Tetanus

Manitoba
Public Health Branch

1. Case Definition

1.1 Confirmed Case:

- Clinical evidence of illness* without other apparent medical cause with or without isolation of *Clostridium tetani* (e.g., swabs from wounds and other lesions) and with or without history of injury (1).

*Clinical illness is characterized by acute onset of hypertonia and/or painful muscular contractions (usually the muscles of the jaw and neck), and generalized muscle spasms without other apparent medical cause (1).

2. Reporting and Other Requirements

Laboratory:

- All positive laboratory results for *Clostridium tetani* are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044).
- Manitoba clinical laboratories are required to submit residual specimens or isolate sub-cultures from individuals who tested positive for *C. tetani* within seven days of report.

Health Care Professional:

- Cases of tetanus are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044) within 5 business days of being identified. The *Clinical Notification of Reportable Diseases and Conditions* form MHSU-0013 should be used. http://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0013.pdf
- Adverse events following immunization should be reported by health care professional by completing and returning the form available at: http://www.gov.mb.ca/health/publichealth/cdc/docs/aefi_form.pdf .

Regional Public Health or First Nations Inuit Health Branch (FNIHB):

- Once the case has been referred to Regional Public Health or FNIHB, the *Communicable Disease Control Investigation* form http://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0002.pdf should be completed and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

3. Clinical Presentation/Natural History

Three clinical syndromes are associated with *C. tetani* infection: localized, generalized and cephalic (2). Localized tetanus is uncommon and is characterized by sustained contraction of the muscles in the same area as the injury site and has a case fatality rate of < 1% (3). Generalized tetanus is the most common, presenting as generalized spastic disease (3). Early features of the disease include spasms of the muscles of the jaw known as trismus or lockjaw (3). Muscle spasms of the face produce *risus sardonicus*, a distinctive facial expression that resembles a forced grin (3). Sustained spasm of the muscles of the back leads to the backward arching of the head, neck and spine (3). Spasm of the glottis may cause sudden death (3). Neonatal tetanus is a form of generalized tetanus occurring in newborn infants, most often as a result of an infected umbilical cord stump (2). In neonatal tetanus, generalized spasms are commonly preceded by the inability to suck or breastfeed and excessive crying (3). In generalized tetanus, case fatality rates vary from 10% to 70% depending on treatment, age and general health of the patient (3). Cephalic tetanus is a rare form of the disease

associated with ear infections (otitis media) or head and neck lesions (3, 4). It presents clinically as cranial nerve palsies, with a case fatality rate of 15-30% (3). Cephalic tetanus can progress to generalized tetanus in which case it has a similarly poor prognosis (3). The tetanus clinical syndrome is similar to that caused by strychnine poisoning (2). The differential diagnosis depends on the clinical form of tetanus and the presenting symptoms (2). Cephalic tetanus may be confused with Bell's palsy and trigeminal neuritis (2).

Tetanus symptoms can progress for a further two weeks after antitoxin is given, and recovery usually takes an additional month (5). Tetanus can occur, rarely, in fully immunized individuals, but in this situation, illness is usually mild (6).

4. Etiology

Tetanus is caused by a neurotoxin (tetanospasmin) produced by the anaerobic bacterium *Clostridium tetani* (6). The toxin is absorbed into the bloodstream and then reaches the nervous system, causing painful and often violent muscular contractions (7).

5. Epidemiology

5.1 Reservoir and Source:

Clostridium tetani has been found in spore form in soil, dust, manure and has also been detected in the intestines of animals and humans (6). If not exposed to sunlight, *C. tetani* spores can persist in soil for months to years (2). The spores are resistant to boiling and many disinfectants (2).

5.2 Transmission:

Soil, dust or fecal matter contaminated with *C. tetani* spores usually enter the body through puncture wounds or tissue injuries, including unclean deliveries, burns, surgery and dental extractions (3, 6). *C. tetani* spores will germinate into bacilli in the anaerobic environment present in the necrotic tissue often associated with blunt trauma or deep puncture wounds (6, 8). However, not all cases of tetanus are preceded by a recognized wound or injury (6).

