ELECTROPLEXY (E.C.T.) TECHNIQUES IN CURRENT USE

A REPORT OF A QUESTIONNAIRE RECENTLY CIRCULATED TO HOSPITALS

By

J. C. BARKER, M.A., M.B.(Cantab.), M.R.C.P.(Lond.), M.R.C.P.(Ed.), D.P.M.
Assistant Psychiatrist
Banstead Hospital, Sutton, Surrey

INTRODUCTION

AT a recent court case (40), the plaintiff, who sustained bilateral acetabular fractures following unmodified electroplexy, maintained that the defendants were guilty of negligence by failing to use relaxant drugs to prevent the risks of injury.

A number of experienced medical witnesses failed to agree upon a uniform technique of electroplexy. Some favoured the routine use of muscle relaxants, whereas others did not, and this resulted in the verdict being returned in favour of the defendants, and also brought the various problems associated with the administration of electroplexy very much before the public eye.

Summing up, the Judge stated that "a professional man was not guilty of negligence if he acted in accordance with a practice which was accepted by a competent body of men skilled in that particular art, merely because there was a body of opinion which took the opposite view". He emphasized that the use of E.C.T. was progressive, and that "the jury must not look with 1957 spectacles at what happened in 1954", suggesting that failure to use relaxants might now be considered negligent.

A SHORT SURVEY OF THE LITERATURE

Previous writers show much disagreement about the best techniques of giving E.C.T., especially since the introduction of the short-acting relaxant drugs, and the routine use of unmodified E.C.T. still has a number of advocates. Kalinowsky (17), writing before the short-acting relaxants were in common use, commented that straight E.C.T. was a surprisingly harmless procedure, and that any recommendations complicating its simplicity should be carefully tested as to their safety. Tyndel (37) maintained that there was no justification for the use of muscle relaxants with or without anaesthesia, and Sargant and Slater (34) asserted that "to add Pentothal and a relaxant to E.C.T. is to add two potential sources of danger, each carrying its own risks of death". This view was shared by Maclay (24), and Eyres (6), and Impastato (16) considered that many fatalities attributed to E.C.T. resulted from pre-medication with relaxants, and quoted five patients who died after receiving relaxants prior to E.C.T.

The opposite view was taken by Bennett (2) who maintained that any form of straight convulsive shock was contraindicated, and more recently by Kelleher

and Whiteley (19) and Murphy (28) who felt that there could be little justification for electroplexy without muscle relaxants.

Opinions differed as to whether muscle relaxants should be administered in conjunction with an intravenous anaesthetic or alone, and in the choice of relaxants. Monro *et al.* (27), Fisher and Bannister (8) and Esplen (5) considered that it was essential to administer a quick-acting barbiturate either before or with the relaxant, because of painful muscular fasiculation and respiratory distress associated with the intravenous injection of these substances alone. Stevens and Tovell (36) favoured Pentothal in addition to suxamethonium chloride ("Scoline") to eliminate anxiety during drug induced relaxation, and Lincoln and Broggi (21) alleged that the use of an anaesthetic tended to reduce the occurrence of post-treatment excitement.

Little and Reid (22) found buthalitone sodium ("Transithal") a superior anaesthetic to Pentothal, in that it appeared to antagonize the delayed return of breathing brought about by Scoline, though it does not appear that this anaesthetic is in current use in association with electroplexy.

The use of relaxants without anaesthesia was first tried out by Gillie and McNeil (9), and Kelleher and Whiteley (19) favoured E.C.T. modified with either Scoline or suxethonium bromide ("Brevedil E") alone, because it was safer, less time consuming and less complex than when given with Thiopentone. Fisher (7), advocating the use of Brevedil E alone, asserted that there was an added risk to life when Thiopentone was used. Beresford Davies (3) shared this view, and considered that Thiopentone increased the danger of laryngeal spasm, particularly if given in small doses.

