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FROM THE

PUBLIC HEALTH STATISTICS SECTION

A CASE OF TETANUS IN A YOUNG LOUISIANA TEACHER

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Case Presentation

A 39-year-old previously healthy male teacher was admitted to a local hospital on April 28, 1974. Two days before his admission, he noticed the onset of a stiff, sore neck. A day later he was seen by a physician and phenylbutazone was prescribed for "muscle soreness," but the symptoms worsened. He then noticed dysphagia and an inability to open his mouth. He denied any use of phenothiazines, or known contact with strychnine.

Physical examination revealed obvious trismus and marked rigidity of his back, neck, and abdominal musculature. Initially neither opisthotonus nor convulsive movements were present. Deep tendon reflexes were slightly hyperactive. The patient's temperature was 99.6°F; pulse, 84; and blood pressure, 180/100.

The man had never been in the military service nor could he remember ever having received any tetanus immunizations. He exhibited no physical evidence of any wound or soft tissue infection; nor could he recall any specific skin injuries in the preceding two weeks. He did, however, do carpentry work and received frequent injuries with small splinters. He also admitted

to cleaning his ears with bobby pins and match sticks.

His laboratory studies included a white blood cell count of 7,300 with a normal differential, and a sedimentation rate of 13. Other routine studies including an STS, SMA-12 profile, serum electrolytes, ECG, chest x-ray, and CSF survey were all normal. A presumptive diagnosis of tetanus was made and 6000 U of tetanus immune globulin (human) as well as 0.5 ml of tetanus toxoid were given IM. He was admitted to the Intensive Care Unit for observation.

Several hours after admission he began to have repeated episodes of generalized "seizures" consisting of severe muscle contractions of virtually all muscle groups. These were brief in duration, lasting only a few seconds. They were precipitated by minor stimuli such as turning on a light. His muscles did not relax fully between "seizures." Therapy with diazepam (Valium) in a dose of 10 to 20 mg intravenously every hour was instituted. A tracheostomy was performed. With Pavulon being administered as a muscle paralyzing agent, respirations were assisted by a volume ventilator. Over the first 48 hours the patient's symptoms worsened and his convulsive episodes became more prolonged

and were precipitated by lesser stimuli. He continued to respond well to intravenous diazepam. Propranolol (Inderal) was given in a dose of 1 mg intravenously as needed to maintain his heart rate below 100 beats per minute. Clinical suspicion of pulmonary emboli was raised on two occasions. Heparin was given but had to be discontinued when occult gastrointestinal bleeding with a drop in hemoglobin occurred on day 13. On day 17 a urinary tract infection was treated with an aminoglycoside antibiotic.

By day 19 the patient was free enough from spasms to be able to breathe normally without ventilator assistance. His diazepam was discontinued and his tracheostomy was removed. By the 24th day he was able to eat and feed himself and was transferred from the Intensive Care Unit to a regular ward bed. Vigorous physical therapy was instituted at that time to help him redevelop his muscle strength. Followup laboratory tests were all within normal limits. He showed much progress in his physical therapy and had nearly achieved his normal strength by the time of discharge.

Discussion

Tetanus is a dread disease with very dramatic clinical manifestations, and as such has given rise to a considerable amount of folklore. Neuromuscular tissues become hyperexcitable due to the exotoxin liberated by the vegetative form of *Clostridium tetani*. This gram-positive obligate anaerobe is innocuous by itself, being noninvasive and producing no suppuration. However, the exotoxin it elaborates is extremely deadly.

The spore form of the organism is ubiquitous in soil, whether or not it is contaminated with animal feces. When introduced into devitalized tissue with a low oxidation-reduction potential (anaerobic conditions), the spore germinates and produces the vegetative form. It is only this latter form that is capable of excreting the exotoxin, tetanospasmin. With the exception of botulinum toxin, this substance is the most powerful poison known. It binds tightly to neural tissue and acts like strychnine to suppress inhibitory influences on motor neurones.

Tetanus may occur even after trivial wounds; indeed, in at least one-fifth of cases no entry wound can be identified. The more characteristic wound is one favoring anaerobic conditions, such as a deep puncture wound or devitalized tissue, such as a burn or crush injury. Heroin addicts

who "skin pop" are a high risk group. The incubation period is inversely proportional to the expected mortality. If less than five days have elapsed, mortality approaches 70 percent. However, if 10 to 12 days transpire, mortality may be as low as 10 percent. Presumably, a longer incubation period allows time for development of some (albeit incomplete) immunity.

