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REVIEW ARTICLE

Wound Tetanus

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KEYWORDS:
Tetanus
Antibiotic Therapy
HTIG

We report a case of wound tetanus in a previously immunized patient. The patient developed generalized tetanus requiring IV antibiotic therapy & human tetanus immune globulin (HTIG) therapy. This is only the 15th case reported this year in the United States.

INTRODUCTION

Tetanus occurs worldwide. It is a common problem in areas of the world that are densely populated, and in hot climates in which the soil is rich in organic matter. Reported cases occur more frequently in underdeveloped, overcrowded and economically disadvantaged countries. The disease has been described in the Bible and ancient writings of Greek and Egyptian physicians. It is the only vaccine preventable disease that is infectious but not contagious.

Approximately seventy-five percent of cases occur between April and October. There are between 800,000 and one million cases worldwide yearly. Worldwide deaths have been reported between 210,000 to one million yearly. Greater than fifty percent of these deaths are from neonatal tetanus. Many cases go unreported each year.[1,2,3,9]

In 1903 there were 406 deaths reported from tetanus due to infections obtained from 3983 hand injuries on the fourth of July from fireworks. This led the American Medical Association to recommend banning hand held fireworks. Prophylaxis against tetanus began in World War I. Immunization programs for the military were in place by 1924 and were routine by 1946. All United States military dog tags from 1940 bore the date of the soldier's tetanus immunization. There were no reported military cases of tetanus during the Vietnam War.

Since 2000 there has been an average of approximately thirty cases per year in the United States. The mortality rate has decreased from ninety-one percent in 1947 to 13-42% today. In the early-to-mid 1940's nationwide immunization programs were instituted in the United States. Tetanus became a reportable disease in 1947. The 560 cases reported yearly have dramatically decreased directly due to the institution of immunization protocols. Only 14 cases were reported in 2014. There have been zero deaths in those patients who have completed a primary immunization series.[4,7]

Risk factors for the development of tetanus include: age > 60, short incubation period, inadequate tetanus toxoid vaccination, tetanus prone wounds, intravenous drug use (IVDU), diabetes mellitus, chronic venous stasis ulcers. Currently most cases if tetanus in the United States occur in patients with a history of under immunization. At greater risk are heroin IVDU and older adults because of their higher rate of being unvaccinated or under vaccinated.

PATHOGENESIS

Tetanus is caused by a gram-positive obligate anaerobic spore forming bacillus, Clostridium tetani. Spores of C. tetani are ubiquitous in nature. They have been found in the gastrointestinal tract of humans and domesticated animals, soil, house dust, fresh and salt water. The spores are highly resistant to temperature extremes and humidity and can survive indefinitely. The spores will not germinate unless adequate anaerobic conditions are present. When favorable tissue conditions exist the spores germinate to form mature bacilli which produce exotoxins tetanolysin and tetanospasmin.

Tetanolysin has an undefined role in the development of clinical tetanus. It is thought to contribute to the development of localized anaerobic tissue conditions by direct damaging effects on traumatized tissue. However, the exact mechanism by which this process takes place is still undetermined.[5,6]

Tetanospasmin is second only to botulinum toxin in potency and is responsible for the clinical manifestation(s) of the disease. Tetanus toxoid is an inactivated form of tetanospasmin. The majority of toxin production occurs at the end of the germination phase which only occurs under strict anaerobic conditions. This exotoxin enters peripheral nerves and via the axonal retrograde transport system is transported

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to the central nervous system (CNS). The exotoxin enters presynaptic neurons and interrupts neurotransmitter release. The inhibitory neurotransmitters gamma-aminobutyuric acid (GABA) and glycine are primarily affected. Once inside inhibitory nerve terminals this exotoxin inhibits the release of GABA and glycine. Lack of GABA prevents inhibition of sustained excitatory nerve impulses. This results in a cumulative disinhibition of end-organ neurons such as motor neurons and those of the autonomic nervous system. This entire process accounts for the characteristic muscle spasms and autonomic instability seen in severe tetanus. Tetanospasmin binding is irreversible and symptoms last for the lifetime of the neuron.[8]

SYMPTOMATOLOGY

Tetanus toxin causes hyperactivity of voluntary muscles, i.e. rigidity and spasm. Tetanus is categorized into four clinical forms: generalized, local, cephalic, neonatal. Excluding the neonatal form, the generalized form accounts for approximately 80% of reported cases.

Tetanus usually follows a recognized injury excluding the neonatal form. The incubation period can range from one day to several months. Most commonly the incubation period is from 3-21 days. The length of time between an injury and the onset of symptoms is a predictor of severity of the disease. Symptoms occurring within one week of injury are frequently more severe.

Localized tetanus involves muscular rigidity generally on the side of inoculation and may persist for weeks or months. Symptoms generally resolve without sequelae. Mortality rate of the localized form is less than one percent.

