Management Of Tetanus In The Elderly

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Abstract: ***Background:*** **Tetanus is primarily a disease of the elderly. Both the incidence and the case-fatality rates are higher in the elderly population. Physicians need to be aware of special needs concerning the treatment of tetanus in this population.**

Methods: **A comprehensive review of the literature concerning the treatment of tetanus was undertaken. Using the key words "tetanus," "geriatric," "elderly," and "aged," the MEDLINE files were searched from 1985 to the present. Articles dating before 1985 were accessed by cross-referencing the more recent articles.**

Results and Conclusions: **Once the diagnosis of tetanus is suspected, intensive, expectant management is necessary. The patient should receive intensive care with treatment aimed at prevention of muscle spasms, prevention of respiratory tract and metabolic complications, and neutralization of circulating toxin. Potential complications of tetanus include pulmonary embolus, aspiration pneumonia, malnutrition, and pressure sores. (J Am Board Fam Practice 1992; 5:43-9.)**

Although tetanus immunization of infants and children has been routine since the 1940s, tetanus still occurs in the United States. Elderly people, because they are less likely to have received primary immunization, are particularly susceptible to tetanus. Elderly tetanus patients also have a higher mortality rate than the young. In this report we review the treatment of tetanus and pay particular attention to the unique problems of treating tetanus in the elderly.

Epidemiology

Since 1947, when national reporting began, there has been a progressive decrease in the average annual incidence of tetanus in the United States. In 1987 only 48 cases of tetanus were reported in the United States compared with more than 600 cases in 1948.[1] Although the number of cases reported to the Centers for Disease Control (CDC) is declining, there is evidence that many cases are not being reported. In a 1990 article comparing cases reported to the CDC with deaths from tetanus reported to the National Center for Health Statistics, it was suggested that only 40 percent of tetanus cases were reported to the CDC.[2]

Submitted, revised, 23 July 1991.

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While the incidence has fallen for all age groups, the decline has been most steep in those younger than 60 years of age. The incidence of tetanus increases with increasing age, with greater than 60 percent of cases occurring in those aged 60 years and older.[3] The case fatality rate is also much higher in the elderly population, reaching 42 percent in those 50 years old and older, while the case fatality rate for those younger than 50 years is 5 percent.[3,4]

The lack of adequate immunization is a major contributing factor in tetanus cases. Fully 95 percent of patients with tetanus reported to the CDC whose immunization status was known had not completed a primary series of immunization.[3,4] Additionally, studies have shown that elderly patients do develop protective titers when immunized.[5-7]

Seventy-one percent of patients with tetanus who were reported to the CDC in 1985–1986 contracted tetanus after an identified acute injury, and 21 percent of the cases were associated with such chronic medical conditions as skin ulcers, abscesses, or gangrene.[3] Only 42 percent of those patients who developed tetanus during 1987–1988 sought medical attention before developing signs of tetanus.[4]

Bacteriology

Tetanus is caused by the organism *Clostridium tetani*, an obligate anaerobic, gram-positive bacillus that produces an exotoxin, tetanospasmin. These bacteria are nonencapsulated and form

spores that are resistant to heating, drying, and disinfectants. Spores of *C. tetani* are ubiquitous and have been cultured from soil, housedust, the intestines of domestic animals, and human feces.[8] Spores that gain entry to tissues cannot germinate or elaborate tetanospasmin unless oxygen is depleted. Such focal anaerobic conditions are most likely to occur in wounds with tissue necrosis or foreign bodies. Spores can persist in normal tissues for several months or years, only to germinate at a later time when another injury provides anaerobic conditions.

Tetanospasmin is elaborated by proliferating cells of *C. tetani*; the toxin then spreads by means of motor neurons to the central nervous system (CNS). The toxin becomes bound to gangliosides within the CNS, where it suppresses inhibitory influences on the motor neurons, which results in reflex irritability.[9] The toxin also inhibits acetylcholine release at the muscle motor end plates. In addition, some patients have autonomic nervous system disturbances, such as sweating, fluctuating blood pressure, episodic tachycardia, and increased excretion of catecholamines. Autonomic hyperactivity is thought to be due to direct stimulation of the autonomic nervous system; it can occur late in the course of the disease and is associated with increased mortality.[10,11]

Clinical Presentation

The tetanus bacillus most commonly gains entry through a puncture wound or laceration. There are, however, several recent case reports of tetanus in patients who could not recall injuries or who had minor injuries that would not have been considered "tetanus-prone."[12-15] Other patients in whom tetanus can occur include postoperative patients; burn victims; patients receiving intramuscular injections; patients with gangrene, chronic skin ulcers, frostbite, dental infections, penetrating eye injuries, or umbilical stump infections (neonatal tetanus); and narcotic addicts.[16-18]