The diagnosis of tetanus is made on clinical grounds. There is no diagnostic laboratory test. The usual laboratory values including cerebrospinal fluid are frustratingly normal. Culture from debrided wound tissues often yield false-negative results and antibody response is usually absent. Fortunately, the clinical manifestations are rather characteristic. The earliest sign is usually trismus (thus the familiar name "lock jaw"). Other muscles soon develop spasms, resulting in back pain and neck stiffness. Opisthotonus can be produced. The sinister smile called risus sardonicus gives the erroneous impression that the patient is enjoying the severe pains produced by his intense spasms. Restlessness and irritability are invariably present. Minor stimuli such as lights or noises can produce tetanic "seizures." Laryngospasm can result in asphyxiation. The intense energy expended in muscle contraction results in fever, diaphoresis, and increased catabolism. Cardiac arrhythmias and wide fluctuations in blood pressure are results of sympathetic overactivity due to vasomotor center stimulation by tetanospasmin.

Patients do not die of tetanus; they die of complications of the disease, generally asphyxiation, infection, or arrhythmias. Thus the treatment centers about supportive care. The best prognosis is achieved in centers that have had experience with the disease and that have excellent nursing care units. Early elective tracheostomy is mandatory. Ventilatory devices are individualized for each case, usually requiring muscular paralysis and artificial ventilation. Meticulous respiratory toilet must be achieved. Aspiration is a constant problem. A quiet, dark room with minimal sensory stimuli must be provided. Analgesia is required since the patient is fully aware of each painful muscle spasm.

Muscle relaxation is provided in any of several ways. Curare is used by some. A combination of barbiturates and phenothiazines is still used in some centers. We recommend the use of intravenous diazepam in a dose titrated for each patient. We found 10 mg every hour sufficed for our patient. Some cases require 10 to 20 mg per kg per day. As noted in our case

report, propranolol is very useful to counteract the sympathetic nervous system overactivity, and seems useful to suppress the arrhythmias that are a common cause of death.

Antibiotics directed against *Clostridium tetani* are of unproved benefit. Nonetheless, it would seem advisable to try to eradicate the organism so that additional exotoxin is not produced. For this goal, penicillin is the drug of choice. Procaine penicillin, 1.2 million units daily for 10 days, is sufficient. For the penicillin-allergic individual, tetracycline 2 grams daily may be used.

Any wound should be vigorously debrided and irrigated with hydrogen peroxide and then left open. However, the treatment should not be performed until after antibiotics and antiserum have been administered. Formerly, only horse antitoxin was available. This was quite effective, but many people were allergic initially and demonstrated anaphylaxis or else developed serum sickness days after therapy. Currently human antitoxin is recommended. Three thousand to six thousand units of human tetanus immune globulin (TIG) is given intramuscularly. Allergic reactions and serum sickness have not been associated with this material. The half-life is 25 days, so one injection is sufficient. It must be remembered that this antibody is effective only against circulating toxin and the toxin that is already attached to neural tissue will not be inactivated. This attached toxin must be metabolized, and this is a slow process. Thus, globulin has no really dramatic effect on the progression of the disease.

Tetanus is a self-limited disease from which complete recovery can be anticipated, providing the patient does not succumb to one of the many complications. The exotoxin is so potent that a tiny amount can produce dramatic disease yet be too little to generate an immune response. Hence, a patient recovered from the disease is still susceptible to a recurrence. Therefore, all patients should receive active immunization which should begin when the disease is first diagnosed. Administration of TIG does not interfere with the immune response

to tetanus toxoid, provided both are given at different sites.

Tetanus is a completely preventable disease. Everyone should receive immunizations since there are no contraindications to tetanus toxoid. Infants should receive the primary injection (DTP) beginning at age 2 to 4 months, then twice more at 4 to 8 week intervals, or it may be given concurrently with oral poliomyelitis vaccine at 2, 4, and 6 months of age. An additional injection one year after the third finishes the "primary series" for children. The first booster is given at 4-6 years of age or just prior to school entrance. For adults, the "primary series" consists of three doses of the combined alum-precipitated tetanus toxoid with adult-type diphtheria toxoid (Td). The second dose of Td is given 4 to 6 weeks after the first, and the third dose 6 months to one year after the second. Thereafter, for all patients, boosters are recommended with Td every ten years. More frequent routine boosters are not recommended since they offer no more protection and only contribute to a hypersensitive state that results in severe local reaction. However, if the patient receives a "tetanus-prone injury," he should receive a booster of Td if it has been more than 5 years since his last injection. Passive protection with TIG should be considered only when the patient has had less than two previous injections of tetanus toxoid or his status is unknown. If the wound is untended for more than 24 hours and the patient has received less than three previous injections of toxoid, TIG may also be indicated. Antibiotics are used by some physicians in an attempt to prevent tetanus following an injury. Such an approach should not preclude administration of tetanus toxoid, which is the only reliable preventive treatment.

