THE CONTRA-INDICATIONS

TO

MODIFIED CONVULSION THERAPY.

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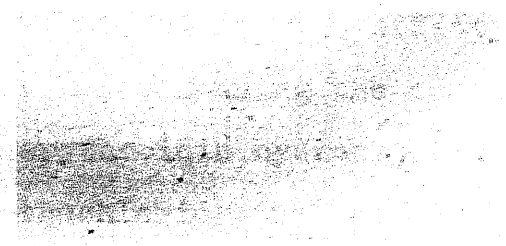
INTRODUCTION

INTRODUCTION

The introduction of electrically induced convulsions by Bini and Cerletti in 1938 marked an advance in the treatment of mental disorders which has been attested by its world-wide use. Although originally intended for the treatment of schizophrenia, it has been found most valuable in the treatment of affective disorders. It is still used as a palliative treatment of schizophrenia, however, and there can be hardly any patient suffering from a major psychosis who is not, at some stage of his illness subjected to this treatment. The scope of the treatment is not confined to major psychoses. In recent years it has been used with more or less success in certain neuroses. Most recently its use has extended beyond the bounds of psychiatry, and it has been tried, with some success in the treatment of rheumatoid arthritis (84). In view of its widespread and extending use, a study of the risks involved in using it, becomes very important. From the early days of convulsion therapy it was found that the treatment had serious disadvantages and a considerable number of contraindications appeared which precluded its use. Some of these were postulated on theoretical grounds. It was assumed that the convulsion was a strain and that a weakened organism would not stand it. Such conditions as cardiovascular disease, old age and pregnancy were in this category, which was later found

to be much less extensive than was first imagined. Other contraindications emerged from experience with the treatment. As the frequency became known with which vertebral fracture and the activation of latent tuberculosis occurred some excluded from treatment were those who showed any kind of abnormality in these regions.

I have limited myself to a discussion of E.C.T., as its predecessor, chemically induced convulsions, although still used, has become practically unimportant. Many reports on the latter treatment apply equally to E.C.T. however, and are considered here.



MODIFICATIONS TO PREVENT INJURY

Various measures have been adopted to prevent injury arising from therapeutic convulsions. To prevent fractures considerable restraint or its entire absence have been recommended (32, 65). Rankin (119) outlines a system of restraint based upon detailed consideration of anatomical and mechanical principles in bony movement. Intravenous Sodium Amytal was tried (73). Spinal anaesthesia has been used (59, 134) where there was a liability to injury in the lower half of the body. It has been claimed that modifications of the current administered to induce the convulsion reduces the risk of injury (99, 113, 141). Recently hypnosis has been advocated to reduce anxiety and hostility in patients undergoing electrical treatment (96).

A group of drugs, of which curare and its derivatives are the best known, has the effect of paralysing muscular contraction and softening the convulsion

Beta-erythroidin hydrochloride (15, 22, 126, 127) quinine methachloride (65) magnesium sulphate (12, 124) and myanesin (69) have been used, but all possess disadvantages which derivatives of curare do not, and are no more effective.

Curare was first known as an arrow poison used by the native inhabitants of parts of South America, and was described first by Spanish adventurers in the sixteenth century (95). In the middle of the nineteenth century, the active principle of the poison was found to be an

extract from the plant strychnos chondrodendron. Many of its properties and its mode of action were investigated by Claude Bernard, (95). In 1938 Richard Gill brought a large quantity of crude curare to the United States where it was investigated by Professor McIntyre of Nebraska University, who collaborated in preparing an aqueous extract which was sold under the name of 'Intocostrin'. Later d.- tubocurarine chloride was found to bear less harmful side-effects, and to be the most active constituent in producing paralysis. The exact mode of action of curarising drugs has not been determined but it is known that it produces a block at the neuro-muscular junction preventing the transmission of nervous impulses and that its action is antagonised by prostigmine (95).

In 1940 Bennet (13) published a report on the use of an aqueous extract of crude curare, standardised on mice, to prevent traumatic complications in convulsions produced by Metrazol. In the following year Harris, Pacella & Horwitz (61) reported on eleven cases who were given 'Intocostrin'. No complications occurred and it was also reported that the electroencephalographic changes following this treatment were not different from those usually following convulsant therapy. In 1942 Cash & Hoekstra (22) reported on 139 cases similarly treated in whom no fractures or dislocations occurred. Similar reports followed from America (12, 17, 21, 54, 88, 149, 152) and

later from other parts of the world (20, 98, 110). However, it became clear that certain risks were attached to the use of curare, most notably respiratory failure (7, 76, 110, 123, 129, 140, 149), cardiac embarrassment (5, 7, 21, 76, 148) and bronchospasm (7, 110). Of these respiratory failure is the most important and deaths from it have been reported (115, 117). Brody (15) recommended the use of a Guedel rubber airway and Marshall & Swanton recommend a rebreathing bag (98) when using curare, but Hobson & Prescott (68) seem to be the first to lay emphasis on the absolute necessity of an efficient practical means of artificial respiration being at hand when a curarising drug is used. Curarisation does not produce unconsciousness (50) and Brody (17) is the first to mention the use of Thiopentone in order to overcome the unpleasant sensations it produces and to combat bronchospasm. This is also emphasised by Hobson & Prescott (68). Patients with myasthenia gravis are extremely sensitive to curare and its derivatives and it should not be given to them (9, 14, 16, 38, 70, 71, 88, 86).

Successful efforts to produce a synthetic drug with a curare-like action have recently been made. In 1948 Paton & Zaimis (114), as the result of research into polymethylene bistrimethylammonium compounds for the purpose, suggested the use of decathemorium iodide (C.10) as a substitute for d.-tubocurarine chloride, at the instance

of the Medical Research Council a careful investigation into its use for the purpose of modifying electrically induced convulsions was carried out and reported in 1949 by Davies & Lewis (33). They showed that C.10 was four times as potent in modifying a fit as d.- tubocurarine chloride, and that its effects were indistinguishable from those of d.-tubocurarine chloride either by the subject or by an observer; that respiration is less affected by C.10 than by d.- tubocurarine chloride in doses producing an equal degree of modification of the convulsion, and that C.10 is free from side-effects, particularly broncho-spasm. In addition it is cheap, easily soluble and miscible with Thiopentone and appears, therefore, to be superior to d.- tubocurarine chloride for the purpose of modifying electrically induced convulsions.

Other synthetic agents have now been produced, but it has not been demonstrated so far that they have any advantage over C.10.

In order to establish the contra-indications to E.C.T. it is necessary to consider what complications have arisen from it and how these could have been foreseen.

Deaths Table 1 shows 42 deaths reported in the literature by various authors which are attributed to convulsion therapy. The total number must considerably exceed this as estimations of death rates by various authors show. In 1939 Meduna & Friedman (100) calculated a death rate

TABLE 1

Reported Deaths resulting from Convulsive Therapy

Ref No.	Year	Age	Abnormal findings on medical examination.	Cause of death or postmortem findings	Convulsive Agent	Remarks
62	1939	56	-	Acute heart failure	Metrazol	-
128	1939	-	-	Lobar pneumonia	Metrazol	-
101	1940	-	-	Femoral embolus	Metrazol	-
101	1940	-	-	Acute bacterial endocarditis	Metrazol	-
44	1942	-	-	Pneumonia	Electricity	-
23	1942	20	Healthy	Respiratory failure	Metrazol	'Intocostrin' given
44	1942	70+	-	Myocardial damage	Electricity	-
72	1942	-	-	Coronary sclerosis	Electricity	-
72	1942	-	-	-	Electricity	-
142	1943	50	-	-	Electricity	-
142	1943	45	-	Cardiac failure	Electricity	-
142	1943	29	-	Status Epilepticus	Electricity	-
142	1943	56	-	Acute respiratory infection	Electricity	Onset 3 months after treatment

TABLE 1 (Contd.)

Ref No.	Year	Age	Abnormal findings on medical examination.	Cause of death or postmortem findings	Convulsive Agent	Remarks
142	1943	75	-	Cardiac fibrillation	Electricity	Curare given
142	1943	79	-	Cardiac failure	Electricity	Death 4 months after treatment
142	1943	58	-	Respiratory failure	Electricity	-
142	1943	50	-	-	Electricity	-
142	1943	77	-	Coronary thrombosis	Electricity	-
142	1943	57	-	Respiratory failure	Electricity	-
135	1943	50	-	Respiratory failure	Electricity	'Intocostrin' given
107	1944	46	None	Haemorrhage in thyroid gland	Electricity	
107	1944	52	None	Fractured pelvis Pulmonary tuberculosis	Electricity	Died 6 months after treatment
107	1944	62	Slightly enlarged heart	Myocardial degeneration	Electricity	Died 2½ hours after fit
107	1944	74	-	Fractured femur Pneumonia	Electricity	

TABLE 1 (Contd.)

Ref No.	Year	Age	Abnormal findings on medical examination	Cause of death or postmortem findings	Convulsive Agent	Remarks
107	1944	54	-	Bronchopneumonia	Electricity	Died 6 days after fit
75	1944	70	-	Heart failure arteriosclerosis	Electricity	Immediate death
75	1944	23	-	Heart failure Pulmonary oedema	Electricity	Died 15 hours after fit
42	1945	-	Weighed 631b.	Pulmonary embolus	Electricity	-
102	1945	53	-	Cerebral fat embolism	Electricity	No source of embolus found
55	1946	-	-	Silent brain tumour	Electricity	-
55	1946	-	-	Volvulus	Electricity	-
123	1947	53	-	Asphyxia	Electricity	'Intocostrin' given
104	1947	-	Coronary disease	Coronary infarction	Electricity	-
104	1947	-	None	Subarachroid haemorrhage	Electricity	-
147	1948	48	-	Respiratory Failure Medullary compression	Electricity	Curare given

TABLE 1 (Contd.)

Ref No.	Year	Age	Abnormal findings on medical examination	Cause of death or postmortem findings	Convulsive Agent	Remarks
147	1948	47	-	Cardiac failure Sclerosis of coronary artery	Electricity	Curare given
7	1948	70	Hypertension Leucotomised.	Cerebral and pulmonary oedema	Electricity	'Intocostrin' given.
53	1950	-	Leucocytosis	'Crush syndrome'	Electricity	
53	1950	-	-	'Crush syndrome'	Electricity	

of 0.29% of cases treated for metrazol; in 1942 Kolb & Vogel (87) reported it as 0.10%. For E.C.T. Kolb & Vogel (87) found a death rate of 0.05%, and L.C. Cook, calculating for E.C.T. and metrazol, considered it to be less than 0.20% (29). Although these figures seem small, when the widespread use of convulsion therapy is taken into account, they must amount to a considerable total.

Cardiac complications far outweigh any other as a cause of death, and respiratory causes are next. Ages are given in only thirty-nine patients, and of these nineteen are over fifty, the youngest being twenty. Seven patients had been given curare. Unfortunately insufficient detail is given in most of these reports from which to draw reliable information about how such an outcome might have been foreseen and prevented. The cardiac complications which arise from induced convulsions are the result of a temporary disturbance of circulation, which is manifested even in the absence of complications. The easily observable changes are a temporary cessation of pulse immediately following the fit and a period of cyanosis which occurs after it. Milch (1941) has observed a constriction of the retinal arteries in the period between the delivery of the current and the onset of the convulsion (103). There is a considerable rise of blood pressure during the fit which is transmitted to the cerebro-spinal fluid thus protecting the cerebral vessels from rupture (24). Immediately after the fit

there is probably a drop in pressure and then another rise (58, 85). A number of less obvious circulatory changes have been demonstrated by Altschule & Tillotson (1948) and their co-workers. A marked rise of venous pressure occurs during and immediately after the fit (3, 6) causing a temporary haemoconcentration and subsequent fluid retention (2). This rise is attributed to the production of the Valsalva phenomenon by the rise of intra-thoracico-abdominal pressure, the squeezing of blood from the muscular capillary beds and an increase in carbon-dioxide tension in the blood (3, 24).

Stimulation of both sympathetic and parasympathetic systems occurs producing a pilomotor response, dilation of the pupil and hyperglycaemia (10, 49, 90, 138).

The electrocardiographic changes noticed after electrically induced convulsions are sinus arrythmia, sinus bradycardia, auricular and nodal premature beats, auricular tachycardia, and sino-auricular heart-block (3, 4, 41, 85). Altschule (1948) suggests that these changes are due to vagal stimulation (4, 7, 75) and that an increase in amplitude of the P wave is due to dilatation of the auricles consequent upon the rise of venous pressure (4).

In a patient who has had a curarising drug these changes are modified. If oxygen is given cyanosis does not develop. There is not such a marked rise in arterial or venous pressure (2, 24, 97), although, according to Wooley

(1944), there is great variation in arterial pressure during and after the fit (148). The electrocardiographic changes are similar to those in patients without curariform drugs but less in amount (5). Curare itself causes no significant change in the electrocardiogram (129).

The two important factors affecting the circulatory system are therefore the rise in venous pressure and the autonomic stimulation, particularly vagal.

A certain number of apparently healthy patients have cardiac complications and this has occurred with both metrazol (27, 35, 51, 101, 120, 153) and electrically induced convulsions. Resulting from the latter, arrhythmias are reported such as auricular flutter (142) and auricular fibrillation (31, 35, 61, 135). The first is extremely rare and the second always transient. Both are probably the result of vagal stimulation. Cardiac failure, pulmonary oedema (142) and collapse (85, 108, 142) are also reported. A rare complication is persistent hypertension (108, 142). Similar complications have occurred in patients who had existing cardiac disease. Hayman (1945) describes the onset of auricular fibrillation in a patient with mitral stenosis (61) and it developed in a hypertensive (92). Activation of old endocarditis (44), precipitation of congestive cardiac failure (45) and aggravation of existing coronary sclerosis (6) are also described.

Of the forty-two deaths reported in the literature and shown in Table 1, there are fourteen in which the immediate cause of death was cardiac. In four of these previous cardiac disease was present; in ten no preceding physical disease is described, but five of these were over seventy; in three cases curare was given.

There are not many reports of cardiac complications in curarised patients. Auricular fibrillation (142), collapse (123,142) and coronary thrombosis (142) are said to have occurred. Of the six deaths in curarised patients shown in Table 1 two were in patients over 70. In none of these deaths is it clear that an adequate method of artificial respiration was available.

On the other hand many patients who have heart disease have had convulsions induced with no ill effect. M.T.Moore (1947) treated 153 patients with heart disease from among 1,596 cases which he discusses (104). There was only one mishap and from his experience he concludes 'cardiovascular disease tolerates electrical convulsion therapy well provided it is not too severe or acute'. The following conditions have been treated with no ill effect hypertension (42,43, 44,45,104), arteriosclerosis (104,77), partial or complete coronary occlusion (42,44,45,77,104,106,140), myocardial disease (104), mitral stenosis, aortic incompetence (77), aortic stenosis (104) auricular fibrillation (42,44,45) bundle branch block (44,104) calcified pericarditis (140),

patent ductus arteriosus (77) cardiac enlargement (45, 77) cardiac failure before treatment (42, 92) and cardiac failure at the time of treatment (42).

We may infer that a small number of apparently healthy patients may have circulatory complications of which auricular fibrillation and cardiac inhibition are the most important. Unless they cause death, however, these are more in the nature of difficulties occurring during the course of treatment than causes of permanent disability. A certain number of patients with cardiac disease may suffer injury and a few have died as the result of E.C.T., but a very much larger number of such patients have had no ill-effects arising from it. Cardiac complications in curarised patients are rare. We are left with the question, therefore, what degree of heart disease is too severe for electrical convulsion therapy to be undertaken and what precautions can be taken to prevent disability arising from the disturbance of circulation occurring as a result of it.

RESPIRATORY COMPLICATIONS

Aggravation of tuberculosis, latent or frank, early claimed attention after the introduction of convulsive therapy. In 1941 Read (120) found that among 320 schizophrenics treated with metrazol 8% had developed pulmonary tuberculosis whereas only 3% of non-treated cases had done so. This was confirmed by Bulley & Greene (18) in 1941, who found that among 277 treated schizophrenics 8.3% developed

tuberculosis whereas the incidence was only 3% in a non-treated group. The onset was so acute in some of these cases as to leave no doubt that the treatment was responsible. Kolb & Vogel (87) give an incidence of 0.1% with metrazol in a large survey. The incidence with electrical convulsion therapy appears to be less although no comparable figures have been published. It does, however, occur (47, 65, 72, 93, 146). Knapp & Cain (86) state that they have treated many cases of fibrous tuberculosis with E.C.T. without spread while Jentoft (74) in discussing 56 tuberculous patients treated with E.C.T. says that 12 were aggravated but only 3 of these could be attributed to treatment.

