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Typhoid Immunization

Recommendations of the Immunization Practices Advisory Committee (ACIP) of the U.S. Public Health Service

These revised recommendations of the Immunization Practices Advisory Committee update previous recommendations (MMWR 1978;27:231-3). They include information on a newly licensed oral live-attentuated typhoid vaccine that was not available when previous recommendations were published.

Introduction

The incidence of typhoid fever declined steadily in the United States from 1900 to 1960 and has since remained at a low level. From 1975 through 1984, the average number of cases reported annually was 464. During that period, greater than 50% of cases occurred among patients greater than or equal to 20 years of age; 62% of reported cases occurred among persons who had traveled to other countries, compared with 33% of reported cases from 1967 through 1976.

Typhoid and Paratyphoid A and B Vaccines

Two vaccines are generally available for civilian use in the United States: 1) a newly licensed oral live-attenuated vaccine (***Vivotif*** manufactured from the Ty21a strain of Salmonella typhi by the Swiss Serum and Vaccine Institute) and 2) a parenteral heat-phenol-inactivated vaccine (manufactured by Wyeth) that has been widely used for many years. In controlled field trials conducted among Chilean schoolchildren, three doses of the Ty21a vaccine were shown to reduce laboratory-confirmed infection by 67% for at least 4 years (95% confidence interval = 47%-79%). In a subsequent trial, a statistically significant decrease in the incidence of clinical typhoid fever occurred among persons receiving four doses of vaccine compared with two or three doses. Since no placebo group was included in this trial, vaccine efficacy could not be calculated. The mechanism by which Ty21a vaccine confers protection is unknown; however, the vaccine does elicit a humoral response. Secondary transmission of vaccine organisms does not occur because viable organisms are not shed in the stool of vaccinees.

In two field trials involving a primary series of two doses of heat-phenol-inactivated typhoid vaccine, similar to the currently available parenteral vaccine, vaccine efficacy ranged from 51%-76%. Vaccine efficacy for an acetone-inactivated

parenteral vaccine, available only to the armed forces, ranges from 66%-94%.

Parenteral heat-phenol-inactivated vaccine and oral live-attenuated Ty21a vaccine have never been directly compared in a field trial, but the live-attenuated vaccine has similar efficacy to the heat-phenol-inactivated vaccine and results in fewer adverse reactions. Experience is limited with the use of the Ty21a vaccine for persons from areas without endemic disease who travel to endemic-disease regions, and for children less than 5 years of age. Also, no experience has been reported regarding its use for persons previously vaccinated with parenteral vaccine.

Vaccines against paratyphoid A and B are not licensed for use in the United States. The effectiveness of paratyphoid A vaccine has never been established, and field trials have shown that the small amount of paratyphoid B antigens contained in "TAB" vaccines (vaccines combining typhoid and paratyphoid A and B antigens) is not effective. Combining paratyphoid A and B antigens with typhoid vaccine increases the risk of vaccine reaction. For these reasons, only monovalent preparations of typhoid vaccine containing ***S. typhi*** antigens should be used.

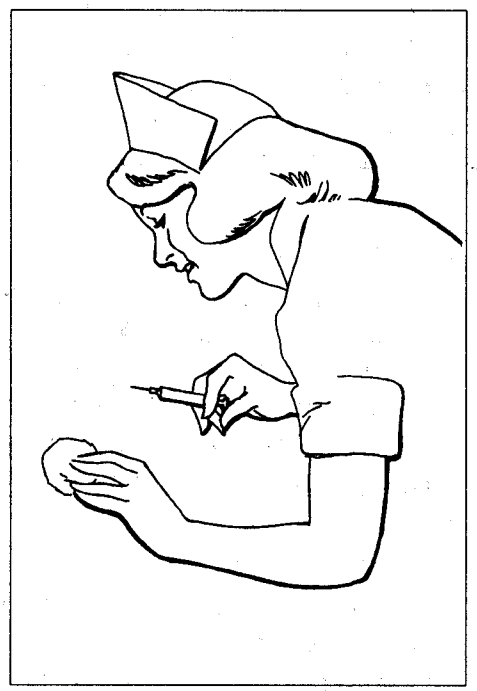
Vaccine Usage

Routine typhoid vaccination is no longer recommended in the United States. However, selective vaccination is indicated for the following groups:

· Travelers to areas that have a recognized risk of exposure to ***S. typhi.*** Risk is greatest for travelers to developing countries (especially Latin America, Asia, and Africa) who have prolonged exposure to potentially contaminated food and drink. Such travelers need to be cautioned that typhoid vaccination is not a substitute for careful selection of food and drink, since typhoid vaccines are not 100% effective, and the protection the vaccine offers can be overwhelmed by large inocula of ***S. typhi.***

· Persons with intimate exposure to a documented typhoid fever carrier, such as occurs with continued household contact.

