The Disease and Its Epidemiology

A. Etiologic Agent

Tetanus is caused by the spores of the bacterium *Clostridium tetani* that produce a potent neurotoxin, tetanospasmin, and a hemolytic toxin, tetanolysin. While the bacterium is sensitive to heat and cannot survive in the presence of oxygen, the spores are not easily destroyed by high heat or commonly used disinfectants.

B. Clinical Description

Tetanus is an acute, potentially fatal disease that is characterized by generalized, progressive rigidity and muscle spasms. Three different forms of tetanus have been described: local, cephalic, and generalized. Local and cephalic tetanus are rare forms of the disease. Generalized tetanus is the mostly commonly reported type, accounting for about 80% of cases. The first symptom is usually trismus, or lockjaw. Muscle stiffness and spasms progress in a descending pattern (e.g., neck stiffness, difficulty swallowing, rigidity of abdominal muscles). Other symptoms include fever, sweating, increased blood pressure, and episodic elevated heart rate. Spasms may occur frequently and last for several minutes. Muscle spasms may persist for one week or longer and complete recovery may take months.

Neonatal tetanus is a form of generalized tetanus that occurs in newborn infants and is known to occur in infants born without protective passive immunity, because the mother is not immune. In some developing countries, neonatal tetanus is common (estimated more than 257,000 annual deaths worldwide in 2000-2003) and likely occurs when an unclean instrument is used to cut or trim the umbilical cord. Neonatal tetanus is very rare in the United States.

Persons with tetanus may experience complications. Spasms of the vocal cords, diaphragm or abdominal muscles can lead to difficulty or inability to breathe. Sustained convulsions or spasms may result in fractures of the spine or long bones. Hyperactivity of the autonomic nervous system may lead to hypertension and/or an abnormal heart rhythm.

Nosocomial infections are common because of prolonged hospitalization. Secondary infections may include sepsis from indwelling catheters, hospital-acquired pneumonias, and decubitus ulcers. Pulmonary embolism is particularly a problem in drug users and elderly patients. Aspiration pneumonia is a common late complication of tetanus, found in 50% to 70% of autopsied cases. In cases reported from 2001-2008 to the National Notifiable Diseases Surveillance System with a known outcome, the case fatality rate was approximately 13%, down from 18% during 1998-2000. Cases most likely to be fatal are those occurring in persons 60 years of age and older (18%) and unvaccinated persons (22%). In about 20% of tetanus deaths, no obvious pathology is identified and death is attributed to the direct effects of tetanus toxin.

C. Reservoirs

*C. tetani* spores (the dormant form of the organism) are found in soil and in animal and human feces. Manure-treated soil may contain large numbers of spores. In agricultural areas, a significant number of human adults may harbor the organism. The spores can also be found on skin surfaces and in contaminated heroin.
D. Modes of Transmission

Environmental transmission occurs when *C. tetani* spores enter the body through breaks in the skin, and germinate under low-oxygen conditions. Puncture wounds and wounds with a significant amount of tissue injury are more likely to promote germination. Transmission is primarily by contaminated wounds (apparent and inapparent). The wound may be major or minor. In recent years, however, a higher proportion of patients had minor wounds, probably because severe wounds are more likely to be properly managed. Tetanus may follow elective surgery, burns, deep puncture wounds, crush wounds, otitis media (ear infections), dental infection, animal bites, abortion, and pregnancy. Tetanus is a noncommunicable disease—it is not transmitted from one person to another.

E. Incubation Period

The incubation period ranges from 3 to 21 days, usually about 8 days. In general the further the injury site is from the central nervous system, the longer the incubation period. The shorter the incubation period, the higher the chance of death. In neonatal tetanus, symptoms usually appear from 4 to 14 days after birth, averaging about 7 days.

F. Period of Communicability or Infectious Period

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

G. Epidemiology

Tetanus occurs worldwide but is most frequently encountered in densely populated regions in hot, damp climates with soil rich in organic matter. In the United States, an all-time low of 18 cases (0.01 cases per 100,000) was reported in 2009. During 2001 through 2008, an average of 29 cases were reported per year, the median age of cases was 49 years (range 5 to 94 years), and the case-fatality rate was 13%. Since the 1940s, reported incidence rates for tetanus declined steadily.

In Colorado, five cases of tetanus were reported from 2004 to 2014.

Almost all reported cases of tetanus are in persons who have either never been vaccinated, or who completed a primary series but have not had a booster in the preceding 10 years. Heroin users, particularly persons who inject themselves subcutaneously, appear to be at high risk for tetanus. Quinine is used to dilute heroin and may support the growth of *C. tetani*.

Case Definition

Clinical Description

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.