Meduna & Friedman (100) estimated the incidence of lung abscess in metrazol therapy to be 0.1%; Parmeijer (112) found 7 cases from 1200 cases treated (0.6%). Epstein (40) believes this complication to be due to clots arising from the injection, but its incidence following electrical convulsive therapy makes it seem that aspiration is a more likely cause as Altschule & Tillotson (1948) suggest (6). In one case (28) severe gum infection preceded the development of a pulmonary abscess. In a review by Kwalwasser et al. (1950) of 2,562 cases who had had E.C.T. it was found that 25 cases had developed pulmonary abscess (89). Five of these cases died and ten retained residual symptoms. The highest incidence was in the right upper or middle lobes which also suggests aspiration as the cause. Other cases

have been reported (28, 93). Bennet reports a case in which prompt aspiration of a plugged bronchus prevented the development of a pulmonary abscess (11).

Pneumonia is a rare complication occurring mostly in elderly patients (43, 44). Parmeijer (112) reports six cases of interlobar empyema following E.C.T., but this complication is not described elsewhere.

In 1943 Samuel (130) described two cases of healed pulmonary tuberculosis who were given unmodified electrical convulsion therapy without reactivation. Pacella (108) treated four such cases with no evidence of reactivation. Moore (104) in an extensive review of the contra-indications to electrical convulsive therapy, cites eight chronic and two active cases of tuberculosis who were treated without further spread. 25 chronic and 8 active cases were treated by Kaldeck and others (77), one case developing a pleurisy. Two of their patients with normal chest films developed pulmonary tuberculosis however. Knapp (86) and Jentoft (74) also report tuberculous cases treated without reactivation. Close (25) reports eight active cases who were treated with electrical convulsion therapy and all improved. He shows that sudden, rapid progression of tuberculous lesions takes place in the ordinary course of the disease and criticises previous reports in which spread is attributed to convulsion therapy on account of its rapidity.

Emphysema, pleural thickening (104), recent pneumonia (139),

bronchiectasis (77) are all reported in patients who were treated without complication. Parker (109) describes a woman who had bronchiectasis and was given E.C.T. modified with tubocurarine, later the lung was removed and she had a further course of modified E.C.T. with no cyanosis, apnoea or other complication, and made a full recovery. One case with bronchiectasis reported by Smith et al (1943) had a haemoptysis, however, following unmodified treatment (135).

Pulmonary tuberculosis is the most frequent serious condition which causes doubt as to the safety of giving convulsive therapy. (Unfortunately, there are no reports in which modified convulsion therapy was given). The greatest risk of spread appears to be where cavitation is present (74), but such risk is of course, great in such cases in any event.

BONY INJURY

Fractures are the most frequent complication of convulsion therapy, and vertebral crush the most common of these. Table 2 shows the incidence of such fractures in various types of convulsion. Stalker (1938) was the first to report this injury (137). The reported incidence for metrazol varies from .3% to 50% and for electrically induced convulsions from 3% to 21%. This variation is probably accounted for by the fact that only a small proportion of these fractures give any symptoms, and many psychiatrists X-ray only those patients who complain. Even

TABLE 2

Incidence of Vertebral Fracture

Authors & Date	Metrazol		E.C.T.		Epilepsy	
	% incidence	No. patients considered	% incidence	No. Patients considered	% incidence	No. Patients considered
20 1939	.3%	687				
111 1939	25%	20				
117 1939	43.1%	51				
122 1940	31.4%	86			34.2%	72
115 1940	50%	32				
57 1940	11%	187				
120 1940	15.3%	320				
50 1941	14.7%	143			10.4%	134
105 1941					66.6%	12
152 1941	28.8%	66			50%	10
47 1941	20 - 30%	Auther's estimate	3%	115		
8 1942	45%	20	15%	20	45%	20
150 1942	40%	Auther's estimate			10%	Auther's estimate
37 1942	23%	200				
153 1942	31%	-				

TABLE 2 (Contd.)

Incidence of Vertebral Fractures

Authors & Date	Metrazol		E.C.T.		Epilepsy	
	% incidence	No. patients considered	% incidence	No. patients considered	% incidence	No. patients considered
12 1943	43 - 51%	Auther's estimate				
19 1946	33%				33%	
70 1946			5.2%	252		
91 1947			21%	230		
77 1948			1%	628		

on radiological examination, the criteria for diagnosing a fracture are variable. Broadly, the incidence in metrazol convulsions is greater than in electrically induced convulsions. These fractures are nearly always a crush of a mid or lower dorsal vertebral body. This unusual site is due to an unphysiological stress on a rigid part of the spine (46, 121). It has been found that similar fractures occur in epilepsy (8, 19, 30, 122). The incidence is twice to three times greater in men than in women (8, 91, 122), and is greater in subjects below 30 and over 60 (37, 91). No neurological complications of such fractures have been reported and a follow-up study of twenty-four patients 10 years after their initial lesion, has shown no evidence of neurological or orthopaedic sequelae (118).

A transverse process is sometimes fractured (106). The most serious fractures which occur are those of the humerus (43, 44, 112, 130, 142) and femur (55, 65, 108, 112, 130, 131, 136, 142, 144). In the femur the usual site of injury is the neck and sometimes the force of the convulsion is sufficient to drive the head of the femur through the acetabulum (77, 106). Fractures of scapula (112, 131) and jaw (112) have also occurred. Dislocation of the jaw was very common (72, 142) but simple precautions have now made it rare. Dislocation of the shoulder (55, 77, 142) sometimes occurs.

Unmodified convulsions have been induced in patients with bony deformities. Spinal deformities, infected bone and arthritis are mentioned by Moore (104) in his survey of contra-indications. Recent fractures of jaw, hip and rib (104) fractured skull (139) and Paget's disease (106) have also been present in patients who suffered no disability.

There are several reports of convulsions being induced in elderly people. Robinson and Shelton (125) induced convulsions with metrazol in patients of 84 yrs, 75 yrs, and 60 yrs, with no ill effects. A considerable number of patients over 60 has been given electrical convulsive therapy without ill effect (43, 45, 77). Wilbur & Fortes (145) treated thirty patients over 70 all of whom had some organic disease with no complications. Gallinek (48) treated 18 cases over sixty some of whom had organic disease, with one vertebral fracture occurring.

PREGNANCY

Table 3 shows details of thirteen pregnant women who are reported by various authors (36, 52, 83, 116) to have had convulsion therapy. Seven of them had curare. One case who had also had insulin, miscarried at four months; otherwise there was no complication which could be attributed to the treatment, and it appears that there is no undue risk in giving convulsive therapy during pregnancy.

Status epilepticus occurs as a rare complication of convulsive therapy (40, 93). Cerebral fat embolism, of

TABLE 3
Convulsions in Pregnancy

Ref.	Date	Age	Duration of pregnancy	Convulsive Agent	No. of Convulsions	Outcome
52	1941	-	4-6 months	Metrazol	13	Normal birth and delivery. Baby normal.
116	1945	33	3½ months	Electricity	-	No complications to mother or child
83	1947	-	6-7 months	Electricity	26	No complications to mother or child.
83	1947	-	3 months	Electricity (Also modified insulin)	-	Aborted at 4 months
83	1947	-	5-7 months	Electricity (Also deep insulin)	20	Normal delivery at term.
35	1948	32	2 months	E.C.T. & curare	6	Normal delivery at term.
"	"	35	4 "	"	10	"
"	"	27	9 "	"	2	"
"	"	25	6 "	"	9	"
"	"	31	3 "	"	18	"
"	"	24	7 "	"	13	"
"	"	40	6 "	"	10	"

of unknown origin (102), and 'crush syndrome' (53) are also recorded singly. Persistent hypertension following induced convulsions is mentioned by two authors (108,142). Patients with meningo-vascular and cerebral syphilis (63,104,142) have been treated, as have patients with Huntington's chorea and post-encephalitic Parkinsonism. Heilbrunn & Weil (64) and Alpers & Hughes (1) have shown that small haemorrhages occur in the brains of animals subjected to convulsive treatment and it is known that electro-encephalographic changes follow such convulsions in humans (151). Karliner surveying the evidence in 1948, however, concludes that it does not warrant the conclusion that structural brain changes are attributable to electric convulsive treatment (78). Taylor & Pacella (1948) have shown that an abnormal electro-encephalogram is not by itself a contraindication to E.C.T. (151).

PRESENT INVESTIGATION

SCOPE AND PURPOSE OF INVESTIGATION

The purpose of this study was to test a recent method of modifying convulsions in order to review the problem of the contraindications to electrically induced convulsions. It was believed that in the light of experiences with modified and unmodified treatment reported in the literature it would be possible to reduce the range of contraindications considerably. This seemed all the more desirable as the importance of modification of convulsions as a means of

reducing the incidence of injury has not been widely appreciated.

The material of the investigation was provided by thirty patients who were given treatment by the writer between October 1947 and July 1949. All of these patients had given rise to doubt regarding the safety of subjecting them to convulsions; in some unmodified convulsion was clearly out of the question; some had remained for a long time in a mental hospital because they were considered unfit for E.C.T. Most of the cases were referred to the writer by medical colleagues who considered them likely to improve mentally with E.C.T. but physically unfit to withstand it. A few cases came directly under my care from the time of their admission to hospital. All cases were seen at a clinical meeting where the question of their suitability for this treatment was considered. They were all given a mental and physical examination before treatment, using such special methods as were thought necessary for an accurate assessment of their physical condition. All the patients who were discharged were followed up by a visit to the home by a Psychiatric Social Worker; by attendance at an out-patient clinic where the writer interviewed them; or by news of their death or re-admission to hospital.

These patients were all taken from the acute and chronic population of a mental hospital serving a large area of Middlesex. They represent therefore, a selection

of the most frequent contra-indications encountered when convulsion therapy is being considered, and of these the most severe are included. Chronic disease of the heart and lung with frailty of the skeletal system form the bulk of the cases. The age of such patients tends to be high, and in the present series the majority of patients lay between 50 and 70 years of age. Cases 5, 6, 7 and 10, were in hospital for over a year before treatment was started and case 10 was discharged after a residence in hospital of 7 years.

TECHNIQUE OF THE TREATMENT

The technique used is substantially that described by Hobson and Prescott (1949) for use in preventing injury to patients who had no physical disease. The essence of the procedure is that the patient is given an intravenous injection of thiopentone, atropine and a drug with curare-like action. This usually produced a cessation of respiration within a minute of the injection and artificial respiration with oxygen was then carried out for the next 3 to 4 minutes. The shock was then given in the usual way and a modified convulsion followed. Artificial respiration was continued until the patient was able to maintain a satisfactory colour by his own respiration. This usually occurred in about 15 minutes after the convulsion and the patient usually returned to consciousness within 40 minutes. This technique will now be described in more detail.

Drugs D.- tubocurarine chloride manufactured by Burroughs Wellcome & Co. and marketed under the name of "Tubarine" was the first drug I used for modifying the convulsion. This was supplied in rubber-capped bottles containing 15 mgm. of the drug dissolved in 1.5 cc. of fluid. If mixed with thiopentone solution a dense precipitate was formed. It was, therefore, drawn up in a separate syringe and injected immediately after the thiopentone by retaining a needle in the vein and changing the syringes.

Later d.- tubocurarine chloride manufactured by Duncan Flockart was used. This mixed with thiopentone without forming a precipitate and both drugs were, therefore, drawn into the same syringe and injected simultaneously. It has been stated that this preparation of d.-tubocurarine is more liable to cause venous thrombosis, but I observed no increased incidence of this complication on the occasions when I used it. The average dose used was 25 mgm. Two preparations of decamethonium iodide were used, "Eulissen" manufactured by Allen and Hanbury and "Syncurine" manufactured by Burroughs Wellcome & Co. These preparations appeared to be identical. They were supplied in 5 cc. ampoules containing 10 mgm. of the drug. They were miscible with thiopentone and injected with it from the same syringe. About 7 mgm. was the dose most commonly used.

Any standard preparation of thiopentone was used in

.5 gm. or 1.0 gm. ampoules according to the number of patients to be treated on each occasion. The dose varied from 0.15 gm. to 0.30 gm. but the dose finally decided as most suitable was 0.25 gm.

Prostigmine in ampoules of 0.5 mgm. was kept at hand and used on two occasions as an antidote to d.-tubocurarine chloride. Pentamethonium iodide (C 5) the antidote to decamethonium iodide was kept on hand in ampoules of 2 mgm. per cc. but was never used. The recommended dose is ten times the dose of decamethonium iodide given.

Atropine sulphate gr. 1/100 was given with each injection to inhibit salivation and maintain a clear airway. It was usually mixed with thiopentone when this was given separately, otherwise with both thiopentone and the curarising drug.

Picrotoxin was ready as an antidote to thiopentone but was never used. Nikethamide was also at hand as a cardiac stimulant.

E.C.T. Apparatus Two types of apparatus were used for administering the electric current. The first, which is the type most generally used, consisted simply of a rheostat and time switch and it delivers a known voltage for a given fraction of a second. The patient is prepared by cleaning the anterior and lateral part of the skull with ether and methylated spirit and then wetting it with saline. Electrodes consisting of lint soaked in saline over metal

plates were then applied to these areas of the skull by means of a rubber band.

The second apparatus is that designed by Strauss and MacPhail (141) which delivers a rapidly decreasing, alternating current by means of a condenser discharge. It was not necessary to clean up the patient using this apparatus. The electrodes, which are considerably smaller than those used with the first apparatus, again consisted of lint soaked in saline overlying metal plates. They were applied to the skull by means of a resilient band of perspex. The first apparatus was used in 15 cases the most frequent dosage being 150 volts for 0.5 second. The second apparatus was used in 9 cases. The most frequent dosage was 30 joules. In 6 cases both apparatus were used.

Respirator The respirator used was that described by Dr. B.G.B. Lucas (94). It consists of a Connel bellows-bag attached to a McKesson pattern face mask. A Heidbrink expiratory valve is fitted to the base of the bag. This valve allows oxygen to escape from the bag should the pressure for which it is set be exceeded. An inlet pipe carries oxygen from a cylinder via a demand regulator and reducing valve. This ensures that oxygen leaves the cylinder at a constant pressure and only flows automatically when the patient inspires or when the bellows-bag is expanded. Briefly, therefore, the respirator can be used to pump air into the lungs or exhaust the chest, should the patient be

apnoeic; or he can be supplied with oxygen if he is breathing himself. The oxygen is automatically cut off when resuscitation is not actually in operation.

A large oxygen cylinder was set in a wheeled stand with a spare cylinder and a rack for the bellows and mask making the whole apparatus easily and rapidly transportable.

If artificial respiration was carried out before the fit a rubber airway was inserted. During the fit a pad of cotton wool in gauze was placed between the teeth. The airway was then re-inserted when artificial respiration was commenced following the fit.

A Mason's gag and tongue forceps were kept at hand but never used. A syringe was also ready should the injection of an antidote or an analeptic be necessary.

Method Treatment was usually carried out at 10.00 a.m. At 7.00 a.m. the patient had a cup of tea and a slice of toast. Immediately before treatment the bladder was emptied as otherwise incontinence was liable to occur during the treatment. Dentures were removed and the patient then lay down in bed with ordinary bed clothes over him. A blood pressure recording was made and the pulse counted during the first two treatments and oftener if any abnormality was noted. The thiopentone, curare-like drug and atropine were drawn into the syringes and the injection made into one of the veins of the antecubital fossa after this had been cleaned with alcohol and ether. As soon as the patient

lost consciousness a vaselined airway was inserted and respiration was assisted with the Lucas respirator. After an interval of four minutes the airway was replaced by a cotton wool gag and the shock was administered after the temples had been cleaned up, if this was necessary. A modified major convulsion then followed. All degrees of modification were seen. Movement might be limited to the muscles around the eyes and the mouth or might include flexion and extension movements of the limbs. Flexion of the spine did not occur. There was rarely any cyanosis. The airway was then replaced. The patient usually became completely apnoeic and artificial respiration was instituted. This was continued until the patient maintained a good colour unassisted. As soon as the patient's respiratory movements reappeared the patient was propped up in a sitting position as the dropping of abdominal viscera allowed freer diaphragmatic movements, which returned before those of the intercostal muscles. Blood pressure recordings were made and the pulse counted at intervals after the convulsion, during the first two treatments and at any other time that it was considered necessary. It usually took about 20 minutes for unassisted respiration to be fully established and about 40 minutes before the patient was fully recovered from the effect of the drugs. The period of amnesia following the treatment was not noted to be longer than that following ordinary E.C.T. After an hour the patient

was usually given a meal and he was allowed up in the afternoon of the same day. This time, of course, varied considerably according to his condition. Patients were given treatment twice a week at the outset. This was dropped to once per week as soon as their symptoms had ceased to give rise to practical problems. Usually this meant as soon as they were able to be up and able to attend the occupational therapy department.

