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CLINICAL MANIFESTATIONS OF TEMPORAL LOBE EPILEPSY AND THEIR RECOGNITION IN RELATION TO SURGICAL TREATMENT*

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> "Before leaving this part of my subject, I remark, by way of recapitulation, that he who neglects the 'dreamy state' because it is indefinite and 'merely curious' and such symptoms as chewing, etc., movements, and apparent alterations in the size and distance of external objects, because they seem trifling things, may not even surmise that his patient has the serious disease of epilepsy in a rudimentary form, until a severe fit comes to tell him so."—
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> HUGHLINGS JACKSON, 1888.

The father of clinical neurology, when he wrote these lines, implied that the symptoms related above arose within the "temporo-sphenoidal" lobe. Even to-day our knowledge of this subject is very incomplete. We know, of course, that epilepsy is not a disease of itself, but a symptom of some underlying cerebral lesion. Jackson's definition of epilepsy as "occasional, sudden, excessive, rapid, and local discharges of grey matter" still holds good. These discharges may be initiated by a wide range of lesions, some of which, such as tumours, abscesses, scars, and vascular malformations, are macroscopic and tangible, but others, such as areas of focal atrophy or gliosis, may only be detectable microscopically. The form that an epileptic attack takes depends not so much upon the pathological nature of the lesion as upon its site, and upon the violence of the neuronal discharges in the neighbourhood of the lesion and the extent of their spread to the rest of the brain.

If we can recognize in any epileptic attack that it arose in a particular region, then, no matter how severe or how complex are its manifestations, we can speak of that attack as being a focal epilepsy. Further, if the attacks should also prove disabling and refractory to medicinal treatment, we may have to consider a surgical attack upon the epileptogenic area and weigh up the prospects of success. The clue to the focal character of any attack is often afforded by an analysis of the initial clinical phenomena (the aura), but generally this has to be followed up by more complex neurological, radiological, or electrophysiological studies. And to-day with increasing experience and knowledge we are able to recognize that the majority of patients with epilepsy have attacks that are focal in origin and hence should be regarded as symptomatic rather than idiopathic.

One well-recognized group which can be taken as the prototype of the focal epilepsies are the Jacksonian motor or sensory seizures associated with lesions around the central fissure. These seizures are characterized by the sudden appearance of either an actual movement or a somatic sensation in one part of the body, generally in the face, the fingers, or the foot. In the confused and traditional terminology of epilepsy such initial phenomena are often described as an "aura," or warning. The aura, however, is not a premonition but the first manifestation of the actual "ictus" or neuronal discharge. The form of the aura depends primarily upon the site of the epileptogenic focus, lesions of the precentral region generally giving rise initially to motor phenomena, and of the post-central region to sensory phenomena.

As regards severity we may distinguish two grades of seizure, termed respectively minor and major Jacksonian attacks, each of which has several subvarieties. In the minor attacks there is no loss of consciousness, and the epileptic manifestations may remain confined for a few seconds or minutes to the part of the body where they appeared, or they may spread to a limited extent into adjacent parts of the limb or trunk. Similarly, an attack which began with motor phenomena may be followed by sensory phenomena, and vice versa, due to the epileptic discharge passing across the central fissure. In the major Jacksonian seizures the same focal phenomena occur at the onset but the epileptic discharge spreads rapidly and widely throughout the brain, quickly resulting in generalized convulsive movements and in loss of consciousness—a grand mal seizure. Then, following the period of convulsive movements there is often a period of post-ictal confusion before full consciousness is regained, and there may also be a transient paresis of the part which was affected by the convulsion (Todd's palsy).

The temporal lobe epilepsies are another group of focal epilepsies which are even more frequent and of much greater social and economic importance. According to various electroencephalographers (Bailey and Gibbs, 1951; Lennox, 1951) they probably account for between a quarter and a third of all epilepsy. These are also particularly liable to be associated with personality and even psychotic disorders (Lennox, 1951; Gastaut, 1953; Hill, 1953; Liddell, 1953). Furthermore, they are often intractable to medicinal therapy, and consequently surgical intervention may be called for. In the Guy's-Maudsley Neurosurgical Unit we are finding that these intractable cases are often benefited by excision of the affected temporal lobe (Hill, 1953; Falconer, 1953; Pampiglione, 1953). Consequently I shall describe the sort of symptoms which these patients show and indicate very briefly the lines upon which the neurological and neurosurgical investigation proceeds.

*A clinical lecture delivered at Guy's Hospital on December 21, 1953.

