epigastric incision, inserted two fingers under the diaphragm, and palpated the heart, which was flaccid. After massage for a few seconds heart beats began to return, and a short period of artificial ventilation with oxygen induced the child to breathe normally. Anaesthesia with 50% cyclopropane and oxygen was maintained for about 15 minutes for closure of the abdominal wound. A month later general anaesthesia was again induced and the meningocele removed; nothing untoward occurred.

Case 8: Cardiac and respiratory arrest during bronchoscopy; cardiac massage; recovery.—A man aged 30 had a right lower and middle lobectomy, with segmental resection of the right upper lobe, for bronchiectasis on February 15, 1950. He developed a collapse of the remains of his right upper lobe. On March 2 it was intended to carry out a bronchoscopic aspiration of his right upper lobe and to crush his right phrenic nerve. Premedication was by $\frac{1}{4}$ gr. (16 mg.) of morphine and 1/100 gr. (0.65 mg.) of atropine. Induction was with tubocurarine and 0.7 g. of sodium thiopentone. Respiratory arrest occurred during the bronchoscopy. The theatre lights were switched on to reveal the characteristic cyanosis fading to pallor to which we have already drawn attention. The bronchoscope was removed and artificial ventilation of the lungs carried out, using a facepiece. There being no improvement in the patient's colour, a midline epigastric incision was made; the heart was found to be flaccid, and massage was carried out through an incision in the diaphragm. In about one minute the heart began to contract, but the circulation of the head and neck, as judged by persistent extreme dilatation of the pupils and cyanosis of the ears, was in abeyance for some five minutes. The pulse and colour, however, returned to normal within ten minutes. Spontaneous respiration did not return for three hours, but part of this delay was felt to be due to overventilation. About half an hour after the heart began to beat intermittent rhythmical movements were noticed in the tongue and lips. Rigidity of the arms soon appeared, and persisted. The temperature was now subnormal.

Eight hours later the patient was still unconscious, with laboured respiration and signs of pulmonary oedema; his temperature had risen to 99.4° F. (37.4° C.). Twelve and a half hours after cardiac arrest he was becoming restless and at 18 hours consciousness was returning. At 24 hours he was drowsy but could be roused to answer questions. By the third day he was sitting up in bed fairly well orientated though somewhat argumentative and easily confused. His chest symptoms were much improved and he began to get up. At the eighth day he was slightly euphoric, with a loss of memory from thirteen days before to four days after the cardiac arrest, though islets of memory persisted up to the time of the accident. Sixteen months later he was still euphoric, but was taking a full-time clerical course. He reported having great trouble in learning shorthand, and is probably going to show some slight permanent intellectual impairment, but not enough to prevent him earning his living.

Summary

The causes of cardiac arrest during anaesthesia are considered. It is pointed out that treatment must be according to the cause, and that only a proportion of cases require cardiac massage.

Details are given of a routine which has proved effective in three successive cases. The essential feature of this routine is that once cardiac arrest has occurred the resuscitatory measures are controlled not by the surgeon but by the anaesthetist.

Our thanks are due to Professor John Morley for permission to record Cases 2 and 3, which were admitted to the Manchester Royal Infirmary under his care and operated upon by one of us; to Mr. A. Graham Bryce for permission to record Case 7; and to Mr. F. Nicholson for Case 4.

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ELECTRIC CONVULSION THERAPY IN TREATMENT OF PROLONGED STUPOR

BY

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States of stupor of many years' duration and complete amnesia for prolonged periods are usually said to be hysterical in origin. A case, therefore, that presents these features with little evidence of hysterical aetiology is worthy of discussion, especially as such states are rather rare.

Case Report

A machine-hand aged 52 was admitted to Whittingham Hospital on August 4, 1950, on a summary reception order. On admission he was in a stuporous state, being content to lie in bed, taking no apparent interest in his surroundings, and making no response when spoken to. He showed no initiative, apart from eating his meals when they were placed in front of him and using the toilet when he was taken there. He appeared to be vaguely depressed, and his facial expression was one of slight apprehension. There was no impulsiveness or evidence of behaviour in response to delusions or hallucinations. Such movements as he made were well co-ordinated and purposive.

