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## PSYCHICAL SEIZURES\*

BY

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The statement has been made that in certain types of abnormal behaviour the patients were experiencing "psychomotor seizures," as though the epileptic discharge were capable of creating and elaborating abnormal thought processes. From the point of view of a psychiatrist it is important to know whether this may be true. Is abnormal behaviour ever a manifestation of a continuing epileptic state? Description of the psychical manifestations of certain types of local seizures and of the abnormal post-ictal states that sometimes follow may throw some light on the answer to this question.

Ictus epilepticus, or an epileptic seizure, is a state produced by intense spontaneous neuronal activity. This activity has a tendency to spread throughout the grey matter of the brain with unbridled augmentation. For the duration of the seizure, until exhaustion sets in, ganglion cells seem to be capable of abnormally great functional discharge. Furthermore, a group of cells discharging at this high rate may produce a similar state in adjacent or in connected groups. Thus, a focal epileptic discharge may spread across grey matter like a prairie fire, or it may follow more distant neuronal pathways to other areas of grey matter.

The presence of a focus of increased ganglionic activity may be detected by electro-encephalography between attacks. The increase and the spread associated with each attack are also easily recorded electrographically, and the neuronal exhaustion that follows is indicated by electrical silence. Thus the suggestion of Hughlings Jackson that seizures begin locally receives further verification. The word *ictus* means seizure; and we may study by electrical methods the inter-ictal state of the focus, the ictal exaltation of metabolic activity, and the post-ictal state of fatigue (Jasper and Penfield, 1943).

The clinical type of seizure depends upon the location of the initial discharge, and the attack should be classified accordingly. For example, twitching of the right thumb signifies discharge in the grey matter of the precentral gyrus where the thumb has its representation for movement. When an epileptic sees moving lights it indicates a discharge in the visual cortex of one occipital lobe. Simple lapse of consciousness without other manifestation may mean discharge in the highest level of functional integration. Any local discharge may spread farther and the seizure become more elaborate, and it may end as a generalized convulsion (*grand mal*). Such major seizures are apt to look very much alike from case to case if seen in the terminal stage. But the important problem is, Where was the original discharge? That question may be answered by

describing the beginning of the attack or the character of the minor seizure. Do not believe, until proved, the statement that a certain patient's attacks begin in various ways, for it is almost never true. Different stages may be observed or remembered. A sensory aura is not a phenomenon essentially different from a seizure. It is a minor seizure if it goes no further. If it is a prelude it indicates the firing of the fuse that is about to explode a succession of nerve-cell groups.

For the purposes of this discussion it is important to emphasize that during local epileptic discharge, as well as in the subsequent period of fatigue, the involved area is paralysed so far as any useful function is concerned. The thumb which is forced into Jacksonian movement cannot be controlled by the patient unless he holds it with his other hand, which still responds normally to activity of the opposite hemisphere. During a visual seizure the patient sees only the lights that blot out vision. He is blind to all else. The *petit-mal* attack, or highest level seizure, "blacks out" consciousness for its duration.

Ictus epilepticus may thus produce amazingly selective paralysis. It was the realization of this fact that placed in the hands of Hughlings Jackson a master key which he used to unlock many an anatomical and physiological problem. The ictal paralysis and the post-ictal paralysis may be equally complete. The thumb is paralysed, the eye is blind, or the patient is unconscious for a little time after the explosion is over as well as during the seizure. This is the negative side of a seizure. It is often overlooked in our thinking, and many seizures actually manifest themselves only by the silence caused by this negative state. This is true in general of the complicated functions of speech and thinking. Discharge in one frontal pole produces silence and loss of consciousness. Discharge in Broca's area of the dominant hemisphere produces not speech but cessation of speaking.

Under the heading of motor or sensory seizures the following may be listed: Jacksonian motor, somato-sensory, contraversive without loss of consciousness, masticatory, auditory, vertiginous, visual, olfactory, autonomic. All of these are either sensory or motor, at least at the outset, and sometimes they may be mixed. Two types of seizure may be mentioned which are not strictly sensory, motor, or psychical: unconscious contraversive and illusion of perception.