· Workers in microbiology laboratories who frequently work with ***S. typhi.***



Routine vaccination of sewage sanitation workers is warranted only in areas with endemic typhoid fever. No evidence has shown that typhoid vaccine is useful in controlling common-source outbreaks. Also, the use of typhoid vaccine is not indicated for persons attending rural summer camps or in areas in which natural disasters, such as floods, have occurred.

Primary Vaccination

The following dosages of typhoid vaccines are recommended, based on the experience in field trials:

Adults and children greater than or equal to 10 years of age

Oral live-attenuated Ty21a vaccine: one enteric-coated capsule taken on alternate days to a total of four capsules. Each capsule should be taken with cool liquid no warmer than 37 C, approximately one hour before a meal. The capsules must be kept refrigerated, and all four doses must be taken to achieve maximum efficacy.

OR

Parenteral inactivated vaccine: 0.5 ml subcutaneously, given on two occasions, separated by greater than or equal to four weeks.

Children less than 10 years of age

Oral live-attenuated Ty21a vaccine**: one enteric-coated capsule taken on alternate days to a total of four capsules. Each capsule should be taken with cool liquid no warmer than 37 C, approximately one hour before a meal. The capsules must be kept refrigerated, and all four doses must be taken to achieve maximum efficacy.

OR

Parenteral inactivated vaccine: 0.25 ml subcutaneously, given on two occasions, separated by greater than or equal to four weeks.

If parenteral vaccine is used and there is insufficient time for two doses of vaccine separated by greater than or equal to four weeks,

common practice has been to give three doses of the parenteral vaccine in the volumes already listed at weekly intervals, although this schedule may be less effective.

Booster Doses

Under conditions of continued or repeated exposure to *S. typhi*, booster doses of vaccine are required to maintain immunity after vaccination with parenteral typhoid vaccines. If parenteral vaccine is used, booster doses should be given every three years. Even if greater than three years have elapsed since the prior vaccination, a single booster dose of parenteral vaccine is sufficient. When the heat-phenol-inactivated vaccine is used, less reaction follows booster vaccination by the intradermal route than by the subcutaneous route. (The acetone-inactivated vaccine should not be given by the intradermal route because of the potential for severe local reactions.) No experience has been reported using oral live-attenuated vaccine as a booster; however, using the primary series of four doses of Ty21a as a booster for persons previously vaccinated with parenteral vaccine is a reasonable alternative to administration of a parenteral booster dose. The following routes and dosages of parenteral vaccine for booster vaccination can be expected to produce similar booster antibody responses:

Adults and children greater than or equal to 10 years of age

One dose, 0.5 ml subcutaneously or 0.1 ml intradermally.

Children 6 months to 10 years of age

One dose, 0.25 ml subcutaneously or 0.1 ml intradermally.

The optimal booster schedule for persons who have received Ty21a vaccine has not yet been determined; however, the longest reported follow-up study of vaccine trial subjects showed continued efficacy five years after vaccination. The manufacturer of Ty21a recommends revaccination with the entire four-dose series every 5 years. This recommendation may change as more data become available on the duration of protection produced by the Ty21a vaccine.

Precautions and Contraindications

During volunteer studies and field trials with oral live-attenuated Ty21a vaccine in enteric-coated tablets, side effects were rare and consisted of abdominal discomfort, nausea, vomiting, and rash or urticaria. In safety trials, monitored adverse reactions occurred with equal frequency among groups receiving vaccine and placebo. Parenteral inactivated vaccines produce several systemic and local adverse reactions, including fever (occurring among 14%-29% of vaccinees), headache (9%-30% of vaccinees), and severe local pain and/or swelling (6%-40% of vaccinees); 13%-24% of vaccinees missed work or school because of adverse reactions. More severe reactions have been sporadically reported, including hypotension, chest pain, and shock. Administration of the acetone-inactivated vaccine by jet-injector gun results in a greater incidence of local reactions and is not recommended.

The only contraindication to parenteral typhoid vaccination is a history of severe local or systemic reactions following a previous dose. No experience has been reported with parenteral inactivated vaccine nor oral live-attenuated Ty21a vaccine among pregnant women. Live-attenuated Ty21a should not be used among immunocompromised persons, including those known to be infected with human immunodeficiency virus. Parenteral inactivated vaccine presents a theoretically safer alternative for this group.