5.3 Occurrence:

General: Globally, 10,337 cases of tetanus were reported to the World Health Organization in 2015 (9). Large clusters of tetanus cases have occurred in conjunction with natural disasters resulting in mass casualties, including the 2004 tsunami in Indonesia, and the 2005 earthquake in Pakistan (2). The majority of reported tetanus cases are birth-associated, occurring in low-income countries among insufficiently vaccinated mothers and their newborn infants, and follow unhygienic deliveries and abortions with poor postnatal hygiene and cord care practices (3, 5). The findings from the World Health Organization's global burden of disease study in 2015 indicated that the highest rates of neonatal mortality were observed in Somalia, South Sudan, Afghanistan, and Kenya (10). Cases of tetanus have been reported in sub-Saharan African countries following voluntary medical male circumcision (11).

Tetanus is relatively uncommon in most developed countries because of effective immunization programs (8). In developed countries, the predominance of cases occurs in the elderly, who are most likely to be unvaccinated or under vaccinated (2, 4). Rarely, cases of neonatal tetanus have been reported in developed countries in unimmunized mothers following non-sterile delivery and umbilical cord –care practices (12, 13).

Canada: Between 2000 and 2013, the number of cases reported annually ranged from one to eight, with an average of three cases reported per year (6). Only six deaths have been reported since 2000, with the last reported in 2010 (6). No cases were reported among neonates (8).

Manitoba: Since 2000, four cases of tetanus have been reported to the Public Health Surveillance Unit; one each in 2003, 2006, 2010 and 2014. All cases were in women in the 30-49 year age group with the exception of the case reported in 2003 which was in an 83 year old woman. Patient outcome or history of laceration/injury was not captured.

5.4 Incubation:

The incubation period is usually three to 21 days but ranges from one day to several months (8). In neonatal tetanus, symptoms usually appear from four to 14 days after birth, averaging seven days (14). In general, the further the injury site from the central nervous system, the longer the incubation period (3). Shorter incubation periods are associated with higher mortality rates (3).

5.5 Host Susceptibility and Resistance:

There is no naturally-acquired immunity to tetanus (3). Immunity to tetanus can be acquired only by active or passive immunization (3). Recovery from tetanus disease does not confer immunity (3). The very small amount of tetanus toxin that is enough to cause disease is not sufficient to stimulate antibody production (3). Infants can be protected by maternal tetanus antibodies which are transmitted through the placenta to the fetus (3). Older adults are at greater risk for tetanus than younger persons, likely due to inadequate vaccination (15).

5.6 Period of Communicability:

Tetanus is not transmitted from person-to-person (9).

6. Diagnosis

The diagnosis of tetanus is established primarily on clinical grounds and secondarily supported by epidemiologic setting (e.g., history of wound contaminated by soil or other material) (2). A negative culture for *C. tetani* does not rule out tetanus because the organism is not always recovered from wounds/lesions in people with tetanus. Also, *C. tetani* can be isolated from people who do not have tetanus. When culture and microscopy is desired, swabs from wounds and other lesions should be submitted to Cadham Provincial Laboratory in transport media.

7. Key Investigations

- Immunization history.

8. Control

8.1 Management of Cases:

Tetanus is a medical emergency. Consultation with Infectious Diseases is recommended.

Treatment:

- Human tetanus immune globulin (TIG) should be administered intramuscularly (preferably in the deltoid muscle of the upper arm or lateral thigh muscle) in an effort to neutralize tetanus toxin in body fluid (8). TIG has no effect on toxin already affixed to nerve tissue (8). The optimal therapeutic dose of TIG has not been established (2, 8, 14). A dosage range of 3,000 – 6,000 units was commonly accepted, based on calculations of the quantity of immunoglobulin necessary to achieve antibody levels in excess of those found to be minimally protective against the effects of tetanus toxin (2). A total dosage of 500 units of TIG is now commonly recommended for children and adults (2, 5, 14, 16), although some authorities continue to prefer 3,000 to 6,000 units (2). The gluteal muscle should not be used as an injection site because of the risk of injury to the sciatic nerve (8).