Physically, no abnormalities were noted apart from a right eye which was fixed in a position of lateral deviation and with a deformed pupil which did not respond to light or show the menace reflex. It was assumed to be blind. The blood W.R., C.S.F., chest x-ray film, and E.E.G. were all within normal limits.

On becoming an ambulant patient his behaviour did not alter. He sat in the ward and showed no initiative or attempt to contact his environment. Once again he ate his meals when they were placed in front of him and used the toilet when he was taken there. The general impression he gave was of a quiet well-trained domestic animal that had lost its usual drives. On casual inspection he seemed to be totally blind and deaf, though it was realized that the deviated and blind right eye made his facial expression more vacant than it might otherwise have been.

History

His wife stated that he was quite well until March, 1946, when, with his son, he attended a football match, at which, owing to a number of circumstances, the crowd became unmanageable. He was separated from his son, swept along helplessly, and sustained a traumatic "hydrocele" by being pressed against a barrier. He arrived home before he was expected, looking pale and ill. He seemed upset, and went to his room, where his wife could hear him pacing backwards and forwards. The son returned after the match, no worse for his experience. Later they learned that there had been several fatal casualties amongst the crowd.

He recovered sufficiently to go out that night, but he soon returned. The family doctor called the following day, told the patient that he must have an operation and on no account return to work. Accordingly he remained at home waiting for a hospital bed. He showed no evidence of mental abnormality at this time.

In October, 1946, he was admitted to a general hospital for his operation. This was quite uneventful, and he appeared to be satisfied and happy at the result. Visiting four days later, his wife was surprised to see the patient depressed, weeping, saying that he was a burden to everyone, that he was "finished" and not fit to live. Later the same day he cut his wrists deeply with a razor in an attempt at suicide. He was certified and admitted to a mental hospital

on the grounds that he was very depressed and agitated, with marked hypochondriacal delusions and delusions of unworthiness. He was, he said, quite worthless, unconsciously harming everyone with whom he came in contact, his troubles being all due to venereal disease. He did not wish to go on living.

After his admission the mental picture changed slowly and he showed increasing evidence of psychomotor retardation. About six weeks later he became completely stuporous and showed concomitant physical deterioration. This became so pronounced that it was considered impossible to give him electric convulsion therapy. He remained in this stupor for about two years, requiring every nursing care and attention.

In the latter part of 1948 a gradual change was noticed in that he was beginning to show more interest in his meals and excretory habits. Apart from this there was no other manifestation of any attempt to respond to his environment. In June, 1949, still in this state, he was discharged home to the care of his wife, under Section 72 of the Lunacy Act.

His wife stated that his physical health improved considerably after he left hospital; otherwise there was no change. He seemed to regard her as someone different from the rest of the family; but took no interest in anything, never spoke, and did not respond to the spoken or written word. If he were led upstairs and his jacket was taken off he would continue to undress himself and eventually get into bed. He used the toilet when led there and ate his food when it was placed in front of him. Eventually, as his wife was uneasy at leaving him alone in the house, he was again certified and admitted to Whittingham Hospital.

Treatment

As the patient had been in a stuporous state for four years and had not been heard to speak for that time, it was decided, partly on the grounds of a necessary expediency, that electric convulsion therapy offered the best and quickest chance of recovery. After a preliminary period of observation and after all attempts to communicate with the patient had failed, treatment was started on August 11, 1950.

The first convulsion showed no special features, the post-ictal phase being quiet. Afterwards there was no change in the patient's general behaviour. He was visited by his wife next day, but she did not notice any improvement. He did not appear to recognize her, nor did he attempt to speak.