Anatomy and Physiology

Firstly, let us consider some general points. The temporal lobe is of course that part of each cerebral hemisphere which lies below the Sylvian fissure and which contains the descending horn of the lateral ventricle. It includes also those intriguing and highly specialized structures—the hippocampus (Ammon's horn), the amygdala (amygdaloid complex), and the uncus. Anteriorly, medially, and superiorly the lobe has well-defined boundaries, although through these it has intimate connexions with the insula and with the inferior frontal region, which lie adjacent to it, as well as more tenuous connexions with the hypothalamus. Posteriorly, however, the temporal lobe continues into the occipital lobe without any structural demarcation.

Our knowledge of the functions of the temporal lobe is still fragmentary. It is based upon observations of the effects of focal injury or disease, and of the responses elicited at operation in conscious patients by electrical stimulation, correlated with those of animal experimentation. The present state of our knowledge can be summarized as follows:

1. The superior temporal convolutions on each side contain the primary cortical centres for hearing (Heschl, 1878), while equilibratory responses can also be obtained on stimulation of this same region (Penfield and Rasmussen, 1950).

2. The uncus and part of the amygdaloid complex are concerned with olfactory and gustatory sensibility (Meyer and Allison, 1949; Penfield and Rasmussen, 1950).

3. The insula and Sylvian region generally are concerned with sensibility in the alimentary tract (Penfield and Rasmussen, 1950).

4. The hippocampus and amygdala as part of the "visceral brain" are concerned with the control of the autonomic nervous system, and are integrated with the cortical autonomic mechanisms which control behaviour (Papez, 1937; Fulton, 1951). Certainly stimulation of those structures in unanaesthetized animals produces marked behavioural changes (Kaada, Jansen, and Andersen, 1953).

5. The temporal lobe as a whole is concerned with memory mechanisms, and with judgments and assessments of current experience based on memory. Penfield (1952) has found at operation in some conscious patients that the application of the stimulating electrode to certain points over a wide extent of the temporal cortex will evoke patches of memory involving both vision and sound. Such recollections are vivid and familiar, and often relate to a connected sequence of events. They vary in complexity, from merely a sense of "something" that had "happened before" to an elaborate theme, as, for example, the recollection of a song, a piece of music, or conversation, or a scene or sequence of scenes. These experiences can be duplicated by repeated stimulation of the same point, no matter whether the patient decides to focus his attention upon it or not, and the patient feels again the same emotion as at the time of the original experience. It is, however, not certain whether these responses are the direct positive effect of stimulating neurones adjacent to the electrode or whether they arise in other neurones released from the control of the ones more directly involved by the stimulation.

The Clinical Contents of Temporal Lobe Seizures

Against this background we can consider many of the phenomena of temporal lobe epilepsy. Just as Jacksonian attacks vary in severity and complexity, so do temporal lobe seizures even in the same patient. As with Jacksonian epilepsy, the factors are: (*a*) the situation of the epileptic focus within the temporal lobe; and (*b*) the violence of the local epileptic discharge and the extent to which it spreads not only within the temporal lobe but to other regions of the brain.

The Auras of Temporal Lobe Epilepsy

These are determined primarily by the situation of the focus and the extent of the local epileptic discharge within the temporal lobe. They consist of various sensory or affective phenomena, and although to a bystander they are sometimes accompanied by motor phenomena, like chewing or other semipurposive movements, subsequently the patient usually remembers only his sensory experiences. Consequently we shall now consider these sensory auras separately from the forms which the attacks may take. These sensory and affective phenomena can be classified into four main groups, and some phenomena from each group may be experienced by any one patient.

1. Crude Hallucinatory Phenomena

These are concerned with those primary sensations which are represented within the temporal region. A very common one is an epigastric sensation which may be likened to "the stomach turning over" or some similar feeling. Sometimes the sensation may be situated instead in the lower chest or even in the umbilical and rectal regions. A common sequence, however, is for the epigastric sensation to rise up quickly to the throat, where a choking feeling ensues. The alimentary representation in the insular and Sylvian regions is presumably concerned with these auras.

Another common aura is a sudden crude sensation of smell or taste, generally of an unpleasant character. Possibly such sensations arise within the uncus and amygdala.

A third common set of auras is concerned with hearing and equilibrium. The patient suddenly experiences a roaring, rushing, or ringing noise, or has a sudden disturbance of balance, often of a vertiginous character. Probably the superior temporal convolution is involved here.

Crude visual hallucinations (as opposed to organized hallucinations) may occur with temporal lobe lesions, but are rather more frequent with occipital lesions, possibly because the primary visual association centres are in the occipital lobe.