Laboratory Criteria for Diagnosis

There is no diagnostic laboratory test for tetanus; the diagnosis is entirely clinical. *C. tetani* is recovered from wounds in only about 30% of cases, and the organism is sometimes isolated from patients who do not have tetanus. Serologic results obtained before TIG (tetanus immune globulin) is administered can support susceptibility if they demonstrate very low or undetectable anti-tetanus antibody levels. However, tetanus can occur in the presence of “protective” levels of antitoxin (>0.1 IU by standard ELISA); therefore, serology cannot exclude the diagnosis of tetanus.
Case Classification

<table>
<thead>
<tr>
<th>Confirmed:</th>
<th>There is no definition for confirmed tetanus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probable:</td>
<td>A clinically compatible case, as reported by a healthcare professional. See above for clinical description.</td>
</tr>
</tbody>
</table>

Reporting Criteria

What to Report to the Colorado Department of Public Health and Environment (CDPHE) or local health agency

- Probable and suspect tetanus cases.
- Tetanus cases should be reported within 7 days of a presumptively positive laboratory test or suspected diagnosis.
- Cases should be reported using telephone, fax or the Colorado Electronic Disease Reporting System (CEDRS) to CDPHE or local health departments. See below for phone and fax numbers.

Purpose of Surveillance and Reporting

- To identify cases for investigation.
- To assure timely administration of tetanus toxoid and tetanus immune globulin.
- To monitor trends in disease incidence.
- To provide data about ongoing vaccine effectiveness.

Important Telephone and Fax Numbers

CDPHE Communicable Disease Epidemiology Branch
- Phone: 303-692-2700 or 800-866-2759
- Fax: 303-782-0338
- After hours: 303-370-9395
CDPHE Microbiology laboratory: 303-692-3480
CDC Tetanus Surveillance Worksheet

State Laboratory Services

Laboratory Testing Services Available
The CDPHE Laboratory does not offer any tetanus testing.

Case Investigation

All reports of tetanus should be investigated. The first steps are to determine whether the case is clinically compatible with tetanus.

Cases should be investigated to:
- Provide recommendations for prompt administration of tetanus toxoid and TIG which may decrease the severity of the disease.
- Provide information about the disease, its transmission, and methods of prevention.
• Promptly identify clusters or outbreaks of disease and initiate appropriate prevention and control measures.

If the tetanus case is unable to be interviewed due to their age or medical condition, information may be obtained from the hospital infection control practitioner, healthcare provider, parents/relatives, friends and/or others involved with the case.

A. Case Investigation / Forms

◦ Organized local health departments have primary responsibility for interviewing cases in their jurisdictions.
◦ Public health nursing services should consult with their CDPHE Regional Epidemiologist to establish primary responsibility for interviewing cases and providing recommendations for administration of tetanus toxoid or TIG.
◦ For probable cases complete the CDC Tetanus Surveillance Worksheet form, which is available on the CD Manual website or http://www.cdc.gov/vaccines/pubs/surv-manual/appx/appendix18-2-tet-wrshl.pdf, or enter information directly into CEDRS.

All information from completed report forms should be entered into CEDRS or completed report forms may be faxed or mailed to CDPHE.

B. Identify and Evaluate Contacts

Because tetanus is not communicable, this is not necessary in most cases unless other persons are known or suspected to have been exposed to tetanus.

C. Reported Incidence Is Higher than Usual/Outbreak Suspected

Call the CDPHE Communicable Disease Program if there are a higher number of cases in your area than usual or an outbreak is suspected.

Disease Control Measures

A. Treatment

Medical Management

◦ If tetanic spasms are occurring, supportive therapy and maintenance of an adequate airway are critical.
◦ Tetanus immune globulin (TIG) is recommended for persons with tetanus. TIG can only help remove unbound tetanus toxin. It cannot affect toxin bound to nerve endings. A single intramuscular dose of 3,000 to 5,000 units is generally recommended for children and adults, with part of the dose infiltrated around the wound if it can be identified. Intravenous immune globulin (IVIG) contains tetanus antitoxin and may be used if TIG is not available.
◦ Because of the extreme potency of the toxin, tetanus disease does not result in tetanus immunity. Active immunization with tetanus toxoid should begin or continue as soon as the person’s condition has stabilized.

Wound Management

◦ All wounds should be cleaned. Necrotic tissue and foreign material should be removed. If tetanic spasms are occurring, supportive therapy and maintenance of an adequate airway are critical.
◦ Antibiotic prophylaxis against tetanus is neither practical nor useful in managing wounds; proper immunization plays the more important role.
◦ Persons with wounds that are neither clean nor minor, and who have had 0–2 prior doses of tetanus toxoid or have an uncertain history of prior doses should receive TIG as well as Td or Tdap. This is because early doses of toxoid may not induce immunity, but only prime the immune system. The TIG provides temporary immunity by directly providing antitoxin. This ensures that protective levels of antitoxin are achieved even if an immune response has not yet occurred.
B. Prophylaxis

The appropriate use of tetanus toxoid and TIG in wound management (Table 1) is also important for the prevention of tetanus.