Dosage An attempt was made to derive the initial dose of d.- tubocurarine chloride from the body weight allowing roughly 2.5 mgm. of the drug per stone of body weight. The initial doses in Cases, 1, 3, 6 and 9, illustrate this. It was felt that muscle was the main factor in body weight which should be taken into consideration and where there was a loss of subcutaneous tissue the dose was raised a little to compensate for this.

It was soon seen however, that body weight did not give an indication of the effective dose of the drug. In Case 15, 20 mgm. gave the most completely modified fit I have witnessed in a man of 95 lbs. Whereas in Case 16 a dose of 45 mgm. did not produce an unusual modification of the fit in a man of 124 lbs.

The second principle on which the dosage was calculated was the degree of modification of the fit required. In practice an initial dose of 20 - 30 mgm. d.-tubocurarine chloride was given according to the necessity for avoiding

violent movements. The dose was then raised, reduced or maintained at the initial level according to the result produced. In Case 18, vertebral fractures required suppression of dorsal movements only, the initial dose was therefore 20 mgm. and this was maintained as it effectively prevented back movements. In Case 21, where the patient was frail and had auricular fibrillation, considerable modification of the fit was desirable and 25 mgm. of d.-tubocurarine chloride was given. This gave a satisfactory modification and was maintained. Case 24, was a very heavily built man with severe osteo-arthritis. He was started at 30 mgm. As this did not produce sufficient modification it was increased to 35 mgm. which was the dose at which he was maintained.

The same principle was observed in using decamethonium iodide. In Case 28 where frailty and arteriosclerosis made considerable modification necessary the dose used was 8 mgm. In Case 26 where a well compensated heart lesion was the only physical abnormality, the initial dose was 5 mgm. This was raised to 6 mgm. and retained at this level.

The doses used are larger than those which have been recommended by others writing on this subject and they have been criticized on this score. Other writings on curare modification of E.C.T. however, deal with normal subjects, whereas patients in this series had severe

physical disabilities which made considerable suppression of the convulsion absolutely necessary.

As far as the electric shock inducing the fit was concerned, it was also higher than that usually employed. This was done as it was felt desirable that a major fit should result from the first shock, in order to allow the fit to occur while the curare-like drug was having its maximum effect and also because a long period of apnoea is apt to accompany the artificially induced minor seizure; dealing with this caused a further delay in producing a major seizure. It was found that older subjects were more resistant to the production of a major convulsion. Failure to produce a fit occurred in 3 cases, two of whom were over 70.

Various doses of thiopentone were tried varying from 0.15 gm. to 0.30 gm. It was found, however, that with a dose below 0.25 gm. patients occasionally regained consciousness before the curare effect had worn off. This gave rise to restlessness and apprehension concerning the treatment. This is seen in Cases 13, and 18 where restlessness following the treatment disappeared when the dose of thiopentone was raised from 0.15 gm. to 0.25 gm. Thereafter 0.25 gm. was given to every patient as a standard dose and it was only reduced in cases where unconsciousness following treatment was unduly prolonged, as in Case 20.

No difference was noted in the curarising action of

C.10 and d.- tubocurarine chloride. The dose of C.10 was about a quarter to a fifth of the dose of d.-tubocurarine chloride required to produce the same effect. The time for which apnoea lasted was shorter with C.10 than with an equivalent dose of d.-tubocurarine chloride and the recovery from the drug was quicker. This is seen clearly in Case 26 where both drugs were used at different times on the same patient. The time required for recommencement of respiration when using d.-tubocurarine chloride was usually 8 minutes; when using C.10 it was 2 minutes.

Carrying out the treatment is a very time-consuming procedure and one modification of technique was tried to reduce the time taken in giving the treatment. Two convulsions were given shortly after one another while the patient was still under the influence of the drugs. This was done in Cases, 23, 24 and 27. It is quite impossible on such a small number of cases to see whether the length of the course was shortened or not. Case 23 and 24 recovered and required courses of 9 and 12 convulsions in 7 and 10 sessions respectively. Among all the patients of the series who recovered however, the smallest number of fits required was 3 and the greatest number 20. The number of fits required did not seem to depend on the length of illness, severity of illness, age or any other obvious factor and was in fact impossible to predict. We are, therefore unable to say whether Cases 23 and 24 had a

smaller number of sessions than would have been required had the convulsions been given singly. In all three cases several other observations were possible however. It was possible to obtained 2 satisfactorily modified fits with a 3 minute interval between them during the time that the curariform drug and thiopentone were acting. The physical condition of the patients was not adversely effected. No greater rise of blood pressure was found than with single fits and there was no delay in return of respiration or of consciousness. The period of amnesia and confusion was considerably prolonged, however, in the 2 cases in which it could be observed (23 & 24) and caused the patients some distress. For this reason I did not persist with the method.

DETAILS OF CASES TREATED AND TREATMENT

Age The age distribution of the cases treated is shown in Table 5.

TABLE 5

Age Group	No. of Cases
Below 40	2
40 - 49	0
50 - 59	4
60 - 69	15
70 - 79	9

It will be seen that the majority of cases are over 60. Age was not associated with difficulty in carrying out the treatment or special liability to complications.

CARDIAC DISEASE

There were seventeen cases of heart disease in the series whose general character is shown in Table 6. All, except one, were over sixty and the average age of the group was sixty-seven. The severity of impairment of cardiac function varied considerably. Case 8 was a frail man with a blood pressure of 194/100, thickened vessels and no other indication of heart disease, during ordinary activity. Case 4, on the other hand, who had severe emphysema, was cyanosed, congested and dyspnoeic at rest. Six cases

TABLE 6

Cases of Cardiac Disease

No.	Age	Clinical Condition
1	56	Hypertension. Cardiac enlargement. Removal of kidney.
2	69	Severe hypertension.
3	69	Moderate hypertension. Cardiac enlargement.
4	63	Moderate hypertension. Inguinal hernia.
5	63	Severe hypertension.
6	70	Moderate hypertension. Cardiac failure.
7	70	Severe hypertension. Paget's disease of the spine.
8	64	Moderate hypertension. Frailty.
9	77	Hypertension. Heart failure.
10	66	Severe hypertension. Old hemiplegia.
11	66	Moderate hypertension. Severe spinal osteoarthritis.
12	74	Auricular fibrillation.
13	73	Auricular fibrillation. Cardiac failure.
14	71	Auricular fibrillation. Cardiac failure.
15	68	Cardiac failure. Coronary thrombosis. Auricular fibrillation.
16	62	Auricular fibrillation.
17	60	Emphysema. Severe cardiac failure.

TABLE 7

Physical Findings in Hypertensive Cases

No.	Age	Heart Failure	Cardiac Enlargement	Resting B.P.	Thickened Vessels	Rise of B.P. during Treatment	Difficulty in Treatment
1	56	-	+	180/105	+	+	-
2	69	-	-	260/120	+	+	+ +
3	69	-	+	160/70	+	-	-
4	63	+	+	185/100	+	-	-
5	63	-	-	220/120	+	+	-
6	70	-	-	150/125	+	+	+ +
7	70	-	-	178/140	+	-	-
8	64	-	-	195/100	+	-	+
9	77	+	+	120/70	+	-	-
10	66	-	+	220/120	+	-	-
11	66	-	-	140/80	+	-	-

TABLE 8

Physical Findings in Cases of Auricular Fibrillation.

Case No.	Age	Cardiac Enlargement	Cardiac Failure	Difficulty in Treatment
12	74	-	-	-
13	73	+	+	++
14	71	+	+	+
15	68	-	+	+
16	62	+	-	+

(Cases 6,9,13,14,15,17) showed heart failure at some time during the period they were under observation. Several cases had associated conditions such as frailty (Case 9) or bony disease (Cases 7,11).

Eleven cases suffered from hypertension and five from auricular fibrillation. The clinical findings in these groups are shown in Tables 7 and 8. Case 10 had a hemiplegia resulting from a stroke four years before treatment was begun. Case 15 had a coronary thrombosis twelve days before treatment was begun.

In all these cases the greatest possible degree of modification of the fit which was safe was aimed at.

The dose of the curarising drug is high and ranges from 20 mgm. d-tubocurarine chloride (Cases 6,7) to 30 mgm. (Cases 11,15). The most frequent dose was 25 mgm. Case 14 was given 7 mgm. C.10. 45 mgm. d.-tubocurarine chloride was given to Case 5, but this was quite exceptional. In all cases the modification of the fit was satisfactory and no complication occurred which could be attributed to the force of the convulsion. Oxygen was administered by means of the Lucas respirator to every case and particular care was taken to prevent cyanosis occurring. In no case did any injury result which was attributable to the treatment.

Difficulties arose in the conduct of the treatment, however, which were of two kinds. Neither was confined to patients who had cardiac disease but they were most common

TABLE 9

Cases showing delayed recovery and Treatment Administered

No.	Duration of Delay	Treatment Administered	Time of Recovery following Treatment.
6	3¼ hrs.	Administration of oxygen only	
11	60 mins.	Administration of oxygen only	
15	60 mins.	Administration of oxygen only	
17	60 mins.	Nikethamide Prostigmine	30 mins.
24	45 mins.	Nikethamide Prostigmine Picrotoxin	Immediate Recovery

in this group. The first was a delay in recovery at some stage: either a delay in the establishment of respiration or a delay in return to consciousness. Delayed recovery occurred, uncomplicated by any other factor, on five occasions (Cases 6,11,15,17,24). All of these cases were suffering from heart disease, except Case 24, in which the delayed recovery was undoubtedly caused by an over-dose of d-tubocurarine chloride. The most important part of the treatment of this complication is to have an adequate method of artificial respiration with oxygen available. In Case 6 this was the only treatment given, by means of a Lucas respirator and later a B.L.B. mask, although the patient did not breathe adequately for three hours. Other cases were given analeptics or prostigmine as is shown in Table 9. In Case 11 lack of experience in using this technique, and in Case 24 an overdose of the curarising agent account for the delay. It is notable that in the remaining three cases cardiac failure was present.

The second difficulty occurred immediately or shortly after the convulsion in patients who appeared to be making a good recovery. Its onset was sudden. Pallor preceded by feebleness and sometimes irregularity of the pulse occurred. If respiration had been established it became weak and gasping. I shall refer to this complication as 'collapse'. Table 10 shows the features found in eight cases. Six of these Cases(2,6,8,12,13,16) were suffering from heart

TABLE 10

Cases of 'Collapse'

No.	Mode of Onset	Time after Fit	Pulse	Colour	Treatment and time of Recovery
2	Sudden	10 mins.	Rapid and Feeble	Pale	Nikethamide 0.5 gm. Prostigmine 0.5 mgm. Recovery in 10 mins.
6	Sudden	Immed-iately	Imperceptible	Pale	Nikethamide 0.5 gm. Recovery in 60 mins.
8	Sudden	35 mins.	Feeble	Cyanosed	Recovery rapid. Administration of oxygen only
12	Sudden	30 mins.	Imperceptible	Pale	Nikethamide 0.5 gm. Recovery in 5 mins.
13	Sudden	Immed-iately	Rapid Feeble Irregular	Pale	Administration of oxygen only
16	Sudden	40 mins.	Feeble Irregular	Pale	Administration of oxygen only. Recovery in 10 mins.
22	Sudden	Immed-iately	Feeble Irregular	Pale	Administration of oxygen only. Recovery rapid
26	Sudden	15 mins	Rapid	Normal	Administration of oxygen only. Recovery in 6 mins.

TABLE 11

Clinical Details of Patients who showed 'Collapse'

No.	Age	Blood Pressure	Pulse	THICKENED VESSELS	HEART ENLARGED	EVIDENCE OF HEART FAILURE	Dose of tubocurarine	Dose of thiopentone
2	69	200/120	Regular	+	–	–	28 mgm.	0.20 gm.
6	70	150/125	Regular	+	–	–	20 mgm.	0.05 gm.
8	64	194/100	Regular	+	–	–	20 mgm.	0.15 gm.
12	74	128/90	Irregular	+	–	–	25 mgm.	0.25 gm.
13	73	150/90	Irregular	+	+	+	25 mgm.	0.15 gm.
16	62	174/90	Regular	+	+	–	25 mgm.	0.25 gm.
22	63	130/90	Regular	–	–	–	20 mgm.	0.15 gm.
26	72	135/80	Regular	+	+	–	25 mgm.	0.25 gm.

disease. Of the other two, Case 26 showed minimal signs of hypertension and Case 22 showed no evidence of heart disease. In Case 2 this reaction occurred twice and was so severe that the treatment was discontinued. This complication has been described by Altschule & Tillotson (7), Jetter (75) and Kalinowsky & Hoch (82). Altschule & Tillotson ascribe it to stimulation of the vagus (7) where the vagal mechanism is hypersensitive or the heart has its reserve diminished by disease. In either case cardiac rhythm is so disturbed that the beat is seriously enfeebled or altogether arrested. The electrocardiogram of normal patients undergoing E.C.T. gives evidence of such vagal action (4).

Table 10 shows the treatment given in these cases. In every case oxygen was given by artificial respiration with a Lucas respirator. In every case except one (Case 20) recovery had occurred within ten minutes.

Auricular fibrillation following the convulsion and lasting for some hours occurred in Case 26. This was prevented by the administration of quinidine as is recommended by Hayman (61a). This complication is also described by Craddock & Gilbert (31) and Smith & Hastings (135).

RESPIRATORY DISEASE

Four cases of pulmonary tuberculosis were treated. Three of these showed intermittent pyrexia, loss of weight, cough, sputum and a high B.S.R. These were regarded as

TABLE 12

Cases of Tuberculosis

Case Number	Age	Character of Chest Lesion	Number of Convulsions	Result
18	57	Active Infiltration of both lungs	9	Rapid improvement.
19	29	Active infiltration of one lung with cavity formation.	7	Slight spread Clinical improvement. Ultimate improvement.
20	36	Active infiltration of both lungs with cavity formation	14	Continued spread ultimate deterioration.
21	64	Inactive fibrotic lesion one lung	10	No change in lesion

active. The fourth had a fibrotic lesion which had shown no signs of activity for some years. Case 18 developed tuberculosis two years before treatment commenced. There was extensive infiltration of the upper and middle zones of the left lung with apical involvement of the right. Case 19 had four years' history of pulmonary tuberculosis and at the time of treatment he had persistent cough, abundant sputum and intermittent pyrexia. X-ray showed a cavity at the apex with considerable infiltration and fibrosis of the right lung. Tuberculosis had been discovered in Case 20 about one year before convulsive treatment had begun and it had been rapidly progressive. He had abundant sputum and intermittent pyrexia and was underweight. This was exacerbated by the fact that he would not eat. X-ray showed a chronic process with a cavity at the right apex, infiltration throughout the lung, and a spread to the left lung. The prognosis in this case, quite apart from his mental illness was very poor, but it was necessary to obtain his co-operation to undertake any active treatment. Case 21 showed a fibrotic and calcified lesion in the upper half of the right lung.

Well modified convulsions were obtained in all cases and no difficulty was experienced in carrying out the treatment. Following it Case 21 showed no alteration whatever in his lung lesion. Case 18 began to show an improvement shortly after treatment was stopped and follow-up

showed that this continued. Case 19 showed a very slight spread to the left lung. Active treatment of his chest condition was undertaken, however, and he later showed considerable improvement. X-ray showed that in Case 20 infiltration was more thick and more widespread than it had been before treatment. The manifestations of his illness improved (i.e. his temperature was more settled; he put on weight; cough and sputum were reduced) with the improvement in his mental condition which allowed more active treatment to be undertaken. His condition ultimately deteriorated however.

