Tetanus (lockjaw)

Signs and Symptoms	Three clinical forms: generalized, localized, and cephalic tetanus. • Generalized: Most common presentation. Descending pattern, trismus (painful contractions of the masseter muscle), stiffness of the neck, difficulty in swallowing, rigidity of abdominal muscles. Spasms induced by sensory stimuli. Opisthotonos (spine and extremities are bent with convexity forward, the body resting on the head and the heels), seizures, fever, sweating, hypertension, and tachycardia may also occur. • Localized: Uncommon. Persistent contraction of muscles in the same anatomic region where injury and spore inoculation occurred. May resolve spontaneously but more commonly represents a prodrome of generalized tetanus. • Cephalic: Rare. Dysfunction of cranial nerves, associated with head and neck wounds. Can precede generalized tetanus. *Neonatal tetanus:* Very rare in the United States. Infant usually presents with generalized weakness and failure to nurse that progress to rigidity and spasms. Mortality rate exceeds 90%. Apnea and sepsis are the leading causes of death.	
Incubation	Varies from 3-21 days, average 8 days	
Case classification	**Clinical definition:** Acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw and neck) and generalized muscle spasms without other apparent medical cause.	
	Confirmed case: There is no definition for "confirmed" tetanus.	**Probable case:** 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
Differential diagnosis	Strychnine poisoning is the only condition that truly mimics generalized tetanus. Other conditions can present with some clinical features common to tetanus including: dental infections, malignant hyperthermia, stimulants use, atropine poisoning, hypocalcemia, phenothiazine reaction, acute abdomen, and meningitis.	
Treatment	Tetanus immunoglobulin (TIG) can help neutralize unbound tetanus toxin. Intravenous immunoglobulin (IVIG) can be used if TIG not available. Supportive care and pharmacotherapy are used to control spasms and manage pain. Additional treatment includes wound care and debridement, antibiotics administration, and tetanus vaccine. Tetanus disease does not reliably result in immunity.	
Laboratory	Diagnosis is clinical as there are no reliable laboratory tests for confirming tetanus.	
Public Health investigation	• Assess the likelihood of tetanus: confirm compatible clinical symptoms, verify vaccination and travel history, and assess exposure risk (e.g. recent injury, gardening, or injection drug use.) • Tetanus is not communicable from person to person. • Outbreaks (same source of infection, e.g. contaminated heroin) are extremely rare. Collect exposure details, demographics, and onset date of any person reported to have a similar illness. • Hospitalized patients should be cared for using standard precautions. • If tetanus immunization not up to date at the time of presentation, a dose should be given. Complete series later, according to the recommended immunization schedule for patient's age. • Environmental evaluation is not indicated.	

Tetanus

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To assist in the diagnosis of possible cases and facilitate prompt administration of tetanus immune globulin (TIG).
2. To identify groups at risk for tetanus (e.g. under-immunized persons, those with an occupational risk, with certain medical conditions, or who inject non-prescription drugs) in order to focus prevention efforts.

B. Legal Reporting Requirements

1. Health care providers: notifiable to local health jurisdiction within 3 business days.
2. Health care facilities: notifiable to local health jurisdiction within 3 business days.
3. Laboratories: no requirements for reporting.
4. Local health jurisdictions: notifiable to the Washington State Department of Health (DOH) Office of Communicable Disease Epidemiology (OCDE) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Begin the investigation within 3 business days.
2. Report all *probable* cases (see definition below) to OCDE. Complete the tetanus report form (available at http://www.doh.wa.gov/Portals/1/Documents/5100/210-061-ReportForm-Tetanus.pdf) and enter the data into the Public Health Issues Management System (PHIMS).

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Tetanus is caused by a neurotoxin produced by *Clostridium tetani*, a gram-positive, spore-forming bacillus. *C. tetani* are obligate anaerobic bacteria: bacterial growth and spore germination can occur only under anaerobic conditions, such as those found in damaged tissue. Tetanus spores are extremely stable and able to survive under a wide range of environmental conditions, including boiling, and can retain the ability to germinate and cause disease indefinitely. Tetanus toxin is produced as the bacteria multiply, and disseminates via the blood and lymphatic systems.

B. Description of Illness

Tetanus is an acute neurological disease caused by tetanus toxin. Three different clinical forms have been described:

Generalized tetanus - About 80% of total tetanus cases present as generalized tetanus. Symptoms include rigidity and painful spasms of skeletal muscles. Generalized tetanus usually presents with a descending pattern. The initial muscles affected are often in the jaw and neck leading to the common name for the disease: “lockjaw”. Trismus (painful

contractions of the masseter muscle) and risus sardonicus (a characteristic grinning appearance caused by fixed contraction of the facial muscles) are common clinical features. Stiffness of the neck, difficulty in swallowing, and rigidity of abdominal muscles can follow the initial presentation. Spasms are painful and can be triggered by sensory stimuli. Seizures, hyperthermia, sweating, hypertension, and tachycardia may also occur.

