

THE TREATMENT OF TETANUS

I. General Consideration - The organisms grow best in devitalized tissue. They are practically harmless on normal tissue. The development of the disease in man usually requires the presence of the organism or of its spores in the wound, devitalized tissue, and anaerobic environment, and the presence of pyrogenic organisms (especially the streptococcus hemolyticus and the staphylococcus aureus) in symbiosis. The streptococci and the staphylococci are introduced not at the time of injury, but from the throat of those who care for the patient in transit and in the hospital.

The presence of foreign bodies favors the development of tetanus. Tetanus may result from re-operation upon old wounds because the spores may become re-activated by the trauma incident to surgery. In contaminated wounds which result in gas gangrene, the bacillus of tetanus remains inactive until the gas infection subsides.

II. Tetanus Antitoxin and Toxoid

Tetanus Antitoxin - is valuable when used prophylactically and early. Its value is questionable when it is used as the sole therapeutic agent in a well established case in which the wound has not been treated adequately. It is very serviceable in neutralizing toxin which is circulating in the blood, but has no effect upon toxin fixed in the tissues of the central nervous system.

Dosage - The usual prophylactic dose is 1500 U.S.P units (representing enough antitoxin to neutralize 2000 minimal lethal doses of toxin for a 150 lb. man). This amount produces a blood titre of 0.05 to 1.10 units per cc., which persists for 5 to 7 days and then declines rapidly.

When conditions are maintained which favor the development of tetanus, such as compound fractures, or the retention of foreign bodies which it is impossible to remove, it is necessary to repeat the injection every 5 to 7 days to maintain a protective titre of 0.05 to 0.10 units per cc. of blood. The prophylactic injection must likewise be repeated following secondary operative procedures (see above).

Technique of administration - To guard against anaphylactic reaction proceed as follows:

- 1) Inject 1 cu. mm. intra-dermally (this produces a wheal about 1 mm. in diameter).
- 2) If no reaction appears about the site of injection, the specified dose is given subcutaneously or intra-muscularly.
- 3) If a reaction appears around the injection site, a desensitizing dose of $\frac{1}{2}$ cc. is injected, following in 2 hours by the amount to be used.

Note: In children the dose and desensitizing dose is according to age and weight.

The above is a safe test for practical purposes except in a definite case of "horse asthma".

Tetanus antitoxin produces merely a passive and a transient immunity.

Tetanus Toxoid - is a de-toxified toxin produced by treatment of the toxin with formalin. It gives an active immunity by the formation of antibodies (antitoxin) following its injection. The first dose usually does not produce a great antibody response, but serves merely to sensitize the patient. Subsequent doses have a stimulating effect, producing an appreciable antibody response. To produce basic immunization three separate doses of 1 cc. of toxoid are usually given subcutaneously at intervals of 3 to 4 weeks. One week after the final injection the blood antibody titre reaches a protective level. The resulting immunity lasts a long time. In patients so immunized a stimulating dose of 1 cc. of toxoid at subsequent more remote periods will raise the antibody titre to protective levels within 7 days time.

When typhoid- paratyphoid vaccine and tetanus and diphtherial toxoids are given simultaneously, a better specific immunity to each individual disease is achieved than when either of the above toxoids are given alone.

Toxoids are relatively stable while antitoxins must be refrigerated to avoid rapid deterioration. Tetanus toxoid is supplied in 1 cc. and 30 cc. containers. It should be stored at 2-5 degrees centigrade.

Toxoids rarely cause any serious serum reaction.

III. The Prophylactic treatment of tetanus:- this consists of:

- A. Measures to assure neutralization of toxins which may eventually reach the blood stream (See administration of antitoxin and toxoid above, and Special rules for administration below).
- B. Care of the Potential Focus - this consists of early surgical care of wounds and the prevention of secondary infection. A mask should be worn at all times and strictest asepsis should be observed.

Early removal of all devitalized tissue and foreign bodies. The wound should be packed with gauze and it should be left open. Immobilization, elevation, and application of a large resilient dressing is indicated in all excised wounds.

If the above measures are possible, then no oxidizing agents are required. But if adequate excision is not possible, as in certain anatomical locations, then zinc peroxide dressings may be packed into the wound, according to the method of Meleny (see technique at end of this paper).

IV. Active Treatment of Clinical Tetanus:

Care of the Wound:

When the initial symptoms of tetanus have appeared, the first requirement is to remove the toxin factory - the focus. This requires complete excision of the wound, irrespective of the time interval since infliction of the wound and as soon as the general condition of the patient permits. The wound is treated as described above under wound treatment.

