Tetanus

Summary

Tetanus, or 'lockjaw', is caused by a neurotoxin produced by *Clostridium tetani*. Tetanus occurs worldwide, but is rare in the United States due to widespread vaccination. From 2009-2018, an average of 29 (range 18-37) cases were reported per year in the US, with a total of 19 deaths, all in adults aged 55 years or older. Almost all reported cases of tetanus are in persons who have never received a tetanus vaccine or were not up-to-date (i.e., no booster in the preceding 10 years). People with immune-compromising conditions or diabetes mellitus are at higher risk of illness. People who inject drugs, especially heroin, are also at higher risk, particularly if they are diluting the product with quinine, which may support the growth of *C. tetani*. Neonatal tetanus is a common cause of neonatal death in areas where mothers are not immune and where non-sterile umbilical cord-care practices are followed.

Agent

Clostridium tetani is a gram-positive, motile, spore-forming, obligate anaerobic bacillus. *C. tetani* spores are ubiquitous in the environment, and if deposited in anaerobic conditions, such as a wound, they may germinate and produce toxins. The bacterium is sensitive to heat and cannot survive in the presence of oxygen. However, the spores are extremely resistant to heat and common antiseptics.

C. tetani produces two exotoxins, called tetanolysin and tetanospasmin. Tetanospasmin, a neurotoxin, is one of the most potent toxins known. The toxin blocks inhibitory action on motor and autonomic neurons, causing the clinical signs of tetanus.

Transmission

Reservoir**:**

Soil and the intestines of horses and other animals, including humans (where it does not produce signs/symptoms). Manure-treated soil may contain large numbers of spores. The spores can also be found on skin surfaces and in contaminated heroin.

Mode of transmission:

- *C. tetani* usually enters the body through a wound. Wounds that are contaminated with dirt, feces, soil, or saliva (e.g., animal bites); deep or puncture wounds; or wounds with devitalized tissue (e.g., crush injuries, burns) are at greatest risk for infection.

Period of communicability:

- Not communicable from person to person.

Clinical Disease

Incubation period:

Most cases occur within 8-10 days of exposure, but can range from 1 to 21 days. (In general, the incubation period is longer the further the injury site is from the central nervous system; shorter incubation periods are associated with more severe disease and higher likelihood of death.)

In cases of neonatal tetanus, symptoms usually appear from 4-14 days after birth, averaging about seven days.

Illness:

There are three overlapping forms of tetanus: generalized, localized, and cephalic.

Generalized is the most common, comprising >80% of cases. The disease usually presents gradually in a descending pattern, progressively worsening over two weeks. The first sign is often trismus, or lockjaw (inability to open mouth). Trismus is often followed by neck stiffness, difficulty swallowing, and rigidity of the abdominal muscles. (Abdominal rigidity is sometimes the first sign in older children and adults.) Other symptoms include an elevation in temperature, blood pressure, and/or heart rate, and sweating. Muscle spasms can occur frequently, be triggered by minor external stimuli, and last for several minutes. The spasms can be severely painful, and can also lead to dysphagia resulting in hydrophobia; urinary retention may occur. Other complications include fractures associated with the muscle spasms, laryngospasm, pulmonary embolism, and aspiration pneumonia. The muscle spasms can continue for 3-4 weeks, and subside over several weeks or months if death does not occur. Ten to twenty percent of cases are fatal.

Localized tetanus consists of painful tonic muscle spasms in the area of the wound. These spasms can also persist for several weeks before eventually subsiding, and while localized tetanus is generally milder, it can progress to generalized tetanus.

Cephalic tetanus is the rarest form, involving cranial nerve dysfunction associated with wounds of the head and neck. It is occasionally associated with otitis media in which *C. tetani* is present in the middle ear. Cephalic tetanus typically has a short incubation period, and can also progress to generalized tetanus.

Neonatal tetanus is a form of generalized tetanus that occurs in newborn infants born without protective passive immunity from their mother. It most often occurs when the umbilical cord is cut with a non-sterile instrument, leading to infection of the umbilical stump. Early symptoms may include inability to suck or breastfeed and excessive crying, before progressing to typical symptoms of generalized tetanus.

Laboratory Diagnosis

The diagnosis of tetanus is entirely clinical and does not depend on laboratory confirmation. Culture of the wound may be performed, but the yield is often poor (30% recovery rate). *C. tetani* is also ubiquitous in the environment and can be isolated from persons who do not have tetanus. If the bacterium is isolated, toxin production can be demonstrated in mice, but this is not routinely done, nor should it impact the decision to treat.

The diagnosis should be made based on clinical presentation and the exclusion of other possibilities, such as hypocalcemia, strychnine poisoning, phenothiazine reaction, or conversion disorder (especially if multiple cases occur in the same place or time).

A protective level of tetanus IgG should not be used to exclude tetanus; although rare, tetanus has been known to occur in people with presumed adequate antibody levels.