In Case 17 (included among the cardiac cases) emphysema and the fixity of the chest wall, made it difficult to secure an adequate gaseous exchange. This patient required more prolonged and constant artificial respiration than was necessary in others.

Of the active cases of tuberculosis Cases 19 and 20 showed a spread of the disease following treatment. Large cavities were present in both, however, before the commencement of treatment, and further infiltration was a very probable contingency during the natural course of the disease, as Close (1949) has demonstrated (25). It is, therefore, impossible to say whether the extension of the disease could be attributed to the treatment. In both cases, however, the mental improvement permitted more active treatment of the phthisis to be undertaken, which, in Case 19,

resulted in a substantial improvement.

MISCELLANEOUS CASES

Three cases of types of physical illness which do not often arise where E.C.T. is being considered were treated. Cases 29 and 30 were suffering from inoperable gastric carcinoma and were aged 60 years and 73 years respectively. In both cases the possible duration of life was uncertain, the mental illness was severe and gave rise to considerable nursing difficulty. It was, therefore, considered justifiable to carry out treatment in these cases. Case 28 had had a gastro-enterostomy performed two months before treatment was undertaken, having suffered for many years from duodenal ulceration. He was so depressed that he refused to eat and his life was endangered by this. All three had well modified fits, gave no difficulty during the treatment and suffered no injury from it. Cases 28 and 29 were able to return to normal life. Case 30 died four months following his treatment, but was quite well mentally during that time.

BONY INJURY AND FRAILTY

Ten cases are included under this heading half of whom were over 70. The nature of these contra-indications to unmodified E.C.T. is shown in Table 12. All were considered so liable to bony injury as to be unsuitable for unmodified convulsion therapy. Cases 23 and 22 were suffering from multiple vertebral fractures caused by previous convulsions and Case 24 had eight months previously fractured a femur

TABLE 13

Cases of Bony Injury and Frailty

No.	Age	Clinical Condition
6	70	Weight 91 lbs. Cardiac Disease.
8	64	Prolonged malnutrition. Weight 95 lbs. Cardiac disease.
9	77	Frailty. Cardiac disease.
12	74	Weight 98 lbs. Cardiac disease.
22	63	Crush fractures T 3 & 7.
23	71	Crush fractures T 4, 5 & 8. Emaciation.
24	50	Recent fracture of femoral neck.
25	50	Severe dorsal osteo-arthritis, Cardiac disease.
26	72	Frailty.
27	68	Recent pneumonia. Weight 104 lbs.

TABLE 14

FOLLOW--UP

Mental Condition	Case Numbers	Totals
Recovered	1,4,9,10,11,14,16,17 18,24,25,26,28	13
Improved	5,12,19,20	4
Unimproved	2,13	2
Relapsed	3,6,7,8,15,21,22,23,29	9
Dead	27,30	2

Each case was seen six months or more after the termination of treatment except Case 14 who was seen five months afterwards, Cases 9,17,22,23, whose relatives reported on them, and Cases 27 and 30, who died within that time. Table 14 shows the results of this follow-up which are reported at length with the case histories. Cases 9 and 10 died from natural causes, nine and seven months after treatment, respectively. They remained well until that time, however, and are included as recoveries. Apart from Case 20, which has already been discussed, and is extremely doubtful, no case showed any disability attributable to the treatment.

DISCUSSION

DISCUSSION

The widespread use of convulsive therapy and the likelihood of wider applications in the future make it important to establish in view of present methods of modification, what complications may be anticipated from its use where bodily disorder or liability to injury is present. There are few systematic considerations of this matter, that of Kalinowsky & Hoch (1946) being probably the most complete (79). In considering modification of convulsions as a means of preventing injuries they say "all reports agree on the effectiveness of curare in the prevention of fractures but unpleasant incidents are also mentioned in otherwise favourable accounts. Respiratory embarrassment is not infrequent and the effect on cardiac action is sometimes serious. Those workers who prefer curare in cardiac patients because of the less violent muscular reaction are dealing with a possibly dangerous situation.. Jones & Pleasant, and Bellet et al. have presented clinical and electrocardiographic evidence against its use in severe cardiac disease. The same must be said of its use in elderly patients in view of the frequency of arteriosclerotic changes in the heart muscle although Hirsch & Quintero Muro have recommended it. Several fatalities have been reported in convulsive therapy combined with curare(Charlton et al. in metrazol, Ebaugh et al., Smith et al., Cash & Hoekstra in E.C.T.)....."

"we limit the use of curare to patients with previous fractures or bone diseases such as osteoporosis, Paget's disease and so on" (80). This cautious attitude may have been justified at the time of the publication of Kalinowsky & Hoch's book (1946). The recent introduction of decamethonium and of more efficient methods of artificial respiration has changed the position considerably and therefore the statement of the two authors is now out of date.

The electrocardiographic evidence against the use of curare given by Jones & Pleasant (76) and Bellet et al (10) is slight and is overshadowed by the later work of Ruskin, Ewald & Decherd (129) who showed that in twenty-one cases given curare for neurological complaints no significant changes in the electrocardiogram occurred. There is considerable evidence to show that the electrocardiographic changes are due to E.C.T. alone (85).

Of the fatalities, to which Kalinowsky and Hoch refer, not all are reported fully enough to show what type of case is reported. It is clear, however, that in these cases the precautions which are deemed essential to the method described here were not used. It emerges that the majority of cases who died were physically healthy people and with due precautions these fatalities could probably have been prevented.

In the light of his own experience, and that of others, the present writer has come to the conclusion that provided

the technique used in the series reported here is rigorously applied, the range of contraindications to E.C.T. is extremely small and certainly much narrower than is generally believed.

As a result of unmodified convulsions bony injury, collapse, activation of latent tuberculosis and death has occurred in apparently healthy patients and certainly in those with bodily disorder. In the series of cases described here there was no indication of bony injury in any patient. It is true that not all cases were subjected to radiological examination following treatment, as curarisation invariably resulted in an abolition of violent muscular contractions which are generally believed to cause fractures. An X-ray examination in the absence of complaint therefore, seemed unnecessary. However, in a number of cases parts of the skeleton which are often fracturedwith unmodified treatment were examined radiologically for other reasons. In five cases the upper part of the trunk was X-rayed for the purpose of examining the chest. In none of them was there any evidence of vertebral injury. Furthermore, in three cases in which the spine was fractured before treatment and in one in which the femur had been fractured, radiological re-examination after modified convulsion therapy showed that no additional injury had occurred.

Similarly, from a perusal of literature, pregnancy

of itself appears to be no contraindication to the use of convulsion therapy with or without a curarising drug. Kalinowsky & Hoch confirm this finding (81). Old age has sometimes precluded the use of convulsion therapy but there seems to be no reason for this provided the modification employed in this series is used. Nine cases of the series were over seventy and another fifteen over sixty and in none of these did any injury result, and there are numerous reports to confirm this (43,45,48, 77,125,145).

The range of cardiovascular disease which would prevent a patient from having suitably modified convulsion therapy must be extremely small. Certainly hypertension, chronic valvular disease, coronary disease, auricular fibrillation, enlargement of the heart or the presence of heart failure need not prohibit it. Collapse from cardiac arrest due to vagal stimulation, will be more frequent in such cases, however, and delayed recovery more frequent where cardiac failure is present. Both conditions, however, can be treated by efficient administration of oxygen during treatment. Kalinowsky & Hoch (1946) mention aneurysm of the aorta as an absolute contraindication but they do not quote any report of a case suffering from this condition being treated and the writer has not encountered any (82).

Pulmonary tuberculosis need not debar any patient

from having modified convulsion therapy. The treatment of acute states of mental disorder in tuberculosis sometimes plays a decisive part in the patient's recovery. Close (25) recently reports eight psychotic patients with tuberculosis whom he treated with unmodified E.C.T. and all of whom showed improvement in their tuberculosis. He points out that active tuberculosis with cavitation tends to spread suddenly and rapidly irrespective of whether E.C.T. is applied and he criticises writers who have indiscriminately attributed such a spread to convulsion therapy. In fact, treatment of the acute mental condition with E.C.T. may prove life-saving in these cases. Case 19 illustrates this point. In this patient an active tuberculosis with cavitation progressed rapidly during a state of severe catatonia. It was felt that unless the mental condition could be improved, the spread of pulmonary tuberculosis could not be halted and would result in early death. The administration of modified convulsion therapy seemed justified here and the result vindicated this decision. Following treatment, the improvement in the patient's mental condition made him accessible to more active treatment of his chest with a consequent slowing and ultimate arrest of the tuberculous process.

Case 10, who had had a cerebral haemorrhage, made a good recovery without any ill effect and there is no evidence in the literature that damage to the nervous

system should be regarded as a contraindication. Patients with Parkinsonism are often depressed and these have been treated without harm (82).

What contraindications to duly modified convulsive therapy remain? Aortic aneurysm, Grave's disease, cerebral tumour, thrombophlebitis, and chronic infections of the ear all seem, on theoretical grounds to constitute a grave risk in convulsion therapy, and until evidence to the contrary is forthcoming must still be regarded as doing so. Acute physical illness rarely arises as a problem. Where it is present it would seem wise to await the outcome before undertaking convulsive therapy. Myasthenia gravis of any degree must be regarded as an absolute contraindication to giving any drug derived from curare. There is as yet no report on the effect of decamethonium on myasthenics, but in view of the fact that it acts by blocking the myoneural junction, it should not be given in such cases.

In view of the fact that a few deaths from convulsion therapy with curare have been reported in the literature and that some have occurred to the writer's knowledge which have not been published, the question may be raised why no fatalities occurred in the present series of cases. It might be contended that the writer was fortunate and attention may be drawn to Case 6, where there was a prolonged period of apnoea, or to Case 2, where the cardiac

rhythm was so seriously disordered that it was felt advisable to discontinue treatment. However, it seems to the writer that even in these cases the risks involved were not excessive considering their serious mental states, and that the absence of fatalities was not due to sheer good fortune but to the method of modification employed and particularly the method of artificial respiration by which a gaseous exchange could be maintained easily in spite of prolonged apnoea. Anaesthetists have stressed the need for an efficient method of artificial respiration where a curarising drug is used as an adjunct to anaesthesia (60,71).

Davies & Lewis (33) found that the dose of decamethonium which produced the same curarising effect as a dose of tubocurarine did not have such a depressant effect on respiration and they therefore regard decamethonium as the most suitable curarising agent at present available for use with convulsion therapy. Other investigations have confirmed the findings of Davies & Lewis (60,71) but a recent article appears to be in contradiction to them. In this Unna et alia (1950) assert that in comparing the effect of decamethonium with that of three other curarising agents in normal subjects, it produces a greater depression of respiration than tubocurarine in a dose which produces an equal amount of muscular relaxation (143). However, the only method of estimating the amount of muscular

relaxation which they describe is hand grip which is particularly unreliable. Very small changes in the position of a dynamometer in the hand will alter the strength of grip recorded. In view of this and of the greater number of reports in favour of decamethonium, it appears to be the most suitable modifying agent for convulsions.

There is no doubt that the use of thiopentone and a curarising drug calls for more knowledge, skill and care than unmodified convulsion therapy. The possibility of difficulties arising during treatment is greater and they must be dealt with promptly when they arise. Laryngeal spasm may occur, if tubocurarine is used, and intubation may be necessary. The question has, therefore, been raised whether this treatment should be carried out by trained anaesthetists. While it is true that careless or unskilled handling constitutes a grave danger to the patient, this danger does not seem greater than that encountered during insulin coma therapy. Although advice and help from an anaesthetist in the matters of technique and training are invaluable, a psychiatrist already experienced in the use of convulsive therapy, of intravenous anaesthetics and the technique of insulin coma treatment should be able to acquire the skill and knowledge to carry out the treatment by being supervised in the initial stages. Especially is this so as laryngeal spasm and bronchospasm have not so far occurred with decamethonium, and the

eventuality seems unlikely in view of the smaller liability of decamethonium to produce histamine-like substances (162).

The use of modification for all cases requiring convulsion therapy has been advocated by Hobson & Prescott; (68): at the Bethlem Royal and Maudsley Hospitals this method has been the only convulsant treatment in use since 1948 and according to Davies (34) 600 cases have been treated in this way with decamethonium. Hobson has treated 350 cases with a total of 2,000 convulsions similarly with tubocurarine or decamethonium (67).

In neither series has any injury to the patient arisen. No published series of cases treated with unmodified E.C.T. can show such freedom from injury and there is no doubt that an anaesthetic, such as intravenous barbiturate, frees the patient from much of the unpleasant sensation associated with curarisation. On the other hand, it is time-consuming and requires medical and nursing staff trained in carrying out the treatment. While, therefore, ideally it is the best method of carrying out convulsion therapy, the facilities available must be considered before it is adopted.

The observations reported here and those made by other workers demonstrate that with the help of modern curarising agents, the range of contraindications to convulsant therapy can be considerably narrowed down with the result that almost all conditions which, until recently,

were regarded as precluding the treatment need no longer do so. However, that does not mean, in the present writer's opinion, that the physician who has to make this decision should not consider every case on its merits or that he is absolved from a most careful consideration of the risks involved. An indiscriminate application of this treatment without due caution to patients of all states of physical health is to be deprecated. It would be a mistake to generalise about the absence of contra-indications in certain types of physical illness. Equally, however, the writer is of the opinion that generalisations identifying broad categories of physical illness as contra-indications, which has hitherto deprived whole groups of patients of the benefits of convulsant therapy, are also unjustified.

CONCLUSIONS

CONCLUSIONS

An unmodified convulsion results in violent muscular contraction with marked respiratory and circulatory disturbance. In apparently healthy patients, bony injury, cardiac failure, activation of latent tuberculosis and death may occur, and this risk is increased when a weakened organism is subjected to convulsion therapy. By modifying therapeutic convulsions with a suitable curarising agent and an efficient means of artificial respiration with oxygen, such risks can be greatly reduced.

The clinical observations presented here illustrate the modifying effect of two curarising drugs, d-tubocurarine and decamethonium on induced convulsions in a selected group of thirty patients suffering from physical conditions which would have precluded ordinary E.C.T. Decamethonium and d-tubocurarine have been found equally effective in abolishing muscular contractions, but decamethonium has decided advantages over d-tubocurarine and is to be regarded as the most suitable curarising drug used for modifying induced convulsions. The reasons for this are that the effect of decamethonium is more transient, and its effect on respiration less depressing than d-tubocurarine, in doses which produce an equal curarising effect.

By the use of appropriate methods all risk of bony injury can be eliminated in healthy patients and in those in whom there is a special liability to such injury.

Complications in carrying out the treatment in such cases are rare.

Patients with chronic cardiovascular disease of any kind or degree of severity may be given convulsion therapy if it is suitably modified. Acute cardiac embarrassment resulting from vagal stimulation, which is liable to occur in such cases in the course of E.C.T. can be counteracted by the efficient administration of oxygen which forms an indispensable part of the modified treatment advocated here. This method has also been found effective in dealing with delayed recovery following the administration of E.C.T.

Patients with pulmonary tuberculosis and other chest diseases, may be treated by appropriately modified therapeutic convulsions and this may allow more active treatment of the tuberculosis.

Any bodily lesion which is likely to be exacerbated by the muscular violence or circulatory disturbance of a fit should not debar convulsion therapy where these factors are modified by the use of a curarising drug in association with an anaesthetic and artificial respiration.

While each individual case must be considered on its merits and the risks involved weighed against the likely benefits of convulsion therapy, there are no general contraindications to duly modified E.C.T.

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A P P E N D I X

CASE HISTORIES 1 - 30

Case No. 1. Age 56 yrs. Admitted 31.5.48
Discharged 1.8.48

Psychiatric Diagnosis: Depression

Physical Diagnosis: Hypertension.

Onset of Present Illness: In 1948 patient, who was a widower, married a woman who had nursed him while he was suffering from renal colic and haematuria. He had previously had one kidney removed. Shortly after his marriage he began to complain to his wife that he was in financial difficulties, which was not true, and also began to worry a great deal about his physical condition. He slept very badly and became very suspicious. One night as his wife was preparing for bed he declared that she had poisoned him, threw open the window, and shouted for the Police.