Neutralization of the Circulating Toxin - By intravenous injection of 50-100 thousand units of antitoxin. There is no advantage in giving it intramuscularly or intra-spinally since it is all absorbed into the blood stream from the point of injection. Administer very slowly by the drip method. Observe the patient carefully for anaphylactic reactions. If these appear, stop the injection, give adrenalin. Re-injection may be resumed after a few hours because desensitization will then usually have occurred.

Nursing Care;- Keep the patient in a darkened room, remove from all noises.

Do not jar the bed; and handle the patient gently.

Control of Contractures - by sedatives.

Do not use morphine. It depresses respiration in the required doses. Milder cases are controlled by barbiturates. If they cannot be given orally because of difficulty in swallowing, they may be administered intravenously or rectally. The dosage is governed by the degree of sedation required to maintain the spasms at a minimum.

The safest and effective sedation is by avertin, rectally in amylene hydrate. But the dose should be limited to 60-80 mgm. per kilo of body weight; for larger doses may depress respiration.

Muscles may lose hypertonicity completely, although this is not always possible. The return of spasms in muscles, even before the patient has shown evidence of coming out of narcosis, is an indication for its re-administration.

Treatment of Asphyxia - Spasticity of the respiratory muscles or the action of the lung has been limited by spasms of the respiratory muscles and the glottis.

Care of the secretions of the mouth and throat:

- 1) Keep the patient on his side with the head elevated, or
- 2) Elevate the foot of the bed.
- 3) Catheter aspiration of the oropharynx is indicated in some cases.

A rise in temperature usually means pulmonary involvement.

Treatment for pneumonia should then be instituted at once - (1/8 to 1/5 of the cases die of pneumonia).

Feeding of patients:- Must be handled with care. Keeping the patient quiet is much more important than meeting the metabolic requirements. Attempts to feed by any route should be abandoned at once if they incite convulsions.

If sedation relieves the swallowing difficulty, give a liquid or a soft diet. Give food at the onset of relaxation.

Do not awaken the patient to feed him.

If the swallowing difficulty is great, the fluid requirements may be met by 3000-4000 cc. of 5-10% glucose solution.

Avoid nasal feedings because of the danger of asphyxial spasms.

Transfusion - of whole blood or serum from actively immunized individuals may possibly assist in the immunological defence mechanism.

Constipation and Retention of Urine - may be caused by a hypertonicity of the spincters. Enemas may be required every other day. Retention of urine may be handled by catheterization.

V. Special Army Rules for the Administration of Tetanus Antitoxin and Toxoid.

Initial Vaccination - 3 doses of 1 cc. each at 3-4 week intervals, preferably 3 weeks, subcutaneously into the deltoid region.

Subsequent Vaccinations:

- a) Stimulating dose of 1 cc. at the end of the first year, regardless of the duration of service.
- b) Stimulating dose during month prior to departure for the theatre of operations, unless such takes place within 6 months after administration of the stimulating dose in a) above.
- c) In emergency an additional stimulating dose immediately to:
 - 1) Each wound or burn received on the battlefield or elsewhere.
 - 2) To a person undergoing a secondary operation or manipulation of an old wound, when deemed advisable by the medical officer.
 - 3) To any person who incurs a punctured or lacerated wound, powder burn, or any condition which might be complicated by the introduction of cl. Tetani into the tissues.

Tetanus Antitoxin - (for dosage see above)

For passive immunity. Will be used for the treatment of clinical tetanus, and when indicated for the prevention of tetanus in persons who have not previously been actively immunized with tetanus toxoid. The administration of tetanus antitoxin will be limited as follows:

- 1) To persons presenting evidence of clinical tetanus.
- 2) To persons incurring wounds, burns, or other conditions necessitating their protection against tetanus, but who have not previously completed the initial vaccination with tetanus toxoid.
- 3) To persons who may previously have been vaccinated but whose records of vaccination have been lost or are not available.

Note: Persons in 2) and 3) above will immediately be immunized passively with adequate amounts of tetanus antitoxin and at the same time will receive tetanus toxoid as described above.

The medical officer in charge is responsible for the accurate recording of the immunization.

In the presence of persistent infection in those not actively immunized (by toxoid vaccination) a re-injection of 1500 U.S.P. units of antitoxin is given every 5-7 days.