Chapter 13: Tetanus

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I. Disease description

Tetanus is an acute, often fatal disease that is characterized by generalized increased rigidity and convulsive spasms of skeletal muscles. Tetanus is caused by the spore-forming bacterium *Clostridium tetani*. *C. tetani* spores (the dormant form of the organism) are found in soil and in animal and human feces. The 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. The vegetative organisms excrete the potent toxin tetanospasmin into the bloodstream. The toxin then reaches the nervous system, causing painful and often violent muscular contractions. The muscle stiffness usually first involves the jaw (lockjaw) and neck, and later becomes generalized. Tetanus is a noncommunicable disease—it is not transmitted from one person to another.

II. Background

In the United States, the reported morbidity and mortality due to tetanus have declined dramatically since the mid- to late1940s, when tetanus toxoid became available. The national tetanus surveillance system documented this decrease in tetanus morbidity from 560 reported cases in 1947, the year reporting began, to a total of 37 reported cases in 2001. This decline in tetanus incidence has resulted from the widespread use of tetanus toxoid in diphtheria and tetanus toxoids and pertussis (DTP) and diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccines among infants and children; the use of tetanus toxoid and tetanus immune globulin (TIG) as post-exposure prophylaxis in wound treatment; and improved wound care management. In addition, increased rural to urban migration with consequent decreased exposure to tetanus spores may have also contributed to the decline in tetanus mortality noted during the first half of the 20th century.[1] Wherever immunization programs are in place, the incidence of tetanus declines,[2] and the sex and age distribution of cases shifts to reflect under-immunization. During the period 1996–2000, a total of 202 cases were reported in the United States: 72 (36%) were aged ≥ 60 years, 116 (57%) were aged 20-59 years, and 14 (7%) were aged < 20 years, including two cases of neonatal tetanus.[1,3,4] A recent review of tetanus in U.S. children under age 15 years from 1992–2000 found that 11 of the 13 non-neonatal cases occurred in children who were unvaccinated because of religious or philosophic objections.[5] Serologic studies of the U.S. population demonstrate an excellent correlation between vaccination coverage and immunity to tetanus among children. However, antibody levels decline over time. A national population-based seroprevalence survey conducted from 1988 to 1994 found that 20% of adolescents 12-19 years of age did not have protective levels of tetanus

antibodies (> 0.15 IU/ml).[6] Immunity levels are lowest among the elderly.[6-10] In the national survey, 69% of adults ≥ 70 years of age lacked protective levels of tetanus antibodies.[6] Despite the availability of tetanus toxoid-containing vaccines (tetanus toxoid (TT), tetanus and diphtheria toxoids (Td), DTaP, DTP, diphtheria and tetanus toxoids (DT); subsequently referred to as tetanus toxoid), tetanus continues to cause a substantial health impact in the world. In 1997, the World Health Organization estimated that there were 248,000 deaths worldwide attributable to neonatal tetanus.[11] In 1999 and 2000, the estimated numbers of deaths from neonatal tetanus decreased to approximately 215,000 and 200,000, respectively.[12] The World Health Organization and its partners (UNICEF and UNFPA) are committed to eliminating maternal and neonatal tetanus (MNT) by the year 2005.

III. Importance of rapid case identification

Prompt recognition of tetanus is important clinically because hospitalization and treatment are usually required. Prompt administration of tetanus toxoid and TIG may decrease the severity of the disease. Because tetanus is an uncommon disease, consultation on clinical management issues may be useful. Outbreaks of tetanus among injecting drug users have occurred.[13,14] An increase in the number of cases among injecting-drug users in California has been noted since the early 1990s.[15]

Because tetanus is preventable, in every case the possibility of failure to vaccinate should be investigated. Each case should be used as a case study to determine which factors contributed to the failure and which measures could be taken to improve the vaccine delivery system.

IV. Importance of surveillance

Because tetanus is preventable, in every case the possibility of failure to vaccinate should be investigated. Each case should be used as a case study to determine which factors contributed to the failure, and which measures could be taken to improve the vaccine delivery system and prevent such cases in the future.

Information obtained through surveillance is used to assess progress towards the disease elimination goals. The information is also used to raise awareness of the importance of immunization and to characterize persons or geographic areas in which additional efforts are required to raise vaccination levels and reduce disease incidence.

V. Disease reduction and vaccine coverage goals

The goal for Healthy People 2010 is to eliminate all tetanus cases among persons under age 35 years in the United States.[16] Since herd immunity does not play a role in protecting individuals against tetanus, potentially all persons must be vaccinated in order to achieve this goal.

VI. Case definition

The following case definition for tetanus has been approved by the Council of State and Territorial Epidemiologists (CSTE), and was published in 1997.[17]

Tetanus clinical case definition

Tetanus is defined by the acute onset of hypertonia or by painful muscular contractions (usually of the muscles of the jaw and neck) and generalized muscle spasms without other apparent medical cause.

Case classification

Confirmed. A clinically compatible case, as reported by a health-care professional.

VII. Laboratory testing

There are no laboratory findings characteristic of tetanus. The diagnosis is entirely clinical. *C. tetani* is recovered from wounds in only 30% of cases, and, not infrequently, the organism is isolated from patients who do not have tetanus. Serology obtained before TIG is administered can support susceptibility if the result demonstrates 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 can never exclude the diagnosis of tetanus.