Kelleher and Whiteley (19) and Monro *et al.* (27), after careful clinical comparison, preferred Scoline as a relaxant to Brevedil E, and Monro stated that he would have been completely satisfied with Scoline were it not for reported cases of prolonged apnoea after the use of this preparation, in association with E.C.T. (14), and in other cases (11, 12, 23).

Grant (10) described a case of respiratory paralysis lasting 2–3 post-operative days after a dose of 80 mg. of Scoline. Impastato (15) summarized the causes and treatment of apnoea following Scoline modified E.C.T., and described the use of a test-dose of 5 mg. of Scoline to determine the sensitivity of the respiratory centre to this preparation.

Prolonged apnoea does not appear to have been reported after Brevedil E, which Wolfers (38) and Gillie and McNeil (9) found to be an extremely satisfactory relaxant for modifying electrically induced convulsions both with and without anaesthesia. Malone and Blayney (25) commented on the extreme shortness of action of Brevedil E, and that its effect might have worn off if for any reason a second electrical stimulus had to be applied. Fisher and Bannister (8) and Malone and Blayney (25) reported that the shorter period of apnoea resulting from an injection of suxethonium bromide ("Brevedil E") gave the compound a decided preference over suxamethonium bromide ("Brevedil M") though Danik (4) regarded the latter preparation as an ideal muscular relaxant for use with E.C.T.

A few writers favoured the electrical modification of electroplexy and used the Ectonus method of E.C.T. administration, an improved version of the old "Glissando" technique. The principles of this method have been described by Russell (31 and 32) who claimed that muscle relaxants could be safely discontinued when the Ectonus technique was employed, which also relieved patients of anxiety associated with premedication and injections (33). However, in a later communication, these workers stated that "there will always be a few

special cases in which the additional precaution of a muscle relaxant is judged essential", and devised a modifying technique combining the smoothing effect of Ectonus E.C.T. with the partial effect of a muscle relaxant.

Kelleher and Whiteley (20) described the occurrence of cyanosis following the use of Ectonus E.C.T., possibly resulting from the Valsalva phenomenon, but this was subsequently denied by Russell and his co-workers, and has not been the experience of this author.

There have been a number of conflicting statements concerning the therapeutic effectiveness of unmodified versus modified electroplexy. Mayer-Gross, Slater and Roth (26), Fisher and Bannister (8) and Lincoln and Broggi (21), considered that the psychiatric results from modified E.C.T. were at least as good as those from unmodified E.C.T. Ardis and Wyllie (1) also shared this view, but noted that in a few instances this was apparently not the case. Later Fisher (7) alleged that the results of E.C.T. were more effective and long-lasting if there was no previous anaesthesia, and Seager (35), after a series of carefully controlled observations, confirmed the previous clinical impressions of his staff, that patients treated by unmodified E.C.T. were in hospital for a shorter period, received less treatments, and were more likely to remain well than those treated by modified E.C.T. However, Holmberg *et al.* (13) found that modified E.C.T. was of greater benefit in the treatment of endogenous depressions than unmodified E.C.T., because of the prolongation of convulsions brought about by modification, though the results were not statistically significant.

The Questionnaire

It is difficult to conceive of another effective treatment used in medicine to an extent comparable with electroplexy about which so many differences of opinion relating to administrative technique appear to exist. These differences are well illustrated in the contradictory replies of the professional witnesses at the recent court case, and are reflected in the opinions of numerous writers on the subject. In view of this, it was considered important to ascertain which techniques of electroplexy were in current practice at various teaching centres and mental hospitals in this country.

The questionnaire seemed the most appropriate method of obtaining this information. At the same time it was regarded as an excellent opportunity to collect some further data about electroplexy, which might not only be of general interest, but would undoubtedly be of particular value in helping to clarify some of these controversial issues, should any further cases of litigation arise.

Fifty-five copies were circulated to thirteen teaching hospitals in London and to forty-two mental hospitals on 20 June, 1957. The mental hospitals represented those where it was known that E.C.T. was carried out on large numbers of patients.

