

TETANUS

Background

1. Definition: acute, often fatal disease caused by *Clostridium tetani* exotoxin characterized by generalized rigidity and convulsive spasms of skeletal muscles

Pathophysiology

1. Pathology of Disease¹
 - *C. tetani*: gram-positive anaerobic rod with terminal spore
 - Spores resist heat, antiseptics, autoclaving, phenol
 - Organism produces neurotoxin: tetanospasmin
 - *C. tetani* enters body through wound
 - Tetanospasmin blocks inhibiting neurotransmitters in central nervous system causing unopposed muscle contraction, spasm, autonomic instability
 - Infectious but not contagious (no human-to-human spread)
2. Incidence, Prevalence¹
 - Occurs worldwide, more common in warmer months in populated regions with hot, damp climates
 - Spores in soil, GI tracts of domesticated animals, skin surfaces of human adults, contaminated heroin
 - United States incidence 2009: 0.01 per 100,000
3. Risk Factors
 - Inadequate tetanus toxoid vaccination²
 - Contaminated wounds of any severity or type
 - Elective surgery
 - Burns
 - Otitis media
 - Dental infections
 - Animal bites
 - Abortion
 - Pregnancy¹
 - Heroin users
 - Diabetes
 - Chronic wounds²
4. Morbidity / Mortality
 - Complications: laryngospasm, respiratory muscle spasm, fractures, hypertension, nosocomial infection, pulmonary embolism, aspiration pneumonia¹
 - 13% fatality in US : 26 of 197 cases 2001-2008
 - Age over 65 is risk factor for fatal disease (OR = 9.6; CI = 3.6-25.0)²
 - No vaccination (versus one dose or greater) is risk factor for fatal disease (OR = 3.1; CI = 0.7-15.1)²

Diagnostics

1. History³
 - Incubation ranges from 3-21 days (average 8 days)
 - Gradual onset, 1-7 days, progressing to severe spasms lasting up to several weeks, gradual improvement over weeks/months in those who recover
2. Physical Examination⁴
 - Tonic neck, jaw (trismus), trunk spasms
 - Abdominal rigidity
 - Larynx, diaphragm involvement may result in respiratory compromise
 - Autonomic instability
3. Diagnostic Testing: none required, clinical diagnosis⁴
4. Laboratory evaluation⁴
 - Exclude intoxications mimicking tetanus
 - Organism recovered in 30% cases.
 - Demonstration of toxin in mice identifies organism.
 - Anaerobic cultures are commonly negative
 - Positive cultures can occur in immune people without disease
 - Serum antitoxin antibody level 0.10 IU/ml by ELISA is surrogate measure of minimal level of protection;
 - Makes dx less likely but not impossible.
5. Diagnostic imaging: none
6. Other studies: none
7. Diagnostic Criteria¹
 - Local tetanus - persistent muscle contraction in same anatomic area as injury; mortality 1%
 - Cephalic tetanus - following OM, head injury; involves cranial nerves
 - Generalized tetanus (80% of cases) - descending pattern.
 - Trismus, then neck stiffness, dysphagia, abdominal rigidity, autonomic dysfunction
8. Recommendation: NA

Differential Diagnosis

1. Key Differential Diagnoses³
 - Strychnine poisoning
 - Antipsychotic drugs
 - Hypocalcemic tetany
 - Psychogenic
2. Extensive Differential Diagnoses⁴
 - Trismus (peritonsillar and dental abscesses, pharyngeal diphtheria, mandibular fracture and mumps)
 - Rabies
 - Seizure disorder
 - Serotonin syndrome
 - Black widow spider envenomation
 - Botulism
 - Cephalic tetanus without trismus - Bell's palsy, stroke, CNS tumor

Therapeutics

1. Acute Treatment¹
 - Clean wound, debride necrotic tissue, remove foreign material
 - Tetanic spasms: supportive therapy, airway maintenance
 - Tetanus immune globulin (TIG) removes unbound tetanus toxin (see Tetanus IG)
 - Intrathecal TIG - improved clinical response versus intramuscular⁵
 - IVIG contains tetanus antitoxin; may be used if TIG unavailable¹
 - Antibiotics eliminate viable bacteria, prevent further toxin release²; Metronidazole drug of choice - penicillin alternate⁶
 - Diazepam - seizure and spasm control: diazepam alone compared with combination of phenobarbitone and chlorpromazine may be more effective⁷
 - Magnesium - no reduction in need for mechanical ventilation, reduces need for adjunctive medication for spasm, autonomic instability⁸
2. Further Management (24 hrs)
 - Observe for possible autonomic dysfunction⁴
 - Once stable, immunization with tetanus toxoid - active disease does not confer immunity (see tetanus toxoid)
 - Adverse reactions to vaccination (see Tetanus diphtheria vaccine)¹
3. Long-Term Care
 - Supportive
4. Recommendation NA

Follow-Up

1. Variable

Prognosis

1. Complete recovery may take months¹

Prevention¹

1. Full vaccination series - most effective, including up to date booster status
2. Clean minor wounds
 - 0-2 prior toxoid vaccinations: Td or Tdap (Tdap if no prior Tdap and greater than 10 years old); TIG not indicated
 - 3 or more prior toxoid vaccinations: Td or Tdap if greater than 10 years since last dose; TIG not indicated
3. Neither clean nor minor wounds
 - 0-2 prior toxoid vaccinations: Td or Tdap; TIG indicated
 - 3 or more prior toxoid vaccinations: Td or Tdap if greater than 5 years since last dose; TIG not indicated
4. Elderly, HIV, immunocompromised may lack immunity regardless of primary immunization status : liberal prophylaxis with TIG, vaccination at time of injury may be warranted⁴

Patient Education

1. Tetanus Questions and Answers: information about the disease and vaccine:
<http://www.immunize.org/catg.d/p4220.pdf>

References

1. Tetanus. In: Atkinson W, Wolfe C, Hamborski, J, eds. Epidemiology and Prevention of Vaccine-Preventable Diseases. 12th edition. Washington DC: Public Health Foundation, 2011:291-300.
2. Tiwari, T, Clark T, Messonnier, N, Thomas C. Tetanus Surveillance --- United States, 2001-2008. Morbidity and Mortality Weekly Report. April 1, 2011: 60(12);365-369.
3. American Academy of Pediatrics. Tetanus (Lockjaw). In: Pickering LK, ed. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 655-660.
4. Altaro P, Mushatt D, Ahsan S. Tetanus: a Review. Southern Medical Journal. 2011; 104(8):613-617.
5. Miranda Filho D, Ximenes R, Barone A, Vaz V, Vierira A, Albuquerque V. Randomised controlled trial of tetanus treatment with antitetanus immunoglobulin by the intrathecal or intramuscular route. BMJ. 2004;328:615-618.
6. Treatment Guidel Med Lett 2007 May: 5(57):33 TOC
7. Okoromah C, Lesi F. Diazepam for treating tetanus. Cochrane Database Syst Rev. 2004: (1):CD003954
8. Thwaites C, Yen L, Loan H, Thuy T, Thwaites G, Stepniewska K, Soni N, White N, Farrar J. Magnesium sulphate for treatment of severe tetanus: a randomised controlled trial. Lancet. 2006; 368: 1436-1443.

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