The incubation period can range from 1 day to several months but most commonly occurs from 3 days to 3 weeks after exposure. Tetanus is most severe when it occurs in patients who are very young or very old. In addition, the length of time between injury and onset of symptoms is a predictor of severity. Those cases with clinical manifestations occurring within 1 week of injury are frequently more severe.[19,20]

Tetanus has been classified into different clinical forms. The most common is the generalized form. Seventy-five percent of patients present with trismus.[9] Other common presenting complaints include neck rigidity, stiffness, dysphagia, restlessness, and reflex spasm. Later in the course, muscle rigidity becomes the major manifestation. The muscle rigidity typically begins in the jaw (trismus or lockjaw) and facial muscles and later spreads to the extensor muscles of the limbs. Reflex spasms are present in the majority of patients and can be set off by external stimuli. Laryngeal spasm can lead to asphyxia and can occur at any time in the disease. For this reason, early and aggressive protection of the airway is indicated.

Tetanic seizures resemble epileptic seizures in that there is a sudden burst of tonic contractions of one or more muscle groups; the patient, however, remains conscious during such episodes and experiences pain. The frequency and severity of tetanic seizures are related to severity of the disease; the presence of seizures portends a poor prognosis.[21-23]

Other less common forms of tetanus include cephalic tetanus and localized tetanus. Cephalic tetanus is frequently secondary to head trauma or chronic otitis media. The clinical picture of variable cranial nerve palsies (usually affecting the cranial nerves VII, IX, X, XII) occurs as a result of the effect of toxin on the brain stem innervation of the jaw and facial musculature. Ophthalmoplegic tetanus is a variant of cephalic tetanus that develops after penetrating eye injuries and results in third cranial nerve palsy and ptosis. If untreated, most cases of cephalic tetanus will progress to generalized tetanus.

Localized tetanus is an uncommon form of the disorder that is characterized by painful spasms of the group of muscles in close proximity to the site of injury. The stiffness and spasm can persist for several weeks, but this disorder is usually self-limiting.

Complications of tetanus include fractures of the long bones, dislocation of the temporomandibular and shoulder joints, pulmonary embolus, hypertension, arrhythmias, coma, paralytic ileus, pressure sores, urinary retention, stress ulceration, and flexion contractures. Most of

these complications can be prevented with careful, supportive care.

Diagnosis

The diagnosis of tetanus is clinical. A history of trauma can be elicited in 71 to 90 percent of patients.[3,16,24] Laboratory studies might show a moderate leukocytosis, and findings from cerebrospinal fluid (CSF) examination are usually within normal limits. Cultures are positive in only 32 to 50 percent.[16,25] In addition, the isolation of *C. tetani* from contaminated wounds does not mean that the patient has, or will contract, tetanus. One must be cautious in diagnosing tetanus in persons with reliable histories of having received two or more injections of tetanus toxoid in the past. Obtaining an assay for antitoxin is helpful in these cases, and the presence of 0.01 IU/mL of serum is generally considered protective.[26]

The differential diagnosis of generalized tetanus presents little difficulty. Tetanus in the early stages, however, can be more difficult to distinguish from other entities. Trismus can occur in patients with intraoral disease or globus hystericus and can be an acute reaction to a phenothiazine drug. Muscular stiffness and rigidity can also be a manifestation of strychnine poisoning or hepatic encephalopathy.

Management

Because immunization of infants and children has been widespread since the 1940s, tetanus has become a disease of the elderly. This population also frequently suffers from multiple underlying diseases, which increases the likelihood of mortality from the disease as well as from iatrogenic complications. For this reason, close monitoring of the elderly during treatment of tetanus is imperative.

