RECOVERY TIME FROM MODIFIED AND UNMODIFIED E.C.T.

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DURING the last few years the use of electroconvulsive therapy in the treatment of out-patients has greatly increased. For example, in 1951, one hundred and forty-one treatments were given in the out-patient department of Freedom Fields Hospital, Plymouth, while in 1955, four hundred and sixty-four were given. There is no doubt that the number of treatments given to out-patients has increased even more in the country as a whole, as many hospitals did not start giving E.C.T. on an out-patient basis until well after 1951.

With this great increase in the number of patients treated it becomes, of course, the more imperative to select the method which is the safest, most effective, and economical in the time of both staff and patients. Four methods were considered in the present investigation:

1. The use of unmodified E.C.T., producing a full grand mal seizure.
2. The application of the same electrical stimulus ten to fifteen seconds after the beginning of fasciculation induced by the intravenous injection of suxamethonium chloride ("Scoline") (20–50 mg. according to weight). (The use of relaxants without anaesthesia was first tried out by Gillie and McNeill (1), and further work was done by Kelleher and Whiteley (2).)
3. The intravenous injection of a sleep dose of thiopentone sodium ("Pentothal") (150–300 mg. according to weight) immediately followed by a dose of suxamethonium chloride (20–50 mg. according to weight), preparatory to the electrical stimulus.
4. The use of a similar technique as in (3), but using buthalitone sodium ("Transithal") (250–500 mg.) as suggested by McColl (3) in a letter to the *Lancet*.

In all cases, patients were given a premedication of 1/75th gr. subcutaneous atropine.

The design of the investigation was as follows. Patients were an unselected group, and consisted of all those attending the out-patient E.C.T. clinic over the period of the experiment. They ranged in age from 20 to 70 and both sexes were represented. Patients were given their atropine injection on arrival at the Clinic. The treatment was then given about half-an-hour later, in one of the four ways described, and at the moment the shock was administered a stop-watch was started. The times when the patient finally stopped twitching and when he drew his first breath were then noted. As soon as he was sufficiently recovered he was handed over to the care of a nurse who kept him under close observation and noted the time at which he regained consciousness as judged by his ability to respond to simple commands.

Several criticisms may be levelled at this method, although they do not appear to invalidate it. In the first place the question of judgment on the part of the individual nurse might well arise, and, secondly, it might be argued that it was essential for the same nurse to be used on each occasion, to reduce any observer error. In practice this proved impossible for administrative reasons, and from time to time the nurses taking part in the investigation were changed. However, in spite of this, it was found that different nurses gave very similar times for recovery so long as one particular method was being used. It was also felt that, as the series was a large one, minor observer errors would tend to cancel out. Another factor which was not specifically controlled was age, but although very old or debilitated patients occasionally show a delayed recovery, this was by no means the rule, and they formed such a small part of a large series that any such delay would have no significant effect on the final result.

For convenience of description the various phases of the sequelae of the electrical shock were numbered. Phase one represents the time between the stimulus and the cessation of twitching. Phase two is the time between the stimulus and the first breath. Phase three is the time between the stimulus and the recovery of consciousness as judged by the criterion mentioned above.

Before tabulating the findings it is worth describing briefly the pattern of response to each method of treatment, and considering relevant problems of technique. First will be discussed unmodified or "straight" E.C.T. In this, the patient immediately upon stimulation goes into clonic spasm which is succeeded by tonic movements during which there is apnoea, and cyanosis develops. In almost every case breathing starts at the same instant as the relaxation of spasm.

If, however, scoline was given intravenously before the shock, the picture was quite different. It was found that the rapidity of action of scoline varied considerably from patient to patient, so that it was found best to judge the best time to apply the stimulus on the effect of the scoline on the individual patient, rather than to stick rigidly to a time-table. The shock was given as soon as fasciculation became well established in the face or upper limbs, or as soon as the patient began to show signs of discomfort (whichever was the earlier). The actual figures varied between 10 and 30 seconds. When this method was used the convulsion was markedly modified and a fairly prolonged period of apnoea succeeded the cessation of the spasm, so that insufflation with oxygen was always necessary.