Case 1: Epigastric and Throat Sensation with Occasional Smell and Visual Hallucinations Due to an Angioma.—A 17-year-old youth, referred by Dr. D. Hill, had for six years experienced frequent attacks in which he would suddenly sit down and stare into space in a bewildered fashion for a few minutes. In other and more severe attacks he would exhibit generalized clonic movements of all limbs. The patient said that just before losing consciousness he usually noticed a choking feeling in his throat, and that this was sometimes preceded by a turning feeling in his epigastrium. Sometimes he also saw black circles and dots dancing in front of his eyes, and on yet other occasions he had experienced a smell of burning oil. Carotid arteriography revealed a large arteriovenous malformation over the convexity of the right temporal lobe. This was excised at operation, and in the two and a half years which have elapsed since then he has had only an infrequent and mild seizure.

2. Emotional Phenomena

In a few patients a sudden change of mood such as fear, anger, bewilderment, or pleasure may signal the onset of a seizure, and may even be the only aura discernible. It is interesting that a possible comparable disturbance of mood can be evoked in experimental animals by stimulation or ablation of the hippocampus or amygdala (Kaada *et al.*, 1953).

Case 2: A Sudden Emotion as the Presenting Symptom.—A 48-year-old man, referred by Dr. Bruce Pearson, suddenly one day looked scared and distressed for a few minutes, and then regained his composure. There had been no prior disturbance. His explanation was: "I felt as if a bomb was going to drop." A similar episode occurred a day or so later. Then within a week he had developed listlessness and headache, and a month later was admitted with the typical symptoms of a malignant glioma in the left temporal lobe.

3. Hallucinatory Phenomena Based on Memory Mechanisms

Here we have what Hughlings Jackson described as the "dreamy state." In its simplest form the patient may experience a sudden feeling of familiarity with his

surroundings, or, conversely, of sudden unreality or strangeness. In his reverie he may have perceptual illusions, so that surrounding objects seem small and receding (micropsia) or unduly large and near (macropsia). Sounds similarly may appear unduly loud or unduly remote.

In a more elaborate dreamy state the patient may suddenly feel that he is taking part in or witnessing a scene in which he has taken part before—*déjà vu* phenomena. In another variant his hallucinatory experiences at the time appear to be rich, vivid, and complex, but somehow he cannot quite recall them afterwards. In yet another variant some sudden idea, thought, or word which has associations from the past may act as the trigger. Presumably some cases of so-called reflex epilepsy are examples of temporal lobe epilepsy.

Case 3: Instance of Reflex Epilepsy Associated with a Focal Lobe Atrophy.—A man aged 38, referred by Drs. R. W. Tibbetts and D. Hill, had since boyhood been subject to frequent amnesic epileptic attacks which were usually induced by the sight, either accidental or deliberate, of a safety-pin. This article had apparently become a symbol around which the patient had centred much conscious and subconscious psychosexual fantasy, and these attacks had replaced his normal sexual outlets. Neurological and radiological investigations did not show any abnormality, but the E.E.G. disclosed a spike-discharging focus in the left anterior temporal region. A left temporal lobectomy, including the uncus and hippocampus, was performed, and in the nine months which have elapsed since then the patient has been free of seizures for the first time in his life, and has been leading a normal heterosexual life. Definite focal atrophic changes have been found microscopically in the resected specimen. This case will be published in full later.

In the most elaborate dreamy states the patient experiences some panoramic memory of the past. Associated with this memory he relives the same emotions as presumably afflicted him on the original occasion. Kinnier Wilson (1928) has remarked that similar panoramic memory is experienced by some victims of drowning during the period when they are submerged. It is therefore not peculiar to epilepsy. Hughlings Jackson and Kinnier Wilson both felt that these memories were a release phenomenon resulting from paralysis of higher centres by the ictus, and the same explanation may possibly account for the similar panoramic memories which, as remarked earlier, Penfield (1952) has produced by electrical stimulation of the brain.

Case 4: Panoramic Memory Associated with Sclerosis of the Hippocampus.—A 49-year-old man, referred by Dr. D. L. Davies, had 10 years before, while serving in the R.A.F., witnessed an aeroplane crash and catch fire. He ran forward to help rescue the pilot and co-pilot, but was ordered back because of the risk of exploding bombs. Within a year he began to have frequent epileptic attacks, which usually began with a sudden vision of the cockpit of a burning plane. He could see two figures struggling inside it. Simultaneously he had a peculiar feeling in his epigastrium and at times he also experienced a pungent smell of burning. Next moment he would lose consciousness, in some attacks exhibiting swallowing movement with semipurposive movements of the limbs, and in other attacks exhibiting grand mal convulsions. Between attacks, whenever he talked about air crashes, or he heard them mentioned, he became emotional, and occasionally attacks had actually been induced by this sort of talk. The E.E.G. showed a spike discharge in the left anterior temporal region. A left anterior temporal lobectomy, including the uncus and hippocampus, was performed, the hippocampus showing macroscopic sclerosis. In the year that has elapsed since then he has been free of attacks (except for one very minor seizure), and he can now discuss aircraft crashes rationally and without any particular emotion.