Treatment has the following goals: (1) to prevent muscle spasms, (2) to prevent respiratory and metabolic complications, (3) to neutralize circulating toxin, and (4) to eliminate the source of the toxin by careful surgical excision. The value of intensive and constant medical and nursing care has been repeatedly reported.[9,13,22,23,27,28] The patient should be kept in a quiet environment, sheltered from any unnecessary external stimuli.[23]

The early prevention of potential respiratory complications is important in maintaining low mortality rates.[21] Prophylactic intubation should be given serious consideration,[9,22,27] and tracheostomy should be performed in patients requiring more than 10 days of intubation[9] or after the onset of the first generalized seizure.[23] In addition, prophylactic tracheostomy can help maintain the airways of patients with opisthotonos, a severe spastic involvement of the back and thoracic muscles.[29]

Tetanus antitoxin does not appear to neutralize toxin already fixed within the CNS but does neutralize circulating toxin, thus preventing further fixation of the toxin to the CNS.[9,27,29] It is now recommended that 3000 to 6000 U of human tetanus immune globulin be given intramuscularly at the time of diagnosis. Allergic reactions are rare with the human tetanus immune globulin.[9,22]

Neuromuscular manifestations, such as tonic spasms and tetanic seizures, are universal in tetanus, and control of these is important. Several classes of agents have been used for this purpose, including sedative-hypnotics, general anesthetics, centrally acting muscle relaxants, and neuromuscular blocking agents. Table 1 lists both the medications more commonly prescribed for the treatment of the neuromuscular manifestations of tetanus and their frequently encountered adverse reactions.

The sedative-hypnotics have become a mainstay in the treatment of tetanus; diazepam has been the most frequently studied. These drugs can act to reduce anxiety, produce sedation, and induce muscle relaxation. In addition, diazepam can be effective in preventing seizures. Diazepam has been used in doses up to 20 mg every 2 to 6 hours and should be titrated to control muscle rigidity and inhibition of spasm, as well as the desired level of sedation.[30-33] A continuous infu-

Table 1. Medications Used to Treat Neuromuscular Manifestations of Tetanus

Medication	Intravenous Dosage	Adverse Effects
Diazepam	40–200 mg/d	Central nervous system depression
Pancuronium	0.5–2.0 mg/h	Respiratory depression
Tubocurarine	6–12 mg/h	Respiratory depression
Pentobarbital	50–200 mg	Respiratory depression
Chlorpromazine	25 mg every 3–4 h	Hypotension
Dantrolene sodium	1–2 mg/kg every 4–6 h	Hepatotoxicity

sion with a serum concentration of > 500 ng/mL has also been recommended.[34] Because of its long half-life, particularly in the elderly, the newer, shorter-acting agents can be an appropriate alternative. Prolonged coma after the administration of diazepam has been observed.[13,35]

If severe muscle spasms cannot be controlled by sedative-hypnotics, mechanical ventilation, along with potent neuromuscular blocking agents, such as pancuronium or tubocurarine, becomes necessary. In a recent report of 42 adult patients (mean age 70.5 years) with severe tetanus, induced paralysis with continuous subcutaneous infusion of pancuronium bromide resulted in an 88 percent success rate.[36] This protocol not only minimizes the sedation, a very important consideration in the elderly, but also allows for better assessment of the level of consciousness and possibly helps in preventing complications.

Barbiturates, such as pentobarbital, have been used to treat tetanus when rapid action is required.[28] Phenothiazines, such as chlorpromazine, have been used in combination with diazepam or barbiturates to reduce rigidity and spasms.[27] These drugs should be used with great caution in the elderly. Strict attention to the blood pressure is important when using this combination, especially under conditions of autonomic instability. A recent report suggests that the peripheral muscle relaxant dantrolene sodium will resolve spontaneous muscle spasms.[37] Opiates, which can cause respiratory depression and nervous system stimulation, are contraindicated.[23]

Surgical therapies are important. Débridement should be performed to remove organisms and to create an aerobic environment. Specimens for culture should be obtained at the time of débridement, and antibiotic therapy should be started to treat bacteremia induced by débridement. Antibiotics considered effective include penicillin G, erythromycin, tetracycline, and chloramphenicol. A recent study comparing penicillin G with metronidazole found that the metronidazole group had a lower mortality rate, a shorter hospital stay, and an improved response to treatment.[38] Antimicrobial treatment is usually recommended for 10 days.

Autonomic dysfunction is one of the most feared complications of tetanus. Prompt recognition and treatment of this complication are important in reducing the overall mortality of tetanus.[9] The syndrome of autonomic instability can occur in up to 60 percent of patients, usually during the second or third week of treatment.[25] Autonomic instability usually follows a three-phase pattern. Initially there can be tachycardia, hypertension, and tachyarrhythmias. During the second phase, hypotension becomes the major manifestation. Finally, there is a return to hypertension and increased systemic vascular resistance.[9,25,27] Because of the frequent and severe swings in blood pressure during the second phase, aggressive monitoring using a pulmonary artery catheter is often necessary.