The questionnaire was addressed to the Physician Superintendents of mental hospitals and to the Consultants in charge of the Psychiatric Departments of teaching hospitals, who were asked to state:

1. The technique of electroplexy in current practice in their hospital on *male* patients. Males were selected because their convulsions following unmodified E.C.T. were more powerful than in females, and hence more liable to result in skeletal complications (18). A list of techniques followed, and they were requested to mark one only with a cross.
   (*a*) E.C.T. unmodified .....
   (*b*) E.C.T. modified by Ectonus .....
   (*c*) E.C.T. modified by Brevedil E alone .....

(*d*) E.C.T. modified by Scoline alone .....
(*e*) E.C.T. modified by Pentothal and Brevedil E .....
(*f*) E.C.T. modified by Pentothal and Scoline .....
(*g*) E.C.T. modified by Pentothal alone .....
(*h*) E.C.T. modified by other anaesthetic and/or relaxant. Indicate which ....
(*i*) E.C.T. by any other technique and reasons for use .....

2. Any particular techniques of performing electroplexy that were disfavoured and why .....
3. Whether E.C.T. was given by single or repeated multiple shocks .....
4. Whether E.C.T. was given by a single shock or modified by Ectonus when relaxants were used .....
5. Whether the services of a Consultant Anaesthetist were employed when anaesthetics and relaxants were administered .....
6. The number of treatments given to new admissions in cases of:
   (*a*) Schizophrenia .....
   (*b*) Depression .....

RESULTS

By the early part of August, 1957, some 47 (85 per cent.) completed copies of the questionnaire had been returned, which was regarded as an excellent response, and taken to indicate a wide interest in the subject. Twelve (92 per cent.) out of thirteen teaching hospitals, and thirty-six (86 per cent.) out of forty-two mental hospitals satisfactorily completed the proforma. Current practices at this hospital in respect of all six items were added to information obtained from the completed questionnaires, and incorporated in the results.

Replies to item 1 are listed in Table I. It appears that E.C.T. modified by Pentothal and Scoline was by far the most popular technique in current practice, being used at some 60 per cent. of hospitals. At some 85 per cent. of the hospitals contacted, E.C.T. was given with relaxants.

TABLE I

E.C.T. Techniques in Current Use

Technique	No.	Per cent. of Replies
(*a*) E.C.T. unmodified	1	2
(*b*) E.C.T. modified by Ectonus	3	6
(*c*) E.C.T. modified by Brevedil alone	4	8
(*d*) E.C.T. modified by Scoline alone	1	2
(*e*) E.C.T. modified by Pentothal and Brevedil E	7	15
(*f*) E.C.T. modified by Pentothal and Scoline	29	60

At a number of hospitals more than one technique were used, but the figures in the table refer to those techniques that were practised solely or in the vast majority of cases, and hence the percentage column does not quite total one hundred.

At a few hospitals other methods of modification were practised such as Evipan with Brevedil M, and Leptazol with Brevedil E, and at one Flaxedil was used.

At eleven (92 per cent.) out of twelve teaching hospitals electroplexy was modified with Pentothal and Scoline. At the remaining hospital, whilst it was customary to use the Ectonus technique for the vast majority of cases, Ectonus E.C.T. with Pentothal and Brevedil E was occasionally given to frail patients.

At one teaching hospital unmodified E.C.T. was only used in conjunction with insulin, and there they considered dangerous the combination of anaesthetic, relaxant and insulin.

At eighteen (50 per cent.) of the mental hospitals that completed the proforma electroplexy was modified with Pentothal and Scoline. At one mental hospital it was reported that some patients actually preferred unmodified E.C.T., though at another they were said to dislike it. At another unmodified electroplexy was only used when there appeared to be no response to modified treatment.

Replies to item 2 were illuminating, and tended to indicate that in many hospitals the technique of administration of E.C.T. often appeared to depend upon a process of elimination of other techniques, rather than upon any special merits of the method itself. The numbers of replies in which the separate techniques were disfavoured are shown in Table II.