The unconscious contraversive seizure results from discharge in one frontal pole. It begins with silence—that is, with loss of all consciousness—and it is followed by turning to the opposite side. Illusion of perception results commonly from discharge in the cortex of one temporal lobe. During a seizure of this sort the patient is still aware of his surroundings, but the interpretation of his present experience is altered. The illusion may be that things seen seem to go farther away or

\* Extracts from an address, delivered May 17, 1946, at Boston, and June 14, 1946, at Oxford. The complete paper will be published with other addresses in book form to commemorate the opening of the MacLean Hospital Laboratories, Boston, Massachusetts.

to come nearer to him; or that sounds seem more distant or louder. A present experience may seem to be remembered and thus appear strangely familiar; his environment may seem suddenly strange, or the patient himself seem remote as though he were an onlooker. Such an experience arising from discharge in one or other temporal-lobe cortex suggests that there are in that region localized neuronal connexion patterns that are utilized in the interpretation of visual and auditory experience. This is one form of what was once called an intellectual aura. Hughlings Jackson referred to it as a dreamy state. But included in the dreamy states of Jackson are also the hallucinations which I have for convenience of discussion included with the psychical manifestations of seizures.

### Psychical Phenomena

These attacks may end as generalized convulsions and thus may be said to become motor, but in the outset they are purely psychical phenomena.

**Hallucinations.**—Elaborate hallucinations, like dreams, constitute a moderately common manifestation of a seizure. The localization of ictal hallucinations is in the cortex of one temporal lobe. The experience may be entirely visual, such as a scene from the distant past. There is usually some doubling of consciousness so that the patient recognizes the significance and the unreality of the state. It may be a vivid past experience, such as that of a woman who saw herself giving birth to her child. It may repeat the formula of a familiar childhood dream, but usually it is a simple experience with no psychological significance and the elements are chiefly visual and auditory. Music as a hallucination may be a simple air or it may be a symphony. It seems to arise at the anterior pole of one temporal lobe.

A few examples may be given.

W. D. experienced an epigastric sensation which rose up to his head at the beginning of an attack. Then he heard words, usually those he had heard recently; and yet if he was at the time in conversation or listening to a lecture they were not the words of the speaker. He never thought that someone was talking to him, and he had never been fooled into believing that the radio had been turned on. He might experience the odour of iodoform at such times—suggesting spread of discharge into the uncinata gyrus.

P. R. seemed to hear the music of a symphony for a few seconds, or she would hear voices and might ask her friends to talk more loudly so that she could understand them in spite of these spurious voices. This might be followed by a feeling of warmth in the right ankle and up the right side, which seems to have been a vaso-motor phenomenon. Her focus was deep in the left temporal region.

H. P. could remember an aura that referred to her childhood. She seemed to be in a park, and saw a boy there and once a girl. She thought the circumstances were always the same and always familiar. Sometimes the figure or scene came very near her, and then she felt sick in her throat. She had a superficial focus in the right temporal lobe. During an operation under local anaesthesia the right hemisphere of the 14-year-old girl was exposed. Some results of electrical stimulation of the temporal cortex were as follows: at one point stimulation caused her to say that she felt as though she might have an attack. When asked what she meant, she said, "That dream, but it passed over." When another point was stimulated she said, "I am seeing somebody." A short interval was allowed and then the point was stimulated again without warning the patient. After a pause she said, "It's coming again." When asked if she saw somebody she said, "Sure, a boy." At another point she said she felt queer; and at still another, lower down, she felt as though an attack were coming on, but it did not come. Stimulation at most of the other points produced some aspect of the dream. At 22 the electrode was kept in place for a longer period. She said, "Dream is starting. There are a lot of people—in the living-room—I think one of them is my mother."

From a psychological point of view there are many interesting aspects to such phenomena. The experience is a continuous progressive one like a dream. It does not happen all at once. In some cases different stages in the dream can be produced by stimulation at different points, and these points remain constant for that particular feature. It is sufficient to point out now that an acquired neuronal connexion pattern, which is evidently related to the mechanism of memory recording, may become so strongly facilitated by the recurring passage over it of an epileptic discharge that it can be activated by electrical

stimulation at various neighbouring points. Furthermore, the patient can himself contemplate such hallucinations and describe them objectively just as he would report a memory that he might summon up.

**Forced Thinking.**—A feeling of compulsion to think or the occurrence of unusual thoughts may be a preliminary to an attack, although this is quite rare and the descriptions are nearly always meagre, as is shown by the following examples.

H. C. found that his attacks began with an alteration in his thinking. He said he felt himself forced to think about something at these times and that he knew this was a signal that an attack might be imminent. But he could not describe the alterations in his mental processes any further.

W. S. would find himself saying to himself that he "told somebody or other to do this or that." It was usually someone he knew at home, but not always the same person, and he did not seem to see the individual; but he knew a major seizure might be imminent. He stated that a succession of thoughts went through his mind.

J. J. said thoughts crowded into his mind. For example, there was a slice of bread on the table, and he felt it necessary to turn or move the bread. The thoughts did not lead him to do anything, but he knew there was a danger of an attack.

