SUXETHONIUM BROMIDE IN E.C.T.

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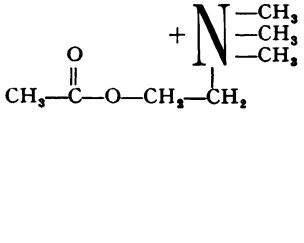
THE use of muscle relaxants in E.C.T. constitutes an important advance in psychiatric practice. The merits of the method are not only due to the beneficial effects of the relaxant itself; the anaesthetic, that is invariably administered at the same time, plays an essential part in the procedure. Every phase of the treatment is greatly improved. Anxiety, which so often develops during unmodified E.C.T., is greatly reduced if not abolished altogether. There is no cry or other noise that might disturb other patients awaiting treatment; the convulsion is attenuated to a reaction that may be varied at will from a mild modified convulsion to a mere flicker of facial muscles or complete absence of muscular activity. Cyanosis is absent and the colour remains good throughout, and—perhaps most important of all from the therapeutic point of view—there is no restlessness or confusion after the treatment, the patient sleeping quietly after the treatment until he wakes up without any unpleasant sensations or memories.

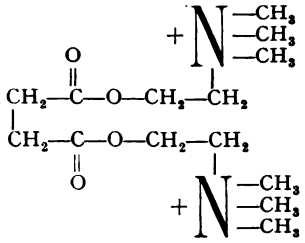
There were, however, certain demerits of the method when the older relaxants such as d-tubocurarine, decamethonium iodide and gallamine triethiodide were used. With most substances the administration of an antidote was required, and there was the danger of prolonged apnoea necessitating artificial respiration for long periods if the injection of the antidote for some reason or other, e.g., very poor veins, was unsuccessful. Other possible complications can arise from side effects of the antidote—usually prostigmine. These drawbacks have been entirely overcome by the introduction of the latest addition to the group, the succinylcholine compounds (1), (2), (3), (4).

So impressive was the effectiveness of these substances, the ease of their administration and the degree of safety and freedom from undesirable side effects that we discontinued entirely the use of other relaxants in E.C.T. and adopted one of these compounds for our routine procedure.

Succinylcholine is closely related to acetylcholine. They can be represented by the formulae :



Acetylcholine (cation).



Succinylcholine (cation).

Like decamethonium and unlike curare and true curarizing agents, the succinylcholine compounds belong to the group of depolarizing agents. They have an acetylcholine-like action on muscle-fibres which manifests itself in muscular twitchings up to *ca.* 30 seconds after the injection. They are broken down by plasma cholinesterase. No other antidote is known nor, indeed, necessary. Anticholinesterases such as prostigmin would only prolong the paralysing effect.

The succinylcholine compounds are eminently suitable for use in E.C.T. Their attenuating effect is of very short duration, and can easily be graded according to the wishes of the therapist and the circumstances obtaining in an individual case. Respiration usually returns very soon after the administration of the shock without further injection of an antidote.

Technique.

Two succinylcholine preparations were used: Brevidil M (the bromide of succinylcholine or suxamethonium bromide) and Brevidil E (the bromide of an ethyl-substituted succinylcholine or suxethonium bromide). Brevidil E proved to have a much shorter action than Brevidil M and was therefore more suitable for E.C.T. Brevidil E was finally adopted as the standard relaxant in all cases.

40–45 minutes before treatment atropine sulphate ($\frac{1}{100}$ gr.) was given by hypodermic injection. As even intravenous injections of atropine take some time before they produce the desired effect there was no point in mixing the atropine with the relaxant and our previous practice of doing so was abandoned. The injection of Brevidil E was invariably combined with thiopentone sodium 0·2. gm. This is essential because the injection of Brevidil alone would cause most unpleasant sensations as the result of the painful muscular fibrillations and a feeling of suffocation due to respiratory paralysis (3). Although, according to the manufacturers, solutions of Brevidil are fairly rapidly inactivated in an alkaline medium, e.g., solutions of thiopentone sodium, we found that simultaneous injection of Brevidil and thiopentone sodium was as effective as separate injections. Both solutions were freshly prepared, mixed in the syringe and immediately injected into a vein. As soon as the twitchings had died down, i.e., at the time of maximum relaxation, a lubricated Phillips type

airway was introduced into the mouth. (The small side-tube had been removed altogether, and the rubber part had been pushed up to the top of the metal piece in order to prevent any possible injury to the teeth.) Then the electric shock or shocks were administered. In most of our cases a "Plexacon" as designed by MacPhail and Strauss was used. It was found that the convulsion threshold was quite considerably raised, which no doubt was due to the central anticonvulsant effect of thiopentone. More electricity in terms of joules or volt × time and/or a greater number of shocks were required to produce a definite reaction. When the attentuated reaction had come to an end artificial respiration was begun at once. This was carried out with the help of a face piece and re-breathing bag, the gas used being a mixture of 95 per cent. O_2 and 5 per cent. CO_2. The admixture of CO_2 was preferred in order to ensure that the CO_2 tension of the blood was not unduly lowered by hyperventilation. Spontaneous respiration returned usually within a minute or so of the termination of the convulsion; on only one occasion was it delayed for five minutes. The apnoea after Brevidil M is slightly longer, but with this substance, too, respiration returns usually within 4 minutes of the injection. The difference between Brevidil E and Brevidil M is, however, sufficiently marked to give the E compound a decided preference. With Brevidil E the whole treatment takes hardly longer than unmodified E.C.T., which is a point deserving some consideration when one is dealing with a long list. After the treatment the patients are turned on one side and placed in a comfortable position. They invariably pass into a restful sleep, from which they can be roused without difficulty, but as this period is probably beneficial they are allowed to sleep as long as practicable. 1½ hours after the treatment they have a full breakfast and out-patients are allowed to leave hospital in the company of a friend or relative.

The dose of relaxant varied with the degree of attenuation aimed at and the sensitivity of the patient, but there was no very close relationship to body weight. The initial dose was 60–80 mgm, as gauged on clinical appraisal of patient in the light of previous experience. The optimum dose was determined by trial and error and varied between 40 and 120 mgm. We never aimed at complete elimination of the muscular response, and there was never any difficulty in deciding whether there was a true reaction or only a stun. The most desirable degree of attenuation of both the initial jerk and the convulsion depended entirely on the physical condition of the patient. Although our doses were comparatively small the attenuation obtained was adequate, and we were able to treat many patients with physical conditions which would have made unmodified E.C.T. contra-indicated (e.g., gross deformity of the spine, pulmonary tuberculosis, osteo-arthritis of the spine, cardio-vascular disease, achondroplasia, old fractures sustained under unmodified E.C.T.).

Conclusions.

Well over 450 treatments have been carried out on 70 patients of both sexes, including a number of out-patients. The ages varied between 14 and 69. No untoward effects of the treatment, such as prolonged apnoea, have been

observed. On one occasion the return of spontaneous respiration was delayed for 5 minutes. (The cholinesterase level in this case was normal.) The psychiatric results of modified E.C.T. are at least as good as those of straight E.C.T. Patients who have undergone the treatment have not complained about unpleasant sensations, and they show less tendency to develop apprehension during the course of treatment. The method has been so successful that attenuation by Brevidil E has become our standard method. All patients having E.C.T. are given this modified treatment unless there are special reasons preventing it, such as very bad veins, or a very high convulsion threshold. Owing to the absence of undesirable sequelae the method was found particularly suitable for out-patients.

We wish to express our thanks to Dr. Duncan Macmillan, Physician Superintendent, for his interest, and to Messrs. May & Baker, Ltd., for trial supplies of Brevidil E and Brevidil M.

References.

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