TABLE II

Techniques Disfavoured

Technique	No.
(*a*) E.C.T. unmodified	20
(*b*) E.C.T. modified by Ectonus	4
(*c*) E.C.T. modified by Brevedil E alone	7
(*d*) E.C.T. modified by Scoline alone	9
(*e*) E.C.T. modified by Pentothal and Brevedil E	3
(*f*) E.C.T. modified by Pentothal and Scoline	4
(*g*) E.C.T. with Pentothal alone	3

Techniques that were in current practice at some hospitals were actively disfavoured at others. As might have been expected, dislike of a particular method often followed a single incident, e.g. a case of "Scoline terror", and it was evident that the choice of technique appeared to depend to a large extent on the personal bias of the doctor concerned. A substantial body of opinion was against the use of unmodified E.C.T. mainly because of skeletal complications, and was against the use of muscle relaxants without anaesthesia on humanitarian grounds, because of unpleasant subjective effects, not always entirely eradicated by the amnesia resulting from the treatment itself.

At four mental hospitals there was definite opposition to the modification of E.C.T. by Pentothal and Scoline. At one of these it was not considered justifiable to use Pentothal with relaxants as a routine, because of prolonged apnoea and experienced fatalities following the use of Scoline in a few instances. At this hospital the process of changing over syringes containing an anaesthetic to one containing a relaxant during the performance of the technique was criticized, and it was also asserted that pentothal alone did not modify the convulsion, and was safer when used with a relaxant than by itself.

At another hospital it was alleged that Scoline was too long-acting to be used in conjunction with electroplexy, whereas Brevedil E, because of the extreme shortness of its action, in some instances failed to modify the convulsion. The replies to this item of the questionnaire also contained numerous references to headaches following the administration of Pentothal.

A number of doctors stated that they had not yet tried the Ectonus technique, while at one hospital this method had been abandoned because of repeated failure of the Ectonus machine.

Replies to items 3 and 4 showed that it was customary at the majority of hospitals to induce E.C.T. by means of a single shock, though at one hospital

multiple shocks, and at four both techniques were practised. When relaxants were given, the majority favoured E.C.T. by a single shock, but at a few hospitals the Ectonus technique was also used. These results are summarized in Tables III and IV.

TABLE III

The Use of Single or Multiple Shocks

Method	No.
1. Single	38
2. Multiple	1
3. Both 1 and 2	4
4. Ectonus	2

TABLE IV

Electrical Technique Used with Relaxants

Method	No.
1. Single shock	32
2. Ectonus	5
3. Both 1 and 2	3

Replies to item 5 indicated a sharp difference of opinion concerning the advisability of having a consultant anaesthetist in attendance when electroplexy was modified with anaesthetics and relaxants, and are shown in Tables V and VI. Where mental hospitals were concerned, opinions were fairly evenly distributed (Table V), but at most teaching hospitals the presence of an anaesthetist (of various grades) during the performance of electroplexy was the rule (Table VI). At three mental hospitals "Anaesthetist Coverage" alone

TABLE V

Anaesthetists at Mental Hospitals

Existing Arrangements	No.
No anaesthetist	14
Consultant anaesthetist	10
General practitioner or registrar anaesthetist	4
Occasional anaesthetist	4

TABLE VI

Anaesthetists at Teaching Hospitals

Existing Arrangements	No.
No anaesthetist	3
Consultant anaesthetist	4
Consultant or registrar anaesthetist	2
Registrar or house physician anaesthetist	3

was considered sufficient, without the necessity of a consultant anaesthetist actually being in attendance.

At four teaching hospitals, consultant anaesthetists were always present when E.C.T. was being given, but at three the anaesthetists were in the Registrar or House Officer grade. At two, either consultants or registrars were employed depending upon availability, and at three no anaesthetist was present.

Two of the teaching hospitals appeared to depart from their routine practices where private patients were concerned. At one, the consultant

psychiatrist always gave the anaesthetic himself, while at the other a consultant anaesthetist was always in attendance.