Generalized tetanus presents with trismus (lockjaw) 75% of the time. The clinical triad of muscular rigidity, spasms and autonomic dysfunction characterize generalized tetanus. The development of "risus sardonicus", the "ironical smile of tetanus" occurs in 50-75% of cases. As the disease progresses camptocormia and opisthotonus may develop. This is a poor prognostic finding. Acute, paroxysmal, uncoordinated generalized muscle spasms are characteristic of generalized tetanus . Muscular spasms last from seconds to minutes and are extremely painful. Periods of relaxation occur in between these episodes. Spasms may be precipitated by a variety of external stimuli such as cold air, noise, lights, drinking, voiding or simple movement of the patient. The peripheral muscles of the hands and feet are relatively spared from any involvement. Sensory nerves may become impaired causing altered sensation and allodynia. Impairment of cognition and mood alterations is generally not reported.

Autonomic instability occurs several days after the onset of generalized symptoms occur. This is a major cause of death of these patients. Approximately one-third of patients with generalized tetanus will develop autonomic instability during the course of their disease. "Autonomic storms" occur with marked cardiovascular instability. Severe fluctuation between hypotension, hypertension, brady-tachy arrhythmias and rapid alterations in systemic vascular resistance predispose the patient to malignant arrhythmias and death. Severity and long term recovery can be based on a severity scale, the Ablett Classification ***(Table 1)***.[10]

TABLE 1

Modified Ablett Classification
Grade 1 (mild) muscle rigidity affecting one or more groups of muscles sparing the muscles of deglutition
Grade 2 (moderate) muscle rigidity involving the muscles of deglutition (trismus, risus sardonicus)
Grade 3a (severe) generalized muscle rigidity/spasms (opisthotonus)
Grade 3b (very severe) autonomic nervous system involvement

DIAGNOSIS

The diagnosis of tetanus is generally clinically based. The causative microorganism is recovered in less than 30% of cases. Bacteriologic studies have confirmed the presence of C. tetani in only approximately one-third of cases. The presence of C. tetani does not mean that the patient has tetanus. There are no laboratory tests that conclusively diagnose tetanus. The measurement of a serum antitoxin level greater than 0.15 units/ml makes the diagnosis of tetanus very unlikely but not impossible.

A bedside diagnostic tool, the "spatula test" may be useful as an adjunct to aid the diagnosis of clinical tetanus. If a spatula (tongue blade) inserted in the posterior pharynx elicits a gag response the test is negative. If the patient has an involuntary biting reflex, the test is positive and suggestive of early tetanus.

Because the diagnosis of tetanus is primarily a clinical determination certain other conditions may mimic the symptoms of tetanus. A useful diagnostic list would include: seizure disorder, serotonin syndrome, black widow spider envenomation, strychnine poisoning, botulism, hypocalcemic tetany, antipsychotic medication toxicity and rabies.

TREATMENT

The medical management of acute tetanus revolves around the prevention of further toxin release, neutralization of unbound toxin and minimizing the effects of bound toxin. Wound management including debridement is an important part of the treatment protocol.

Penicillin and metronidazole are the antibiotics of choice to eliminate viable C. tetani bacteria as a source of infection. Erythromycin and clindamycin are acceptable alternative antibiotics. Some studies have shown the use of metronidazole may decrease both recovery time and mortality.

Minimization of external stimuli is required. Most patients do better symptomatically is a quiet, secluded, lowly lighted room. Maintenance of an adequate airway and control pf muscle spasms are of paramount importance. Early intubation must be undertaken if there is any evidence of airway compromise.

An active case of tetanus itself does not impart immunity. Nonimmunized survivors of tetanus have been victims a second time. Tetanus toxoid vaccination should be given as a part of the treatment regime. It takes 4-7 days for clinically detectable antibody levels to be achieved. This immune response is frequently delayed for weeks in the elderly.

Fifty percent of leukemia/lymphoma patients who undergo chemotherapy lose immunity to tetanus. Bone marrow transplant patients need revaccination 12-24 months post-transplant.

Neutralization of unbound tetanus toxin is achieved by the use of human tetanus immunoglobulin (HTIG). This should be administered within 24 hours of the clinical suspicion of acute tetanus. HTIG has a half-life of 25-30 days. It neutralizes circulating tetanospasmin but has no effect of neuron-bound toxin. A single dose is sufficient. However, there is great controversy surrounding optimal dose therapy. Most authorities consider 500 IU administered intramuscularly as the optimal dose for both pediatric and adult patients.