4. Auras Arising from Adjacent Regions of the Brain

Sometimes, before he loses consciousness, a patient with a lesion of the temporal lobe will exhibit symptoms which indicate that the epileptic discharging process has already spread into adjacent regions of the brain. For instance, it is not uncommon for a patient to show either twitching movements or a numbness of one side of the face or body suggesting involvement of the sensorimotor areas above the Sylvian fissure (cf. Case 5). Again, when the dominant hemisphere is involved the patient may remark on aphasic difficulties occurring with the onset of the ictus. These phenomena, however, are always associated with other and more characteristic auras.

Comments

The eliciting of these auras often requires patience, tact, sympathy, and perseverance on the part of the examiner. Some relative or close friend must always be interrogated to corroborate the patient's story and to fill in the gaps. Some patients are reluctant to discuss their sensations lest they be accused of describing something which is unbelievable. If attacks continue over many years the aura may change, usually from the more elaborate to a simpler form, and the patient may forget elements of his aura and even deny that he had once described them (Hill and Mitchell, 1953). Sometimes the aura may change to a different pattern, suggesting that the attacks originate from different points around the periphery of the lesion. This is quite common with tumours, but it can occur with other large structural lesions. Occasionally following an attack a patient may not recall having experienced any aura, although at the time he may have actually complained of one, or his actions suggested that one was present. Instances of these difficulties are illustrated by the following cases.

Case 5: Changing Aura with a Tumour; Crude Hallucinatory Phenomena with Crude Somatic Sensation.—A 59-year-old woman, referred by Sir Charles Symonds, had had her first seizure seven years before, but subsequently she could not remember this, as well as five further seizures in the first year. Yet at the onset of each attack she had complained to her husband of a sudden "far-away feeling" before she went into a daze. Then one day she suddenly complained of a peculiar nasty smell which nobody else noticed, and which lasted a few minutes; there was no loss of consciousness, and subsequently no further attacks of this sort occurred. Next she started complaining of attacks which would be initiated by a sudden buzzing noise in her ears, and sometimes also by streaks of light in front of her eyes. Sometimes these sensations would last an hour, and then disappear without consciousness having been lost. On other occasions they were quickly followed by a major convulsive attack. Once, five years ago, while out walking, she must have had some mental aberration, for an hour later she found herself sitting on a grassy bank on an unaccustomed course two miles in the opposite direction to that intended. More recently, the aura of tinnitus at the beginning of her attacks was also associated with a tingling sensation in the fingers of the left hand, and with numbness and weakness of the left leg. There had never been any symptoms of raised intracranial pressure, and the neurological examination was negative. The E.E.G. and the radiological studies, however, indicated a right temporal tumour, and at operation a large meningioma growing from the tentorium into the inferior surface of the temporal lobe was removed. There have been no epileptic phenomena in the nine months which have elapsed since operation.

Case 6: Differing Auras with a Porencephaly; Elements of Déjà Vu, Dreams, Vertigo, and Visual Hallucinations.—A girl aged 14, referred by Sir Charles Symonds, had since the age of 7 been subject to attacks in which suddenly all that was happening around her seemed strangely familiar, and she felt she had seen and heard it all before. Such attacks lasted one to three minutes, and recurred several times weekly. In some of them she had the horrible feeling that someone was going to be murdered, and in a few that she herself was the victim. She did not, however, lose consciousness in these attacks. From the age of 10 onwards she also experienced a second type of attack in which she would suddenly feel herself spinning to the right, and would then lose consciousness. Occasionally in these attacks she would also see a red or orange light above and to her left side. More recently, she had had yet a third type of attack, in which she said she could not see, and appeared to be dazed for a few minutes. Neurological examination was negative, but air encephalography disclosed a small porencephalic cyst in the right inferior temporal region communicating with the temporal horn. At operation its margins were excised. In the 15 months which have elapsed since then she has had no further attacks.

