

ELECTRONARCOSIS : A SAFE TECHNIQUE FOR ROUTINE ADMINISTRATION UNDER ANAESTHESIA AND EULISSEN (DECAMETHONIUM IODIDE OR C.10).

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ELECTRONARCOSIS (E.L.N.) is a state of unconsciousness brought about by the passage of an electric current through the forebrain. The current has a much lower milliamperage than that which is used in electro-convulsive therapy (E.C.T.).

In view of considerable dangers reported to be inherent in electronarcosis—e.g. by Garmany and Early (1948)—it is proposed to describe a method which is both simple and free from danger. It is felt that these dangers have been so emphasized that what might be a most valuable type of treatment is being abandoned. The method to be described was administered to 70 patients, and a total number of 600 treatments were given without serious complications. When first used for patients who had failed to respond to the already well established shock therapies a number of complications were seen; these included burns at the site of contact between the electrodes and the skin of the forehead, dangerous apnoea, prolonged delays in recovery from treatment, apprehension and refusals. Most of these were due to faults in our technique; in the absence of anaesthesia and curarization, considerable experience and skill were needed to keep the patients smoothly under electronarcosis. It was decided that the treatment should be carried out in the operating theatre containing the most modern equipment, with the aid of a skilled anaesthetist able to deal with the purely anaesthetic emergencies, and with a completely reliable method of laryngeal relaxation to ensure a clear airway. In this way an adequate depth of electronarcosis could be maintained throughout.

A standardized method of treatment based on that described by Paterson and Milligan (1947) was developed. Anaesthesia and muscular relaxation were produced by the intravenous injection of thiopentone sodium and d-tubocurarine, and we followed the modification of this technique first suggested by Caplan (1948). On the recommendation of Dr. J. P. Cuddigan, our anaesthetist, tubocurarine was replaced by C.10 in August, 1949.

The treatment was carried out on three mornings a week. Each session started at 9 a.m. and lasted about 2½ hours, 8 to 10 minutes being allotted to each patient. To ensure a quick turnover of cases with the maximum safety from risks, it was essential that it should be under the control of an efficient team, consisting of a specialist anaesthetist, the psychiatrist, a theatre sister, a nurse to assist the anaesthetist, and at least two orderlies for transporting patients. The first patient is under observation in the recovery room, while

the second one is on the operating table undergoing treatment and the third is waiting in an adjoining room.

When E.C.T. was preferred to E.L.N., these additional cases could be included in the same session, following the technique described by Hobson and Prescott (1947).

PREPARATION AND PRE-MEDICATION.

On the day before treatment a list is published which includes the names of the in-patients and out-patients, the ward, the number of previous treatments and the recommended dosages. No solid food is taken by mouth for at least 4 hours before the treatment begins, but a morning cup of tea, "sweetened to taste," is permitted on waking. The bladder is emptied just before entering the theatre. One hour before the treatment begins the patient is given atropine, gr. $\frac{1}{16}$ to $\frac{1}{8}$, or scopolamine, gr. $\frac{1}{16}$ to $\frac{1}{8}$, but no patient over the age of 60 is given scopolamine.

EQUIPMENT.

The operating table, which has an adjustable arm-rest at the side, is covered with a Dunlopillo mattress, on top of which is placed a canvas stretcher with strong rope loops. A small firm pillow is used as a head-rest. Two stretcher trolleys are available for taking patients back to their wards.

The anaesthetic apparatus in use is a standard Boyle machine with a Coxeter-Mushin carbon dioxide absorber. The trolley also has an emergency tray with a laryngoscope, laryngoscope forceps, gauze swabs, Mason's gag, Guedel rubber airways and Magill's tracheal tubes.

The anaesthetist's table :

- (i) Bowls containing sterile water, sterile swabs, spirit.
- (ii) Kidney trays for sterile syringes.
- (iii) Syringes, sizes 10 and 20 c.c.
- (iv) Short-bevelled needles, sizes 17 and 18.
- (v) Thiopentone sodium in bottles containing 5 gm.
- (vi) C.10 in 2.5 c.c. ampoules.
- (vii) Sterile glass tube for mixing purposes.
- (viii) Large needle for drawing up.