The second convulsion, on August 15, was in itself without incident, but afterwards the general behaviour of the patient changed. He was more active, moved about the ward spontaneously, and gave the impression of trying to speak.

The third convulsion, on August 19, showed a restless post-ictal phase. Eventually the patient sat up in the bed, looked around the room, and seemed extremely bewildered. As on the previous occasions, he was asked his name, and this time he answered, giving it correctly. The suggestion was then made that he could speak normally and would continue to do so. The following conversation then took place:

"You can speak quite well now, can't you?" "Yes."

"Where do you come from?" "B. . . ."

"Where are you now?" No answer.

"What is your name?" No answer.

So he lapsed into silence, but remained extremely apprehensive and bewildered in appearance. Throughout the rest of the day he was very restless, approached patients and staff as though he were going to speak to them, then wandered off again without having said anything.

The following day he was visited by his wife. To her delight and surprise, after an initial outburst of sobbing, he spoke to her, asking her how he came to be where he was and inquiring about his family. On his return to the ward he continued to speak and, indeed, apart from the fact that his speech was slow and stilted, he appeared quite normal. His affective response was adequate and appropriate. He expressed great bewilderment at his situation,

as he claimed to have complete amnesia for everything after the football match, four and a half years previously; and his memories of this match were very vague.

On August 22 an attempt was made to hypnotize him. Some relaxation resulted, but the hypnotic state was not induced. He was questioned about the football match, and with strong persuasion and some suggestion his story of the events at the match was obtained, to the accompaniment of considerable emotional release. This was most noticeable when his separation from his son was discussed. The session was terminated with the suggestion that he would be able to remember things more clearly and that his speech, which was still rather stilted, would steadily improve.

The next day a further attempt to recover memories of the previous four years was made, using ether. This was singularly unsuccessful in its object, the only result being a prolonged and violent outburst of weeping. After recovering from this his speech showed a great improvement, losing its stilted hesitant characteristics. Further attempts to hypnotize the patient were made without success, but rather vague memories of the period after the football match were recovered.

Finally, on August 28, narcoanalysis, using intravenous thiopentone, was tried. Strong suggestion and an attempt to recover memories of the most recent happenings, such as admission to Whittingham, met with no success at all. Attempts to stimulate associations were made, with the patient still in a confused state, by taking him to the admission ward. He admitted that he felt that he had seen the bed-tables somewhere before, but he would not admit to any clear memory of the place. His feeling about the bed-tables appeared to be little more to him than a *déjà vu* phenomenon. Narcoanalysis was repeated without further progress.

Despite his complete inability to recall events of the previous four years the patient now seemed quite well. His speech and conversation were normal for a man of his social standing; indeed, he gave the impression of being rather better educated than one might have expected. He expressed what appeared to be genuine concern over the trouble that he must have been to everyone, and he was anxious to return home and pick up the threads of his old life as soon as possible. For this reason and others, he was discharged recovered on September 14, 1950. He was well at the time of writing, one year later.

Patient's Story

He describes going to the football match with his son, being trapped in the crowd, separated from his son, and pressed against a barrier. He felt a severe pain in the groin. He thinks he must have fainted and been passed over the heads of the crowd, for the next thing he remembers is sitting on the ground at the back of the stands. He made his way home, feeling weak and ill. He remembers pacing about his bedroom, looking at himself in the mirror, thinking he was badly hurt, and feeling as though he had been in a "cyclone or a herd of elephants." He felt relieved when his son returned, doubly so when he learned later that there had been many fatal casualties in the crowd. The same night he felt well enough to go out to the "local," probably to discuss the disaster.

From this point onwards his story becomes vague. He describes being worried about the impending operation, of a constant pain in his groin and over the back of his head, an anxiety about being unable to work, but little else. Time relations are extremely hazy.