- Tetanus antitoxin dosing may be product specific and there may be contraindications to TIG use. **Clinicians must refer to the specific product monograph(s) for the tetanus antitoxin prior to ordering and using the product to ensure correct usage**. Links to the product monograph(s) of the tetanus antitoxin product(s) currently available in Manitoba can be found on the Communicable Disease Control Protocol Manual website: http://www.gov.mb.ca/health/publichealth/cdc/protocol/index.html below the Tetanus protocol.
- **Acquisition of Tetanus Immune Globulin (TIG):** TIG may be ordered through local hospital pharmacies. If not available, Manitoba Health, Seniors and Active Living maintains a supply of TIG at the provincial vaccine warehouse which can be accessed by calling 204-948-1333 or Toll-free 1-855-683-3306 during regular business hours. After regular hours, Infectious Diseases on call (204-787-2071) or the Medical Officer of Health on call (204-788-8666) may be contacted for assistance in obtaining TIG.
- Because tetanus is caused by the toxins produced by the tetanus bacterium and not the bacterium itself, recovery from tetanus disease does not confer immunity (8). Persons who have recovered from tetanus disease should receive tetanus toxoid-containing vaccine as recommended for people who have not had the disease (8). Refer to Manitoba Health, Seniors and Active Living's age appropriate tetanus immunization schedule for individuals NOT previously immunized http://www.gov.mb.ca/health/publichealth/cdc/div/not.html .
- All wounds should be cleaned and debrided properly, especially if extensive necrosis is present (14). In neonatal tetanus, wide excision of the umbilical stump is not indicated (14).
- Supportive therapy and maintenance of an adequate airway (16).
- Oral (or intravenous) metronidazole (30 mg/kg per day, given at 6-hour intervals; maximum, 4 g/day) is preferred treatment and is effective in decreasing the number of vegetative forms of *C. tetani* (14). Parenteral penicillin G (100,000 U/kg per day, given at 4 to 6 hour intervals; maximum 12 million U/day is an alternative treatment (14). Therapy for 10 to 14 days is recommended (14).

Infection Prevention and Control: Routine Practices. Refer to the Manitoba Health, Seniors and Active Living document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf .

8.2 Management of Contacts:

Management of contacts is not required as tetanus is not person-to-person transmissible (14).

8.3 Management of Outbreaks:

In the rare instance of an outbreak, search for the source, especially contaminated street drugs or other common-use injections (17). Refer to section 8.1 for management.

8.4 Preventive Measures:

- Immunization with tetanus toxoid-containing vaccine according to the currently recommended schedule. Refer to Manitoba Health, Seniors and Active Living immunization schedule: http://www.gov.mb.ca/health/publichealth/cdc/div/schedules.html .

- **Post-exposure Prophylaxis:**
  - Refer to Table 1 for recommendations. The purpose of post-exposure prophylaxis is to remove the source of toxin production (by thorough wound cleaning) and neutralize any toxin (by providing/inducing high circulating concentrations of tetanus antibody which inactivate the toxin) which may have been released (8).
  - The recommended dose of TIG for adults and children > 7 years of age is 250 units administered intramuscularly (8). Tetanus antitoxin dosing may be product specific and there may be contraindications to TIG use.
  - **Clinicians must refer to the specific product monograph(s) for the tetanus antitoxin prior to ordering and using the product to ensure correct usage.** Links to the product monograph(s) of the TIG product(s) available in Manitoba are found on the Communicable Disease Control Protocol Manual website: http://www.gov.mb.ca/health/publichealth/cdc/protocol/index.html below the Tetanus protocol.
  - Antimicrobials are not recommended for tetanus prophylaxis; however, should signs of infection occur, antimicrobial treatment should be initiated promptly (2).

Table 1: Guide to Tetanus Prophylaxis in Wound Management (from the *Canadian Immunization Guide*)

History of Tetanus Immunization	Clean, Minor Wounds		All Other Wounds	
	Tetanus toxoid-containing vaccine*	TIG (tetanus immune globulin)	Tetanus toxoid-containing vaccine*	TIG (tetanus immune globulin)**
Unknown or less than 3 doses in a vaccine series[H]	Yes	No	Yes	Yes
3 or more doses in a vaccine series and **less than 5 years** since the last booster dose	No	No	No	No[I]
3 or more doses in a vaccine series and **more than 5 years but less than 10 years** since the last booster dose	No	No	Yes	No[I]
3 or more doses in a vaccine series and **more than 10 years** since last booster dose	Yes	No	Yes	No[I]

***** Refer to the *Canadian Immunization Guide* for specific tetanus toxoid-containing vaccine recommendation based on age https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-22-tetanus-toxoid.html .