Mental State: His expression showed abject misery and he took no interest in his surroundings. He was retarded in thought and movement. No spontaneous conversation was offered and he disliked answering questions. He expressed ideas of guilt, worthlessness, hopelessness, suspicion and apprehension. He complained that he enjoyed nothing. He slept only with sedative and ate reluctantly.

Physical Condition: He was thin and dyspnoeic at rest. Resting blood pressure was 180/105. The apex beat was in the 6th interspace considerably displaced to the left.

The area of cardiac dullness was enlarged to percussion. The blood vessels were thickened and tortuous. E.C.G. showed no abnormality. The patient had had one kidney removed and large calculi were present in the remaining one. His blood urea was 32 mgm. per 100 c.c.

Character of Treatment: He had five convulsions and these were adequately modified with 25 mgm. d. tubocurarine chloride. His blood pressure rose to 260 m.m. following the fit, but no difficulty was encountered during treatment.

Mental State following Treatment: He talked spontaneously, read with interest, and would answer questions fully. He was cheerful and no longer expressed ideas of guilt, hopelessness or suspicion. He slept and ate well.

Follow-up: Six months after the termination of treatment, patient was seen at home. He said that he had had no recurrence of his depression since his discharge from hospital. He appeared cheerful, conversed freely, and showed no evidence of suspicion. He was doing part-time work to keep his mind occupied.

Case No. 2 Age 69 yrs. Admitted 15.9.43
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension.

Onset of Illness: In February 1939, patient began to complain that he had heart trouble, and became frightened that this might cause his death. He became quiet, careless in his work and of his personal appearance. His mother, daughter and wife, died within a year. He became very depressed and requested to be sent to a mental hospital, as he feared that he might commit suicide. He became worse in 1943 and was admitted to hospital.

Mental State: He was depressed and agitated. He lay in bed all day taking no interest in his surroundings. In conversation he reiterated that he was completely finished, and that there was no hope for him. He stated that he had no body, no bowels and no head; also that his body was made of wood. He believed that he had killed all the other patients in the ward and should himself be put to death. It was impossible to occupy him. He ate and slept fairly well.

Physical Condition: The highest resting blood pressure recorded was 260/120. There was no evidence of cardiac enlargement. Heart sounds were normal. Vessels were thickened.

Character of Treatment: He had two fits which were satisfactorily modified with 28 mgm. d-tubocurarine

chloride. Following the first convulsion, the patient became pale and pulse rose to 140. He was given 0.25 gm. Nikethamide and .5 mgm. Prostigmine intravenously. He recovered consciousness in about 10 mins. but remained pale, dyspnoeic and sweating with a poor pulse for some hours after this. A similar reaction followed the second fit and treatment was thereafter abandoned. There was no evidence of physical impairment resulting from the treatment.

Mental State following Treatment: This remained unchanged, and he remained in hospital.

Case No. 3 Aged 69 yrs. Admitted 19.2.49
Discharged 17.5.49

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension.

Onset of Present Illness: In November 1948 patient was accidentally knocked down by a woman pushing a pram. He complained of pain in his side and remained in bed for about three weeks after this. His Doctor was called in but could find no cause for his disability. The patient began going out but became very depressed. He worried that he had the name of his foster-parents, and not his own, and gave himself up to the Police on this account. He reported to the Pension Authorities that he had given them a false name. He finally attempted to commit suicide by throwing himself over a bridge.

Mental State: His expression was depressed. He conversed readily, but was agitated. He said that he felt depressed, muddled, and hopeless. He reproached himself bitterly for his former suicidal wishes. He felt at he had no right to receive the services of the hospital without paying for them. He was solitary, took no interest in his surroundings, ate well, but slept badly unless he had sedative.

Physical Condition: Weight: 120lb. Blood pressure 160/70. Apex beat was in 6th interspace, 5½" from the mid-line. Blood vessels were thickened. X-ray showed slight cardiac enlargement with aortic widening and atheroma.

Character of Treatment: He had five convulsions which were adequately modified with 25 mgm. d-tubocurarine chloride. No difficulty was experience during the treatment.

Mental State following Treatment: He was cheerful, interested in his surroundings, and well occupied. He showed no evidence of his former delusions. He ate and slept well.

Follow-up: Patient was interviewed 8 months after the termination of treatment. He was living at home and able to get about, but was low-spirited and apathetic. Admission to hospital was advised, but he refused it.

Case No. 4 Age 63 yrs. Admitted 4.10.46
Discharged 6.7.48

Psychiatric Diagnosis: Depression

Physical Diagnosis: Hypertension.

Onset of Illness: Patient became worried, in 1945, about difficulties the war was creating in his job. He lost sleep, his appetite was poor, and he had difficulty in making any effort. He had an attack of influenza in December 1945, and became more depressed. He was agitated and muttered to himself continually. The slightest noise upset him. He could not bear to be left alone in a room and he would shout for his wife if she left him. By July 1946 he was unable to work. He refused to see a doctor or to take any medicine.

Mental State: His expression was that of depression and he took no interest in his surroundings. He refused to answer questions. He appeared perplexed and was probably disorientated. He was resistive to all attention, and it was difficult to persuade him to eat. He refused to dress or wash. He slept poorly.

Physical Condition: The resting blood pressure was 185/100. The area of cardiac dulness was enlarged to percussion, and x-ray showed cardiac enlargement. Vessels were thickened and tortuous. E.C.G. showed no abnormality. He was breathless on mild exertion.

Character of Treatment: He had ten convulsions which were adequately modified with 22 mgm d.-tubocurarine

chloride. There was no rise of blood pressure during the fit, and no difficulty was experienced in carrying out the treatment.

Mental State following Treatment: His conversation was normal, showing no retardation. He was cheerful, active and took an interest in things around him. He showed no defect of memory or of orientation. He slept and ate well and enjoyed going home on leave.

Follow-up: Patient was visited by a Psychiatric Social Worker nine months after the termination of treatment. His conversation was normal, and showed no retardation. He was cheerful and well occupied. He liked gardening, read and listened to the wireless with enjoyment. His wife confirmed that he was mentally well.

Case No. 5 Age 63 yrs. Admitted 23.1.48
Discharged 13.10.48

Psychiatric Diagnosis: Depression

Physical Diagnosis: Hypertension.

Onset of Present Illness: Just before Christmas 1947, patient began to be worn and tired. He appeared to be worried at this time and did not sleep well. He was unable to continue at work. He began to be very hesitant in answering questions and seemed to lose interest in everything around him. He cried, slept poorly, and lost a great deal of weight. He frequently expressed a wish to die.

Mental Condition: His expression was that of depression. He showed little interest in his surroundings and talked very little. He answered questions after considerable delay and them very hesitantly and slowly. He thought that people were against him, and was hopeless of recovery. Movement was retarded. He slept poorly and he required to be tube-fed. His weight dropped to 100lbs.

Physical Condition: Heart was not enlarged to percussion or on X-ray. Blood pressure 220/120. Blood vessels were thickened and tortuous.

Character of Treatment: He had five convulsions. The doses given are shown in the table below.

No.	Date	d.-Tubo-curarine Chloride mgm.	Thiopen-tone gm.	Current Joules	Reaction
1	10.7.48	25	0.15	35	G.M.
2	14.7.48	30	0.15	30	G.M.
3	17.7.48	35	0.15	30	G.M.
4	21.7.48	40	0.15	30	G.M.
5	28.7.48	45	0.15	30	G.M.

During his first convulsion there was considerable spasm, and clonic movement in both limbs. Pulse and respiration remained satisfactory throughout and he recovered consciousness within 30 minutes. Subsequent convulsions were more modified, but not markedly so until the fifth. He suffered no physical injury from treatment, and no difficulty was encountered.

Mental Condition following Treatment: He was cheerful and active, taking a keen interest in things around him. He no longer thought people were against him, and he lost his depressive ideas. He ate and slept well. He gained 35 lbs. in weight.

Follow-up: He was visited by a Psychiatric Social Worker six months after his discharge. His wife appeared dissatisfied with him, and thought he had relapsed a little. She said he was irritable, seclusive and

dissatisfied with everything. The wife was herself an invalid, and complained a good deal when the patient was in hospital. When the patient was interviewed he was found to be cheerful and talked readily. He admitted that he was sometimes irritable. He assisted his wife in the house. He ate and slept well. A neighbour thought the patient was much better, and it was thought that the wife was complaining of patient's personality rather than his illness.

Case No. 6 Age 70 yrs. Admitted 28.7.34
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Frailty; Hypertension.

Onset of Present Illness: Patient had been a coach builder all his life, but with the dying out of his craft, he had long spells of unemployment. About Christmas 1932, he began to get low-spirited, irritable and lacking in concentration. This grew worse until he attempted to commit suicide by cutting his throat in August 1934, and was admitted to Shenley Hospital.

Mental State: He was low-spirited and retarded in speech and movement. He said that he was responsible for his illness and for reducing his family to dire poverty through neglect of his work. He occupied himself in no way and undertook no spontaneous conversation. He only ate under supervision, as otherwise he would give his food away. He required sedative to sleep.

Physical Condition: He weighed 91 lb. He was blind in his right eye from an old injury. Blood pressure was 150/125, vessels were thickened and tortuous. E.C.G. showed occasional extra systoles. He became breathless on mild exertion.

Character of Treatment: Treatment was commenced fourteen years after his admission. He had ten convulsions which were adequately modified with 20 mgm. d.-tubocurarine chloride. Following the first convulsion the patient

became cyanosed and his pulse feeble. He then became white and his pulse disappeared altogether for about 30 seconds. He was given intravenous Nikethamide, his pulse returned and he gradually improved. His breathing remained shallow for about 45 mins. He recovered in an hour.

The dose of Thiopentone was reduced from 0.15 gm. to 0.05 grm. for the second convulsion. This convulsion gave rise to no difficulty.

Following the third convulsion he remained comatose for three hours and required the administration of oxygen the whole time. His pulse was regular and of good volume during the whole of this time. He recovered consciousness and began to speak six hours following the fit.

Subsequent convulsions gave rise to no difficulty. He usually recovered within 45 minutes.

Mental State Following Treatment: He showed some improvement after the third convulsion. He conversed spontaneously. He lost his depressive delusions. He could laugh at a joke. He was satisfactorily employed in the carpenter's shop and appeared to like this. At the end of his course of treatment, although he maintained his improvement he lacked spontaneity, was solitary and required encouragement to remain occupied.

Follow-up: Six months after the termination of his treatment he had relapsed to his former mental state. He was solitary, low-spirited and unoccupied.

Case No. 7 Age 70 yrs. Admitted 10.4.45
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension; Paget's Disease of the Spine.

Onset of Present Illness: In 1944 patient had to leave a job which he had held since his retirement some years previously, owing to ill-health. He became very worried and low-spirited. He was restless at home and talked to himself a great deal. He remained in bed continuously for several months and was then seen as an out-patient at St. Thomas's Hospital. He improved after a course of E.C.T. but relapsed later and was admitted to Shenley Hospital.

Mental State: His expression showed marked dejection. He was retarded in movement and thought. He did not converse spontaneously and showed no interest in his surroundings. He answered questions rationally. He expressed no delusions but was abnormally occupied with financial worries. He constantly said he could not cope with his affairs and he was ruined. He ate only with encouragement and required sedation to sleep.

Physical Condition: A tall thin man who had obviously lost weight. Blood pressure was 200/140. X-ray showed widening of the aortic arch and also that he had Paget's disease of the spine.

Character of Treatment: On 27.4.46 he was given an unmodified convulsion following which he was cyanosed

and dyspnoeic for some time. Following this he had eighteen electrically induced convulsions which were adequately modified with 25 mgm. d.- tubocurarine chloride. No difficulty was experience in carrying out the treatment and he suffered no injury from it.

Mental State Following Treatment: He appeared more cheerful, took some interest in his visitors, took part in conversation, but offered no spontaneous talk. He was very solitary, but ate and slept well.

Follow-up: Six months following treatment he had relapsed completely to his former mental state.

Case No. 8 Age 64 yrs. Admitted 24.8.50
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Frailty and Hypertension.

Onset of Illness: No detailed history was available. Illness dated from patient receiving a report that his son had been killed at sea.

Mental State: He was depressed and agitated. He kept wringing his hands and muttering comments of despair or self-commiseration. He shrank away and appeared terrified whenever he was addressed. He showed no interest in his surroundings. He reproached himself for doing wrong but could not say what he had done. He refused to eat because he thought his food was poisoned. He was restless and slept badly at night.

Physical Condition: He was poorly nourished and weighed 95 lbs. His blood pressure was 194/100; vessels were thickened and tortuous.

Character of Treatment: He had fourteen convulsions. The fit was unusually well modified with 20 mgm. d.-tubocurarine chloride; movement being limited to muscles around mouth and eyes. The pulse remained satisfactory throughout and there was no rise of blood pressure. He recovered uneventfully within 30 mins. of having the fit. Some difficulty was experienced in giving this patient intravenous injections.

About 35 minutes following the sixth convulsion

patient suddenly became cyanosed, his pulse became feeble and he had marked tremor all over his body. He recovered in five minutes, and showed no abnormality thereafter.

Mental State following Treatment: Following his first treatment patient made a dramatic recovery. He relapsed however, but recovered after each subsequent treatment. After the ninth treatment he was well continuously. He showed no sign of depression, was active and co-operative. He began to relapse after about a fortnight however, and at the end of the thirteenth and fourteenth treatments, remained well for only a day after the treatment.

Follow-up: He relapsed completely to his mental state before treatment and remained in hospital.

Case No. 9 Age 77 yrs. Admitted 5.11.40
Discharged 14.7.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension and frailty.

Onset of Illness: On admission to hospital patient was difficult with food, slept badly and could not concentrate. He spoke little and was very apprehensive. He believed that his bowels never worked, that he was rotting away and that a horrible death was being prepared for him. His memory was poor and he was poorly orientated. He was then thought to be suffering from senile dementia. No previous history was available.

Mental State: He was restless, agitated, solitary and resistive to attention. He offered no spontaneous conversation. Replies to questions were given very slowly, all movements were retarded and he did not occupy himself in any way. He had many hypochondriacal ideas and believed that his bowels were stopped up. He said that his life was hopeless. He showed no deterioration in behaviour.

Physical Condition: A very frail man. Resting blood pressure was 120/70. The apex beat was found in the 5th interspace displaced to the left and the area of cardiac dulness was outside normal limits. Blood vessels were thickened and tortuous. X-ray showed enlargement of the left ventricle. E.C.G. showed left axis deviation with an inverted T wave.

Character of Treatment: He had five convulsions which were adequately modified with 20 mgm. d.- tubocurarine chloride. No difficulties arose during treatment.

Mental State following Treatment: He was cheerful and interested in his surroundings. He spoke spontaneously, read the newspaper and did a crossword puzzle every day. His movements were no longer retarded and his answers were prompt. He was not disorientated and gave a clear accountof the events of his past life. He no longer held his former delusions.

If he was on his feet for more than a few hours his ankles became oedematous, and he became breathless on mild exertion.

Follow-up: Patient died of pneumonia seven months after the termination of his treatment. He remained mentally well.

Case No. 10 Age 67 yrs. Admitted 3.2.45
Discharged 28.7.48

Psychiatric Diagnosis: Depression.

