CLINICAL AND SOCIAL PROBLEMS OF EPILEPSY*

BY

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LECTURE II

The Causes of Epilepsy

There are two ways of looking at the problem of epilepsy in an aetiological sense. One is to regard all forms of convulsive attack as epilepsy, which then becomes simply a symptom of many general and nervous diseases; Cobb (1936) lists sixty clinical causes of fits. The other is to reserve the term for an essentially neurogenic disorder in which there is episodic disturbance of cortical function: this would include idiopathic epilepsy, and might reasonably include also symptomatic epilepsy due to primary intracranial disease. It would exclude convulsions due to general circulatory changes, to circulating toxins, or to metabolic poisons. According to this definition it would be correct to speak of cysticercosis epilepsy or traumatic epilepsy, but incorrect to speak of "cardiac epilepsy," "hypoglycaemic epilepsy," or "uraemic epilepsy." This clinical classification seems to me a useful one.

In every case in which an initial diagnosis of epilepsy has been made two further aims should be in the mind of the physician: (1) to determine the part of the brain in which the disturbance starts; (2) to decide the nature of the lesion at that point.

The Anatomical Diagnosis.—Localization of the site of the discharge is clinically precise in local epilepsy of all types and in generalized seizures with consistent focal onset. Lennox and Cobb (1933) instituted an inquiry into the aura or first stage of the fit in 1,359 patients. A similar inquiry was made by Gowers (1901) in 2,013 patients, and it is remarkable to find that the percentage reporting an aura of some kind is almost identical in the two series—namely, 56.2% and 57%. An aura occurred with equal frequency in idiopathic and symptomatic cases, but in only a minority was it of precise localizing significance. Aid in localization is also given by electro-encephalography, and Jasper (Penfield and Erickson, 1941) believes that such records have their chief value in demonstrating or confirming the focal origin of attacks.

The Pathological Diagnosis.—Determination of the site of a discharging lesion or epileptogenic focus, if this is possible, does not of itself, as Hughlings Jackson pointed out, give any information about the nature of the lesion. An initial approach to the problem of the pathological diagnosis is afforded by consideration of the types of cerebral lesion which predominate at different periods of life. Thus in infancy the chief organic cerebral causes of epilepsy are developmental brain defect and birth injury. Such injury

may result from prolonged asphyxia or from cortical laceration, and in these children there are generally other evidences besides epilepsy of diffuse or focal brain injury. It is important to remember that the development of fits originating from the neighbourhood of the injury may be delayed until later childhood or even adult life (Penfield and Erickson, 1941). Acquired cerebral lesions of childhood are often followed by epilepsy. In these, as in birth trauma, there are likely to be focal signs of brain injury, especially hemiplegia. Occurring as a complication of infections of known and unknown nature, and accompanied at the outset by convulsions, the cerebral injury is probably more often due to vascular thrombosis than to encephalitis. After childhood the major organic cerebral causes of epilepsy are head injury, cerebral tumours, and cerebral arteriosclerosis. These have their maximum incidence in early adult life, middle age, and old age respectively.

Significance of Infantile Convulsions

Assessment of the significance of convulsions in an individual child is a clinical problem involving a weighing of the evidence. The presence of signs of pre-existing brain defect or injury is unfavourable. Recurrent attacks occurring at intervals without known exciting cause are strongly suggestive of idiopathic epilepsy, which is likely to continue. Petit mal attacks have the same significance. These considerations apart, an isolated convulsion or a short series of convulsions occurring in early childhood during an acute infective illness, and unaccompanied by persisting evidence of brain damage, need not cause anxiety about the future or call for continued anticonvulsant treatment: the great majority of such children do not develop epilepsy. This is in accordance with the usual belief, but does not justify a tendency to regard infantile convulsions generally as of little moment.

Age of Onset of Idiopathic Epilepsy

A diagnosis of idiopathic epilepsy implies the exclusion so far as is possible of all organic cerebral lesions and in general a tendency to recurrence of attacks without known cause. Idiopathic epilepsy may arise at any age, but does so especially in childhood and youth. An onset in later years is usually stated to be decidedly infrequent. Most textbooks contain warnings such as the following: "It is always well to be suspicious of 'epilepsy' beginning in adult life, for in a majority of such cases the disease is not epilepsy" (Christian, 1942).

Organic disease of the brain which may cause epilepsy is commoner in later life, and therefore epilepsy in such patients is more likely to be due to progressive intracranial disease than in children or adolescents. Nevertheless I see many patients whose fits begin in adult life and continue

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without evidence of any structural basis for the attacks. In order to clarify this matter I have made an inquiry into the age of onset in my cases, and secondly into the cause of attacks in the later age groups.