GENERAL REFERENCES

- Heurich AE, Brust JCM, Richter RW: Management of urban tetanus. *Med Clin North Am* 57:1373-1381, 1973.
- Weinstein L: Tetanus. *N Engl J Med* 289:1293-1296, 1973.
- Collected Recommendations of the Public Health Service Advisory Committee on Immunization Practices. U.S. Department of Health, Education, and Welfare. *Morbidity and Mortality*. Vol. 21, No. 25, June 24, 1972.

PUBLIC HEALTH NURSE AND SANITARIAN UNCOVER SALMONELLA OUTBREAK

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Thirty-eight of sixty-four people who attended a family reunion dinner in Iberia Parish on June 8, 1974 developed an illness of fever, chills, and diarrhea approximately 8 to 12 hours after the meal. The menu consisted of meat balls in tomato sauce, crab dip, shrimp dip, deviled eggs, and chicken salad sandwiches.

An investigation utilizing food consumption history, symptoms, and stool and food culturing uncovered evidence to suggest that the chicken salad was the vehicle for disseminating *Salmonella bredeney* to the guests. Of the culture reports available, 32 of 37 (87%) of those who ate the chicken salad were culture positive and of those who did not eat the chicken salad only 2 of 25 (8%) were culture positive (from Fisher's exact test $p < 10^{-3}$).

Symptoms occurred in all but 3 people who ate the chicken salad; however the stool culture in each of the three was positive for *Salmonella bredeney*. Food consumption histories revealed that eight people ate only chicken salad and all of them became ill.

Subsequent patient follow-up via a second stool culture approximately two weeks later in 10 of those who initially had positive cultures revealed three people still carrying *Salmonella bredeney*. Of interest is the fact that these three people did receive some sort of antibiotic treatment for their illness while none of the others did.

Usually one of two food handling techniques is the culprit causing this type of outbreak: improper heating (never cooking with a temperature greater than 140°F), or re-contamination of a food item once cooking has been properly completed. Moreover, most *Salmonella* serotypes (excluding *S. typhi*) also require 4-5 hours to incubate in food in order to be present in large enough numbers to cause disease. The ideal incubation temperature is about 35°C.

In the case described, chicken for the chicken salad was placed on a table as the pots used to boil them were readied. While cooking, some of the people in the kitchen were busy cleaning the box the chickens came in, as this box was to be used for storing the chicken salad sandwiches later. Some of their cleaning materials were placed on the table top. When finished boiling, the chickens were placed back on the table top to cool. They cooled for 3-4 hours and then were sliced for the chicken salad. As soon as the salad was made (taking approximately 1 hour), it was used to make the sandwiches. The sandwiches were then stored in the "cleaned" box and, along with the left-over chicken salad, promptly refrigerated.

Salmonella bredeney was isolated in one of two cultures from left-over chicken salad not used in sandwich preparation. This left-over at no time came in direct contact with the "cleaned" box.

It appears that re-contamination via the table top, and the time and temperature of cooling and salad preparation were adequate to allow the *Salmonella* to proliferate sufficiently to lead to the outbreak. Care must be taken in food preparation, even in the most spotless kitchens (as this kitchen was) to prevent re-contamination. Knives should be washed, tables cleaned, and any possible contaminants (such as the box that carried the chickens) be removed. Moreover, food should be refrigerated as soon as possible to prevent bacterial proliferation.

This outbreak also supports the findings of other investigators who have reported increased duration of excretion of *Salmonella* in patients with active salmonellosis dysentery who have received antibiotics.¹⁻³ Antibiotic treatment also favors the development of antibiotic resistant strains, making infection possibly more dangerous. For these reasons antibiotic

therapy in uncomplicated *Salmonella gastroenteritis* is not recommended.²

REFERENCES

1. Dixon, JMS: Effect of antibiotic treatment on duration of excretion of *Salmonella typhimurium* by children. *Dr Med J* 2:1343-1345, 1965

2. Aserkoff, B., Bennett JV: Effect of antibiotic therapy in acute salmonellosis on the fecal excretion of *Salmonellae*, *N Engl J Med* 281:636-640, 1969

3. Smith, ER, Bodley BWO: Treatment of *Salmonella enteritis* and its effects on the carrier state. *Can Med Assoc J* 104:1004-1006, 1971

HUMAN RABIES IMMUNE GLOBULIN

Human Rabies Immune Globulin (HRIG) was licensed on July 12, 1974, and will be available for commercial distribution in early September. It is prepared from plasma pools with high rabies antibody titer obtained from immunized volunteers. HRIG has been shown in extensive laboratory and field evaluations to induce antibody levels equivalent to those following antirabies serum of equine origin. It will be a valuable alternative product for patients who are unable to receive antirabies serum.

At least initially, HRIG will likely be in short supply. It thus becomes particularly important that HRIG be used primarily for patients who are known to be hypersensitive to horse serum, are skin-test positive to antirabies serum of equine origin, or, in view of theoretical concern over fetus development, are pregnant.