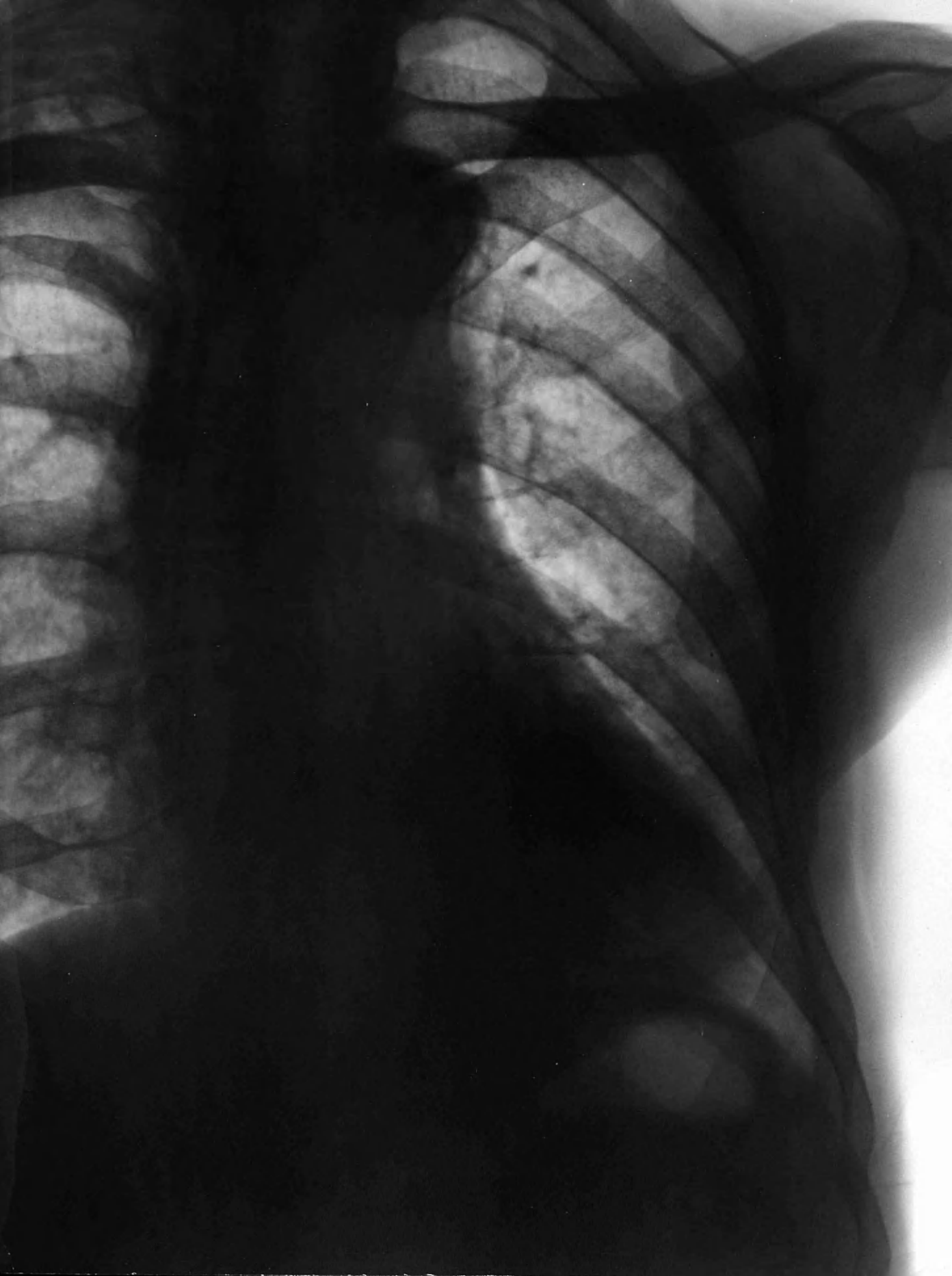
Physical Diagnosis: Old Hemiplegia; Hypertension.

Onset of Illness: Patient became very worried and nervous following the outbreak of war. In October 1944 he had a hemiplegia of the right side. By Christmas he was up, but was unable to resume work owing to the weakness of his right arm. He became very depressed and could not be assured that he would recover. In January 1945 he attempted to commit suicide by cutting his throat.

Mental State: He was low-spirited and agitated. He thought (falsely) that he suffered from venereal disease. He said that he had exposed himself to a dog which had played with his genitals and that he had given birth to pups in the observation ward. He said that he wished to die. His memory for recent events was poor and he was disorientated for time and place.

Physical Condition: The resting blood pressure was 220/120. The apex beat was 5½ inches from the mid-line in the sixth interspace and the area of cardiac dulness was enlarged to percussion. There was a loud systolic murmur at the apex. His vessels were thickened and tortuous and fundal examination showed retinal arterio-clerosis.

He still had residual evidence of hemiplegia. His



His right face, arm and leg were weak, with increased tendon jerks. An extensor plantar response was obtained from the right foot and the right abdominal reflexes were absent. The right pupil was smaller than the left and both reacted sluggishly to light. The W.R. was negative.

Character of Treatment: He had ten convulsions and the fit was well modified with 20 mgm. d.-tubocurarine chloride. No difficulty was experienced throughout the treatment and he suffered no physical damage from it.

Mental Condition following Treatment: He was cheerful, active and took an interest in his surroundings. His conversation was spontaneous and he showed no evidence of his former delusions. He had a good grasp of contemporary news. He showed no impairment of memory or of orientation.

Follow-up: This patient was interviewed by me one year after the termination of his treatment. His conversation and behaviour were normal, and he had gained 28 lbs. in weight since his discharge. His wife worked and he ran the house. His wife confirmed that he had remained well.

Case No. 11 Age 66 yrs. Admitted 1.5.47
Discharged 23.3.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension and spinal Osteo-arthritis.

Onset of Illness: In December 1946 the patient, who was a widower, married again and went to live in his wife's house. He had formerly lived with a step-son and, following his change of residence, he became very suspicious. He would not sign cheques; refused to give his wife any house-keeping money and said that poison was put in his tea. He was low-spirited, tearful and distressed. He refused to leave his house to see a Doctor, and was unwilling to go into hospital.

Mental State: He looked miserable and was very agitated. He was unable to carry on normal conversation because of his complaints. He reproached himself for having led a wicked life, for neglecting his property and for bringing ruin upon himself. He accused his relatives of trying to steal his property and the nursing staff of poisoning him. He said he did not wish to live.

He was unable to carry out instructions or to co-operate in any tasks. He complained that his memory was poor. He slept very badly, but ate fairly well.

Physical Condition Blood vessels were thickened and tortuous; blood pressure 140/80. X-ray showed calcification of the internal iliac artery. There was a dense cloud of albumen in his urine but no other abnormality. An

intravenous pyelogram revealed no abnormality of the renal tract. Blood urea was 52 mgm 100 c.c. blood. X-ray showed gross osteo-arthritis of the lumbo-sacral spine.

Character of Treatment As this was the first case in the series treated by this method, the dose of d. tubocurarine chloride was experimental, but the fit was adequately modified with 27 mgm. Spontaneous respiration began 10 mins. after the fit and he recovered consciousness within half-an-hour. There was no rise of blood pressure. He had 10 fits in all.

Mental State following Treatment: He was cheerful, conversed rationally and took an interest in things round about him. He expressed no delusions and he ate and slept well.

For about a month after treatment had finished he lacked confidence in going out and complained of vaguely localised pains. He was quite normal at the end of this time however.

Follow-up: Patient was interviewed by a Psychiatric Social Worker one year after his discharge. His behaviour was normal, he conversed rationally and was quite cheerful. He was able to conduct his own business and said that he had had no recurrence of his depressive symptoms.

Case No. 12. Age 74 yrs. Admitted 4.6.48
Discharged 28.11.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Auricular Fibrillation: Frailty.

Onset of Present Illness: Patient was admitted to Bethlem Royal Hospital on 3.11.38. His illness appeared to have begun six months previously. On his admission he was agitated, with ideas of unworthiness and the delusion that he had ruined his family. During his stay in hospital he became less agitated and deluded but very withdrawn. He spoke only when addressed and then answered as briefly as possible. He appeared hopeless about the future. He was considered unfit for convulsive therapy on account of his physical state. He was transferred to Shenley Hospital on 4.6.48.

Mental State: He was solitary and apathetic. He offered no spontaneous conversation and answered only in monosyllables when pressed. He ate poorly and slept only with sedative.

Physical Condition: He was thin and weighed 98 lb. Blood pressure 128/40. Pulse and heart sounds were irregular. An electrocardiogram showed this to be due to auricular fibrillation. He had bilateral reducible inguinal herniae.

Character of Treatment: He was given eighteen convulsions which were adequately modified with 25 mgm. d.-tubocurarine chloride. Great difficulty was experienced in inducing

a fit and high voltage had to be used. On the fifth and sixth occasions 50 units of insulin were given to facilitate a convulsion, but this was discontinued as it led to hypoglycaemic phenomena later in the day.

Thirty minutes following the second fit he became pale and pulseless with a cold sweat. Nikethamide (.5 gm.) was given intravenously and he recovered in a few minutes.

No other difficulty was experience and he suffered no disability from the treatment.

Mental State following Treatment: He made slow improvement from the commencement of therapy and when the course was finished he conversed spontaneously and answered fully. He was much more interested in his surroundings and ate well. He appeared to be addicted to Paraldehyde and could not sleep without it. He was apprehensive about going home as he had been in hospital for over ten years.

Follow-up: Patient was seen twice within ten months after the termination of treatment. He spoke freely and appeared cheerful. He had taken up many of his old interests. His wife stated that he was very well but tended to be rather seclusive and did not like to have people in the house. He ate well but still required sedative to sleep.

Case No. 13 Age 73 yrs. Admitted 5.5.47
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Auricular Fibrillation.

Onset of Illness: For some years before admission patient had complained of breathlessness on exertion and had several attacks of bronchitis during each of which he had heart failure. He was admitted to the Central Middlesex Hospital in January 1947 with such an attack. During his stay there he became low-spirited and refused food because, he said, he was all wrong inside. He was discharged but became worse at home. He complained of bodily illness. He was unable to concentrate, and was so agitated that he could not hold a conversation.

Mental State: He was agitated and took no notice of what went on around him. He offered no spontaneous conversation. He said that he could not swallow and that his bowels would not work. He said that medicine scalded his inside, that his case was a hopeless one and that he wanted to die. He ate only with persuasion and could not sleep without sedative.

Physical Condition: On admission the patient was cyanosed and dyspnoeic. Numerous moist anddry rales could be heard all over the chest. The apex beat was not palpable. Heart sounds were rapid and irregular in rate and volume. The neck veins were full. Blood pressure was 150/90. X-ray showed enlargement of the left ventricle. E.C.G. showed

the irregularity of the pulse to be due to auricular fibrillation. His condition improved after the administration of digitalis.

Character of Treatment: Three unsuccessful attempts were made to give this patient a fit after the injection of d-tubocurarine chloride and Thiopentone. Following the the pulse became rapid and shallow. His colour was pale and he required artificial respiration for sixty minutes. For the next two and a half hours the pulse was very feeble and irregular. He had completely recovered by the following day but treatment was discontinued.

His physical condition was not worse following this attempt to induce a modified convulsion, and there was no evidence that he suffered any injury.

Mental State following Treatment: Patient's mental state remained unchanged.

Follow-up: Patient remained in hospital.

Case No. 14 Age 71 yrs. Admitted 13.3.49
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Auricular Fibrillation; Cardiac failure.

Onset of Present Illness: Four years before his admission to hospital patient had to retire from work on account of breathlessness on exertion and oedema of his ankles. In 1948 he was admitted to Central Middlesex Hospital as these symptoms had become worse. Two weeks after admission he was noticed to be gloomy and apathetic. He thought he had committed a dreadful crime, that he was accused of being lazy, and that his name was being bandied about the ward. He thought that other patients were plotting against him.

Mental State: His expression was miserable. He was restless and talkative at night. He took little interest in his surroundings. He reproached himself for not having looked after his family properly and for being lazy. He thought that he ought to be punished. He ate fairly well, but slept only with sedative.

Physical Condition: He weighed 113 lb. Crepitations were present at the base of the lungs. The apex beat was in the 6th interspace 5¾" from the midline. Heart sounds were irregular. Vessels were thickened and tortuous. Blood pressure 160/140. There was slight oedema of his ankles.

X-ray showed that he had auricular fibrillation. He was treated with Digitalis and 'mersalyl' and improved mentally and physically. He was fairly well for four months but then again showed signs of heart failure and depression. His physical condition improved with rest in bed.

Character of Treatment: He had ten convulsions which were adequately modified with 7 mgm. Decamethorium Iodide. No difficulty was experienced in carrying out the treatment. Spontaneous respiration began five minutes after the fit and he recovered within thirty minutes. His physical condition was improved following the treatment.

Mental State following Treatment: He was cheerful, conversed freely and rationally, and was co-operative. He showed no ideas of self-reproach or guilt. He slept without sedative and ate well. He got up for most of the day and took light exercise without developing oedema

Follow-up: Five months after the termination of treatment he was still in hospital as there was nowhere else for him to go. He had no recurrence of his depressive symptoms. He was cheerful, occupied and able to take moderate exercise without discomfort.

Case No. 15 Age 68 yrs. Admitted 4.6.48
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Auricular fibrillation, coronary thrombosis, cardiac failure.

Onset of Illness: The patient retired from his work as a buyer in Selfridges' in February 1947. At that time he weighed 13 st. Shortly after his retirement he had to curtail a great many of his other activities owing to heart disease. He began to become depressed. One day he went out and 'phoned his wife to say that he was very wicked and was going to give himself up to the Police. He was taken to see a Psychiatrist and admitted to hospital.

Mental State: His expression showed depression and he took little interest in things around him. He stated that he was worthless and guilty of many crimes; also that he had been unfaithful to his wife. He felt that everything was hopeless, that he was ruined financially, and that he would never recover from his illness. He ate and slept badly.

Physical Condition: Apex beat was in the 5th interspace five inches from the mid-line. The area of cardiac dulness was not enlarged. Heart sounds were of good quality with numerous extra-systoles. Bloodpressure was 145/100. Blood vessels were thickened and tortuous, ankles were oedematous. X-ray showed an atheromatous aorta.

On 2.7.48 he complained of pain in the region of the sternum and upper abdomen. He was pale and sweating with

a lowered blood pressure. This was thought to be a coronary thrombosis and following this he developed auricular fibrillation.

Character of Treatment: The patient had fifteen treatments which were adequately modified with 25 mgm. d.-tubocurarine chloride. Following the second fit he took 60 mins. to recover consciousness, but recovered within 30 mins. from all subsequent fits.

Mental State following Treatment: By his tenth treatment patient was cheerful and interested in his surroundings. He slept well without sedative, ate well and began to gain weight. A month later he went home on leave and relapsed. His physical condition also deteriorated. He became more breathless and oedematous. Five more treatments were given without improvement, and his physical condition continued to deteriorate.

Follow-up: A year after the termination of treatment he was confined to bed severely depressed. His liver was enlarged and he had much oedema.

Case No. 16 Age 62 yrs. Admitted 16.3.49
Discharged 27.7.49

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Aortic Stenosis.

Onset of Present Illness: In 1940 patient received an injury to his leg on account of which he was discharged from the A.R.P. service. He took up light work, but seemed to worry unduly about money matters and to be afraid to spend money. He gradually became depressed and thought that he was going to be arrested for his wickedness. He was admitted to Mill Hill Emergency Hospital, but relapsed shortly after being discharged. He was admitted to Springfield Hospital. Convulsive therapy was considered, but his physical condition was thought to preclude it. He was discharged unimproved.

After his mother's death in 5.3.49, he grew much worse and was admitted to Shenley Hospital.

Mental State: He looked miserable. His movements were retarded and his voice was tremulous. He was easily moved to tears. He believed that he was going to be executed for crimes he had committed in the past and that this would also bring punishment on his family. He thought he had been moved to hospital as a preliminary to execution. He ate fairly well, but slept only with large amounts of sedative.

Physical Condition: Apex beat was in the 6th interspace 4½ inches from the midline. Heart sounds were regular

but there was a harsh systolic murmur audible at the apex and also at the base. Blood pressure was 174/90. Vessels were thickened.

On 31.3.44 the pulse was noted to be irregular and auricular fibrillation was diagnosed. He was given a course of quinidine and on 2.4.49 his pulse was found to be regular.

Character of Treatment: He had twenty convulsions. The first twelve were adequately modified with 25 mgm. d.-tubocurarine chloride and the rest with 6 mgm.

Forty minutes after the first fit patient quickly became cyanosed. His pulse became imperceptible at the wrist, and his respirations were weak and gasping. On auscultation heart sounds were found to be rapid (over 140) and irregular. Oxygen was administered and after five minutes his colour improved. He completely recovered in ten minutes.

On the second occasion he had a similar reaction but recovered more rapidly. On all other occasions he recovered within thirty minutes of the convulsion with no untoward incident.

The thirteenth convulsion was modified by 5mgm. decamethonium iodide. This fit was not so well modified as previous ones and the dose was thereafter raised to 6 mgm. which gave an adequate modification

of the fit. Spontaneous respiratory movements began about two minutes after the fit whereas with d.- tubocurarine chloride they had taken about 8 minutes.