VIII. Reporting

Each state and territory has regulations or laws governing the reporting of diseases and conditions of public health importance.[18] These regulations and laws list the diseases to be reported and describe those persons or institutions responsible for reporting, such as health-care providers, hospitals, laboratories, schools, daycare facilities, and other institutions. Tetanus is a reportable disease in all states and territories of the United States.

Reporting to CDC

A provisional report should be sent by the state health department to the CDC via the National Electronic Telecommunications System for Surveillance (NETSS) or National Electronic Disease Surveillance System (NEDSS), when available, within 14 days of the initial report to the state or local health department. Supplementary information may be sent via NETSS or extended screens, NEDSS investigation screens or on paper forms to the CDC (see **Appendix 18**). **Reporting should not be delayed because of incomplete information.**

Information to collect

The following data are epidemiologically important and should be collected in the course of case investigation. Additional information may be collected at the direction of the state health department.

- Demographic information
  - Name
  - Address
  - State of residence
  - Date of birth
  - Age
  - Sex
  - Ethnicity
  - Race
  - Occupation

- Reporting Source
  - County
  - Earliest date reported

- Clinical
  - Hospitalization and duration of stay
  - Date of onset of symptoms
  - Type of tetanus disease
  - Wound location and management
  - Complications
  - Pre-existing conditions (e.g., diabetes, chronic otitis media)
  - Outcome (case survived or died)
  - Date of death

- Treatment
  - Prophylaxis with Td and TIG
  - Date started

- Vaccine Information
  - Dates of vaccination (prior tetanus toxoid history)
  - Time since last dose of tetanus toxoid
  - Manufacturer of vaccine
  - Lot number
  - If not vaccinated, reason

- Epidemiological
  - Risk factors for disease such as history of a wound or injury, recent injection drug use, tattooing, or body piercing
  - For neonatal cases, maternal country or origin and number of years of residence in the U.S.

IX. Vaccination

Health-care providers should maintain a list of those patients for whom Td is deferred, and recall them for vaccination once supply is adequate.

Primary tetanus immunization with diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP) is recommended for all persons at least 6 weeks old, but < 7 years of age and without contraindications.[19] DTaP is the preferred vaccine for all doses in the vaccination series (including completion of the series in children who have received one or more dose of whole-cell DTP). The primary vaccination with 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 15–18 months of age to maintain adequate immunity during preschool years. The fourth dose should be administered ≥ 6 months after the third dose. If the interval between the third and fourth doses is ≥ 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 4–6 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. Routine tetanus booster immunization, combined with diphtheria toxoid, is recommended for all persons ≥ 7 years of age every 10 years. Td, the adult formulation of tetanus and diphtheria toxoids, is the vaccine of choice. The appropriate use of tetanus toxoid and TIG in wound management is also important for the prevention of tetanus (see **Table 1**).[20]

X. Enhancing surveillance

A number of specific activities can improve the detection and reporting of tetanus cases and the comprehensiveness and quality of reporting. Additional activities are listed in Chapter 16, "Enhancing Surveillance."

Promoting awareness

Efforts should be made to promote physician and infection control practitioner awareness of the need to report suspected cases of tetanus promptly. The completeness of reporting to CDC of tetanus mortality has been estimated at 40%, and completeness of reporting for tetanus morbidity may be even lower.[21] Lack of direct benefits, administrative burdens, and a lack of knowledge of reporting requirements and of needed public health actions are all thought to contribute to incomplete reporting of infectious diseases by physicians and other health-care providers.

Providing feedback

National and statewide surveillance data concerning tetanus should be regularly shared with infection control nurses, hospital epidemiologists, neurologists, and other clinicians; all should be regularly updated concerning reporting requirements. Feedback should also be provided to the persons who reported the cases. The state and local health departments should attend meetings of infection control nurses and other scientific gatherings to share surveillance data and to discuss the quality and usefulness of surveillance.

Review of mortality data

Mortality data are available through the vital records systems in all states, and they may be available soon after deaths occur in states using electronic death certificates. Although the number of tetanus cases in the United States is small, each is important and warrants a full investigation. Mortality data should be reviewed each year to identify deaths that may be due to tetanus. Any previously unreported cases identified through this review should be reported. Nationally, the completeness of reporting of tetanus deaths to the vital records system is estimated at 60%.[21]

XI. Case investigation

The Tetanus Surveillance Worksheet (see **Appendix 18**) may be used as guidelines for the investigation, with assistance from the state health department. At the direction of the state health department, additional assistance may be obtained from the Bacterial Vaccine Preventable Diseases Branch, National Immunization Program, CDC at 404-639-8257.

Table 1. Guide to Tetanus Prophylaxis in Routine Wound Management[20]

History of adsorbed tetanus toxoid (doses)	Clean minor wounds		All other wounds[a]	
	dT[b]	TIG[c]	dT[b]	TIG[c]
Unknown or < 3	Yes	No	Yes	Yes
> 3 doses[d]	No[e]	No	No[f]	No

[a] 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.

[b] For children younger than 7 years of age, diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP) is recommended; if pertussis vaccine is contraindicated, DT is given. For persons 7 years of age or older, dT is recommended. dT indicates adult-type diphtheria and tetanus toxoids; TIG, tetanus immune globulin (human).

[c] Equine tetanus antitoxin should be used when TIG is not available.

[d] 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.

[e] Yes, if more than 10 years since the last dose.

[f] Yes, if more than 5 years since the last dose. More frequent boosters are not needed and can accentuate side effects.

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