The recommended dose of HRIG is 20 IU/kg. Up to 50% of the globulin dose should be used for infiltrating the wound and the rest for intramuscular injection.

Human rabies immune globulin (HRIG) has been shown to suppress the antibody response to rabies vaccine as has equine antirabies serum.^{1,2} When hyperimmune serum and vaccine is administered for postexposure rabies prophylaxis, 21 doses of vaccine plus booster doses

on the 10th and 20th day after the completion of the initial course should be administered to assure an adequate antibody response.³

Physicians may obtain this product by contacting Cutter Laboratories, 8610 Directors Row, Dallas, Texas 75247. Twenty-four hour, 7 day per week telephone service for emergency shipment of HRIG throughout the continental United States will be available through the Dallas Distribution Center, telephone number (214) 631-6240.

REFERENCES

1. Hattwick M, Rubin RH, Music S, et al: Postexposure rabies prophylaxis with human rabies immune globulin. *JAMA* 227:407-410, 1974
2. Loofbourov JC, Cabasso VJ, Roby RE, et al: Rabies immune globulin (human): Clinical trials and dose determination. *JAMA* 217:1825-1831, 1971
3. Rubin RH, Sikes RK, Gregg MB: Human rabies immune globulin: Clinical trials and effects on serum antiglobulins. *JAMA* 224:871-874, 1973

SOURCE: C.D.C. "Morbidity and Mortality Weekly Report", 23:291, August 17, 1974

SELECTED REPORTABLE DISEASES

(By Place of Residence)

STATE AND PARISH TOTALS Reported Morbidity August, 1974	ASEPTIC MENINGITIS	DIPHTHERIA	ENCEPHALITIS	ENCEPHALITIS, POST INFECTIONOUS	HEPATITIS A AND UNSPECIFIED	HEPATITIS B	TUBERCULOSIS, PULMONARY	MENINGOCOCCAL INFECTIONS	PERTUSSIS	RABIES IN ANIMALS	RUBELLA*	SEVERE UNDERNUTRITION	SHIGELLOSIS	TYPHOID FEVER	OTHER SALMONELLOSIS	TETANUS	MEASLES	GONORRHEA	SYPHILIS, PRIMARY AND SECONDARY
TOTAL TO DATE 19 73	80	0	13	4	465	97	385	36	12	36	99	37	177	6	137	3	84	15524	498
TOTAL TO DATE 19 74	106	0	15	5	408	131	401	32	17	20	58	18	120	9	118	3	12	16839	428
TOTAL THIS MONTH	22	0	2	2	34	4	69	3	1	0	0	1	43	0	28	2	0	1966	37
ACADIA																		18	
ALLEN							2												6
ASCENSION					1														8
ASSUMPTION																			10
AVOYELLES					1		2												3
BEAUREGARD															1				10
BIENVILLE																			134
BOSSIER							2						1						1
CADDO							7						21		11				67
CALCASIEU					1		2	1					1		2				1
CALDWELL																			1
CAMERON																			10
CATAHOULA																			5
CLAIBORNE																			9
CONCORDIA																			101
DESOTO							1									3			7
EAST BATON ROUGE					3	1													15
EAST CARROLL							1												6
EAST FELICIANA							1												1
EVANGELINE																			6
FRANKLIN																			2
GRANT																			10
IBERIA					2														1
IBERVILLE							1												3
JACKSON																			5
JEFFERSON	1		1		1		2						2		3				108
JEFFERSON DAVIS																			2
LAFAYETTE					1		2												32
LAFOURCHE					1														23
LASALLE							1												37
LINCOLN												1							3
LIVINGSTON																			10
MADISON																			15
MOREHOUSE			1																25
NATCHITOCHE							1												15
ORLEANS	16			2	6	2	20						18		7	2			664
OUACHITA					1		2												107
PLAQUEMINES																			4
POINTE COUPEE																			105
RAPIDES					1		1												1
RED RIVER																			14
RICHLAND							2												2
SABINE																			3
ST. BERNARD					3				1										8
ST. CHARLES	2																		6
ST. HELENA																			9
ST. JAMES							2												6
ST. JOHN								1											1
ST. JOHN																			20
ST. LANDRY					1														10
ST. MARTIN							1												17
ST. MARY	2					1													16
ST. TAMMANY					1		7	1											1
TANGIPAHOA					10		2												37
TENSAS																			2
TERREBONNE	1						1												33
UNION																			8
VERMILION							1												4
VERNON																			126
WASHINGTON							4												21
WEBSTER							1												23
WEST BATON ROUGE																			3
WEST CARROLL																			29
WEST FELICIANA																			2
WINN																			2
OUT OF STATE																			2
																			1

* Includes Rubella, Congenital Syndrome

From January 1 through August 31, the following cases were also reported: 3-Brucellosis; 1-Malaria (contracted outside the U.S.A.)