Case 7: Retrograde Amnesia for Attacks Due to an Obscure Lesion.—A 48-year-old woman, referred by Dr. A. H. Douthwaite, for a year had suffered from nocturnal seizures in which she would sit up and wave her hands around in semipurposive fashion for a few minutes, not understanding or responding when spoken to. This would be followed by a period of confusion lasting an hour or more in which she would reply, but not

sensibly. Sometimes during these episodes she was incontinent of urine. Once she actually woke her husband up to warn him that a "turn" was about to begin, but next morning she could not remember this. Her only recollection of any of these attacks was that sometimes on waking in the morning she would recall having experienced a nasty smell during the night. As a tumour was suspected because of some bony thickening of one sphenoidal ridge and a slow-wave focus in the E.E.G., she was submitted to a left lateral craniotomy, even though the neurological and encephalographic studies were negative. The temporal pole and superior temporal convolution seemed congested, and electrocorticography suggested a lesion here. A left temporal lobectomy was then performed, and subsequently an unusual glial change suggestive of a small infarct was observed microscopically (Professor A. Meyer). There was no tumour. The patient subsequently has been free of fits.

Forms of Temporal Lobe Seizures

From the case histories which have been cited to illustrate the variability and diversity of the aura phenomena it can be seen that the form of the seizure subsequent to the aura also varies, presumably according to the speed and extent with which the neuronal discharge spreads from the temporal lobe to other parts of the brain. Indeed, three main grades of seizures can be recognized: (1) minor seizures without loss of consciousness; (2) amnesic attacks without convulsions; and (3) major convulsive seizures.

1. Minor Seizures

These usually consist only of a sudden and transient appearance of the sensory aura, and are the counterpart of the minor Jacksonian attack. In the simplest form of seizure the experience may be entirely subjective, and may last from one or two seconds to a few minutes without bystanders being aware of any disturbance. At other times the patient may appear pale or flushed and may seem unduly quiet, but he quickly regains his composure. In these minor seizures the epileptic discharge remains confined to the temporal lobe, or at least to one hemisphere (Hill, 1949). Occasionally an aura such as a smell sensation, an epigastric sensation, or a tinnitus (cf. Case 5) may persist or recur frequently for hours or even days without loss of consciousness occurring: there is probably an analogy here to epilepsia partialis continua.

2. Amnesic Attacks Without Convulsions

In this group of seizures there is dazing accompanied by confused or semipurposive behaviour but not by generalized convulsions. It is this type of seizure which has stimulated interest in temporal lobe epilepsy, for these seizures have no obvious counterpart in the Jacksonian epilepsies, occupying as they do a position which is an intermediate equivalent between the minor and major Jacksonian seizures. They may begin with any of the auras which have been listed, but in any particular patient the aura or auras are mostly similar to those experienced in the minor attacks. The sensory aura is quickly followed by transient dazing or even by loss of consciousness, and during this period the patient indulges in motor activities which appear to be the motor concomitants of this sensory experience. The ictus proper may last from a few seconds to a few minutes. It is then often followed by a period of confusion, which may be short, but which may persist for an hour or more; and during this period the patient may engage in activities that are purposive but inappropriate and apparently an expression of his confusion. The E.E.G. at the onset of these amnesic seizures usually shows a suppression of electrical activity over both hemispheres for a few seconds, followed by more or less symmetrical and rhythmical bilateral 6–8 c.p.s. waves which increase in amplitude but slow in rate as the seizure proceeds to give place to irregular activity during the period of confusion (Gibbs, Gibbs, and Fuster, 1948; Hill, 1949; Jasper, Pertuisset and Flanigin, 1951). Prior to the seizure the epileptic focus in the affected temporal lobe has usually been firing frequently.

Once the patient regains consciousness all that he may remember of the fit and of the confused period is the sensory experience which ushered it in. He seldom realizes that there were also motor phenomena. Sometimes he cannot recall how his attacks began, even although at the onset he may have spoken to a bystander to tell him that an attack had started (cf. Cases 5 and 7). Occasionally he may not even realize that he has had an attack, especially if the attack occurred by night. In both circumstances the sensory aura and its nature can often be inferred from the motor phenomena. Another characteristic of the temporal lobe epilepsies is that they are often sleep-sensitive: the attacks tend to occur as the patient is relaxing, dozing, or sleeping, and the existence of the attacks may be known only because a spouse or other person happened to be in the room at the right time (cf. Case 7). Indeed, it would appear that of all the epilepsies temporal epilepsy is the one most likely to be associated with nocturnal seizures.

To a bystander, therefore, it is the motor phenomena which characterize these amnesic seizures. In the simpler seizures the patient may merely appear dazed and pale, and he is usually not responsive to a verbal inquiry. This is the ictal period, and it may last a few seconds or a few minutes. During it the patient may even carry on with what he is doing, such as playing the piano or driving a car. His performance may seem without fault, or he may betray himself by ignoring the traffic lights (cf. Case 5, in which the patient walked in the wrong direction). These coordinated and purposeful movements are continued during the post-ictal confusional period. Hughlings Jackson (1875) put it more clearly when he said, ". . . if a slight fit occurs while the patient is already employed in something which is largely automatic, as, for example, playing a well-practised tune, he may go on doing that automatic thing. . . . The automatic action had, so to speak, possession of the mind, and consciousness was not concerned in it before the paroxysm occurred. Everyone has seen a person play a simple, well-learned tune when talking of something else; a transitory lack of consciousness might not interfere with his performance." A similar continuance of automatic actions can occur with others forms of focal epilepsy—for example, frontal.