There was a wide variation in the replies to item 6. Whilst at some hospitals no fixed courses of treatments were given, at others electroplexy ranged from one to over twenty individual treatments for schizophrenia, and from one to sixteen for depressions. The average numbers for the two conditions were calculated, and are shown in Table VII. At a few hospitals it was maintained that E.C.T. was not the treatment for schizophrenia, and that the type of depression was important when determining the number of treatments to be given.

TABLE VII

The Average Number of Treatments in Schizophrenia and Depression

Diagnosis	Average Number of Treatments
Schizophrenia	9
Depression	6·5

DISCUSSION

It is shown in Table I that at some 60 per cent. of the hospitals that responded to the questionnaire, modified E.C.T. with Pentothal and Scoline is the current practice. If, therefore, the contentions raised by Fisher (7) and Seager (35) are correct, that the results from modified E.C.T. are less satisfactory than those from unmodified E.C.T., then these hospitals, which represent a substantial majority, may be depriving their patients from the maximum therapeutic benefits of electroplexy. A hint that this state of affairs existed was made at one mental hospital, where modified E.C.T. was the routine, for it was there alleged that unmodified E.C.T. was "often found efficacious following no response to modified treatment".

It also would appear from this table that when Pentothal is given, Scoline is used more frequently than Brevedil E, possibly because Brevedil E and solutions of thiopentone are incompatible (38), though they may be given in separate syringes. Without anaesthesia, Brevedil E is used more commonly than Scoline.

A marked difference exists between the number of teaching hospitals that use the pentothal and scoline technique, compared with the number of mental hospitals (92 per cent. against 50 per cent.), and is undoubtedly related to the different staff-patient ratios at the two types of hospital. Compared with a mental hospital, the numbers of persons undergoing electroplexy at a teaching hospital are likely to be relatively small, and anaesthetists are more readily available. Also at many mental hospitals where large numbers of electrical treatments may have to be carried out, the Pentothal and Scoline technique, being the most time-consuming, is often the least practical, and recourse must be had to other methods.

The replies to item 2 indicated the important role played by the doctor's personal bias in determining the choice of technique to be followed, and the case of "Scoline terror" is a good example of this. Kalinowsky and Hoch (18) refer to a fear of E.C.T. which may develop after a certain number of treatments, and it may well be impossible to distinguish this from that which may accompany the intravenous injection of a short-acting muscular relaxant. To condemn a technique on such uncertain evidence is hardly justifiable, when the alternative, which involves the additional use of an anaesthetic, may turn out to be a more

dangerous procedure. This latter view appeared to be shared at a number of hospitals where relaxants without anaesthesia were employed as a routine, and it was found to be an extremely satisfactory method of modifying E.C.T., that hardly ever gave rise to any unpleasant subjective effects. A great deal seemed to depend on the time interval between the injection and the application of the stimulus, for if this was too long there was more chance of unpleasant choking sensations being remembered. In this respect Brevedil E, being quicker-acting, was superior to Scoline, and certainly safer as judged by reports in the literature. Headaches following the use of both relaxants have been observed by Wolfers (38), but Pentothal may also be responsible for this as suggested from the replies to the questionnaire.

Opinions varied less concerning the electrical modification of E.C.T. than they did with regard to the other items asked, for in most cases electroplexy was given by means of a single shock. However, at one teaching hospital two shocks were sometimes given during the first 3–4 treatments in agitated cases, which was a practice advocated by Kalinowsky (17) and Reitman and Delgado (30), the latter authors employing two or sometimes three sub-threshold stimuli to delay and soften the onset of the seizure, with Pentothal and Scoline pre-medication. These views are in sharp contrast to the opinion expressed at one teaching hospital, that the use of any apparatus which allowed the passage of current for more than 0·1 second gave rise to brain damage, which would preclude not only multiple shocks and repeated sub-threshold stimuli, but also the Ectonus technique.