Treatment

Tetanus is a medical emergency requiring hospitalization. All wounds should be properly cleaned and debrided. If tetanic spasms are occurring, supportive therapy and maintenance of

an adequate airway are critical. Tetanus immune globulin (TIG) is recommended for treatment. TIG can only remove unbound tetanus toxin and cannot affect toxin already bound to nerve endings. A single intramuscular dose of 500 units is generally recommended for children and adults, with part of the dose infiltrated around the wound if it can be identified. If TIG is not available, intravenous immune globulin (IVIG) may be used.

Tetanus disease does *not* result in immunity, and administration of TIG does not preclude the need for vaccination. (If TIG and tetanus vaccine are given at the same time, they should ideally be administered in different anatomic sites.) Immunization with a tetanus-toxoid-containing vaccine should begin or continue as soon as the person's condition has stabilized. Oral or intravenous metronidazole can reduce the presence of *C. tetani* bacteria; parenteral penicillin G may be used as an alternative. Supportive care and pharmacotherapy to control spasms may also be necessary.

Surveillance

Case Definition (2010)**:**

Confirmed - There is no definition for "confirmed" tetanus.

Probable - In the absence of a more likely diagnosis, an acute illness with:

- Muscle spasms or hypertonia, **AND**
- Diagnosis of tetanus by a health care provider

OR

- Death, with tetanus listed on the death certificate as the cause of death or a significant condition contributing to death

Reporting:

Report all patients suspected of having tetanus to the New Mexico Department of Health's Infectious Disease Epidemiology Bureau (IDEB) at 1-833-SWNURSE (1-833-796-8773) for assistance with evaluation and follow-up. Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, health care provider, and vaccination history if available.

Case Investigation:

On-Call Epi staff should complete the CDC Tetanus Surveillance Worksheet and mail to the IDEB, P.O. Box 26110, Santa Fe, New Mexico 87502-6110, fax to 505-827-0013, or otherwise securely provide to the Vaccine Preventable Disease Epidemiologist. Investigation information should also be entered in NMEDSS by an epidemiologist per established procedures.

Control Measures

1. Case management

   1.1. Isolation: None required.

2. Contact management

   2.1. Not applicable: Tetanus is not transmissible person-to-person.

3. Prevention

3.1. Routine immunization: Five doses of tetanus toxoid-containing vaccine are recommended for all children at 2, 4, 6, and 15-18 months of age, with a booster at 4-6 years of age. The preferred vaccine is DTaP (combined with diphtheria toxoid and acellular pertussis), which is available for children under age 7. If there is a contraindication to pertussis vaccination, Td vaccine should be used (and may be used off-label for children aged <7 years). Active protection should be maintained by administration of Td or Tdap (tetanus toxoid combined with diphtheria toxoid and acellular pertussis) vaccine every 10 years.

3.1.a Tetanus toxoid-containing vaccines have been part of routine childhood immunization since the late 1940s. However, if a person older than 7 years has no documentation of completing at least 3 doses of tetanus-toxoid-containing vaccine in their lifetime, they should complete a three-dose primary series using Td or Tdap, preferably with at least one dose being Tdap. They should continue to receive a booster of Td or Tdap every 10 years afterwards. See Pink Book for more details.

3.2. Wound management should include cleaning and thorough debridement of all wounds.

3.3. If wounded, immunization status should be assessed, and intervention as follows:

Tetanus Wound Management

Tetanus Vaccination History	Clean, minor wounds		All other wounds*	
	DTaP, Tdap, or Td**	TIG§	DTaP, Tdap, or Td**	TIG§
Fewer than 3 doses or unknown	**Yes**	No	**Yes**	**Yes**
3 or more doses	No if <10 years since last tetanus vaccine	No	No if <5 years since last tetanus vaccine	No
	Yes if ≥10 years since last tetanus vaccine	No	**Yes** if ≥5 years since last tetanus vaccine	No

* Include, but are not limited to: wounds contaminated with dirt, feces, soil, or saliva (e.g., bites); puncture wounds; avulsions; and wounds resulting from missiles, crushing, burns, or frostbite.

** DTaP is used in children younger than 7 years. Tdap is preferred over Td in older children and adults due to the additional benefit of boosting pertussis protection.

§ People with HIV infection or severe immunodeficiency who have contaminated wounds (including minor wounds) should also receive TIG, regardless of their tetanus vaccine history.

Managing Tetanus in Child Care Centers

All staff and children should be up to date for their age on tetanus vaccination. As tetanus is not transmissible from person-to-person, there is no concern for further spread of tetanus from one case in a childcare center.

References

American Academy of Pediatrics. "Tetanus" In: Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH, eds. *Red Book: 2021 Report of the Committee on Infectious Diseases*. 32nd ed. Itasca, IL: American Academy of Pediatrics; 2021:750-754.

Tiwari TSP, Blain A. "Tetanus." *Manual for the Surveillance of Vaccine-Preventable Diseases.* https://www.cdc.gov/surv-manual/php/table-of-contents/chapter-16-tetanus.html.

Heymann D, ed. Control of Communicable Diseases Manual. 19th ed. Washington, DC: American Public Health Association; 2008.

Centers for Disease Control and Prevention. "Tetanus" In: Hall E, Wodi AP, Hamborsky J, et al, eds. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 14th ed. Washington D.C.: Public Health Foundation; 2021:315-328.

See Tetanus Fact Sheets (English) (Spanish).