Opisthotonos, an extreme hyperextension of the spine with the head and heels bent backwards, may occur in severe generalized tetanus.

Gowers provided the quintessential description of generalized tetanus in 1888:

*Tetanus is a disease of the nervous system characterized by persistent tonic spasm, with violent brief exacerbations. The spasm almost always commences in the muscles of the neck and jaw, causing closure of the jaws (trismus, lockjaw), and involves the muscles of the trunk more than those of the limbs. It is always acute in onset, and a very large proportion of those affected die.**

*Gowers WR. *A Manual of Diseases of the Nervous System*. Philadelphia: Blackiston & Son; 1888.

Complications of generalized tetanus include fractures, difficulty breathing (due to spasms of the respiratory muscles), abnormal heart rhythms and aspiration pneumonia. Nosocomial infections may occur when prolonged hospitalization is required. Case fatality rate for tetanus varies widely among reports. CDC surveillance data shows a 13% case fatality rate in the United States between 2001 and 2008**.

**CDC. Tetanus surveillance---United States, 2001--2008. MMWR 2011; 60(12);365-369.

Localized tetanus - This is a less common form of tetanus. It manifests as muscle spasms but is confined to the region where injury and spore inoculation occurred. This form of tetanus may resolve spontaneously but more commonly represents a prodrome of generalized tetanus.

Cephalic tetanus - This type of tetanus is rare and presents as a dysfunction of cranial nerves. It is usually associated with wounds to the head or neck, but can also occur when *C. tetani* is present in the middle ear of acute otitis cases. Cephalic tetanus can also progress to generalized tetanus.

In addition, neonatal tetanus is seen in developing countries and occurs when the mother is not immune. Infants receive no passive immunity and therefore are unprotected. Neonatal tetanus causes significant mortality in some developing countries when infants born to unimmunized women develop tetanus following contamination of the umbilical stump. In newborns, tetanus usually presents with generalized weakness and failure to nurse that progresses to rigidity and spasms. The mortality rate for neonatal tetanus exceeds 90%, with apnea and sepsis being the leading causes of death. Only two cases of neonatal tetanus have been reported in the United States since 1989, both in infants born to unimmunized mothers.

Differential diagnoses: Strychnine poisoning is the only condition that truly mimics generalized tetanus. Other conditions that can present with some clinical features common to tetanus include: dental infections (trismus), malignant hyperthermia (hyperthermia and generalized muscle spasms), stimulant use (trismus, tremor, seizures,

tachycardia, and hyperthermia), atropine poisoning (trismus, tremor, tachycardia, and hyperthermia), hypocalcemia (trismus and muscle spasms), phenothiazine reaction (trismus and generalized muscle spasms), acute abdomen (trismus and abdominal muscle spasms and rigidity), and meningitis (hyperthermia, trismus, and muscle spasms).

C. Tetanus in Washington

Five cases of tetanus have been reported in Washington State since 2005, most in older adults. This is consistent with national data that shows approximately 50% of cases are 50 years of age and older[†].

[†]Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hamborsky J, Kroger A, Wolfe S, eds. 13th ed. Washington D.C. Public Health Foundation, 2015.

Table 1. Tetanus cases in Washington State 2005-2015

Year	Sex	Age	Vaccination status	Type of exposure	Death
2005	Male	61	Not up to date	Puncture in arm/ garden	No
2012	Male	72	Unknown	Puncture in leg/ garden	No
2014	Female	65	Up to date	Dog bite in upper extremity	No
2014	Female	85	Up to date	Abrasion in upper extremity/ garden	Yes
2014	Female	2	Unimmunized	No clear risk/ recent scratch to face	No

Prior to this, the most recent case of tetanus in Washington was reported in 2000.

D. Reservoir

Tetanus occurs worldwide and it is more common in warmer climates. Tetanus spores are ubiquitous in the environment, are found in soil, and are normal and harmless inhabitants in the intestines and feces of many animals. Heroin may become contaminated with tetanus spores.

E. Modes of Transmission

Growth of the organism occurs in anaerobic devitalized tissue making contaminated wounds a risk. Predisposing wound types include punctures, lacerations, abrasions, bites, burns, and damage to soft tissue caused by recent delivery or abortion. The injury may be minor and sometimes (up to 20%) not apparent upon medical examination. Injection drug use has also been associated with tetanus.