Mental Condition following Treatment: He was cheerful, interested, well occupied and conversed readily. He did not express any of the delusions he had formerly held.

Follow-up: Patient was interviewed six months after the termination of his treatment. He had remained cheerful and occupied himself with household jobs and visiting his friends. He had occasional short periods of depression, but these were quickly over and not regarded seriously by his relatives who were satisfied that he had remained quite well.

Case No. 17 Age 60 yrs. Admitted 12.1.48
Discharged 8.5.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Emphysema. Congestive Heart Failure.

Onset of Illness: Patient was admitted to a general hospital on 14.12.47 suffering from heart failure. He had had bronchitis for the previous 20 yrs. and for one year before admission was unable to walk more than 100 yds. without becoming breathless. On admission he was dyspnoeic, veins in the neck were full and rhonchi were found throughout the chest which was barrel-shaped and hyper-resonant. On 15.12.47 he got up in the evening and started to walk home in his dressing gown and slippers because, he said, he had no right to use hospital pyjamas. He became suspicious and declared that his case was hopeless. He said that he was responsible for deaths that occurred in the ward. He refused food and barely spoke.

Mental State: He looked miserable, offered no spontaneous conversation and completely disregarded his surroundings. His movements and his answers to questions were slow. He said that there were killings in the ward for which he was responsible. He had delusions of unworthiness concerning his bodily functions. He felt hopeless. He ate little food only with encouragement and slept badly.

Physical Condition: He was cyanosed and dyspnoeic at

rest. Neck veins were full and other veins congested. Pulse was regular, but poor in volume. Chest was barrel-shaped and hyper-resonant with a poor respiratory excursion.

Character of Treatment: He had five convulsions which were adequately modified by 25 mgm. d-tubocurarine chloride. There was a delayed recovery after the 4th fit. He had to be sat well up immediately after each fit to secure adequate oxygen intake after the fit even with respiration fully assisted.

Mental State following Treatment: He was cheerful, took an interest in his surroundings, offered spontaneous conversation and read newspapers. He showed no evidence of his former delusions. He was able to be up all day and take a moderate amount of exercise. He ate and slept well.

Follow-up: Patient died nine months after termination of treatment, during his sleep. Until his death he showed no evidence of returning depression. He had appeared happy, ate and slept well.

Case No. 18 Age 57 yrs. Admitted 8.5.48
Discharged 28.7.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Pulmonary Tuberculosis.

Onset of Illness: Patient first developed malaise and fever in July 1947. A few months later he was admitted to hospital and found to be suffering from pulmonary tuberculosis. This was confirmed by finding tubercle bacilli in his sputum. He was given a left phrenic crush and returned home after 3 months. In March 1948 he was admitted to a sanatorium and X-ray showedthat he had extensive infiltration of the upper and mid-zones of the left lung and a spread to the right apex. He began to be worried and to lose sleep. His thyroid gland appeared to be enlarged and he was given a trial course of
On 8.5.48 he attempted to commit suicide by cutting his wrist.

Mental State: He was dejected in appearance and took little interest in his surroundings. He offered no spontaneous conversation but answered when questioned. He said he was unable to enjoy anything and reproached himself for having had a love affair with a young woman in his office. So far as could be ascertained this was untrue. He thought his case a hopeless one. He required encouragement to eat and slept only with sedative.

Physical Condition: X-ray showed extensive involvement of the left lung and of the right apex. Tubercle bacilli

CASE 18

X-RAY OF CHEST BEFORE TREATMENT

CASE 18

X-RAY OF CHEST AFTER TREATMENT

were found in his sputum. For six weeks following admission he had intermittent pyrexia, raised pulse and E.S.R. was 33 m.m. per hr.

Character of Treatment: He had nine convulsions which were adequately modified with 20 mgm. d.-tubocurarine chloride. No difficulties were experience in carrying out the treatment. He recovered consciousmess each time within thirty minutes of having the fit.

Following treatment his physical condition improved. His temperature and pulse settled: cough and sputum disappeared and he made a small gain in weight. The sedimentation rate dropped to 13 m.m. per hr. An X-ray a short time after the conclusion of his treatment showed slight hardening of the previous area of infiltration with no evidence of spread.

Mental State following Treatment: He was cheerful and took more interest in his surroundings. He conversed spontaneously and easily. He showed no evidence of his former delusions and was hopeful of his prospects of recovery. He ate well and slept without sedative.

Follow-up: Patient was visited by a Psychiatric Social Worker seven months after the termination of his treatment. He conversed freely and was quite cheerful. He occupied himself about the house and also did some painting which was his hobby. He said that he had had no recurrence

of his depression and this was confirmed by his wife.

He was attending a chest clinic at two-monthly intervals and a report from the Physician stated that he was making satisfactory progress.

Case No. 19 Age 29 yrs. Admitted 11.10.48
Not discharged

Psychiatric Diagnosis: Schizophrenia

Physical Diagnosis: Pulmonary Tuberculosis.

Onset of Present Illness: Patient was a Polish soldier who was admitted to a hospital for pulmonary tuberculosis in 1945. In 1948 he was described as being idle and apathetic. He talked little. His behaviour was off and on one occasion he refused to have an X-ray. On another he grabbed the stethoscope of the examining Doctor and looked at it suspiciously. He attempted to commit suicide by hanging.

Mental State: He refused to speak or respond to questions even when addressed in Polish. He was apathetic and took no interest in his surroundings. He was sometimes co-operative and at other times resistive. He sometimes refused to eat and he made several suicidal attempts.

Physical Condition: Weight 122 lb. He had a persistent cough and abundant sputum. He had remittent fever. X-ray of his chest showed a cavity at the right apex with considerable infiltration and fibrosis. Tubercle bacilli were cultured from his sputum. B.S.R. was 70 m.m. per hr.

Character of Treatment: Patient had ten convulsions all of which were well modified with 25 mgm. d.-tubocurarine chloride, at the 2nd, 3rd and 4th sessions of treatment two convulsions were given, without ill effect.

No difficulty was experienced in carrying out this

CASE 19

X-RAY OF CHEST AFTER TREATMENT

treatment.

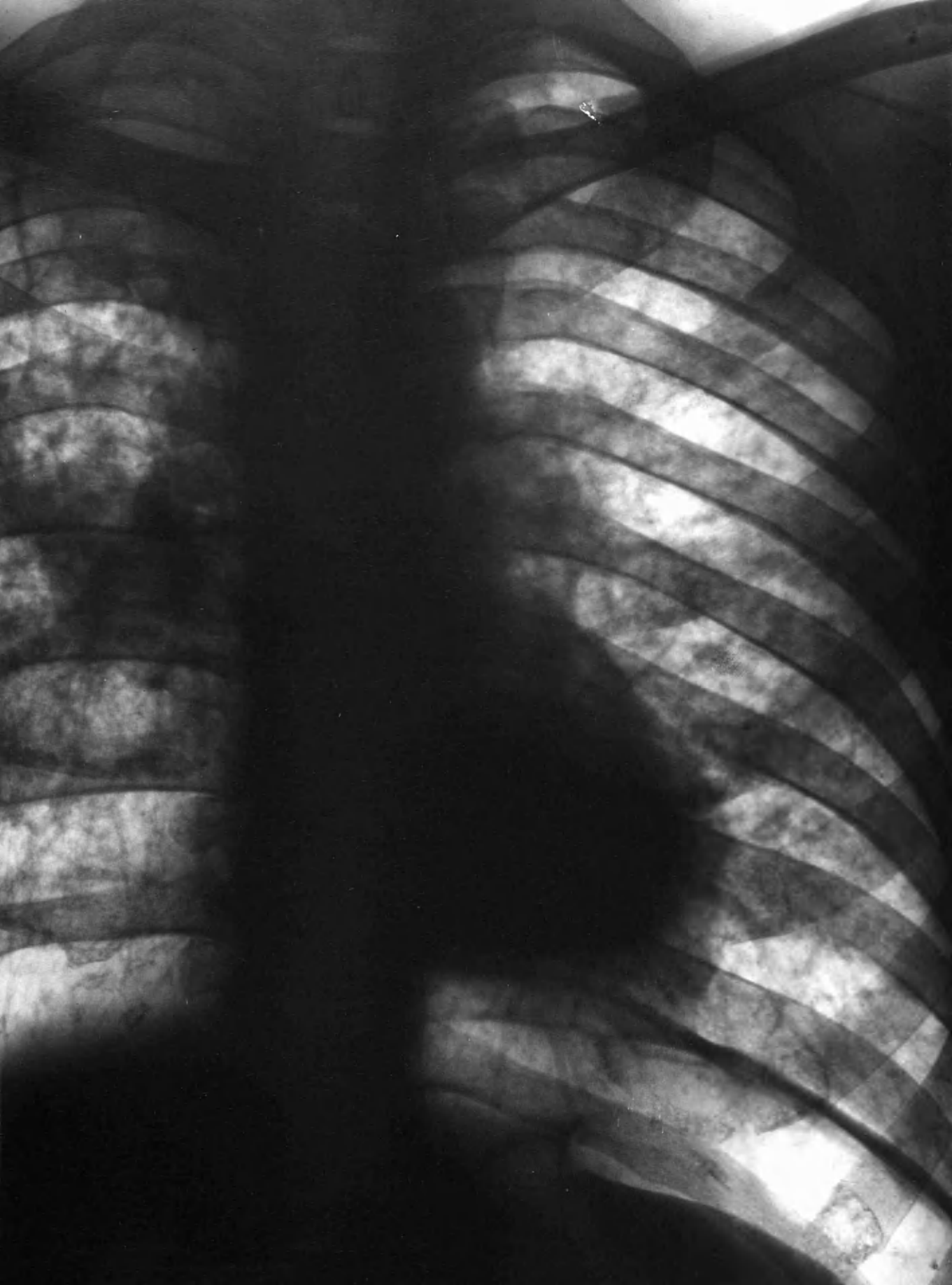
Result of Treatment: About three weeks after his course of treatment had finished he began to improve. He stayed in bed without persuasion and ceased his suicidal attempts, and was much less difficult to care for. His temperature became more settled. His cough, and sputum, were much reduced. Over the course of six weeks he put on a stone in weight. Four months after the termination of treatment he was sufficiently co-operative for a phrenic crush and pneumo-peritoneum to be carried out.

X-ray showed no evidence of spread of his tuberculosis following treatment.

Follow-up: One year after the termination of treatment the improvement in his behaviour had been maintained. He ate well and voluntarily, showed no further suicidal tendencies but remained apathetic. He had an intermittent pyrexia; B.S.R. 76 m.m. per hr. His weight had remained constant and his chest lesion had made no further progress on X-ray.

CASE 20

X-RAY OF CHEST AFTER TREATMENT



and tubercle bacilli were found in the sputum.

Character of Treatment: He had fourteen convulsions. For the first two convulsions 7 mgm. C.10 were given which was very well modified. Respiration began 13 minutes after the fit and he recovered consciousness within 30 mins. When the dose was reduced to 5 mgm. C.10 respiration began 5 minutes after the fit which was adequately modified. No difficulty was experienced during the treatment.

Result of Treatment: He was more cheerful, conversed freely and was co-operative. He was less restless and made no further attempts to injure himself. He ate well and slept without sedative. X-ray showed that the infiltration was thicker and more widespread than it had been previously to the treatment. His physical condition, generally, improved however. Temperature and pulse were normal. He had less cough and 3 oz. sputum per day. E.S.R. was 10-25 m.m. per hr. but his sputum still contained tubercle bacilli. A pneumoperitoneum was induced and he had a course of para-amino salicylic acid.

Follow-up: Nine months after the termination of treatment he was still cheerful and co-operative for the most part, except during three short periods during which he had been garrulous and elated. His tuberculosis and progressed steadily with increased signs of activity and his general condition was poor.

Case No. 21 Age 64 yrs. Admitted 18.1.46
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Old Pulmonary Tuberculosis.

Onset of Illness: After twenty years' service as a postman patient was discharged from his employment, complaining of head pains. From 1940 to 1944 he seemed depressed. He was unemployed and went out very little. During 1945 he refused to go out alone. He refused to drink or smoke, because, he said, the taste and smell were objectionable to him. He had formerly enjoyed doing these things. Following the death of his daughter he attempted to commit suicide by cutting both his wrists.

Mental State: He looked miserable and took little interest in his surroundings. He expressed delusions of unworthiness and was very worried lest his family should get into trouble on his account. He said that one half of his mind was working to do good and the other to do evil. He had suicidal thoughs. He ate and slept badly.

Physical Condition: Chest x-ray showed a fibrotic region with calcified nodules in the upper half of the right lung. Patient had tuberculosis at the age of 46.

There was a deficiency in the skull, one inch in diameter resulting from a head injury in 1917 which was operated on in 1925.

Character of Treatment: Treatment was begun 2½ years after admission and he had ten treatments. The convulsion was well modified with 20 mgm. d.-tubocurarine chloride. The patient began spontaneous respiration almost immediately after the fit and had recovered consciousness within thirty minutes. X-ray showed no evidence of further activity of his tuberculosis.

Mental State following Treatment: He became more cheerful and more interested in his surroundings. He showed no evidence of his previous delusions. He ate and slept well. He went home on leave for a few days and relapsed completely about one month after treatment had ceased.

Follow-up: A few months following his relapse patient was given E.C.T. without modification. After one fit he complained of pain between his shoulder clades and x-ray showed a crush fracture of the 6th dorsal vertebra. Treatment was discontinued and his mental condition remained unchanged.

Case No. 22. Age 63 yrs. Admitted 1.9.47
Discharged 6.9.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Fractured Vertebrae.

Onset of Present Illness: Patient retired from work in April 1946 and seemed to lose interest in life. In October he became worried about an undescended testicle which he had had all his life and had, at his own request, an operation for this and also for a hernia. Following this he complained of deadness in his stomach, blurred vision and severe headache. He was also in very low spirits.

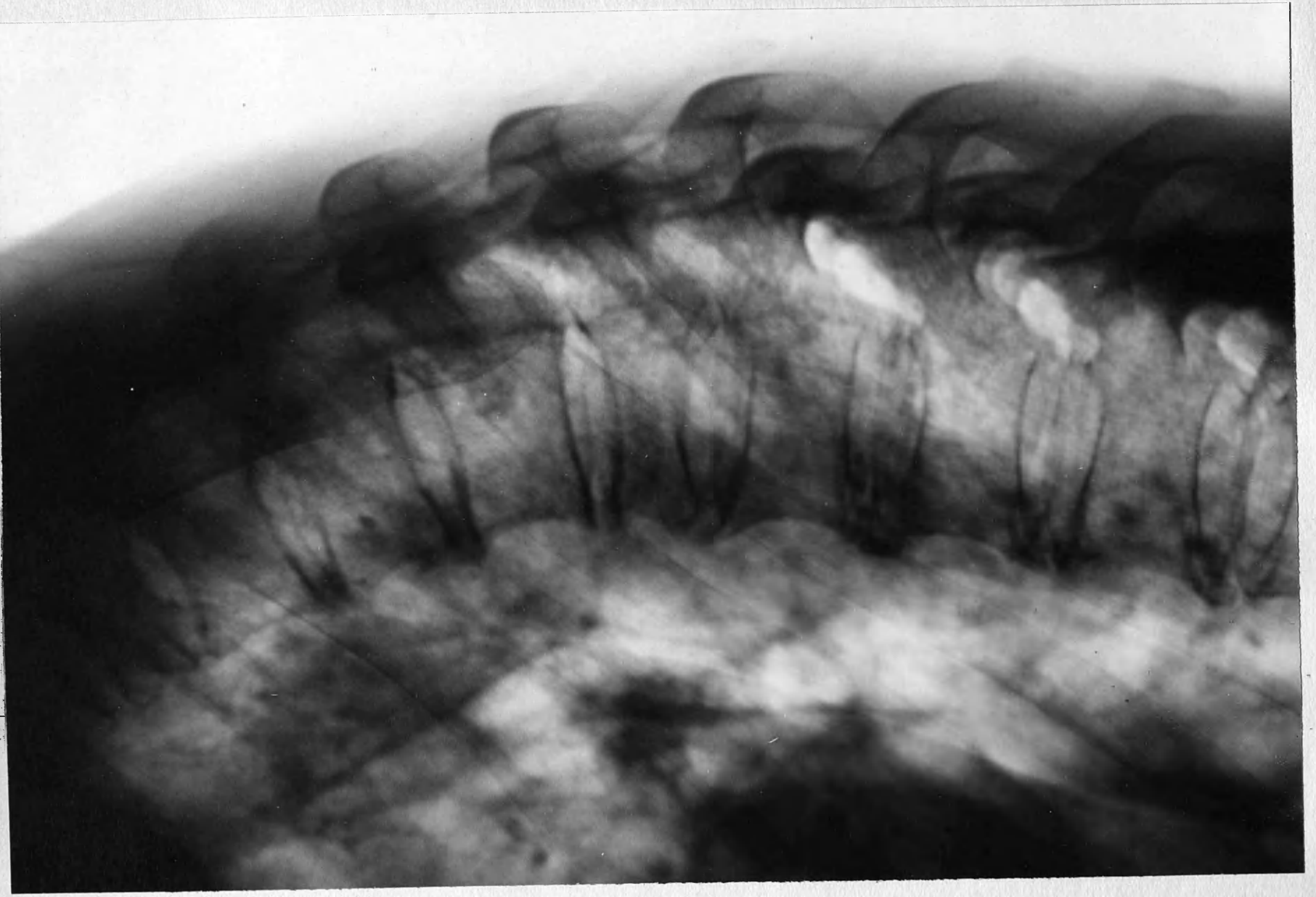
Mental State: His expression showed deep depression. He took no interest in his surroundings and spoke little. His movements were retarded. He believed that his genitalia were dead and that seminal fluid remained within his body upsetting his head and heart. He was very self-reproachful. He thought nobody could do anything for him and he had no confidence in himself. He slept only with sedative but ate fairly well.