The use of botulinum toxin in the treatment of generalized tetanus has been attempted in several cases with varying results.[11]

CASE HISTORY

A 43-year-old Caucasian male presented to a rural hospital emergency department following a skill saw accident resulting in a 3.8 cm laceration to the palmar aspect of his left thumb. There was no tendon or bone involvement and minimal contamination with wood fragments. He underwent a simple laceration repair with the placement of 5 interrupted sutures, received a diphtheria-pertussis-tetanus injection and placed on double strength sulfamethoxazole-trimethoprim twice daily for ten days. Seventeen days later he followed up in the emergency department for a wound recheck. His laceration had healed with only a small escar remaining. There was no discharge or drainage from the sutured wound. He did have a small amount of erythema to the palmar surface of the left thumb. A decision was made to continue antibiotics and he was placed on minocycline 100mg P.O. BID and clindamycin 300mg P.O. QID. Three days later (20 days post injury) the patient presented again to the emergency department for complaints of left jaw pain, muscle spasms of his abdomen and right upper extremity. He complained of being awakened from sleep with left jaw pain followed by the development of abdominal wall fasciculation's. These symptoms progressed to painful muscle spasms of the right and left upper extremity. He had no complaints of difficulty breathing or swallowing. A tentative diagnosis of tetanus was made. The patient received 2.5 mg diazepam IV, 2mg morphine sulfate IV and 250 IU HTIG IM. He was transferred to a tertiary medical center where he received supportive care in ICU. He received an additional 3000 IU HTIG IM and was placed on metronidazole 500mg IV every eight hours after transfer. He remained hospitalized for 72 hours and was discharged home with minimal residual spasms of the right lower extremity. He remained asymptomatic sixty days post discharge.

CONCLUSION

Tetanus is an uncommon disease in the United States. It is a very rare disease in children because of laws mandating pediatric immunization. The patient population in the US most likely to present with acute tetanus are older adult males and intravenous drug users (IVDU).

Lack of routine medical care and failure to maintain updated tetanus vaccination status contribute to low levels of tetanus immunity. This translates into a population at risk for the development of tetanus. The diagnosis of tetanus is generally clinically based. The presentation of this disease is so characteristic that a presumptive diagnosis can be made in most circumstances. Treatment includes preservation of an adequate airway, controlling muscle spasms, administration of HTIG and appropriate antibiotic therapy. Mortality rates are generally low and no tetanus deaths have occurred in individuals who received primary tetanus immunization. The best treatment is prevention of injury and maintenance of tetanus immunity.

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2015 Calendar of Events

May 6-10, 2015
Maine AOMA 93rd Annual Convention
Arizona Grand Resort & Spa
Phoenix, AZ
www.az-osteo.org

June 5-7, 2015
Maine ACOFP
Samoset Resort
Rockport, ME
www.mainedo.org

June 5-7, 2015
Indiana Osteopathic Association 118th Annual Spring Update
Crowne Plaza Union Station
Indianapolis, IN
www.inosteo.org

July 10-12, 2015
Direct Primary Care Summit
InterContinental Kansas City at the Plaza
Kansas City, MO
www.dpcsummit.org

July 22-26, 2015
ALOMA 25th Annual Emerald Coast Conference
Hilton Sandestin
Destin, FL

July 29 - August 2, 2015
Florida Society ACOFP 35th Annual Convention and Family Medicine Update
Hilton Bonnet Creek
Orlando, FL

July 30 – August 2, 2015
MAOFP Summer Family Medicine Update Conference
Grand Traverse Resort
Acme, MI
www.maofp.org/cme

August 4-9, 2015
TOMA-Texas ACOFP 2015 Joint Annual Convention
Omni Bay Front, Corpus Christi, TX

August 6-9, 2015
CA-ACOFP 39th Annual Scientific Medical Seminar
Disneyland Hotel
Anaheim, CA
www.acofpca.org

August 7-9, 2015
POFPS 40th Annual CME Symposium
Hershey Lodge, Hershey, PA
www.poma.org

August 12-16, 2015
AOMA 30th Annual State Convention
Chateau on the Lake
Branson, MO
www.arosteopathic.org

August 13-16, 2015
CSOM Summer CME & Membership Program
Vail, CO
coloradodo.org

August 14-16, 2015
NC Society of the ACOFP Annual CME Meeting
Pinehurst Resort
Pinehurst, NC
www.nc-acofp.org

August 21-23, 2015
ACOFP Intensive Update & Board Review
Loews Chicago O'Hare
Rosemont, IL
www.acofp.org

August 28-31, 2015
KMA Annual Meeting
Hyatt Regency Louisville
Louisville, KY
www.kyma.org

September 18-20, 2015
OPSO Annual Primary Care CME
Downtown Portland Embassy Suites
Portland, OR
www.opso.org

October 17-21, 2015
OMED 2015: ACOFP/AOA's 121st Annual Osteopathic Medical Conference & Exhibition
Hyatt Hilton and Convention Center
Orlando, FL
www.acofp.org

November 5-8, 2015
WVOMA 113th Annual Fall CME Conference
The Greenbrier Resort
White Sulphur Springs, WV
www.wvoma.org

April 6-10, 2016
ACOFP Annual Convention & Scientific Seminars
Puerto Rico Convention Center
San Juan, Puerto Rico
www.acofp.org

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MARCH/APRIL 2015 ANSWERS: **1.** C **2.** B **3.** D **4.** A **5.** A **6.** B **7.** C **8.** B **9.** A **10.** A