In other seizures motor phenomena of a more characteristic kind are seen, and among these may be instanced chewing, sucking, or swallowing movements (masticatory phenomena), rubbing of the abdomen, grimacing, fidgeting, and other semipurposive movements of the limbs. It is common for a patient who may describe epigastric or olfactory sensations or fear emotions to exhibit masticatory phenomena during his seizure (Magnus, Penfield, and Jasper, 1952). Their precise significance has not been established, but Hughlings Jackson regarded them as the motor accompaniment of a taste hallucination. A similar chain of reasoning will connect rubbing movements of the hands across the abdomen with some abdominal sensation. Again facial grimacing may indicate a vivid dreamy state, or peering with the eyes, and groping, plucking, clutching, or other semipurposive movements of the hands be likewise regarded as an acting out of a sensory experience. Dilatation of the pupils (a unilateral dilatation or constriction of a pupil is an occasional pointer to the side of the underlying lesion), and pallor or flushing of the face may be regarded as evidence of autonomic disturbances. In the more severe amnesic seizures the patient may slump or fall to the ground and become cyanosed. Incontinence is not uncommon. The actual ictal period may last from one to five minutes, and then be followed by a period of confusion.

The motor phenomena we have just considered—namely, masticatory phenomena, grimacing, and the semi-purposive movements of the limbs—have been shown by simultaneous cinematographic and electroencephalographic recordings of fits to be ictal in time of occurrence and character (Gastaut, 1953), and thus are part of the actual fit pattern. During the period of confusion, however, the patient may set out to perform some volitional but inappropriate action to which the term post-epileptic automatism may be given. Undressing is a common example, or a patient may attempt to

shut a door, climb a fence, open a cupboard, or sing a song. A housewife preparing a meal may suddenly switch to something else, like rearranging flowers, furniture, or books. An aggressive individual, thwarted or disturbed during the fit or confusional period, may become belligerent. Tyson (1650–1708), a physician at the Bethlem Royal Hospital, called patients subject to attacks of fury "epileptick mad" (quoted by Lennox, 1951).

Case 8: Aggressive Behaviour Following Seizure Secondary to Sclerosis of Hippocampus.—A ne'er-do-well young man aged 23, referred by Dr. D. Hill, had since early childhood been subject to amnesic seizures which would begin with a sudden abdominal pain and a feeling that someone was standing behind him. He had often been arrested for fighting and for disorderly behaviour. On one well-documented occasion he had the misfortune one morning to have two fits outside the same hospital casualty department. The casualty doctor, noting that there had been no convulsive phenomena, deemed him to be shamming, and on the second occasion had him shown to the door. The patient responded by assaulting the doctor, cursing, and attracting a crowd so that the police had to intervene. In due course it was found that he had an epileptic focus in the right temporal lobe. A temporal lobectomy followed, disclosing gross sclerosis of the hippocampus. Since then he has been improved, as regards both fits and behaviour, although an occasional seizure still occurs (follow-up, one year).

3. Major Convulsive Seizures

In the most severe grade of temporal lobe seizures a generalized convulsion occurs, which, unless the initial aura has been witnessed, may be indistinguishable from grand mal attacks resulting from lesions in other parts of the brain. Such attacks may occur at any hour by day or night, but it would seem that grand mal seizures which occur during sleep are particularly likely to be of temporal lobe origin. The occurrence, in the same patient, but at different times, of amnesic seizures without convulsions and of grand mal seizures has frequently been noted in the literature and described as if the patient had had two different kinds of epilepsy. This view is fallacious, the distinction between the two types of attack being merely one of severity.

Comment

The temporal lobe epilepsies are thus a wide and varied group. The patterns, which can be discerned, depend largely on the precise part of the temporal lobe which is involved and on the severity and extent of the epileptic discharge. Some of these patterns have led to the use of a number of terms, such as psychomotor epilepsy, uncinate epilepsy, psychical epilepsy, and epilepsy with an intellectual aura. Each of these terms attempts to describe some aspect of the seizure, but none suffices to describe the group as a whole, and hence the generic term of "temporal lobe epilepsy" is preferable. A characteristic of this group of epilepsies is the variability of the patterns which may be shown by any one patient, and this is well illustrated by a classical case described long ago.