Table I shows the age of onset in 991 cases. While, in accordance with general experience, the highest incidence is in the second decade, it will be noted that 12% showed the first evidence of epilepsy between the ages of 30 and 40, and 17% after the age of 40.

TABLE I.—Age of Onset of Epilepsy in 991 Cases

0-10 years	19%	31-40 years	12%
11-20 "	30%	Over 40 "	17%
21-30 "	22%		

Table II shows a comparison of this series with some previous records.

TABLE II.—Percentage of Cases of Epilepsy with Onset over Age 30

Gowers	Turner	Spratling	Starr	Kraepelin	Paskind	Present Series
9.3	9.8	7.4	12.7	12.8	19.2	29.0

It will be noted that the figures of Paskind (1932) and my own series indicate a markedly higher proportion than the others of patients in whom the first fits occurred after the age of 30. This observer's statistics and my own are comparable because we were both dealing with patients in private practice or in the purely consultative out-patient service of a general hospital. Most if not all of the other assessments were made on patients in institutions or attending special hospitals for epilepsy. These represent a more severe and deteriorated group, and in such patients the age of onset is earlier. Of Paskind's patients 93.5% were in excellent mental health and were engaged in occupations similar to those of the great mass of the population. Tylor Fox (1939) states that there are about 20,000 epileptics in various institutions in this country, and estimates that there are at least 100,000 in the community at large. The extramural group is therefore more representative of epileptic patients as a whole.

Table III gives the results of a follow-up, after not less than three years, of 100 cases of epilepsy with onset after the age of 40.

TABLE III.—Follow-up of 100 Cases of Epilepsy with Onset after the Age of 40

Deaths	25
Tumour—proved 8, probable 2	10
Effects of cerebral arteriosclerosis	5
Heart failure	3
Air raid	1
Pancreatic tumour ? hypoglycaemia	1
G.P.I.	1
Cause unknown	4
Improved (fits ceased or diminished)	48
I.S.Q. or worse	27

Of the 25 deaths 10 were due to intracranial tumour and five to cerebral arteriosclerosis. Of the 75 surviving patients none showed on re-examination any symptom or sign of intracranial tumour. Their general condition on the whole was good: most of them were living almost normal lives and were at work. A gratifying number seem to have been much improved by treatment.

Evidences of arterial disease are not conspicuous in these patients. Without doubt cerebral arteriosclerosis may cause epilepsy. But it is not justifiable to assign seizures to this cause merely because the patient is of advanced age. Analysis of blood pressure readings does not seem to indicate the presence of hypertension in these epileptic patients in any greater proportion than in non-epileptic subjects of the same age.

Other evidences of cerebral arteriosclerosis—for example, strokes and mental deterioration—were notably infrequent.

The question arises whether Jacksonian epilepsy is specially suggestive of tumour. Of the 100 patients with onset after the age of 40, 11 are known to have had Jacksonian attacks (Table IV). Of these 8 are dead, the cause being shown.

TABLE IV.—Significance of Jacksonian Epilepsy among 100 Patients

Number known to have Jacksonian attacks	11
Deaths	8
Tumour	3
Cerebral arteriosclerosis	1
G.P.I.	1
Heart failure	2
Unknown	1

The mortality is unexpected, but the point which emerges is that Jacksonian attacks, while revealing the site of the disturbance, give no indication of the nature of the lesion.

One further point of clinical significance is the time of attacks. For the 75 surviving patients this is shown in Table V.

TABLE V.—Time of Epileptic Attacks in 75 Patients over Age 40

Diurnal only	31	Irregular	17
Nocturnal only	27		

A final statistical item invites an approach from another angle—namely, the incidence of epilepsy in a series of intracranial tumours. My colleague G. F. Rowbotham has kindly allowed me to analyse the records of 200 consecutive cases of verified tumour admitted to his clinic in the course of about two years.

TABLE VI
Incidence of Epilepsy in 200 Cases of Intracranial Tumour

Number with fits	56 (28%)
Number with fits at onset	38 (19%)
Grand mal	22
Jacksonian	14
Petit mal	2

Time of Appearance of other Signs of Tumour in 38 Cases with Epilepsy at Onset

Period	No. of Cases	Period	No. of Cases
1-6 months	10	5-6 years	1
6-12 "	8	6-7 "	2
1-2 years	5	7-8 "	1
2-3 "	4	8-10 "	1
3-5 "	5	10-12 "	1

Fits occurred in 28% at some stage. In 19% the patients came under observation because of some type of epileptic attack. In more than half the initial attack was of the grand mal type, in about a third Jacksonian; while in two patients the earliest attacks were of the petit mal variety. Half of these patients with epilepsy at the onset developed other symptoms and signs of intracranial tumour within twelve months. In the remainder such evidence was delayed up to five years, and in isolated cases up to twelve years.

