SOME OBSERVATIONS ON ALLERGY IN NEURITES

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There are comparatively few accounts of experimental studies of allergy in nervous conductors [2, 3, 4, 5, 10, 11, 12, 13], and very little is known about how this process develops.

We have studied changes in the functional condition of the neuromuscular apparatus produced by the direct action of an antigen on the nerve. The activity of the nerve could be inferred from tetanic muscular contraction produced by stimulating the nerve at various frequencies. This method of studying the activity of nervous structures is used both clinically and experimentally [1, 6, 8, 9].

METHOD

The experiments were carried out on normal and on sensitized guinea pigs. Normal horse serum was used for sensitization. An injection of 0.1 ml was given subcutaneously, by the method usually used to sensitize guinea pigs. The weight of most of the guinea pigs was 400-500 g. Guinea pigs which had been sensitized for from 7 to 51 days were taken. The lability of the neuromuscular apparatus was determined from the frequency of stimulation applied to the nerve. The index of the pessimal effect was the reduction of the tetanus of the muscle. In our experiment, we recorded the contractions of the tibialis anterior muscle while stimulating the peroneal nerve. Reduction of tetanus occurred at different frequencies: in the great majority of guinea pigs the value of this frequency was 50-80 impulses per second. The threshold stimulus for the nerve was found at a constant frequency of 25 impulses per second, and varied between 0.5 and 0.7 v. For electrical stimulation, a value 25% above threshold was used. The experiments were carried out on spinal animals in order to avoid any effect of the anesthetic on the lability of the nervous structures.

The spinal cord was cut between the cervical and thoracic cord. A preparation was made of the tibialis anterior muscle and the peroneal nerve. The peripheral end of the cut peroneal muscle was stimulated with a square-wave voltage at various frequencies. The contractions were recorded on a rotating drum kymograph. Ink-writing was used.

The experiment was carried out one hour after sectioning the cord. A series of 6-8 impulses at different frequencies was applied to the nerve. Stimulation lasted 3-5 seconds, and the intervals for 15-20 seconds. A rest period of 5-10 minutes then followed, after which a series of stimuli was once more applied. A wad soaked in antigen was placed on the nerve between the muscle and the electrode for 5 minutes. A test for sensitization was made by injecting the permissible dose of antigen [7]. In most cases, the effect of the antigen on the nerve of both limbs was studied in the same animal.

Nineteen experiments on 10 unsensitized animals and 45 on 17 sensitized guinea pigs were carried out.

RESULTS

In the unsensitized guinea pigs, in most cases, when the antigen was applied to the nerve, no definite changes in the neuromuscular apparatus occurred. The muscular contractions resulting from stimulating the nerve at diff-

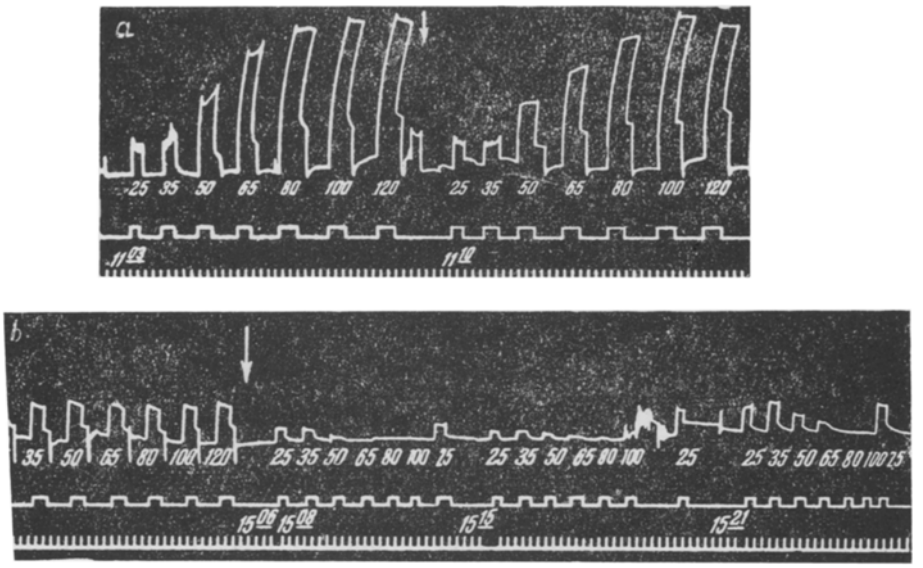

FIGURE. Muscular contractions on stimulating the nerve at different frequencies in (a) the unsensitized and (b) the sensitized guinea pigs. Curves, from above downwards: muscular contractions; nerve stimulation; figures indicate number of stimuli per second; time marker (3 seconds); ↓— moment of stimulation (a wad soaked in normal horse serum applied to the nerve).

erent frequencies were the same before and after applying the antigen (see Figure, a).

Applying the antigen to the nerve of the sensitized animals caused marked changes in its activity (see Figure,b). When the nerve was stimulated in the same way as before, the resulting muscular contractions were entirely different. They were reduced in height, and in some cases, immediately after the application of the antigen to the nerve, no contractions occurred, and appeared only after an interval of several minutes. This result indicates a suppression of nervous conductivity due to antigen action. If the nerve was stimulated below the region where the antigen had acted, muscular contractions were evoked. Thus, conductivity is disturbed only in that portion of the nerve to which the antigen had been applied.

When antigen is applied to a nerve, changes in the reponse depend also on the frequency of stimulation. At first there is a change to high frequency stimulation. This result indicates that the lability of the nerve is reduced, and falls below even the value for the lability of the neuromyal junction, because if the nerve is stimulated below the portion to which the antigen has been applied, that is,nearer to the muscle, the normal muscular contraction takes place.

The change in nervous conductivity was temporary, and disappeared when the nerve was washed with physiological saline. The described changes in the nerve could be obtained several times. In recovery, conductivity returned first for low frequencies, and later for high.

Thus, in nerve allergy, secondary changes in the activity of the neuromuscular apparatus, associated with a disturbance of the conduction of impulses from the central nervous system may occur.

We have shown previously [7] that when antigen is injected into the blood of a sensitized animal, it depresses the lability of the neuromuscular junctions.

The results obtained indicate that in the allergy of neurites and in the associated impairment of activity of the neuromuscular apparatus, in addition to other causes, the direct action of the antigen on the nerve fibers may also play a part in a sensitized animal.

SUMMARY

Experiments were performed on guinea pigs. It was shown that the antigen,normal horse serum,acted on the nerve of a sensitized animal to depress its conductivity. The conduction of high frequency impulses was the first

to be affected. No such changes occurred when the antigen acted on the nerve of a non-sensitized animal.

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