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* Reprinted from MMWR 1990;39 (No. RR-10):(1-5).

**One study indicates that adverse reactions are uncommon among children 1-5 years of age. Data are unavailable regarding efficacy for this age group or adverse reactions and efficacy among infants. The vaccine manufacturer recommends that Ty21a not be given to children less than six years of age.

Human Rabies in Texas*

Case History

The first case of human rabies reported in Texas since 1985 occured along the Mexican border in Hidalgo County in June 1990. The victim, a 22-year-old Hispanic male, native to Texas, was bitten by a bat on April 13. He sustained the bite while helping to remove a bat from the storage closet of a tavern. Despite urging from his family and friends to seek medical care, he refrained from doing so.

On May 30, the man began to experience weakness in his right hand and reported this to his supervisor. The following day, he complained of numbness and dysesthesias involving his entire right arm. On June 2, he left work early after exhibiting several 10- to 15-second episodes of staring and unresponsiveness. He visited a physician in Mexico, who prescribed an unknown medication. Later that evening, he reported to an emergency room (ER) complaining of pain in his right hand. Because he gave a history of having injured his right hand on a catfish scale a week earlier, he was treated with ceftriaxone and tetanus toxoid and released.

On the afternoon of June 3, he returned to the ER complaining of "convulsions." He was observed to be hyperventilating and had an arterial pH of 7.59 and a pCO2 of 16. He was discharged after reporting that he felt better. Later that afternoon, he began to experience hallucinations of spiders on his abdomen and had intermittent episodes of rigidity and breath holding. He became sensitive to air currents and insisted that his family close the windows and turn off the fans. He began having trouble swallowing and refused liquids, declining even water to wash down pills.

That evening, June 3, the man was admitted to the intensive care unit of another hospital, with admitting diagnoses of encephalitis vs. tetanus; isolation precautions were instituted. On admission, he was noted to be hyperventilating and to havea temperature of 101.1 degrees F. He was lucid, but had repetitive facial spasms that interrupted his speech so often that it was described as a stutter. His neck was supple; his right arm and hand strength were graded 2/6. He had frequent, though not tetanic, spasms of his right arm. By his second hospital day, he was unable to control his copious oral secretions and was intubated. His temperature rose to 107 degrees F, and he became profusely diaphoretic. He became comatose and died the following day.

On the second hospital day, after his supervisor related the history of the bat bite to hospital personnel, rabies was suspected. CSF and serum samples submitted to the Centers for Disease Control were negative for rabies antibody. A skin biopsy taken from the nape of his neck was also negative for rabies.

Postmortem, however, the brain was found to be strongly positive for rabies. Monoclonal antibody typing proved the rabies to be the Mexican free-tailed bat strain.

Contact Investigation

Direct, human-to-human transmission of rabies has never been documented, though four cases did occur after corneal transplants. The period of potential infectivity is unknown for humans, though it is probably only a few days at most. For contact investigation in this case, a conservative period of two weeks prior to the onset of symptoms was used. Over 100 possible contacts were identified among family, friends, coworkers, and medical personnel; 67 received rabies prophylaxis.

As with an animal rabies case, exposures were classified as either bite or non-bite. There were no bite exposures. Non-bite exposures were considered to have occurred when an infectious body fluid came into contact with broken skin or mucous membranes. Infectious fluids were considered to be saliva, tears, and urine sediment. Blood was considered to have low or no potential for transmission. Because of the victim's extrene diaphoresis, there was considerable concern about the possible transmission of rabies via perspiration. Because of the lack of data on this question, perspiration was treated as an infectious fluid in this situation, but only for exposures that occurred after the negative skin biopsy.

Most of the persons receiving prophylaxis had mucous membrane exposure to saliva. These persons had shared food or drinks with the victim during, or just prior to, his illness. While these exposures involved minimal risk of transmission, anxiety among the contacts, as well as among those making recommendations, led to the liberal use of prophylaxis.

This victim worked as a phlebotomist for a blood bank. After reviewing his work habits, investigators determined that his activities posed no risks to the donors or to the general blood supply. The victim, however, had donated blood eight days before his symptoms began. Although most of his blood products were retrieved and destroyed, the platelets had been transfused before he became ill. Even though rabies virus has not been isolated from blood, and the man probably was not infectious when he donated the blood, the platelet recipient was given rabies immunoprophylaxis.

