the risk for tetanus.

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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 potent neurotoxin produced by the vegetative state of the bacterium growing in contaminated wounds.

MODE OF TRANSMISSION

C. tetani spores are ubiquitous in the environment and can be introduced into the body through nonintact skin, usually via injuries from contaminated objects. Lesions that are considered “tetanus prone” are wounds contaminated with dirt, feces, or saliva; punctures; burns; crush injuries; or injuries with necrotic tissue. However, tetanus has also been associated with apparently clean superficial wounds, surgical procedures, insect bites, dental infections, compound fractures, chronic sores and infections, and intravenous drug use. In 10% of reported cases in the United States, no antecedent wound was identified. Tetanus is not transmitted from person to person.

EPIDEMIOLOGY

Tetanus occurs everywhere in the world, almost exclusively in people who are inadequately immunized. Travel does not increase risk of disease. In the United States, tetanus occurs rarely in people who have completed the primary series and received appropriate boosters. In 2006, an estimated 290,000 people worldwide died of tetanus, most of them in Asia, Africa, and South America.

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. Worldwide, the disease is more common in agricultural regions and in areas where contact with soil or 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.

There is no increased risk to travelers who are adequately vaccinated. With or without travel, inadequately vaccinated people are at risk when they are injured by a contaminated object, use injection drugs, or require surgery or dental care in unhygienic conditions. In addition, there may be an increased risk of neonatal tetanus for infants of inadequately vaccinated mothers who deliver outside the United States, if the birth occurs in an unhygienic environment.

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.

Generalized Tetanus

Generalized tetanus is the most common form, accounting for more than 80% of cases. Neonatal tetanus usually occurs because of umbilical stump infections. 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, seizurelike 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 death rates of 10%–20%.

Localized Tetanus

Localized tetanus is an unusual form of the disease consisting of muscle spasms in a confined area close to the site of the injury. Although localized tetanus often occurs in people 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 (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 made clinically, since tetanus is a clinical syndrome without confirmatory laboratory tests. 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, although 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 aggressive wound care and antibiotics as indicated. TIG is administered intramuscularly in doses of 3,000–6,000 IU. If immunoglobulin is not available, tetanus antitoxin (equine origin) in a single large dose should be given intravenously, after testing for hypersensitivity.

Metronidazole is the most appropriate antibiotic. It is associated with the shortest recovery time and lowest case-fatality ratio. It should be given for 7–14 days in large doses, which 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

Personal Protection Measures

Universal active immunization with adsorbed tetanus toxoid gives durable protection for ≥ 10 years; after the initial basic series has been completed, single booster doses elicit high levels of immunity. Travelers should ensure they have adequate immunity to tetanus provided by completion of the 3-dose tetanus toxoid primary series and a booster if it has been >10 years since the last dose. 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.

Prophylaxis in Wound Management

Tetanus prophylaxis in wounded patients is based on careful assessment of whether the wound is clean or contaminated, the immunization status of the patient, proper use of tetanus toxoid or TIG, wound cleaning, and where required, surgical debridement and the proper use of antibiotics. [Table 3-18](#) provides recommendations on provision of Td (tetanus and diphtheria toxoids vaccine) or TIG on the basis of the circumstances of the wound and

immunization status of the patient. However, it may be difficult to determine whether a clean, minor wound is tetanus prone. In those circumstances, providers should consider giving Td as a booster dose to people with ≥ 3 previous doses if it has been >5 years since the last dose.

Vaccine

Complete vaccination of children aged <7 years with 5 doses of acellular pertussis vaccine in combination with diphtheria and tetanus toxoids (DTaP) is recommended; an accelerated schedule of doses may be used to complete the DTaP series. When contraindications to pertussis vaccine exist, a double (DT) antigen vaccine can be used. Children aged 7–10 years who are not fully vaccinated against pertussis and for whom no contraindication to pertussis vaccine exists should receive a single dose of Tdap to provide protection against pertussis. If additional doses of tetanus and diphtheria toxoid-containing vaccines are needed, then children aged 7–10 years should be vaccinated according to catch-up guidance, with Tdap preferred as the first dose. Adolescents aged 11–18 years should receive a single dose of Tdap instead of Td for booster immunization against tetanus, diphtheria, and pertussis if they have completed the recommended childhood DTwP/DTaP vaccination series and they have not previously received Tdap. Tdap should also be used instead of Td as wound prophylaxis in adolescents who have not previously received Tdap.

Adults aged 19–64 years who have not previously received Tdap should receive a single dose of Tdap to replace a single dose of Td for booster immunization against tetanus, diphtheria, and pertussis regardless of interval since their last tetanus toxoid-containing vaccine (such as Td). Adults aged ≥ 65 years who have or who anticipate having close contact with an infant aged <12 months and who have not previously received Tdap should receive a single dose of Tdap to protect against pertussis and reduce the likelihood of transmission; all other adults aged ≥ 65 years who have not previously received Tdap may be given a single dose of Tdap instead of Td.

Adolescents and adults who have never been immunized against pertussis, tetanus, or diphtheria, who have incomplete immunization, or whose immunity is uncertain should follow the catch-up schedule established for Td/Tdap. Tdap can be substituted for any of the Td doses in the series. 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 people, even though the immune response may be suboptimal.

Table 3-18. Summary guide to tetanus prophylaxis in routine wound management

HISTORY OF TETANUS IMMUNIZATION (DOSES)	CLEAN, MINOR WOUNDS		ALL OTHER WOUNDS	
	Td ¹	TIG	Td ¹	TIG ²
Uncertain or <3 doses	Yes	No	Yes	Yes
≥ 3 doses	No, unless >10 years since last dose	No	No, unless >5 years since last dose ³	No

¹For children aged <7 years, DTaP (DT, if pertussis vaccine contraindicated) is preferred to tetanus toxoid alone. For children aged 7–10 years who are not fully vaccinated against pertussis and for whom no contraindication to pertussis vaccine exists, a single dose of Tdap should be given to provide protection against pertussis. If additional doses of tetanus and diphtheria toxoid-containing vaccines are needed, then children aged 7–10 years should be vaccinated according to catch-up guidance, with Tdap preferred as the first dose. For adolescents and adults aged 10–64 years, a single dose of Tdap should be provided in place of one Td booster if the patient has not previously been vaccinated with Tdap. Adults aged ≥65 years who have or who anticipate having close contact with an infant aged <12 months and who have not previously received Tdap should receive a single dose of Tdap to protect against pertussis and reduce the likelihood of transmission; all other adults ≥65 years who have not previously received Tdap may be given a single dose of Tdap instead of Td.

²Passive immunization with ≥250 IU of TIG intramuscularly (or 1,500–5,000 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 3 previous tetanus toxoid doses. When tetanus toxoid and TIG or antitoxin are given concurrently, separate syringes and separate sites must be used.

³More frequent boosters are not needed and can accentuate side effects.

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