When the anaesthetic was injected intravenously just before the scoline, it was found advisable to delay the stimulus until fasciculation was well established all over the body and beginning to pass off, in order to ensure the greatest degree of modification. Again, the time between injection and stimulation varied, but worked out on an average thirteen seconds longer than when scoline alone was used. With pentothal a prolonged period of apnoea succeeded the cessation of the twitching, so that insufflation was necessary in nearly every case. However, using transithal, the period of apnoea was very short indeed, and breathing usually recommenced only a few seconds after the cessation of the twitching. With transithal, insufflation was rarely essential.

As the full findings were striking and somewhat complex, it would be best to present them in tabular form, and then to discuss their possible significance.

From these figures a number of conclusions may be drawn, but it is desirable to make several observations about certain of them. Firstly, it would appear that scoline prolongs twitching time (Phase 1), but there was one figure of 115 seconds in the scoline series which lies nearly five standard deviations outside

TABLE I
Mean Recovery Times

			No. of Treatments in Series
Phase 1:			
Straight E.C.T. ..	.. 40 seconds	$\sigma = 5{\cdot}9$	55
E.C.T. with scoline alone	.. 46 seconds	$\sigma = 14{\cdot}25$	54
Pentothal plus scoline	.. 34 seconds		57
Transithal plus scoline	.. 39 seconds		57
Phase 2:			
Straight E.C.T. ..	.. 40 seconds	$= 6$	
E.C.T. with scoline alone	.. 100 seconds	$\sigma = 36$	
Pentothal plus scoline	.. 72 seconds		
Transithal plus scoline	.. 54 seconds	$\sigma = 17{\cdot}5$	
Phase 3:			
Straight E.C.T. ..	.. 5·8 minutes	$\sigma = 2{\cdot}12$	
E.C.T. with scoline alone	.. 7·3 minutes	$\sigma = 2{\cdot}73$	
Pentothal plus scoline	.. 10·4 minutes	$\sigma = 3{\cdot}43$	
Transithal plus scoline	.. 7·6 minutes	$\sigma = 3{\cdot}07$	

the mean, and this may be an artefact. Consequently significance was also calculated when this figure was left out. Secondly, as the stimulus was, on the average, given thirteen seconds earlier when scoline alone was used, it might be argued that the apparently greatly prolonged Phase 2 was simply due to the fact that the scoline had been given relatively later. Consequently a correction was made for this by deducting thirteen seconds from all Phase 2 times in the scoline series, so that the scoline effect could be approximately standardized. As will be seen, however, the effect of scoline on Phase 2 was so marked that the correction does little to influence the final results.

Certain conclusions may be drawn from the above findings, and some of them will then be discussed. It will be better, however, to mention them by the various phases to which they apply.

Phase 1

If we compare the duration of this phase, when scoline is used, with its duration in "straight" E.C.T. we find, as mentioned above, that the difference is highly significant (P=·1 per cent.). Possibly, however, the figure of 115 seconds twitching in one of the scoline cases was due to an unusual response to the scoline rather than to the fit itself. If this were so then this figure would have to be left out of the calculations, and if this is done the difference becomes "probably significant"; (Table II (*a*) and (*b*)) so there remains a distinct possibility that the addition of transithal or pentothal to scoline reduces the twitching time. However, our present figures do not warrant any firm conclusion.

Phase 2

Scoline very significantly delays the return of breathing (Table II (*d*)), but the use of transithal in addition to it strongly antagonizes this effect of scoline (*c*), as apparently does pentothal also, to a lesser extent.

Phase 3

Scoline very significantly delays recovery of consciousness, but pentothal has a very marked effect over and above that due to scoline. (It may be, as has been suggested, that the breakdown products of scoline have a depressant effect on consciousness.) It is very highly probable, however, that transithal does not

significantly delay recovery time beyond the inevitable delay caused by the scoline which is given with it. (Table II (*e*), (*f*), (*g*), (*h*), (*i*).)

