

been taken during a period either of normal or subnormal temperature and pulse. In only one case of the seventy-one could it be shown that a negative result had occurred coincidentally with a raised temperature. The remaining twenty-three of the seventy-one cases each gave a variable result, i.e., being one day positive, and another day negative. It was almost invariably found in any given case that when the temperature was normal or subnormal the reaction for albumin was negative, and that as the temperature rose the albumin reappeared. This was seen clearly in twenty of these twenty-three cases, in each of which the sputum was examined daily over a period of from five to eight days. In only three cases was this correspondence not to be observed.

Moreover, in three cases running afebrile courses the same striking correspondence between albumin and pulse existed.

Does this relation of temperature to the test apply in the cases of suspected tuberculosis? A re-examination was made of the charts of the cases in Group 2, and the same relation was found to hold good. Chart 3 is an example.

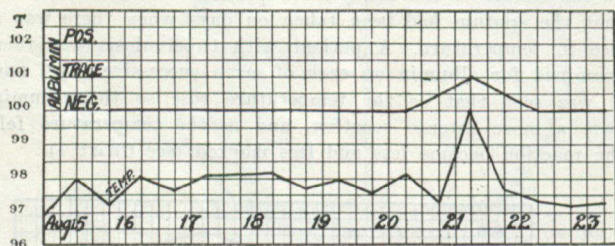


CHART 3.

CONCLUSIONS.

- (1) In chronic bronchitis the albumin test is invariably negative.
- (2) In cases of suspected tuberculosis without definite signs about 87 per cent. give a positive reaction, and probably 60 per cent. of these show the organism within two or three months.
- (3) In cases of clinical tuberculosis 79 per cent. will show albumin if the sputum be taken during an elevation of temperature, but albumin is nearly always absent from sputum collected when the temperature and pulse are normal or subnormal.
- (4) In about 98 per cent. of cases of proven tuberculosis, the albumin test is positive at some period in the course of the disease.
- (5) In examining sputum for albumin, whether the case be one of suspected, clinical, or proven tuberculosis, a negative result gives no information unless the sputum be taken over a period of time on successive days and during a rise of temperature. In other words, choose a febrile period for taking the sputum, as albumin will be present then if ever.

DELAYED TETANUS.

By HARRY MORELL, Captain C.A.M.C., Officer in Command District Laboratory, M.D. No. 5, Quebec, Canada.

DELAYED tetanus is rather an unusual type of the disease which might result from an incomplete neutralization of the toxin by the immunizing dose of tetanus antitoxin. There is an extension of the period of incubation and an absence or a modification of the classical symptoms as generally described under tetanus. The following case is quoted in which it is shown that the incubation was slow and the manifestations of the disease delayed for almost three months:—

No. 234968 Private C. E. F. was admitted to the Military Hospital, Quebec, from the Clearing Depot on December 2, 1917. This man had just returned from overseas and had been sick for the past forty-eight hours. He presents the following history: On September 6, 1917, he had his left arm amputated 2 in. below the shoulder-joint for a shrapnel wound received in action about one week before. He states he was given an injection of tetanus antitoxin within three hours after being hit, and that the wound healed kindly without any unusual symptoms. At the present time the stump looks healthy, with a linear cicatrix about 2 in. in length, which is discharging very slightly. There is no

rigidity or spasm in the muscles of the stump, nor is there any pain in this region. A culture of pus from the wound shows pyogenic cocci only. He says that two days ago a slight headache developed, accompanied by nausea and persistent vomiting, which has continued, also he has pain and stiffness at the angle of the jaws, which is gradually becoming worse.

The patient is a fairly well-nourished man, slightly pale. Heart and lungs normal, pulse 115, temperature 99°, respirations 36. Urine negative.

The jaws are tightly closed, impossible to open them even for nourishment; any sudden noise or irritation, as when spoken to, causes the whole body to become rigid and tense. These spasms, though severe, do not cause opisthotonos. There is a slight convergent strabismus and spasm of the eyelids. His mind is clear, he being able to give information regarding himself perfectly, except for the difficulty experienced in making himself understood on account of the severe spasms. The paroxysms persisted and became more aggravated, and death suddenly occurred from heart failure during a convulsion thirty hours after admission. Temperature just before death was 103.4° F. No post-mortem was made.

In commenting on this case it might be interesting to review the causes which may have to do with the late appearance of the disease after infection. It is usually stated that the incubation period of tetanus is about two weeks, but this stage may be lengthened, as it is known that the bacilli may remain for some time inert before producing toxins. This may be due to (a) condition of the tissues infected; (b) the virulence of the bacilli; (c) the amount of soluble toxin secreted; (d) the path of infection; and (e) the amount of antitoxin injected.

Below is a brief statement on the behaviour of the *Bacillus tetanus* in the tissues and the development of its toxin, which may explain why the period of incubation and the symptoms of the disease may be delayed for a considerable time.

The most suitable soil for the growth of the *B. tetani*, which grow anaerobically, is a lacerated, dirty wound, though it is impossible from the appearance of any particular wound to say whether or not it is infected with tetanus bacilli, and in healed and sealed wounds there is created an absence of oxygen, which condition is required for their growth. Again, it is held that the tetanus bacilli grow more favourably in the presence of aerobes such as the *Staphylococcus aureus*. The latter, using up all the available oxygen, produces a more suitable nidus for the anaerobic *B. tetanus*, and it is here the bacilli will grow most luxuriantly, giving off their secretion products into the surrounding tissues. This product, the toxin, or ectotoxin, is one of the most powerful poisons known, and it has an affinity for the nerves of the cerebro-spinal system.

Not even in the most severe and fatal cases of tetanus are the bacilli found in the blood. They are confined to the local lesion only. Another thing—spores alone, or tetanus bacilli without spores, die in the tissues, and there is evidence that the bacilli with spores may remain a considerable time shut up in the body before producing toxin.

The immunity conferred by an injection of antitoxin lasts a short time—about two weeks—or only so long as the toxin secreted by the bacillus is neutralized by this injection of antitoxin; for, though the toxin is neutralized by the antitoxin injection, it does not necessarily cause the death of the bacilli, which may continue to manufacture toxin.

To neutralize all free toxin formed, and also to provide an excess of antitoxin to neutralize the toxin as rapidly as it is produced, several successive doses of antitoxin should be used. It is therefore essential that a second, third, and fourth subcutaneous injection should be given to all wounded men; and, in order to anticipate the total disappearance of antitoxin from the body, the second injection should follow the first at an interval of seven days, or as soon after as possible. The third and fourth injections must also follow at the same intervals of time.