The next thing he describes is four and a half years later, the physician's face looking at him and his voice saying that he was now quite well and could speak perfectly. In the patient's words: "My thoughts became muddled. It was like a nightmare. I knew I could speak, but didn't know where I was. My head felt queer. I could see people whom I'd never seen before. I wanted to ask questions, but didn't know whether I was dreaming or not. Then I realized that the pain in my head and groin had gone and that I felt

really well. It wasn't till my wife came the next day that I realized that I really was alive and that everything was all right. My family all grown up! Strange!"

He admits that he did not feel so surprised as he should have done at seeing his family changed so much, and describes the same vague feeling of familiarity in connexion with this as with the admission ward.

Past History

There is no known family history of psychosis or psycho-neurosis. The patient was the eldest of the family, having seven siblings. His father was a collier, and, although financial circumstances were always strained, his life was happy enough and there was no undue friction in the home. At the age of 11 he was delivering newspapers after school. At 13 he left school to work in a foundry, but after accidentally losing the sight of his right eye he went to work in a coal-mine. He found this too heavy for him and had a succession of jobs till he was 21. He then found employment as a stone polisher and remained at this work until 1945. Then, becoming a driller in the engineering industry, he at last felt that he was earning a relatively good wage, though not very fond of the work.

He married at the age of 25 and has four children. His married life has been happy. He appears to be genuinely fond of his wife and family, and his wife stated independently that he could "never do too much for them."

He had a good baritone voice and used it to help improve the family finances by singing in public houses, which activity he disliked intensely. He was sociable, had numerous acquaintances, and enjoyed attending football and cricket matches. Fishing was another of his activities, but his favourite sport was "knocking a golf ball round a field." He read a good deal, preferring biographies to novels. He admitted being vaguely dissatisfied with his achievements, and felt that he could have done better if he had had a better education, though he did not appear to be bitter about it.

His medical history showed no evidence of previous psychotic or psychoneurotic manifestations. His wife described him as always being even-tempered and happy, never unduly depressed or otherwise. Apart from the accidental loss of the sight of the right eye and a minor operation on the left leg for a "neuroma," both many years previously, there is no noteworthy event in his medical history.

Discussion

This case presents three outstanding features: a prolonged stupor reaction; dramatic recovery from this, following electric convulsion therapy; and a residual complete inability to recall the period of the stupor and a short preceding period. It is often not possible to fit any psychiatric reaction into a watertight diagnostic compartment, and this case certainly shows evidence of mixed elements.

It would be tempting to describe the whole episode as a hysterical reaction. Hysterical stupor is dismissed in the general textbooks with brief references. All these agree that it may be of many years' duration, often not very deep, and the patient will allow himself to be fed and will move about in bed (Tredgold, 1945; Price, 1948); or it may not be described at all (Henderson and Gillespie, 1950). Hoch (1921) compares hysterical stupor with true ("benign") stupor, stating: "There is usually little difficulty in the discrimination of hysterical stupor. Occasionally it shows, superficially, a similarity to the manic-depressive type. Fundamentally there is wide divergence between the two processes in that in the hysterical form a dissociation of consciousness takes place, the patient living in an artificially suggested environment, while in a true stupor there is a withdrawal of interest as a whole and a consequent diffuse reduction of all mental processes."

If the episode were hysterical one would have expected some manifestation of this tendency to show itself before the age of 48 in a hysterical personality. The patient,

however, seems to have been a stable conscientious person who did not shirk his responsibilities, even indulging in a disliked activity—singing in public houses—to help his family. This perhaps could be classed as a histrionic type of activity, as could "knocking a golf ball round a field"; but one can find no other hysterical trends in the previous history of the patient. It should be realized that his life is fairly typical of a broad cross-section of the Lancashire working population of the area in which he lives.

The onset of the illness seems to be typically that of involuntional melancholia. Physical trauma in the genital region, prolonged idleness awaiting operation, with inability to support his family, and self-reproach at exposing his son to the danger at the football match may have combined to precipitate this, which presented as a mixture of agitation and retardation, marked delusions of unworthiness, hypochondriacal preoccupations, and a suicidal tendency (Sargant and Slater, 1948). There would certainly not appear to have been any of the emotional self-pity associated with the hysterical types of depressive reactions (Parfitt and Gall, 1944).