The origin of the attack in these cases has so far proved to be in the posterior part of one frontal lobe anterior to the motor cortex. Perhaps the experience is not properly called forced thinking, for it is remarkable that there are not in our series more complicated types of thought process which the patient can remember. None of the individuals regarded such thoughts as meaning anything—except a warning. Even during this alteration of thinking the subject felt himself to be an onlooker, perceived the significance of the state, and usually tried to turn his mind to something else.

**Stereotyped Behaviour.**—In a small group of patients there has occurred stereotyped behaviour during a seizure. One man, M. R., clutched his own throat as though he would choke himself and resisted with great strength any effort to stop him. He then behaved in a confused manner for hours. He had a scar and an epileptogenic focus, resulting from a depressed fracture, situated in the right frontal lobe near the midline and just anterior to the motor cortex. Electrical stimulation here reproduced the state just described (Penfield and Erickson, 1941). He had amnesia for the whole seizure.

More recently in several similar cases coated electrodes were placed in the subdural and extradural space about the frontal lobes so as to record the beginning and the spread of spontaneous seizures. Without describing these cases in detail here it may be pointed out simply that stereotyped abnormal behaviour has occurred during or just after a localized seizure involving the posterior or median part of one frontal lobe near the longitudinal fissure. It has not yet been observed in association with attacks arising in other areas. How much of the behaviour is the result of release of brain areas by local ictal or post-ictal paralysis and how much is due to discharge in some neurone pattern must remain an open question.

**Automatism.**—Automatic behaviour as a post-ictal phenomenon has been well described by Hughlings Jackson. This state is a frequent sequel to attacks arising from different areas, but it is seen most often following short attacks localized in the region of one fissure of Sylvius. Most often the seizure manifests itself only as a masticatory attack. Thus the patient smacks his lips and swallows for a time, then he is apt to walk away or move about the house in an aimless manner. Such patients are violent only if opposed. They have amnesia for the period and come to themselves rather suddenly and without a period of sleep. It is obvious that most cortical mechanisms are intact during post-ictal automatism, but the higher neural centres which are the anatomical substratum for conscious activity are paralysed.

**Ictal Automatism.**—This occurs most frequently in idiopathic or cryptogenic epilepsy. The discharge is evidently taking place in the neural substratum or consciousness just referred to, the highest level of integration. This is evidently a midline area in close anatomical relation with the frontal lobes, to judge from the electro-encephalographic and other evidence that need not be recapitulated now. The attack is commonly referred to as petit mal. The patient may carry on in an automatic manner activity which he had already intended, but he is

confused. The paralytic effect is produced by the discharge and may be continued during the post-ictal fatigue period. The automaticity may therefore be considered both ictal and post-ictal.

*Post-Status-Epilepticus Psychotic State.*—Finally, psychotic behaviour with negativism, fixed delusions, and hallucinations continuing for days and weeks occurs in rare cases. This is the sequel to a series of seizures continuing for some time. In all patients of this type that we have observed, and in which a focal discharge could be proved, the location of the focus has been in one or other frontal lobe.

For example, N. J. had a small infiltrating tumour in the left posterior frontal area. After admission she had a series of attacks originating in the left frontal region. On the sixth day she was confused, suspicious, negativistic, and said her medicine was poison. Before the attacks Dr. Jasper found multiple spikes, also slow and sharp waves originating from the area of the tumour. But during the negativistic state that followed the seizures there was an increased abnormality of cortical rhythm from the region about this focus, but only minor abnormality from posterior and contralateral regions.

This condition seems to follow a series of seizures. It follows status epilepticus. We have assumed that this is not the result of post-ictal paralysis nor of ictal discharge. Instead, it seems to be associated with an alteration in the normal function of the cortex, chiefly in one area of the brain, and is of interest because of the apparent localization of the abnormality.

### Conclusion

In general, automatism may occur during or after a seizure, and post-ictal automatism may succeed ictal automatism with little or no sign of the transition. In either case it seems to be the result of functional paralysis of a restricted area of the central nervous system, an area very high in the scale of functional re-representation. It is a negative manifestation of the attack. On the other hand both hallucinations and perceptual illusions are ictal phenomena and may sometimes be produced by temporal stimulation. These states do not greatly alter the patient's behaviour, for he recognizes them to be spurious. The state which we have called forced thinking is clearly ictal. But it, too, is recognized by the patient as something different from normal thought.