Glioma of a cerebral hemisphere was much the commonest cause of fits; cases which were latent for several years were either astrocytomas or meningiomas. High intracranial pressure *per se* is not an important cause of fits; for example, they are rare in posterior fossa tumours, though these are usually associated with early internal hydrocephalus.

Similar conclusions have been published by a number of observers (Sargent, 1921; Parker, 1930; Dowman and Smith, 1928; Penfield and Erickson, 1941), though the time relationship between epilepsy and other symptoms has not to my mind been sufficiently stressed. The proportion of cases with epilepsy at the onset is considerably lower in most of these reports.

Discussing the causes of epilepsy, Penfield and Erickson (1941), while recognizing that idiopathic seizures may start

at any time, write as follows: "In cases of onset between 35 and 55, the most frequent cause is cerebral neoplasm." "After 55 years the various cerebral lesions produced by abnormality of the cerebral blood vessels become more frequent, though the strong probability of neoplasm must still be remembered." "Idiopathic epilepsy comes on in youth, not in early infancy, and not in middle age or old age."

With reference to these conclusions I would point out that statistics about epilepsy are affected by the tendency for the patients to fall into different groups. There is the broad division between institutional and non-institutional cases. There is also, I think, a process of selection operating in regard to patients sent to neurological surgeons: in a personal communication Penfield agrees with this opinion. I would be the last to minimize the importance of seeking an organic cause in all cases, and especially in patients of tumour-bearing age, but I cannot avoid the conclusion that among epileptics as a whole the largest group must still be classified as idiopathic. When fits are due to tumour careful observation reveals other symptoms and signs within a few months in the majority of cases if these are not already present at the onset of the illness.

Aetiology of Idiopathic Epilepsy

The term "idiopathic" is a deliberate declaration of aetiological ignorance. Without doubt a proportion of cases so classified are due to unrevealed structural causes. Of the remainder it seems probable that the chief cause is an inherited instability of the cortex. But if this is so, then what is inherited is infrequently actual epilepsy; more often a less specific dysrhythmia.

Evidence about heredity is derived primarily from studies of family histories. It has been estimated that 1 in 200 to 300 of the population as a whole has had fits at some time. Among the near relatives of epileptics 1 in 40 to 50 has had fits (Lennox, 1945b). That is to say, seizures are five to six times more frequent in the parents, siblings, and children of epileptics than in the general population. Taking relatives as a whole and not only near relatives, a family history of epilepsy has been obtained by various observers in some 4% of non-epileptics and in from 20 to 30% of epileptics. This figure is less when attacks begin in adult life. Very striking is the finding in a series of identical twins that in 70% of these if epilepsy was present in one twin it was present in the other (Lennox, Gibbs, and Gibbs, 1940).

Further evidence comes from electro-encephalographic records. Soon after the initial discovery of distinctive records in epileptic attacks several observers (Lowenbach, 1939; Strauss *et al.*, 1939) recorded abnormal waves in the relatives of patients. In one study 60% of the near relatives of a group of epileptics were found to have various abnormal rhythms, as compared with 10% of controls with no such family history (Lennox, Gibbs, and Gibbs, 1940). It is important to note, however, that the proportion of relatives whose records showed paroxysmal disturbances of specifically epileptic type was much smaller. Again of special interest is the observation (Lennox, Gibbs, and Gibbs, 1942) of seven pairs of identical twins: one of each pair had epilepsy, and in each instance the other twin showed a significantly abnormal record.

These studies of family trees and electro-encephalograms agree in showing a hereditary predisposition which is very much more frequent than the direct inheritance of epilepsy. It has been suggested that epilepsy results when acquired factors such as trauma or tumour combine with genetic factors. This theory is attractive, but seems to have only a limited application, since in the majority of cases no exciting cause can be found for the onset of overt epilepsy.