The deep stupor which followed was preceded by a period in which the retardation became the most predominant element. This stupor, with its concomitant physical deterioration, seems fairly typical of depressive stupor. It was followed, after it had lasted for two years, by a stage in which apathy appeared to take the place of the depression, though the patient always seemed to show some evidence of the latter affective state. Hoch, of course, described a type of "benign stupor" in which the predominating symptom was apathy, and separated this from the stupor of the manic-depressive reaction. This separation is not generally accepted, and certainly the case described shows features of both types.

The response to electric convulsion therapy tended to follow the general pattern of response of the psychotic, in that three convulsions were needed for complete recovery. Akinetic states are among those which respond well to electric convulsion therapy (Fernandes and Polonio, 1946), and the general pattern of response is gradual in all psychotic states, except epileptic psychomotor automatisms (Caplan, 1946). To some extent the patient showed this gradual response, as there was some change in his behaviour after the second convulsion and a dramatic change after the third; but it was only after the visit of his wife that recovery became apparent. The response immediately after the third convulsion, in which the patient gave his name, then lapsed into silence, would be expected when the pattern of recovery from the electrically induced convulsion is considered (Hemphill and Grey Walter, 1941). As soon as the patient's awareness extended to his environment, its understandingly bewildering impact would be enough to produce the state of perplexity which he describes.

However inaccessible a patient may be while in a state of depressive stupor, he is usually able afterwards to describe his mental content during the stupor. When amnesia occurs the stupor is more likely to be hysterical, especially when the amnesia is complete and involves a period of several years, as in the present case. It will be remembered, moreover, that the patient was unable to recall the greater part of the period when he was waiting for his operation, a time when he appeared mentally normal to his relatives. This amnesia would appear to have been hysterical until one remembers that it was completely resistive to measures to which hysterical amnesia would be expected to respond—persuasion, suggestion, and the use of intravenous barbiturates and ether. It seems more likely that the amnesia was defensive in type (Parfitt and Gall, 1944). Inability to remember, usually isolated events, is the keystone of much psychopathology, and it is not inconceivable that the patient, during his period of stupor and before, was living a life of fantasy, intolerable to him after recovery. The fascinating hypothesis that during the period of stupor there was almost complete lack of registration receives a little support from the feeling of vague familiarity that the patient expressed

at being shown the admission ward after his recovery and also from his expressed lack of surprise at seeing his family grown up after four years. This hypothesis would almost demand an organic cortical inhibition, as the stupor remained so stable for such a long period and completely resisted superficial attempts to break it down. In this connexion, it would have been helpful to be able to relate the anaesthetic given the patient at the time of his operation to the beginning of the psychosis, but there was a period of four days after the operation in which the patient appeared normal.

Finally, where was the gain, real or imagined, that the classical hysterical breakdown demands? There was certainly no real gain, and there seemed to be no intolerable situation to escape from, except, possibly, the delusional wickedness of the patient's own creation.

Conclusion

The lack of opportunity to try less dramatic methods of treatment before electric convulsion therapy precludes any definite conclusions, but the weight of the evidence supports the hypothesis that this reaction was depressive in type.

While bearing in mind the undesirability of trying to classify psychiatric material too closely, the aetiology of a state that seemed to have become stabilized, and the possible further duration of this state without treatment, become fascinating problems. It seems sufficient to show that the reaction was not hysterical and to leave the subject with the tentative suggestion that a generalized psychic inhibition with a reversible organic basis seems indicated. The "protective" cortical inhibition described by Pavlov (Sargant, 1951), protective in this case from the intolerable delusional ideas of the patient, might well be the aetiological basis of this prolonged stupor, and would certainly account for the prolonged amnesia, the stable state of stupor, and its relatively rapid and complete response to electric convulsion therapy.