Tetanus in the United States tends to occur among un-immunized or under-immunized older persons and often follow injuries incurred during outdoor activities such as working in gardens or on farms. Unsanitary birth conditions can result in contamination of the umbilical stump and neonatal tetanus in infants born to unimmunized mothers.

F. Incubation Period

3 to 21 days. Most cases occur within 8 days. More severe disease and a higher mortality rate have been associated with shorter incubation periods.

G. Period of Communicability

Tetanus is not communicable person to person.

H. Treatment

Treatment of generalized tetanus is based on four key principles: a) sedation and paralysis to control the progressive spasms and autonomic dysfunction and to avoid exhaustion; b) surgical debridement and antibiotic treatment for the source of infection; c) neutralization of the circulating toxin; and c) supportive care in an ICU.*

*Rodrigo C, Fernando D, Rajapakse S. Pharmacological management of tetanus: an evidence-based review. Critical Care. 2014;18(2):217. doi:10.1186/cc13797. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4057067/

Passive immunization with human tetanus immune globulin (TIG) shortens the course of tetanus and may lessen the severity. TIG is administered intramuscularly with part of the dose infiltrated around the wound if one can be detected. TIG is available in most hospitals in Washington. If TIG is not available, intravenous immune globulin (IVIG) can be considered.

For detailed information and a complete management protocol of generalized tetanus, see:

Bleck TP, Hodowanec A. Chapter 246: *Clostridium tetani* (Tetanus). In: Mandell GL, Bennett JE, Dolin R, eds. Mandell, Douglas, and Bennett's Principles of Practice of Infectious Diseases Eigth Edition. Philadelphia: Elsevier Churchill Livingstone; 2015.

I. Immunity

If tetanus immunization is not up to date at the time of wound treatment, a dose of tetanus-containing vaccine should be given, and the series should be completed later according to the recommended schedule for the patient's age. With a subsequent exposure, tetanus could reoccur if the patient does not receive tetanus vaccine, because the amount of toxin produced by the disease is inadequate to induce immunity.

Vaccination with tetanus toxoid provides active immunity which lasts for at least 10 years after full immunization. Though protection is incomplete after the first vaccine dose, protective concentrations of antitoxin are achieved in the majority of vaccinees after completion of 2 doses; a third dose induces immunity in nearly 100% of those immunized.
http://www.who.int/immunization/wer8120tetanus_May06_position_paper.pdf

3. CASE DEFINITIONS

A. Clinical Criteria for Diagnosis

Acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw and neck) and generalized muscle spasms without other apparent medical cause.

B. Laboratory Criteria for Diagnosis

None.

C. Case Definition (2010)

***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

[*]There is no definition for "*confirmed*" tetanus (see Section 4.B. below).

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Diagnosis of tetanus is based on the clinical presentation.

B. Services Available at the Washington State Public Health Laboratories (PHL)

There are no laboratory tests available that can confirm a tetanus diagnosis.

5. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent information.

A. Evaluate the Diagnosis and Assist with Securing Tetanus Immune Globulin (TIG)

Assess the clinical presentation (e.g., lockjaw, rigidity, spasms), risk factors (e.g., gardening, farm work, injection drug use), and immunization history for the patient.

B. Identify Source of Infection

Tetanus-prone wounds that might be significant if they occur in the 3–21 days period prior to onset include, but are not limited to:

- Minor or major injury particularly if contaminated (e.g. with dirt, feces, soil, saliva), infected, punctate, or with extensive tissue damage such as burns.
- Wounds containing foreign bodies, especially wood splinters
- Compound fractures, avulsions, and wounds resulting from crushing.
- Injection drug use
- Failure of aseptic technique during care of newborn umbilical stump
- Wounds prone to necrosis such as those due to frostbite.
- Recent exposures to soil or manure

C. Identify Potentially Exposed Persons

Outbreaks are extremely rare. Collect exposure information, demographics, and onset date of any person reported to have a similar illness.

D. Environmental Evaluation

An environmental evaluation is usually not needed since tetanus spores are ubiquitous in the environment and the source of the infection is rarely determined with certainty. Contact OCDE if you have high suspicion for a source of infection, such as potentially contaminated heroin.

6. CONTROLLING FURTHER SPREAD

A. Infection Control Recommendations/Case Management

Hospitalized patients should be cared for using standard precautions.

B. Contact Management

No contact follow-up is needed since tetanus is not transmitted from person to person.

C. Environmental Measures

Typically no environmental measures are required.