Stereotyped behaviour, like automatism, occurs during a period for which the patient has no memory. It differs from automatism in that there is some definite pattern of action which the patient adopts at such times. Our observations indicate that it is ictal inasmuch as it has occurred during a seizure, but whether the behaviour is the positive result of the discharge, or whether it is due to activity of the central nervous system released from the usual influence of the portion of the frontal lobe that seems to be chiefly involved in the seizure, is not clear.

### REFERENCES

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The Ministry of Education has issued a circular (No. 117) on homecraft as a subject of further education. It is intimated that in framing their plans local authorities should not interpret the word "homecraft" too narrowly, and a list of subjects which it may embrace is given. These include sanitation, ventilation, and water supply, maternity and child welfare, the care of children, and health education, with the treatment of common accidents and ailments. The Ministry says that it should be the aim of education authorities to make provision to cover all these subjects except in so far as the needs are met by other existing agencies such as the maternity and infant welfare service. The educational provision may take various forms such as short full-time courses or longer part-time courses on selected topics, or lectures and demonstrations, or the help given at advice centres by personal contact and simple leaflets. It is added that while this further education in homecraft is primarily directed to women it should not be considered as for women only, and lectures or short courses may well be arranged for fathers and husbands concerning the problem of bringing up children or other home duties.

## THE BLOOD GROUP Rh\*

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### PART II

#### CLINICAL APPLICATIONS IN TRANSFUSION THERAPY AND IN HAEMOLYTIC DISEASE OF THE NEWBORN

##### The Rh Factor in Blood Transfusion Therapy

As shown in the foregoing section, in each individual the Rh factor consists of two sets of three elementary antigens, and theoretically the recipient of a blood transfusion might develop antibodies against any one of the antigens which he or she lacks. Thus far five of the six possible antibodies have been identified, but while some are common others are exceedingly rare. ABO blood grouping is now so well understood and reliable grouping sera are so generally available that transfusion reactions due to errors in ABO groupings are rare. Reactions between bloods compatible on the basis of ABO groups are designated "intra-group reactions," and such intra-group incompatibility is due mainly to the Rh factor, although on rare occasions other blood group factors such as P, M, and N may be concerned.

When a Rh-negative individual receives repeated transfusions of Rh-positive blood the first transfusion is normally symptomless, and the transfused cells may survive satisfactorily in the recipient's circulation. In others the donor's cells are destroyed more quickly than usual, and the lasting benefit may not be obtained. Further transfusions of Rh-positive blood in such cases are likely to be followed by progressively more severe symptoms—chills, headache, rigors, jaundice, and, later, haemoglobinuria and anuria. These phenomena are due to iso-immunization of the Rh-negative recipient by the antigens of Rh-positive blood, and are commonly accompanied by the appearance of Rh antibodies in the serum. In most cases transfusion of Rh-positive blood must be repeated several times before iso-immunization appears; but, exceptionally, a single transfusion may initiate the process and a second transfusion be treated as incompatible (Callender and Paykoç, 1946). These workers made a careful follow-up of 100 cases. In all groups there were only two with irregular iso-agglutinins, active at 37° C., but several of the 15 Rh-negative recipients had failed to become immunized or sensitized in spite of having received as many as 30 transfusions over a period of two years. Lack of reaction in the first transfusion of Rh-positive blood to a Rh-negative recipient does not always apply to women in pregnancy or, indeed, to women who have previously borne children; this aspect of the subject is considered in detail later.

When iso-immunization of a Rh-negative recipient *cde/cde* is induced by transfusion of Rh-positive blood it is usually the elementary antigen D which is effective. The transfused blood in 70% of cases will contain the antigens CDe (type Rh<sub>1</sub>, 70%) and in 30% the antigens cDE (type Rh<sub>2</sub>, 30%), although in about one-half of the latter the R<sub>2</sub> will be associated with R<sub>1</sub> (type Rh<sub>1</sub>Rh<sub>2</sub>, =15%). The resulting antibodies have usually the specificity of anti-D (85%), but this may be accompanied by the agglutinoid or blocking anti-D, so that agglutination is not apparent in tests conducted by the standard saline dilution method. In some cases the anti-D is accompanied by anti-C, and a double agglutinin serum (anti-Rh<sub>1</sub>=87%) results. If in this case sufficient blocking anti-D develops to neutralize the agglutinating anti-D the resulting serum gives the reactions of anti-C (70%). When the transfused cells have been of type Rh<sub>2</sub> (cDE) only the D is usually effective and the elementary antigen E rarely gives rise to antibodies; when it does, a double agglutinin serum results (anti-D plus anti-E), and here, too, the development of blocking anti-D can give rise to a serum of more restricted specificity—the 30% anti-Rh" (i.e., anti-E type).

An important aspect of this question is the observation that once sensitization has been established it appears to remain

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