Summary

A case of stupor of over four years' duration is described, with its rapid and complete recovery—apart from a complete amnesia for the period of the stupor and a short preceding period—following electric convulsion therapy.

The case is discussed, and it is suggested that its aetiology may be similar to that of the generalized "protective" cortical inhibition described by Pavlov.

My thanks are due to Dr. A. R. Grant, medical superintendent of Whittingham Hospital, for permission to publish the case material, and to Dr. C. S. Parker, consultant psychiatrist, for the report on the electroencephalogram.

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A pamphlet just issued by H.M. Stationery Office deals with education during National Service. The War Office offers considerable facilities for Servicemen wishing to prepare themselves for civilian occupations during their off-duty time. As well as correspondence courses and the possibility of attending evening classes at polytechnics and the like, there are special higher education centres at Aldershot and Catterick in this country, and abroad in Germany and the Middle East and Far East. Biology and chemistry are among the two dozen subjects offered at these centres.

CORTISONE AND TUMOUR GROWTH

BY

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AND

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Green (1950) postulated, on the basis of the inhibitory action of A.C.T.H. and cortisone on epidermal mitosis (Green and Savigear, 1951; Green and Ghadially, 1951), a hypothesis of their mode of action in rheumatoid arthritis and other hypersensitive states. This was that antibody formation was retarded, not by some direct chemical antagonism, but because the very-short-lived antibody-forming mesenchymal cells were not being replaced. The well-known involution of lymphoid tissue, for instance, became from this standpoint not a "degenerative" but an aplastic process.

We have not yet seen in immunological studies with cortisone any evidence which would exclude this hypothesis, and we now have some further evidence in its favour in transplantable cancer studies. It was shown (Green, 1951) that the shock state (and therefore, presumably, cortisone-like steroids) did not affect transplanted sarcoma growth, and (Green and Savigear, 1951) that mitosis in the precancerous epidermal cell, unlike the normal cell, was not strongly inhibited by shock or by cortisone treatment.

With these facts in mind it seemed possible that cortisone might in fact facilitate rather than retard transplanted tumour growth by diminishing antibody formation. This was shown to be so quite convincingly. Strong depression of homologous immunity, in this case to rat sarcoma iso-antigens, was readily achieved. About 40% of sarcomata (Rb/1) growing in a strain of Wistar rats different from its normal host strain regress completely at some stage. In five out of eight of such rats following systemic treatment with cortisone acetate (20 mg. subcutaneously daily for four days) vigorous growth was resumed. The responsive tumours weighed at the time of treatment from 5 to 20 g. (roughly estimated) and had been regressing strongly for from 7 to 14 days. Renewed growth was always obvious seven days after beginning treatment, and continued until the rat was killed by the tumour. This chemically induced sarcoma has never behaved spontaneously in this way during many years of transplantation. The three failing to respond were all small hard nodules (not more than 1 by 0.5 cm.), and as they continued to be rapidly absorbed it is likely that they did not now contain viable sarcoma cells.

Rat-to-Mouse Transplantation

Depression of heterologous immunity in two strains of mice was then attempted. Two of six mice developed microscopic invasive growths when given rat sarcoma (Rb/3) mince mixed with 0.04 ml. (1 mg.) of cortisone suspension followed by systemic treatment with cortisone acetate (0.5–1.5 mg. subcutaneously for 7–10 days). In the remaining four mice, as in the six controls, the inoculated cells did not survive, let alone grow. A further group of four CBA mice, similarly treated except that cortisone was not added to the tumour mince, showed no survival of the implant.

However, when the technique was altered so as to include pretreatment with cortisone a conclusive result was obtained. Cortisone was injected (1 mg. subcutaneously daily for four days) before the implantation (both subcutaneous and intra-peritoneal) of 0.05 ml. of tumour mince mixed with 0.04 ml.