Hughlings Jackson's (1888) Case.—A medical man, while still a university student, began experiencing vivid and unexpected "recollections" or reminiscences, which lasted a minute or two but which afterwards he could not quite recollect. Some mornings he would wake up to find a little saliva on his pillow, and his tongue sore as if he had bitten it. Then three years later he had his first "haut-mal." Thereafter he continued to have frequent "petits-maux" as well as attacks of "haut-mal" at intervals of up to 18 months. During one of the minor attacks he once crossed over a Swiss glacier, and subsequently was surprised to see how he had threaded his way over the broken ice, terrain which normally would have been difficult for him. Sometimes if a minor seizure occurred during a journey he would carry on without subsequent recollection for 10–15 minutes, and then find himself still on his correct course. On other occasions, he would find himself going in the wrong direction. Once he had had an attack while examining a patient with pneumonia. On regaining his wits he found himself sitting at a writing-table in the same room speaking to another person. On inquiry he learned that he had evidently correctly diagnosed his first patient, and advised him to go to bed. The case notes he had made, however, were disjointed and difficult to decipher. This patient at no time had complained of any crude sensations of smell, taste, hearing, or sight; there was no epigastric sensation and no vertigo. Some of his colleagues, however, had observed during the attacks "a modified and indistinct smacking of tongue like a tasting movement" and "a motion of the lower jaw"; also one or two light taps on the floor with his right foot. He died at the age of 41 from an overdose of chloral, and at necropsy Hughlings Jackson and Walter Colman (1898) found a small cavity resulting from an old softening in the left uncinate region.

Associated Personality and Behaviour Disorders

A characteristic of temporal lobe epilepsy is that its victims often exhibit an associated personality disorder or even a psychosis. In this respect temporal lobe epilepsy stands in marked contrast to other forms of cortical epilepsy (Gibbs, 1951; Gastaut, 1953). Indeed, possibly a half of all patients with temporal lobe epilepsy exhibit severe personality disorders during the inter-seizure period (Gibbs, *et al.*, 1948), while from another viewpoint the majority of epileptic patients in mental hospitals show temporal epileptic foci on E.E.G. examination (Liddell, 1953). The epileptic personality can take various forms. Most patients who exhibit it display a feeling of aggressiveness and hostility—they are quick to take offence, hold grudges for long periods, and imagine other people to be conspiring against them. Against this common background some patients exhibit anxiety states, a few depressive states, and others even schizoid states. Often as the fits come under control with medication the behavioural disorder worsens—in a sense the fits and the behaviour disorder are thus antithetic. A continued psychosis is not common, although some patients will exhibit acute and transient psychotic phases in which they are actively hallucinated and very restless.

Recently two cases of fits and behaviour disorder occurring in children, which were apparently due to a peculiar calcifying lesion in the temporal lobe (hamartoma) and which were benefited by temporal lobectomy, have been reported in detail from this unit (Falconer *et al.*, 1953). The following case seems to be similarly successful.

Case 9: Temporal Lobe Epilepsy and Associated Behaviour Disorder Presumably Secondary to Sclerosis of Hippocampus.—A 13-year-old boy with a congenital nystagmus, referred by Dr. D. A. Pond, had started life with a difficult instrumental birth. From the age of 3 he had been subject to frequent seizures, which usually began with a painful sensation in the upper abdomen, followed by stiffening of the right limbs and by turning of the eyes to the left side. Shortly afterwards he also developed a severe behaviour disorder which soon led to his committal to various epileptic institutions. His temper at times was explosive, and he was difficult to control. Recently he had also exhibited sexual perversions. Examinations disclosed a boy of low average intelligence without abnormal neurological signs other than the nystagmus. The E.E.G. disclosed a constant spike focus in the left anterior temporal region, and the skull *x*-ray films showed that the left half of the cranial cavity was slightly smaller than the right, while the temporal horn of the left lateral ventricle was slightly dilated. The anterior part of the left temporal lobe, including the uncus and hippocampus, was removed, the histological findings being those of gross sclerosis of the hippocampus. In the year that has elapsed since then the boy has not had any further seizures, has been living at home, is manageable, and is now attending a modern secondary school with children of his own age—the first time in his life that he has been able to attend a school for normal children.

Discussion

The manifestations of temporal lobe epilepsy are thus complex, but protean. All the features which I have outlined are well known, but what is not commonly realized is that with few exceptions they are the signatures not of "idiopathic" epilepsy but of epilepsy of focal origin arising in the temporal lobe. No patient will show all these manifestations, but an individual patient will often show several of them. The more diligently we inquire into the history and clinical features shown by any patient, the more numerous are the manifestations we are likely to find in that patient. A patient with temporal lobe epilepsy may complain of smell and epigastric sensations, one bystander may

remark on strange chewing movements without convulsions, another may have observed the climax of an occasional grand mal seizure, while the patient's family may seem more concerned about his behavioural disorder, regarding the fits as a doubtfully related condition which, anyway, to their eyes has been "improving" because the actual fits are now less severe and less frequent than formerly. It requires an understanding observer to synthesize all these features into one connected clinical story.

