

LOCAL TETANUS AFTER INTRADERMAL INJECTION OF TETANUS TOXIN

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SUMMARY

When tetanus toxin is injected by the intradermal route, signs of the disease will first develop in the limb closest to the site of the injection. Since the toxin cannot reach the muscles directly, these experiments strongly suggest that: 1) Local tetanus must depend upon transport of the toxin by the peripheral nerve trunks; 2) That this phenomenon takes place not only in motoneurons; 3) That a pressure gradient is not a necessary prerequisite for the transport of toxin along nerves.

INTRODUCTION

In most work on experimental tetanus the intramuscular or subcutaneous route has been employed and we have not found any reference to intradermal injections throughout the literature at our disposal. During a recent attempt to duplicate SPERANSKY'S findings² on the protection afforded when Novocain was injected simultaneously with the toxin, we decided to employ the intradermal route.

MATERIAL AND METHODS

One-half cubic centimeter of 1% Novocain was injected intradermally. After 2 minutes 50 guinea pig MLD of crude toxin was injected into the same wheal. The experiment involved 20 white mice and an equal number of controls.

Novocain failed to influence the incubation time, the severity of symptoms or mortality. This trial nevertheless proved worthwhile, since it indicated that the chronology of muscular hypertonia depended closely upon the site of injection. We there-

fore decided to repeat those experiments with a lower dose of toxin (10 MLD) omitting Novocain and marking the site of the injection with ink.

RESULTS

The first sign of tetanus was hypertonia of the limb closest to the injection, the limb becoming extended and immobile well in advance of any further sign of the disease. Scoliosis was apparent after a few hours, the trunk curving toward the side in which the injection was performed. In the first group of animals the toxin was injected into the skin of the back. The same sequence of events was seen when the skin of the abdomen was chosen, with a slightly longer period of incubation being seen. When the toxin was injected into the midline of the body, these events did not take place.

When toxin was injected into the midline, subcutaneously, and intradermal injections of saline performed in different sites, no clear rigidity of the corresponding limb developed, though a certain awkwardness in the use of that limb seemed apparent.



Fig. 1 — Animal injected 24 hours previously with 10 MLD of tetanus toxin into the skin of the right lower back. The right hindlimb is held rigidly in extension. Note the curvature of the body.

DISCUSSION

Our data are not meant to deny the findings of KLENSCH & SCHLOEMER¹, who succeeded in demonstrating local tetanus after subcutaneous injection of irritating substances into the limb, while tetanus toxin was administered in the midline of the back. These authors hold that local tetanus is due to a combined central and peripheral action of the toxin.

These experiments provide one more argument against ABEL's theory; clearly one would not expect hypertonia to depend upon the site of the intradermal injection if absorption and transport of the toxin were effected solely by the blood. But even those who oppose ABEL's theory meet some difficulty proving that local tetanus is initiated by central action of the toxin and not at some peripheral site. Payling WRIGHT says to this effect²: "...no crucial experiment has yet been designed that has successfully surmounted all the objections raised by those who oppose this view". Though the dosis of toxin used in our experiments is large and

always leads to generalized tetanus and death, we think that our findings provide a sensitive and simple model for demonstrating the mechanism of local tetanus. Since the toxin cannot reach the muscles directly when injections are carried out intradermally, it must be admitted that the transport by cutaneous nerves and localization of the toxin in a nervous center is the first step in the chain of events that lead to muscular rigidity. It also seems as if our experiments contradict the view that a pressure gradient is necessary for the transport of toxin along the nerves to take place, since admittedly such a gradient does not exist in the skin and subcutaneous space³.

RESUMO

Tétano localizado após injeção intradérmica de toxina tetânica.

Quando a toxina tetânica é injetada por via subcutânea, os primeiros sinais da enfermidade aparecem no membro mais próximo ao local da injeção. Uma vez que a toxina não poderá atingir os músculos diretamente, estas experiências fornecem fortes indícios de que: 1) O tétano localizado deva depender do transporte da toxina pelos nervos periféricos; 2) Que este fenômeno não é próprio apenas dos nervos motores; 3) Que não há necessidade de um gradiente de pressão para este transporte se efetuar.

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