There was a sharp difference of opinion concerning the necessity of having an anaesthetist in attendance when electroplexy was modified. At half the mental hospitals from which replies were received, anaesthetists were available on treatment mornings, but at the remainder anaesthetics and relaxants appeared to be given by the psychiatric registrar, sometimes single-handed, who may or may not be familiar with anaesthetic techniques, and with methods for coping with emergencies. It is difficult to find justification for this arrangement, when it has been clearly stated (39) that "only in exceptional circumstances should an operator acting alone also function as an anaesthetist". When this view is accepted, and bearing in mind the present shortage of anaesthetists to carry out this type of work in mental hospitals, there is a strong argument in favour of abandoning techniques involving the use of thiopentone, for as was stressed by Kelleher and Whiteley (20), insistence upon the presence of an anaesthetist on all occasions "might impose an impossible condition on the administration of E.C.T.". Other writers, such as Lincoln and Broggi (21) always have an anaesthetist in attendance during the performance of electroplexy, but the opposite view was taken by Seager (35), who did not consider that an anaesthetist was necessary provided that the psychiatrist had knowledge of the principles involved in dealing with an unconscious patient, given by Mushin (29), and stated that this applied equally to both unmodified and modified E.C.T.

Regarding the numbers of individual treatments given to cases of schizophrenia and depression, it was noted that the averages, given in Table VII, tended to conform fairly closely to opinions expressed by previous workers, e.g. Kalinowsky (17). However, it was considered that the questionnaire provided a good opportunity to ascertain the current practice on this controversial issue, so as to enable psychiatrists to have some form of base line from which to plan their treatments for these conditions.

Differences of opinion have been shown to exist in connection with almost every aspect of electro-convulsion therapy, and especially with regard to its

technique of administration. Opinions advocated by some are disfavoured by others, but the reasons for holding these opinions have been shown to be not entirely scientific, for in many instances they are founded upon subjective impressions and reports of single incidents (perhaps at other hospitals), or are based on hearsay. It was therefore considered that proper scientific data were urgently required, upon which to base a preference for a particular technique of E.C.T. These data can be obtained in two ways:

1. By a carefully controlled study, using a number of different techniques on the same patients, to determine which appears to be the most generally satisfactory, from the point of view of ease of administration, complications, patient's preference, etc. This is a fairly short-term project involving few staff but does not take into account any possible differences in therapeutic effectiveness between the different techniques. A scheme, conducted along these lines, has been in operation at this hospital during the past year, and will be reported later.

2. A longer term project involving more staff, using different groups of patients, in which an attempt would be made to investigate, amongst other things, any differences in the degree of recovery and the incidence of relapse following the use of different E.C.T. techniques. It would also be useful if this study could be extended to cover female as well as male patients.

Summary

1. At a recent court case a number of psychiatrists failed to agree upon a uniform technique of electroplexy, as a result of which the plaintiff lost his case.

2. Previous writers presented a confusing picture concerning techniques of E.C.T. administration, and it was considered important to ascertain which techniques were in current practice at various mental hospitals and teaching centres in this country, and to obtain other useful data.

3. A questionnaire was sent out. This showed that opinions were sharply divided about the best technique of giving E.C.T. and whether an anaesthetist should or should not be in attendance. At some 60 per cent. of the hospitals contacted, E.C.T. was modified with Pentothal and Scoline, and at 85 per cent. relaxants were used. These findings were considered to be of value should any further cases of litigation arise.

4. The results were discussed in detail, and were taken to indicate the necessity for obtaining proper scientific data concerning the most satisfactory technique of giving E.C.T. A research scheme on these lines is at present in progress at Banstead Hospital. Future studies should include female as well as male patients.

Acknowledgments

I wish to express my sincere thanks to Dr. A. A. Baker, Deputy Physician Superintendent of Banstead Hospital, and Dr. T. G. Grygier, Senior Psychologist, for helpful advice and criticism, and to Dr. E. P. H. Charlton, Physician Superintendent of Banstead Hospital, for permission to publish this paper.

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