Physical Condition: He was very thin and weighed 100lbs. After one unmodified electrical convulsion on 19.3.48, he complained of pain in his back and x-ray showed compression fractures of 3rd and 7th dorsal vertebrae.

Character of Treatment: He had four convulsions which were adequately modified with 20 mgm. d.- tubocurarine

CASE 22

X-RAY SHOWING FRACTURES OF 3RD AND 7TH DORSAL VERTEBRAE BEFORE TREATMENT



chloride. He had no movement of his back but some spasm of his limbs.

For about an hour after each fit patient was very restless. He san snatches of songs, his conversation was rambling and his movements inco-ordinated. The dose of Thiopentone was reduced from 0.15 gm. to 0.10 gm. to over come this, without effect.

After the 3rd fit he became pale, pulse became weak and irregular and blood pressure dropped below 100 (systolic). He recovered in a few minutes without special measures.

Mental State following Treatment: He was cheerful, self-confident and interested in his surroundings. He lost his former delusions and expressed no feelings of self-reproach. He slept without sedative and ate well. His weight rose to 122 lb.

Follow-up: A letter from patient's son six months after the termination of treatment stated that he had completely relapsed. He was again hypochondriacal and depressed. He was eating and sleeping badly.

Case No. 23 Age 71 yrs. Admitted 13.5.48
Discharged 2.10.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Fractured Vertebrae and Frailty.

Onset of Illness: In 1946 patient retired from an active business life and towards the end of that year he became depressed. In August 1947 he went to Bethlem Royal Hospital where he was treated with E.C.T. He was discharged in 1948, having improved, but continued to be restless and depressed. He was admitted to Holloway Sanatorium where he had eight electrically induced convulsions but refused to continue the course and he was transferred to Shenley Hospital.

Mental State: His expression showed deep dejection. He was agitated and spent most of his time pacing up and down the ward. He took no interest in his surroundings or the people about him.

He could hold a rational conversation and said that he felt hopeless. He reproached himself for coming into hospital, for neglecting his wife and felt himself to be responsible for his won illness through his wickedness. He said that he had made a mess of everything and was outside society. He felt constantly fatigued and had great difficulty in concentrating on whatever he did. His appetite was poor and he slept badly even with sedative.

Physical Condition: His height was 6'1" and he weighed

7st 7lb. X-ray of his spine showed collapse fractures of the 4th, 5th and 8th dorsal vertebrae. These were believed to be due to previous E.C.T.

Character of Treatment: He had two courses of eight treatments as he had relapsed about a month after the first course. The fits were satisfactorily modified with 20 mgm. d.-tubocurarine chloride, but this dose had to be increased later to 25 mgm. as the patient's physical condition improved. He was rather restless during the recovery period and following the 7th fit the dose of Thiopentone was increased from 0.15 gm. to 0. 25 gm. This diminished the restlessness considerably. There was no other difficulty encountered in the treatment and there was no x-ray evidence of further injury following it.

Mental State following Treatment: He was cheerful and no longer agitated. He became more active and sociable and no longer expressed ideas of self-reproach. He slept and ate well and his weight on discharge was 149 lb.

Follow-up: Patient again relapsed to his former mental state about two months after his discharge and was admitted to another mental hospital.

Case No. 24 Age 50 yrs. Admitted 29.1.47
Discharged 20.2.48

Psychiatric Diagnosis: Depression.

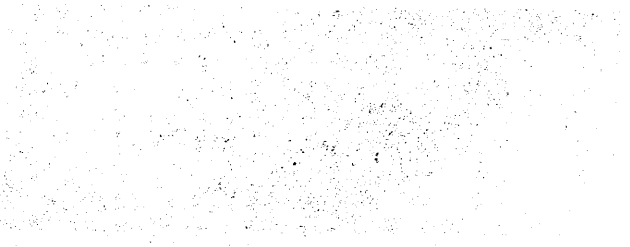
Physical Diagnosis: Fractured Femur.

Onset of Illness: Patient was worried during the war by overwork and because he was unable to buy special foods to which he was used. In December 1946 he secreted an alarm clock in his bed and warned his wife that "they" would try to take it away. He became more taciturn and restless and went off his food. He rose at 4 a.m. one morning and attempted to commit suicide by drinking ammonia. His wife went to 'phone a doctor and when she returned found that he had cut both his wrists and was bleeding profusely.

Mental State: He appeared depressed and agitated. He spoke little and his answers to questions were slow. He believed that he suffered from venereal disease, that he was very wicked and unfit to associate with other ward inmates. He also believed that he was unfit to eat and tried to give his food away. He slept badly.

Physical Condition: Following a successful course of electrical convulsion therapy, the patient slipped and broke his right femur. He relapsed to his former mental state during the time that his leg was in plaster. The fracture healed in four months.

Character of Treatment: He was given 10 convulsions which were adequately modified by 25 mgm. d.-tubocurarine chloride. His treatment gave rise to no difficulties and he received no further injuries.



CASE 24

X-RAY FOLLOWING TREATMENT SHOWING HEALED FRACTURE OF RIGHT FEMORAL NECK

Mental State following Treatment: He was cheerful, interested, spontaneous in conversation and emotional response. He was well occupied in the occupational therapy dept.

Follow-up: Patient was seen by me at an out-patient clinic 11 months after his treatment had been completed. He appeared cheerful. He talked freely and his behaviour appeared quite normal. He showed no evidence of his previous depressive delusions. Owing to worry about his work, which had changed in character with the advent of the National Health Service, he had sometimes slept badly. He himself was anxious to retire and his employers were advised that this was the best course.

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the treatment and he usually recovered completely within 30 minutes.

In order to lessen the number of treatments required, two fits were given on the 5th, 6th and 7th occasions. No untoward effects were noticed during the treatment and recovery was not delayed. The post-convulsive period of partial amnesia lasted for a longer period than usual however, and caused the patient some distress. This practice was therefore, discontinued.

Mental State following Treatment: He became cheerful, conversed freely and was well occupied. He enjoyed reading the paper and listening to music. He gave no evidence of his former delusions.

Follow-up: In an interview six months after the termination of his treatment, patient appeared quite well. He had resumed his employment as a works manager shortly after leaving hospital, and had had no return of his depressive symptoms.

Case No. 26 Age 72 yrs. Admitted 10.12.48
Discharged 8.3.49

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Frailty.

Onset of Present Illness: Patient first became ill following his wife's death 10 years before his admission to hospital. He became unhappy and solitary, but was unable to continue at work until he was admitted to a mental hospital for six months. He was discharged, against advice, little improved. Three months before his present admission, he began to eat and sleep badly. He was low-spirited and lost interest in things he formerly enjoyed. One day he said he had taken poison and was admitted to hospital.

Mental State: He was low-spirited and easily moved to tears. He took no interest in his surroundings, avoided conversation and shunned company. He said that he had led a wicked life and deserved to be punished. He said there was no hope at all for him and he wished to die. He ate food reluctantly and slept only with sedative.

Physical Condition: He was frail and emaciated, weighing 120 lb. The apex beat was in the 5th interspace 5" from the midline. Vessels were thickened and tortuous; blood pressure was 135/80. X-ray showed slight ventricular enlargement and unfolding of the aorta.

Character of Treatment: Patient had five convulsions which were adequately modified with 20 mgm. d. tubocurarine

chloride.

Following the first fit he required artificial respiration for an hour as he became very cyanosed without it. His pulse rose to 140 for about 10 minutes after the fit and on auscultation at the apex reduplication of the first sound was audible. Patient recovered about two hours after the fit.

About 15 minutes following the second fit the pulse rose to 140, 'gallop rhythm' was audible at the apex, and there was some irregularity of the pulse. Patient was propped up high in bed and given oxygen. He recovered in one hour. On each of the remaining occasions the pulse rose to 140 as it had done previously, but the patient recovered each time in about 40 minutes.

He suffered no physical injury from the treatment.

Mental State following Treatment: He was cheerful and interested in his surroundings. He was no longer agitated and did not express his former delusions. He ate and slept well.

Follow-up: Patient was visited in his home one year after the termination of his treatment. He was happy and spoke freely. He spent most of his time pottering in the garden. The relatives stated that there had been no recurrence of his depression since his discharge from hospital.

Case No. 27 Age 68 yrs. Admitted 24.4.47
Discharged 6.3.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Frailty.

Onset of Illness: During the war this patient was worried by having to travel to work through the bombing and he lost much sleep. He went for a holiday, but was unable to resume work as he was depressed. In 1942 he recovered after a course of E.C.T. in hospital.

In January 1947 he had pneumonia. During his convalescence he woke up one night and said that his bowels were blocked and his intestines rotten. He refused to eat and was again admitted to hospital.

Mental State: He was mildly depressed and restless. He offered no spontaneous conversation and was retarded in speech. He answered questions rationally however. He showed little interest in his surroundings, was solitary and unoccupied. He was pessimistic and very worried about bodily functions. He ate only with encouragement and required sedative to sleep.

Physical Condition: He was thin (weight 104 lbs.) and had obviously lost weight. He had recently had pneumonia.

Character of Treatment: He had five convulsions which were adequately modified with 26 mgm. d.-tubocurarine chloride. There was no difficulty in carrying out the treatment and suffered no injury.

Mental State following Treatment: He was cheerful and interested in his surroundings, He conversed spontaneously and rationally. He expressed no delusions or worries about his bodily health. He occupied himself in rug making, ate well and slept well. His weight rose to 120 lbs.

Follow-up: In reply to a letter of enquiry patient's wife stated that he had died of pneumonia about six months after his discharge from hospital, and he had remained mentally well until the time of his death.

Case No. 28 Age 61 yrs. Admitted 5.5.48
Discharged 14.7.48

Psychiatric Diagnosis: Depression.

Physical Diagnosis; Recent Gastro-enterostomy.

History of Present Illness: Patient had suffered from a duodenal ulcer for 10 yrs. He developed symptoms of pyloric stenosis and on 8.4.48 a gastro-enterostomy was done. Following the operation he became low-spirited, refused to eat and was actively suicidal.

Mental State: His expression showed profound dejection. He took no interest in his surroundings. He would answer no questions but hold his head in his hands, groaning and muttering such phrases as "I have made a complete mess of everything". His movements were retarded. He ate slowly only with encouragement and could not sleep without sedative.

Physical Condition: He weighed 105 lbs. and showed that he had recently lost weight. He had a recent left paramedian operation scar on his abdomen, where his gastro-enterostomy had been performed.

Character of Treatment: Treatment was commenced seven weeks after his operation. He had four convulsions which were adequately modified with 22 mgm. d.-tubocurarine chloride. Movement was limited to the facial muscles. No difficulty was experienced in carrying out the treatment from which he recovered each time within 30 mins. He suffered no physical injury due to the treatment.

Mental State following Treatment: He was cheerful and interested in his surroundings. He talked spontaneously, ate well, and slept well.

Follow-up: Patient's wife was interviewed by a Psychiatric Social Worker seven months after the termination of his treatment. He was happily occupied and cheerful. He had shown no recurrence of his depression or of his stomach trouble. He had a light job in a printing works which he had done since six weeks after his discharge.

Case No. 29 60 yrs. Admitted
Discharged

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Hypertension; Emphysema; Gastric Carcinoma.

Onset of Present Illness: Twelve months before his admission patient began to complain of indigestion. For three months prior to his admission he began to worry unduly about his business and he foolishly sold two shops which were part of it. His son was able to retrieve the situation however. He was quiet and said that black market goods were being sold in his shops. He became disinclined to eat, slept badly and had threatened to commit suicide.

Mental State: He was agitated, resistive to attention and took his food only with difficulty. He thought that patients and staff on the ward avoided him because he was too wicked to associate with them. He thought that a dreadful fate was in store for him. He slept badly.

Physical Condition: A florid heavily-built man who had obviously lost weight recently. His chest was barrel-shaped and there was diminished respiratory excursion. The apex beat was in the 6th inter-space 5" from the mid-line. Blood pressure was 170/110: peripheral vessels thickened. He complained of indigestion and after his sixth treatment he was sufficiently co-operative to have a barium-meal, which revealed a carcinoma of the cardiac end of the stomach. This was considered to be inoperable.

Character of Treatment: He had nine convulsions which were adequately modified with 25 mgm. d.-tubocurarine chloride. No difficulty was experienced in carrying out the treatment and he suffered no physical injury from it. On the last two occasions he was given two convulsions each time, three minutes being allowed between consecutive convulsions. All fits were adequately modified. The only other difference noted was that the period of disorientation and confusion following treatment lasted for longer.

Mental State following Treatment: He was cheerful and took an interest in things around him. His conversation was spontaneous and he showed no evidence of his former delusions. He ate and slept well and said that he had no symptoms of indigestion.

Follow-up: Five months after the termination of treatment he relapsed completely and was re-admitted to hospital.

Case No. 30 Age 73 yrs. Admitted 11.5.49
Not discharged.

Psychiatric Diagnosis: Depression.

Physical Diagnosis: Auricular Fibrillation; Gastric Carcinoma.

Onset of Present Illness: Patient became morose following the death of his wife in 1942 but was still quite active. In 1948 he had a cataract operation and this worried him very much. Later in the same year he was found to have a gastric carcinoma and was given a diet to take. This was difficult as he lived alone and had hus meals in restaurants, and it worried him greatly. He was admitted to the Central Middlesex Hospital but became very depressed, refused all food and attempted to cut out his eyes.

Mental State: He appeared low-spirited, took no interest in his surroundings and offered no spontaneous conversation. He declared that he had done something unnatural for which he ought to be punished, that his case was a hopeless one and he had no desire to live. He ate and slept poorly.

Physical Condition: He was emaciated and weighed 136 lb. Pulse and heart sounds were irregular due to auricular fibrillation. Blood pressure was 160/100, vessel thickened and tortuous and on fundal examination, vessels showed arteriosclerotic changes. A small hard mass was palpable in the right epigastrium. X-ray showed calcaneous plaques in the aorta.

CASE 30

X-RAY BEFORE TREATMENT SHOWING

CARCINOMA OF PYLORIC END OF STOMACH

Character of Treatment: He had three convulsions which were adequately modified with 8 mgm. C.10. There were no spontaneous respiratory movements for 13 minutes following the fit, but within 5 minutes of their commencement he was breathing freely. No other difficulty was encountered during treatment, and he suffered no physical injury attributable to treatment.

Mental State following Treatment: He was cheerful, conversed readily, laughed at jokes and took an interest in his surroundings. He ate and slept well. As he had no home to go to he remained in hospital.

Follow-up: Two months after the termination of treatment he was still well mentally but subject to occasioned bouts of vomiting. He deteriorated rapidly and died three months later.
