Brit. J. Pharmacol. (1960), **15**, 410.

THE ISOLATED CHICK BIVENTER CERVICIS NERVE-MUSCLE PREPARATION

BY

B. L. GINSBORG* AND JOAN WARRINER

From the Department of Pharmacology, University of Edinburgh

(RECEIVED FEBRUARY 24, 1960)

The isolated biventer cervicis nerve-muscle preparation can be used to distinguish between neuromuscular blocking agents which cause depolarization and those which do not. Both reduce the contractions caused by nerve stimulation, but depolarizing drugs also cause a contracture of the muscle.

Child and Zaimis (1954), Child (1955) and Tyler (1960) have described the use of certain muscles of the chick, the semispinalis cervicis and the biventer cervicis, as isolated preparations. Like the rectus abdominis of the frog, these respond to the application of depolarizing substances by giving a contracture.

We have found it possible to obtain a nerve-muscle preparation by using the innervated lower belly of the biventer cervicis whose nerve supply is enclosed by the tendon between the two bellies. A stimulus applied via electrodes in contact with this tendon results in a contraction of the muscle. The preparation may therefore be used to test simultaneously both for neuromuscular blocking activity, as indicated by a reduction in the contraction produced by nerve stimulation, and for depolarizing activity, as indicated by contracture. This preparation was demonstrated to the Physiological Society in July, 1959.

METHODS

Chickens (50 to 250 g.) were anaesthetized with sodium phenobarbitone (9% solution in water; 0.2 ml./100 g.) injected into a wing vein. The dissection was similar to that described by Child (1955) (compare Tyler, 1960). The back of the neck was plucked and the skin incised along the midline from the skull to below the base of the neck, exposing the two biventer cervicis muscles on either side of the midline and immediately below the skin. A thread was tied round the upper belly of one muscle which was then cut free from its attachment to the skull. When the thread was gently pulled the tendon joining the two bellies of the muscle and the lower (caudal) belly of the muscle could be identified and separated from the underlying semispinalis cervicis

*Member of the External Scientific Staff of the Medical Research Council.

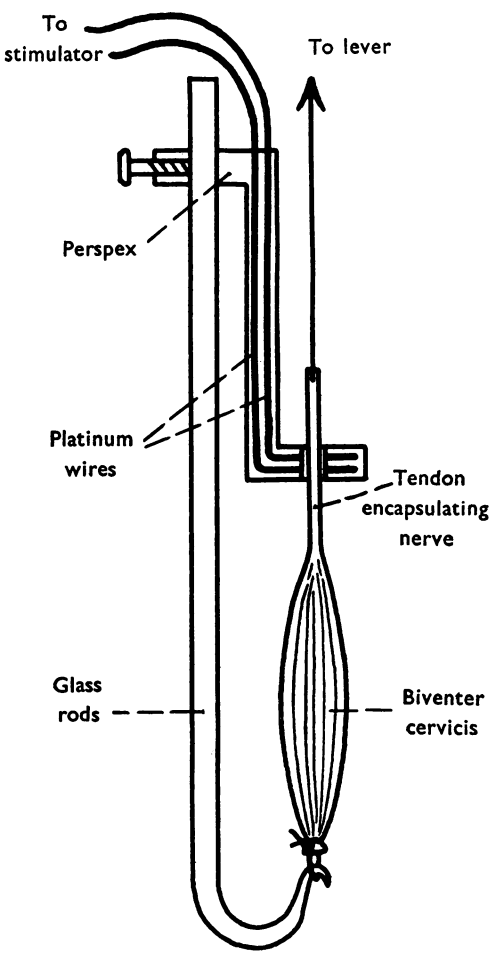

FIG. 1.—Electrode assembly.