I cannot survey here all the evidence which would relate these various manifestations to the temporal lobe. Some may argue that epilepsy arising in other parts of the brain may show similar characteristics. However, of all the patients with the amnesic aconvulsive type of seizure who have been operated on for various lesions in this unit during the past three years (approximately 50 patients) only one, a patient with a unilateral suprasellar meningioma, had an obvious lesion which was not directly involving the temporal lobe, and even this lesion was in close proximity to the temporal lobe. Even the E.E.G. localization is not a hard-and-fast criterion of distinction, for in several instances in which an inferior frontal focus was reported the actual lesion was yet found to be involving the temporal lobe. For those who would seek further I have indicated references to some of the more important articles in the literature.

It will be noted from the cases described that temporal lobe epilepsy can affect patients at all ages and can be caused by a great variety of lesions. Some of these lesions, such as tumours, cysts, vascular malformations, and porencephaly, can be appreciated by the naked eye, and can also often be demonstrated pre-operatively by neurological and radiological means. Others, such as areas of focal atrophy and gliosis, may be appreciated only by microscopical examination. The occurrence of epilepsy, therefore, is not determined by the nature of the lesion so much as by its site. Therefore in any patient in whom the clinical features suggest a temporal lobe origin but in whom the neurological and radiological investigations are negative, the diagnosis made should not be idiopathic epilepsy (with the feeling of hopelessness which this term engenders), but temporal lobe epilepsy secondary to some pathological change as yet undetermined.

It is not my purpose to discuss the details of pathological diagnosis and treatment in such patients. Temporal lobe epilepsy is so common and yet so often benign that it is impracticable to submit every suspect to the fullest investigation. The following broad principles, however, should give some guidance:

1. The recent appearance of temporal lobe seizures may signal the presence of a cerebral tumour. This diagnosis becomes obvious if appropriate neurological signs or features of raised intracranial pressure are present. If the suspicion of cerebral tumour arises in any particular patient, neurological investigation supplemented by appropriate radiological studies is indicated.

2. In cases in which the fits are of long standing, and there is nothing obvious in the clinical picture to suggest tumour, an attempt should be made to control the seizures by drugs. Phenobarbitone and phenytoin ("epanutin") have been our chief stand-bys, but the recently introduced drug primidone ("mysoline") has also been claimed to have beneficial properties.

3. In cases in which the fits cannot be properly controlled and are disabling, or in which there is a severe personality disorder, recourse should be made to full neurological, radiological, and E.E.G. investigations. Of the various diagnostic procedures, the E.E.G. in our experience is the one which is most likely to give a decisive answer, but this investigation may have to be repeated over a long period and under special circumstances, such as during induced sleep and with sphenoidal electrodes (Hill, 1953). In a patient with intractable epilepsy the E.E.G. demonstration of an epileptic focus which is confined to one temporal lobe, or if bilateral predominantly on one side, is in our experience an indication for operation.

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DENTAL STRUCTURE AND CARIES IN 5-YEAR-OLD CHILDREN ATTENDING L.C.C. SCHOOLS (1949 AND 1951)

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This paper describes the findings in the sixth of a series of surveys of the dental condition of 5-year-old children attending day schools under the authority of the London County Council, and makes reference to the earlier surveys begun in 1929 by one of us (M. M.). Owing to unforeseen circumstances the publication of the results has been delayed until now. Visits were paid to 26 schools, most of which had been included in the earlier studies. The total number of children examined for dental structure and caries was 1,395, each of whom had achieved his fifth but not his sixth birthday at the time of inspection.

Methods and Criteria

The examination procedure and standards used were essentially the same as those devised on the basis of earlier animal experimental work and clinical investigations and employed in all the surveys undertaken by one of us (M. M.) and her colleagues since 1923. For a detailed description of the methods and criteria see Mellanby and Coumoulos (1946).

In all the work from 1943 onwards the incidence and extent of surface structural defects, as well as caries, have been estimated and analysed for each tooth, since this detailed system gives the best guide to the condition of the teeth of any group of children. By making an assessment for every tooth examined, and, in the case of caries, by including in the assessment any tooth known or assumed to have been extracted because of disease (which, except in 1929, could only have been a very small proportion of the whole), the trend of the abnormalities from survey to survey