****** Given at different injection sites than the vaccine, using separate needles and syringes.

[H] Refer to age appropriate tetanus immunization schedule.

[I] Unless known to have a humoral immune deficiency state, in which case TIG should be given.

References

1. Public Health Agency of Canada. Case Definitions for Communicable Diseases under National Surveillance. *Canada Communicable Disease Report CCDR* 2009; 35S2:1-123.

2. Roper MH, Wassilak SGF, Tiwari TSP and Orenstein WA. Tetanus toxoid. In: Plotkin SA, Orenstein WA, Offit PA, eds. *Vaccines Sixth Edition*. China: Elsevier Saunders Inc. 2013:746-772.

3. World Health Organization. Tetanus vaccines: WHO position paper –February 2017. *Weekly Epidemiological Record* 2017; 6(92):53-76.

4. Tosun S, Batirel A, Oluk AI et al. Tetanus in adults: results of the multicenter ID-IRI study. *Eur J Clin Microbiol Infect Dis* March 2017.

5. Hodowanec A and Bleck TP. Tetanus (*Clostridium tetani)* In: *Mandell, Douglas, and Bennett's* (eds) *Principles and Practice of Infectious Diseases 8th ed.* Elsevier, Philadelphia, 2015.

6. Public Health Agency of Canada. Tetanus, 2014. Available at: http://www.phac-aspc.gc.ca/im/vpd-mev/tetanus-tetanos/professionals-professionnels-eng.php .

7. Tiwari TSP. Chapter 16: Tetanus. VPD Surveillance Manual 5th Edition, 2011. Available at: https://www.cdc.gov/vaccines/pubs/surv-manual/chpt16-tetanus.html

8. Government of Canada. Tetanus Toxoid. In: *Canadian Immunization Guide* 2016. Available at: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-22-tetanus-toxoid.html .

9. World Health Organization. Immunization, Vaccines and Biologicals: Tetanus, January 2017. Available at: http://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/passive/tetanus/en/ .

10. Kyu HH, Mumford JE, Stanaway JD et al. Mortality from tetanus between 1990 and 2015: findings from the global burden of disease study 2015. *BMC Public Health* 2017; 17:179.

11. Grund JM, Toledo C, Davis SM et al. Notes from the Field: Tetanus Cases After Voluntary Medical Male Circumcision for HIV Prevention – Eastern and Southern Africa, 2012-2015. *Morbidity and Mortality Weekly Report (MMWR)* 2016; 65(2):36-37.

12. Centers for Disease Control and Prevention. Neonatal Tetanus ---Montana, 1998. *Morbidity and Mortality Weekly Report (MMWR)* 1998; 47(43):928-930.

13. Yaffee AQ, Day DL, Bastin G et al. Notes from the Field: Obstetric Tetanus in an Unvaccinated Woman After a Home Birth Delivery –Kentucky, 2016. *Morbidity and Mortality Weekly Report (MMWR)* 2017; 66(11):307-308.

14. American Academy of Pediatrics. Tetanus (Lockjaw). In: Pickering LK ed. *Redbook 2012 Report of the Committee on Infectious Diseases 29th ed.* Elk Grove Village, IL: American Academy of Pediatrics, 2012; 707-712.

15. Centers for Disease Control and Prevention. Tetanus Surveillance ---United States, 2001 – 2008. *Morbidity and Mortality Weekly Report (MMWR)* 2011; 60(12):365-369.

16. Centers for Disease Control and Prevention. Chapter 21 – Tetanus. Epidemiology and Prevention of Vaccine-Preventable Diseases, *The Pink Book*: Updated 13th Edition 2015:341-352. https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/tetanus.pdf .

17. Heymann David L. Tetanus (lockjaw) In: *Control of Communicable Diseases Manual 20th ed*, American Public Health Association, Washington, 2015; 607-613.