Table 1. Guide to Tetanus Prophylaxis in Routine Wound Management

<table>
<thead>
<tr>
<th>History of adsorbed tetanus toxoid (doses)</th>
<th>Clean minor wounds Tdap or Td†</th>
<th>Clean minor wounds TIG§</th>
<th>All other wounds* Tdap or Td†</th>
<th>All other wounds* TIG§</th>
</tr>
</thead>
<tbody>
<tr>
<td>fewer than 3 or unknown</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3 or more doses¶</td>
<td>No**</td>
<td>No</td>
<td>No††</td>
<td>No</td>
</tr>
</tbody>
</table>

* Such as (but not limited to) wounds contaminated with dirt, feces, soil, and saliva; puncture wounds; avulsions; and wounds resulting from missiles, crushing, burns, and frostbite.

† For children younger than 7 years of age, DTaP is recommended; if pertussis vaccine is contraindicated, DT is given. For persons 7 to 9 years of age, Td is recommended. For persons >10 years, Tdap is preferred to Td if the patient has never received Tdap and has no contraindication to pertussis vaccine. For persons 7 years of age or older, if Tdap is not available or not indicated because of age, Td is preferred to TT.

§ TIG is human tetanus immune globulin. Equine tetanus antitoxin should be used when TIG is not available.

¶ If only three doses of fluid toxoid have been received, a fourth dose of toxoid, preferably an adsorbed toxoid, should be given. Although licensed, fluid tetanus toxoid is rarely used.

** Yes, if it has been 10 years or longer since the last dose.

†† Yes, if it has been 5 years or longer since the last dose. More frequent boosters are not needed and can accentuate side effects.

C. Vaccination

Numerous formulations of tetanus toxoid-containing vaccines are available in the United States.

- Tetanus and diphtheria toxoids and acellular pertussis (DTaP) and diphtheria and tetanus toxoids (DT) are licensed for infants and children younger than 7 years of age; and tetanus and diphtheria toxoids (Td) and tetanus toxoid (TT) are licensed for children 7 years of age and older and adults.
- Two tetanus and diphtheria toxoids and acellular pertussis formulation for adolescents and adults (Tdap) were licensed in 2005. Tetanus and diphtheria toxoids and whole-cell pertussis (DTP) vaccine is no longer available for use in the United States.
- Other pediatric combination vaccines containing tetanus and diphtheria toxoids and acellular pertussis along with other antigens are also available.

Primary tetanus vaccination with DTaP is recommended for all infants and children aged 6 weeks through 6 years who do not have contraindications.

- DTaP is the preferred vaccine for all doses in the vaccination series (including completion of the series for children who have received one or more doses of whole-cell DTP).
- Primary vaccination with the DTaP series consists of a three-dose series, administered at ages 2, 4, and 6 months, with a minimum interval of 4 weeks between each of the first three doses.
- The fourth (first booster) dose is recommended at 15 to 18 months of age to maintain adequate immunity during preschool years. The fourth dose should be administered 6 months or more after the third dose. If the interval between the third and fourth doses is at least 6 months and the child is unlikely to return for a visit at the recommended age, the fourth dose of DTaP may be administered as early as age 12 months.
- The fifth (second booster) dose is recommended for children aged 4 to 6 years to confer continued protection against disease during the early years of schooling. A fifth dose is not necessary if the fourth dose in the series is administered on or after the fourth birthday.
- Adolescents and adults with a history of incomplete or unknown tetanus vaccination should receive a series of three vaccinations. The preferred schedule is a dose of Tdap, followed by a dose of Td at least 4 weeks after Tdap, and another dose of Td 6 to 12 months later.
Routine tetanus booster vaccination is recommended for adolescents and adults every 10 years.

- A single dose of Tdap is recommended for adolescents at age 11 to 18 years if they have not previously received Tdap.
- A single dose of Tdap is also recommended for adults age 19 years and older who have not previously received Tdap, to replace the next Td. Adults should receive Td at least every 10 years thereafter.

D. Education

- Efforts should be made to promote awareness among physicians and infection control practitioners of the need to report suspected cases of tetanus promptly. The completeness of reporting of tetanus mortality to CDC has been estimated at 40%, and completeness of reporting for tetanus morbidity may be even lower.
- Cases and providers should receive information on the mode of transmission, lack of communicability, reservoirs of *C. tetani* as well as the recommendations for immunization and/or tetanus toxoid or TIG.

E. Environmental Measures

No specific environmental measures are recommended.

References


CDC Website: [www.cdc.gov](http://www.cdc.gov) (click on “Diseases and Conditions”)