Some of our findings are, of course, of purely academic interest, and lie rather in the field of pharmacology; others, on the other hand, are of great practical value. Before dealing with these, however, it is worth answering a few further objections which may be made at this stage about the technique and findings. Firstly, there was no significant difference in the equivalent doses of pentothal and transithal used. With both drugs sleeping and not anaesthetic dosages were given. Secondly, it might be thought that larger doses of scoline would have been used in the absence of an anaesthetic, but this was not so. If anything, the tendency was to use smaller doses. Again, it might be argued that the prolonged apnoea after scoline was due to excessive insufflation of oxygen, but, in fact, the minimum was used in order better to judge when breathing restarted.

We confirm that the use of scoline without anaesthetic has certain advantages (1, 2) and that it gives a satisfactory modification of the fit. Although we watched for them, we had no complaints of any of the unpleasant side effects described by Meyerhofer (4). We did, however, note that scoline prolonged Phase 2.

We found, in addition, that the use of transithal with scoline had many advantages over the use of scoline alone. Respiration became re-established much more quickly, so that insufflation was rarely necessary and the patient was anaesthetized, which obviated the danger of a "stun" shock followed by a return of consciousness before the painful scoline effect was over. We found that, if the injection was given reasonably slowly, there were no side effects beyond occasional coughing of a mild degree, and the drug did not delay the return of consciousness. The only disadvantages which our technique has over that using scoline alone is that the danger of intra-arterial injection remains, and a two-syringe technique is still required. Neither of these failings appears of great enough importance, if due care is exercised, to outweigh the advantages of the technique.

If, however, we compare transithal with pentothal as an anaesthetic for E.C.T., there seems little doubt that transithal is greatly superior, as the patients breathe much sooner and also regain consciousness very much more quickly. Not only does this facilitate their early co-operation in removal to a recovery room; it also saves nurses' time. Although it has not been measured objectively, it has frequently been remarked by the nursing staff that the patients are ready to go home far sooner, and it is certainly a fact that clinics finish far earlier than they used to do when pentothal was used (5).

Conclusion

Transithal possesses nearly all the advantages of the technique where scoline alone is used, the drug is greatly superior to pentothal as an anaesthetic for E.C.T., and there appear to be few if any dangerous side effects. Its use results in a pronounced saving in the time of both staff and patients.

Table II
"t" Test Results

Phase 1:
(*a*) Scoline Mean time 46 seconds
(*b*) Straight Mean time 40 seconds
$t = 3 \cdot 94$ $< \cdot 1$ per cent. level
If figure of 115 excluded, $t = 2 \cdot 09$ (5 per cent. level)

Phase 2:

(*c*) Scoline alone compared to scoline plus transithal—
t=8·45 uncorrected. t=6·05 (corrected) <·1 per cent. level, "Highly significant"

(*d*) "Straight" and scoline—
t=4 <·1 per cent. level, "Highly significant"

Phase 3:

(*e*) "Straight" and scoline — t=3·55 <·1 per cent. level, "Highly significant"

(*f*) Scoline and pentothal with scoline — t=5·3 <·1 per cent. level, "Highly significant"

(*g*) Pentothal plus scoline and transithal plus scoline — t=4·5 <·1 per cent. level, "Highly significant"

(*h*) Scoline and transithal plus scoline — t=0·54. No significant difference

Summary

Comparison was made of the recovery times from E.C.T. using four methods:

(1) "Straight" E.C.T.
(2) E.C.T. with scoline but no anaesthetic.
(3) E.C.T. with scoline and thiopentone sodium.
(4) E.C.T. with scoline and buthalitone sodium.

It was found that scoline greatly delayed the return of breathing, a delay which was antagonized by buthalitone. The latter drug is judged to be superior as an anaesthetic for E.C.T. because the patient breathes much sooner and regains consciousness earlier, although safety is in no way sacrificed. The time of patients and staff is therefore greatly spared.

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