Treatment trolley with—

- (i) The Shotter-Rich electronarcosis apparatus.
- (ii) Pair of electrodes (see below).
- (iii) Bowl of 20 per cent. saline (for saturating gauze pads).
- (iv) 2-in. square pads of 16 thicknesses of gauze with stitched edges.
- (v) Smith time-keeper clock, indicating minutes.
- (vi) Sphygmomanometer.
- (vii) Plexacon electroshock apparatus.

Emergency tray—a table containing pentamethonium iodide, as an antidote for C.10, nicamide, amyl nitrite, picrotoxin, and adrenaline.

It has long been considered advisable to have a suction apparatus and a tipping table in the remote event of regurgitation of stomach contents.

TECHNIQUE.

In my experience the electrodes supplied with the E.L.N. machine, are difficult to manage. A pair of electrodes designed by Dr. B. P. Armstrong are now being used instead. Each one is made of nickel-plated brass, $1\frac{1}{2}$ in. square, and slightly concave to fit the forehead comfortably. On the back of the electrode there is a bridge soldered on, about a quarter of an inch high. The centre of each bridge has a binding screw to hold a terminal. Two metal hooks connected by a narrow rubber head band, 1 in. in width, engage holes on the outer side of the bridge of the electrodes. There is a metal bar on the inner side of each bridge, through which an adjustable rubber strap is passed, thus holding the two electrodes together.

On entering the theatre the patient is asked to lie on the table with the head raised in a comfortable position on the small pillow. The arm into which the injection is to be made is stretched out on the arm rest at one side. When a patient is having treatment for the first time, a small dose of C.10 is injected intravenously, slowly at first to allow for the possibility of idiosyncrasy, and this is followed by thiopentone. At the second treatment the most suitable dose of thiopentone sodium and C.10 can be mixed and given from the same syringe. The dose of thiopentone varies from 0.4 gm. to 0.6 gm. and the C.10 from 1.5 mgm. to 5.0 mgm.

Two of the gauze pads, saturated in 20 per cent. warm saline, are placed about 1 in. apart on the forehead, the skin of which has previously been smeared with saline jelly (3 per cent. NaCl in tragacanth jelly). The electrodes are placed on top of these pads and then connected to the hooks on the rubber head band. It is essential that this head band should be tight and maintain firm, even pressure at the site of contact of the electrodes. About one and a half minutes after the injection the current is turned on at 200 milliamperes, or at zero and rapidly increased to 200 milliamperes, and is kept at this level throughout the treatment. Both these methods are used and seem to be equally effective.

There is an immediate modified tonic response, followed by an initial apnoea for some 30 to 40 seconds. When breathing begins it is extremely shallow, almost imperceptible; it is sometimes necessary to start insufflating the lungs with oxygen at this stage. Sometimes a good respiratory exchange is quickly established and the treatment continues without further oxygen; at other times there is a persistent apnoea and, since the vocal cords have now completely relaxed, constant insufflation with oxygen can be maintained easily by means of the Coxeter-Mushin bellows.

If a modified convulsion occurs the treatment is temporarily interrupted by the reduction of the current. After the cessation of the fit and when breathing begins again the current is quickly returned to 200 m.a. and the treatment is continued.

A time-keeper clock is set for 5 minutes, which seems an adequate time for the duration of each treatment. When a bell rings the current is switched off and the electrodes are removed. The patient is transferred on the canvas stretcher to a trolley and taken to the observation room next door to the theatre, as soon as the anaesthetist is satisfied that there is sufficient amplitude in the breathing to maintain adequate oxygenation. The patient is kept under observation in this room until there are signs of returning laryngeal reflex. It is then safe to take the patient back to the recovery ward. Strict observation is continued for at least 20 minutes, by which time the effects of thiopentone and C.10 have worn off.

COMPLICATIONS AND THEIR PREVENTION.

Burns.—In order to prevent the development of first degree burns at the site of contact between the electrodes and the skin, it is essential that a well-fitting rubber head band should hold the electrodes firmly in position, and thus maintain uniform pressure on the forehead. In this way the concentration of current at points, rather than over a wide area, is avoided.

Consciousness.—A painful awareness of the treatment in progress is seen occasionally in tense, over-anxious patients and is a very disturbing complication, sometimes leading to intense antagonism and refusal of further treatment. It occurs in lightly anaesthetized patients when the laryngeal spasm necessitates the reduction of the current and cessation of electronarcosis. When the current is switched on at 200 m.a. in a fully anaesthetized and curarized patient pain and flashes of light are not experienced. The state of narcosis remains smooth and constant.