7. MANAGING SPECIAL SITUATIONS

A. Natural disasters

Following natural disasters, increased risk for injury may be present due to damaged structures, flooding, and clean-up activities. A general notification during such situations is appropriate to encourage up-to-date tetanus vaccination for populations at risk including relief workers.

B. Outbreaks

In rare outbreak situations where a source of infection that could put others at risk has been identified (i.e., contaminated heroin) provide education to persons at increased risk. Include information regarding the importance of vaccination against tetanus, typical symptoms of tetanus, and the importance of seeking treatment immediately should those symptoms occur. Potential partners for education include needle exchange programs.

Health care providers and hospital emergency departments serving the population at risk should be advised regarding the current increased risk of tetanus.

8. ROUTINE PREVENTION

A. Immunization Recommendations

1. Immunization with tetanus toxoid in combination with diphtheria toxoid and acellular pertussis vaccine is recommended for all children according to the table below as part of the routine schedule recommended by the Advisory Committee on Immunization Practices (ACIP).

Table 1: Routine Schedule for Childhood Tetanus Vaccination

Dose	Age	Minimal Interval
DTaP 1	2 months	N/A
DTaP 2	4 months	4 weeks
DTaP 3	6 months	4 weeks
DTaP 4	15–18 months	6 months
DTaP 5*	4–6 years	6 months
Tdap **	11-12 years	N/A

*Five DTaP doses are recommended. However, if the fourth dose is given on or after the fourth birthday, the child can be considered up to date.

** Adolescents aged 11 through 18 years who have completed the recommended childhood diphtheria and tetanus toxoids and pertussis vaccine (DTP/DTaP) vaccination series should receive a single dose of Tdap instead of tetanus and diphtheria toxoids (Td) vaccine, preferably at a preventive-care visit at age 11 or 12 years. For children7 through 10 years who receive a dose of Tdap as part of the catch-up series, an adolescent Tdap vaccine dose at age 11 through 12 should NOT be administered.

The full routine childhood vaccination schedule and catch-up recommendations are available at: http://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html

2. Persons aged ≥11 years who have not received Tdap vaccine or for whom vaccine status is unknown should receive a dose of Tdap followed by tetanus and diphtheria toxoids (Td) booster doses every 10 years thereafter.

   Administer 1 dose of Tdap vaccine to pregnant women during each pregnancy (preferably during 27–36 weeks' gestation) regardless of interval since prior Td or Tdap vaccination. The full routine adult vaccination schedule and catch-up recommendations are available at: http://www.cdc.gov/vaccines/schedules/hcp/adult.html

3. For additional information regarding use of the tetanus vaccines, adverse reactions and contraindications see the most recent CDC Pink Book: Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hamborsky J, Kroger A, Wolfe S, eds. 13th ed. Washington D.C. Public Health Foundation, 2015. http://www.cdc.gov/vaccines/pubs/pinkbook/index.html#chapters

B. Wound Management to Prevent Tetanus

All wounds should be cleaned and properly debrided, if necessary. The administration of antibiotics solely for prophylaxis against *C. tetani* is not recommended.

When assessing the need for vaccine and/or tetanus immune globulin (TIG) to prevent tetanus, the condition of the wound and the immunization status of the patient should be considered. Recommendations are summarized in Table 2.

Table 2: Tetanus Wound Management

Vaccination History	Clean, minor wounds		All other wounds[¶]	
	Tdap or Td*	TIG	Tdap or Td*	TIG
Unknown or less than 3 doses	Yes	No	Yes	Yes
3 or more doses	No[†]	No	No**	No

[¶]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.
*Tdap is preferred to Td for adults who have never received Tdap. Single antigen tetanus toxoid (TT) is no longer available in the United States.
[†]Yes, if more than 10 years since last dose.
**Yes, if more than 5 years since last dose.

Source: Centers for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hamborsky J, Kroger A, Wolfe S, eds. 13th ed. Washington D.C. Public Health Foundation, 2015.

ACKNOWLEDGEMENTS

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UPDATES

January 2010
Case classification changed: There is no longer a ‘confirmed’ tetanus case classification. Criteria for the probable case classification were added.

January 2011
The Legal Reporting Requirements section has been revised to reflect the 2011 Notifiable Conditions Rule revision. Text changed to reflect ACIP recommendations for use of Tdap in persons over 65 and 7 through 9 years of age.

March 2016
Epidemiology and Treatment sections were reviewed and updated according to the most recent medical literature available. Neonatal tetanus section was expanded. Text changed to reflect ACIP recommendations for use of Tdap in all age groups and an updated catch-up schedule. Wound management table was updated.