Beta-blockers are effective for the treatment of hypertension and tachycardia. Propranolol[39] and labetalol[40,41] have been effective in the treatment of sympathetic nervous system overactivity. Hypotension, when it occurs with bradycardia, is an ominous sign. Phentolamine has been used for hypotension, but if the cardiac output falls, agents such as dopamine and dobutamine become necessary.[22]

Age and tetanus are both risk factors for developing deep-vein thrombosis and pulmonary embolism.[9,27] For this reason, prophylactic heparin (5000 U subcutaneously twice daily) should be administered until the patient becomes ambulatory. Techniques to prevent pressure sores should also be adopted. One series reported that 3 percent of patients had gastrointestinal bleeding.[22] Administering H_2 receptor blockers can prevent this complication.

Maintenance of nutrition is extremely important; however, feeding by nasogastric tube can be associated with an increased rate of aspiration pneumonia, especially in the elderly.[23] Other methods of maintaining nutrition include parenteral hyperalimentation and nasoduodenal tube and gastrostomy tube feeding. The gastrointestinal tract should be used whenever possible. With

Table 2. Routine Diphtheria and Tetanus Immunization Schedule for Persons Aged 7 Years and Older.*

Dose	Interval
Primary 1	First dose
Primary 2	4–8 weeks after first dose†
Primary 3	6–12 months after second dose†
Boosters	Every 10 years after last dose

*Immunization Practices Advisory Commitee.[45]
†Prolonging the interval does not require restarting the series.

Table 3. Guide to Tetanus Prophylaxis in Routine Wound Management.*

History of Adsorbed Tetanus Toxoid (doses)	Clean, Minor Wounds		All Other Wounds†	
	Tetanus-diphtheria‡	Tetanus Immune Globulin	Tetanus-diphtheria‡	Tetanus Immune Globulin
Unknown or < 3	Yes	No	Yes	Yes
≥ 3§	No¶	No	No‖	No

*From Centers for Disease Control.[1]

†Such as, but not limited to, wounds contaminated with dirt, feces, soil, saliva, etc.; puncture wounds; avulsions; and wounds resulting from missiles, crushing, burns, and frostbite.

‡For children aged < 7 years; diphtheria-pertussis-tetanus (diphtheria and tetanus if pertussis is contraindicated) is preferred to tetanus toxoid alone. For persons aged ≥ 7 years, diphtheria and tetanus is preferred to tetanus toxoid alone.

§If only 3 doses of fluid toxoid have been received, a fourth dose of toxoid, preferably an adsorbed toxoid, should be given.

¶Yes, if > 10 years since last dose.

‖Yes, if > 5 years since last dose. (More frequent boosters are not needed and can accentuate side effects.)

severe tetanus, however, parenteral alimentation frequently becomes necessary because curarization can lead to ileus.

Once the disease has subsided, most patients will regain full activity and mobility quickly, but some patients will remain hypertonic for some time after therapy.[22] To prevent contractures, mobility should be encouraged early. Patients who have recovered from tetanus must then be actively immunized, as the amount tetanospasmin elaborated is usually insufficient to provoke a protective titer of antibody.[42]

Comment

The impact of intensive care unit (ICU) capabilities has been great in the care of patients with tetanus. In a comparison study of 306 patients treated with intensive care management and 335 patients from the same hospital prior to the institution of the ICU, mortality decreased from 43.6 to 15 percent with intensive care management.[43] Because of positive experiences in treating the elderly, aggressive supportive management is indicated.[13,27,36]

Treatment of tetanus in the elderly would not be necessary had recommended preventive measures not failed. The thrust of this review is on the treatment of tetanus, but several points about prevention deserve emphasis. Elderly persons are susceptible to tetanus because many have not received primary immunization or received boosters when recommended. Surveys have shown that tetanus antitoxin titers decline with advancing age. Elderly women are less likely than men to be immune.[44]

Tetanus vaccine (usually given as a tetanus-diphtheria toxoid to insure immunity to diphtheria as well) is highly effective in preventing tetanus. The CDC (Table 2), the American College of Physicians, and the US Preventive Services Task Force recommend that all adults complete primary immunization against tetanus-diphtheria and receive booster immunizations every 10 years.[45-47] No upper age limit has been suggested for tetanus immunization. In accordance with CDC recommendations (Table 3), immunization boosters should be administered every 10 years or more frequently when indicated. Studies have shown poor compliance with these recommendations in a variety of settings, including office practice, emergency departments, and nursing homes.[48-53] Closer attention to these recommendations by physicians and patients will reduce the number of cases of tetanus in the elderly.

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