Restlessness during the treatment may also occur when similar unfavourable conditions are present.

Collapse is liable to occur in old and debilitated people if there is inadequate oxygenation, and cyanosis must not be tolerated under any circumstances.

Transient signs and symptoms which occur in some patients after treatment are :

(i) *Occasional intense headaches* which tend to last for several hours ; they are always relieved by tab. codein. co. There is no obvious relationship between this symptom and the mode of treatment.

(ii) *Memory disturbances.*—The presence of memory loss or confusion varies enormously from patient to patient, and can vary after each treatment in the same patient.

(iii) *Thrombosis of veins.*—Frequent injections of thiopentone and C.10 are liable to cause a thrombosed vein. It is recommended that the arm be raised and the veins gently massaged centripetally after the injection. It has been observed that thrombosis of veins does not occur so frequently with C.10 and thiopentone mixture as it did with d-tubocurarine and thiopentone.

CLINICAL MATERIAL.

When electronarcosis was first introduced into this country from the U.S.A. by Paterson (1946), it was thought that it might be a substitute for insulin coma therapy in the treatment of schizophrenia. It is now known that it cannot replace insulin shock, and there is scanty evidence to show that it has a specific effect upon schizophrenia.

In this series the treatment was given to three distinct groups of cases, while a fourth group was treated by both electronarcosis and electroshock.

Depression.—There were 32 cases in a mixed group of depressive syndromes.

(a) Nineteen of these had previously been treated with E.C.T. and had relapsed. A course of E.L.N. resulted in 15 remissions, but 4 did not improve.

(b) The remaining 13 cases had no history of previous psychiatric disorder ; 9 cases recovered, and 4 were only slightly improved.

Schizophrenia.—There were 25 cases of schizophrenic reaction. This group was also mixed, and included cases, between the ages of 18 and 30, that had failed to respond to insulin coma therapy. There were also a series of paranoid states, chiefly in patients over 30. Electronarcosis resulted in 3 recoveries, 6 showed considerable improvement, 5 were slightly improved, 4 failed to respond and eventually had leucotomy, 3 failed to respond and were given deep insulin, 4 showed no improvement.

Psychoneurosis.—Thirteen cases ; 9 were chronic anxiety states, of whom 6 improved ; 4 were obsessive compulsions, 3 improving.

In addition to these, each session included a number of treatments for aged, debilitated, senile and arteriosclerotic patients by electro-shock, modified by C.10, and it is now becoming a routine method of treatment for patients over 70.

SUMMARY AND CONCLUSIONS.

This report deals with 18 months' experience with electronarcosis.

The establishment of a technique by the use of thiopentone and C.10 is described. It is dependent upon an efficient team and correct doses of thiopentone and C.10, as well as upon the anaesthetist's ability in caring for the apnoeic patient.

Electronarcosis is a relatively safe form of physical therapy, and complica-

tions should not arise if the technique as described above is correctly carried out. In this series the few experienced could all be traced to errors in technique.

Patients are surprisingly undisturbed throughout the whole course of treatment, and are able to carry out their usual activities within 3 hours.

In this hospital there has been a gradual reduction in the use of chemical narcosis through the introduction of E.L.N.

It is particularly noticeable that patients who are familiar with the nature of epileptiform convulsions prefer "shock" treatment with anaesthesia and curarization rather than without it, and have no hesitation in accepting E.L.N. and E.C.T. under the above conditions.

In contrast to d-tubocurarine, C.10 has the following advantages: it has a quicker action, and produces as good, if not better, relaxation of the vocal cords. There is less involvement of the respiratory muscles. Its effects wear off more quickly, and the period under observation in the recovery room is much reduced.

With increasing experience and confidence in the technique an increasingly larger number of senile patients are being treated.

At this stage no claim is made that the method described is superior to other forms of shock therapy, but, in certain patients, it does produce striking results where other methods have failed. There is some evidence to suggest that the paranoid reaction in older patients responds well to electronarcosis.

I am indebted to Dr. D. N. Parfitt, Medical Superintendent of Holloway Sanatorium, for permission to publish this report; also to Drs. J. P. Cuddigan and B. P. Armstrong, our anaesthetists, who have been chiefly responsible for making the psychiatrist's task so easy.

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