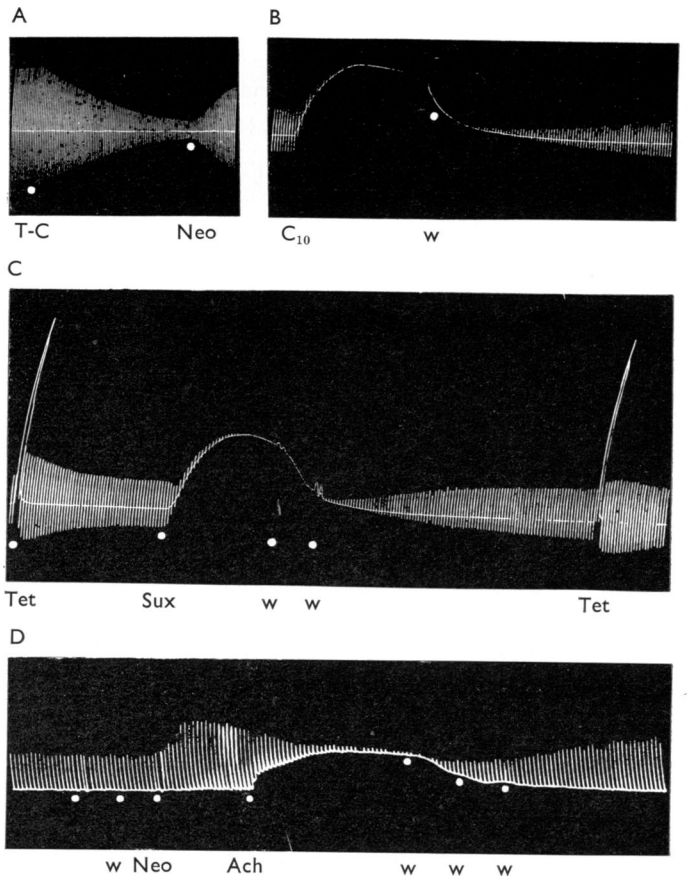

FIG. 2.—Contractions of isolated biventer cervicis muscle evoked by supramaximal nerve stimulation at 12/min. The tetani (Tet) in (C) were evoked by stimulation at 125/min., the maximum tetanic tension being 12 g. The contractions in (A), (B), and (C) were recorded with an "isometric" lever, and those in (D) were recorded using the mechano-electric transducer valve RCA 5734. (A) At T-C tubocurarine chloride was added to give a bath concentration of 1.4×10^{-5} M. At Neo, neostigmine bromide (3.3×10^{-6} M) was added. (B) At C_{10}, decamethonium iodide (3.4×10^{-8} M). (C) At Sux, succinylcholine dichloride (2.8×10^{-6} M) was added. (D) At Ach, acetylcholine chloride (1.3×10^{-6} M) was added before and after the addition of neostigmine bromide (6.6×10^{-6} M). At W, the bath was washed out.

muscle. The tendon and muscle were carefully removed together with the lower tendon which attaches the muscle to the supraspinous ligament. The anatomy of the chick has been described by Chamberlain (1943).

A loop which served to attach the preparation to the hook on the electrode assembly (Fig. 1) was tied around the lower tendon and the thread on the upper end of the muscle was passed through the electrode and attached either to a light semi-isometric lever writing on a smoked drum or to the lever of an RCA 5734 transducer valve suitably connected to a pen recorder. The electrode was lowered until it was in contact with the tendon surrounding the nerve. The organ bath (30 to 50 ml. capacity) contained Krebs-Henseleit (1932) solution which was maintained at a constant temperature between 37° and 40° and which was well stirred with a mixture containing 95% oxygen and 5% carbon dioxide. The preparation remained in good condition for several hours when stimulated supramaximally at a frequency of 12/min.

RESULTS

Fig. 2 (A) shows the effect of tubocurarine chloride (1.4×10^{-5} M in the bath) and the reversal of the neuromuscular block by neostigmine bromide (3.3×10^{-6} M). Fig. 2 (B) and (C) illustrates the contractures caused by decamethonium iodide (3.4×10^{-8} M) and succinylcholine dichloride (2.8×10^{-6} M). Fig. 2 (D) shows the effect of acetylcholine chloride (1.3×10^{-6} M) before and after the addition of neostigmine bromide (6.6×10^{-6} M).

DISCUSSION

The simplicity of the preparation should make it suitable for students' use.

We are grateful to Professor E. J. Zaimis and Dr. K. J. Child for showing us their techniques, and to Dr. R. B. Barlow for his help.

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