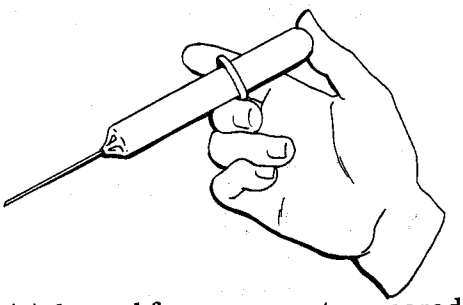
Editorial Note: This was a preventable case of human rabies. The bite incident was reported to family and friends at the time it occurred, and the patient was advised to seek treatment. It is not clear why he did not do so.

Prevention of human rabies is straightforward. The first, and most important, preventative measure is avoidance of possible rabid animals. Rabies may affect ant terrestrial mammal or bat. Animals exhibiting atypical behavior should be avoided.

Dogs and cats should be immunized against rabies annually.

If a bite does occur, the most immediate action is thorough cleaning of the bite with soap and water to the depths of the wound. Medical care should be sought to assess the need for rabies prophylaxis, tetanus immunization, and general wound care. If possible, the animal should be captured and tested for rabies or properly quarantined. This should be done only by animal control workers and veterinarians who are experienced in handling possibly rabid animals.

Rabies immunization improved tremendously in 1980, when human diploid cell vaccine (HDCV) was licensed in the United States. Previously, duck embryo vaccine was used in a series of 14-23 doses. This vaccine was more painful, less effective, and had a higher risk of adverse side effects than today's vaccine. Currently, for post-exposure prophylaxis, HDCV is given as a series of five injectons in the deltoid muscle. HDCV is 100% effective when given correctly and has an extremely low incidence of serious complications. For post-exposure prophylaxis, rabies immune globin (RIG) must be given with HDCV or other rabies vaccine for maximal protection.



*Adapted from a report prepared by Michael F. Kelley, M.D., M.P.H., Chief, Bureau of Disease Control and Epidemiology, Texas Department of Health, Which appeared in the Texas Preventable Disease News 1990; 50 (15).

Cases of notifiable diseases, Virginia, for the period August 1 through August 31,1990.

DISEASE	Total Cases Reported This Month						Total Cases Reported to Date		
		REGIONS					THIS YEAR	LAST YEAR	5 YR AVG.
	STATE	N.W.	N.	S.W.	C.	E.	(STATE TOTALS)		
Acquired Immunodeficiency Syndrome	44	3	22	2	8	9	421	265	165
Campylobacter Infections	53	17	13	8	9	6	370	454	433
Gonorrhea	1979	--	--	--	--	--	11958	9980	10725
Hepatitis A	19	1	6	4	2	6	185	208	167
B	37	3	5	7	9	13	163	214	282
Non A-Non B	5	0	2	2	0	1	31	54	51
Influenza	3	0	0	3	0	0	767	1875	2085
Kawasaki Syndrome	3	0	2	1	0	0	16	15	18
Legionellosis	2	0	0	2	0	0	9	6	9
Lyme Disease	35	6	2	1	3	23	88	30	15
Measles	4	0	0	0	0	4	74	21	50
Meningitis - Aseptic	53	9	21	3	14	6	157	166	139
Bacterial*	14	5	2	3	1	3	98	130	140
Meningococcal Infections	4	0	1	1	1	1	40	46	44
Mumps	5	0	3	2	0	0	90	85	69
Pertussis	1	0	0	1	0	0	15	24	25
Rabies in Animals	11	4	0	2	3	2	133	180	187
Reye Syndrome	0	0	0	0	0	0	1	1	1
Rocky Mountain Spotted Fever	8	0	1	1	6	0	16	6	18
Rubella	0	0	0	0	0	0	1	0	3
Salmonellosis	174	20	39	28	27	60	807	904	996
Shigellosis	18	0	11	2	1	4	102	323	173
Syphilis (Primary & Secondary)	115	7	27	6	41	34	600	347	254
Tuberculosis	43	6	14	6	8	9	246	232	254

Localities Reporting Animal Rabies: Frederick 1 skunk; Mathews 1 raccoon; Newport News 1 raccoon; Page 1 raccoon; Prince Edward 1 raccoon; Prince George 1 raccoon; Smyth 1 skunk; Surry 1 cat; Tazewell 1 skunk; Warren 1 fox, 1 skunk.

Occupational Illnesses: Asbestosis 7; Carpal Tunnel Syndrome 55; Coal Workers' Pneumoconiosis 47; Contact Dermatitis 2; De Quervain's Disease 1; Loss of Hearing 14; Repetitive Motion Disorder 1.

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