Medicinal Treatment

On May 11, 1857 (*vide Lancet* of that date), Sir John Locock presided at a meeting of the Royal Medical and Chirurgical Society of London at which an address on epilepsy was given by Sieveking. In the discussion Locock mentioned that he had been trying treatment by bromide of potassium at the suggestion of an unnamed German physician. The suggestion was made because this medicine had been found to depress sexual activity, and the idea had long been prevalent that masturbation was an important cause of epilepsy. This belief persisted: as late as 1880 a paper was read at the annual meeting of the British Medical Association at Cambridge on the treatment of epilepsy by castration (Temkin, 1945). Bromides in various combinations became the first effective treatment of this disease, and remained unchallenged for fifty years.

Phenobarbitone

Medicinal treatment is now more hopeful than in the past, but rather more complex because several drugs of proved efficacy are available and it is necessary in each case to decide which remedy or combination of remedies is most likely to be successful. Phenobarbitone has very largely replaced bromides because both clinically and experimentally it is a more effective anticonvulsant, is easier to take in tablet form, and is almost free from toxic effects. The dose which can be tolerated without drowsiness varies very much in different individuals. It is generally sufficient to give it morning and night in a dose of 1½ gr. (0.1 g.) for an adult, but this may be pushed considerably higher in some patients if control of attacks is inadequate. Patients who have only nocturnal attacks may take a rather larger dose at night, but it is probably best not to omit altogether a smaller morning dose, because if it is given only once in twenty-four hours there is a tendency for attacks to be postponed to the uncontrolled period. When the optimum dose has been decided it should be maintained with great regularity: if attacks have been absent for three years it may be reduced gradually and finally discontinued. Sudden cessation frequently leads to return of attacks.

"Epanutin"

In an exhaustive series of experiments Merritt and Putnam (1945) found that the most effective anticonvulsant tested was the sodium salt of 5, 5, diphenyl-hydantoin, known in this country under the approved name of soluble phenytoin and "epanutin," and as dilantin sodium in America. A large number of reports have been published since this drug was introduced ten years ago (Parke, Davis and Co., 1945). There is no doubt it is the most powerful anticonvulsant known, and it has the great advantage that in therapeutic doses it has practically no hypnotic effect. It is especially potent in the control of psychomotor attacks. It has not, however, displaced phenobarbitone, because with its use there is a much higher incidence of toxic effects. These are rarely dangerous, but they may be alarming, and the margin between the effective therapeutic dose and the toxic dose is often narrow.

When toxic symptoms occur they usually do so early in treatment, but occasionally they appear after several months. Nausea and vomiting are generally avoided by giving the remedy with meals. Erythematous rashes with fever are infrequent but necessitate withdrawal of the drug, with resumption in gradually increasing doses. The most frequent and disturbing effects are referable to the nervous system, and include nystagmus and diplopia, tremors, and ataxia of upper and lower limbs.

A curious oedema of the gums has been reported with varying frequency in different series. In spite of much work on it the nature of the change is obscure: its incidence is diminished by preliminary removal of oral sepsis, and continued care of the teeth and massage of the gums usually render it unnecessary to discontinue the drug.

No serious blood changes have been reported from the use of epanutin.

The usual minimal effective dose for adults is three capsules (each 1½ gr.: 0.1 g.) daily, one with each of the principal meals.

If a distinct effect is not observed a fourth dose may be added, and further additions may be made in cases under continuous observation. Most British reports on this remedy come from institutions, and therefore concern severe cases and usually those which have failed to respond satisfactorily to phenobarbitone. For less severe cases it is not always necessary to give full doses; furthermore, if the treatment is begun and increased gradually toxic effects are lessened (Pullar-Strecker, 1945).

Both phenobarbitone and epanutin are anticonvulsants and of chief value in the control of major seizures. They are often without effect on petit mal, and indeed epanutin may increase the number of attacks of this type. In cases resistant to either drug alone a combination of the two may prove more effective. Such combined medication is in fact very commonly used, but it is important to realize that if this plan is followed the dosage of each drug should be adequate. There is reason to believe that the action of the two is different: the beneficial effects of the second drug are not obtained unless it is given in sufficient amount to produce an effect by itself, and the toxicity of the one is neither enhanced nor diminished by the other (Blair, 1947).

"Tridione"

The frequent failure of the anticonvulsants to influence petit mal gives importance to the introduction of a drug which has a striking effect on this type of attack and also on the allied akinetic seizures and on epileptic myoclonus. This is 3,5,5-trimethyloxazolidine-2,4-dione, or "tridione," and its use for epilepsy is due to Lennox. It has become available in this country only in the past few months, and only one report has yet been published by a British observer (Butter, 1948). I can therefore only speak of it from a very limited personal experience, but it may be useful to mention the main facts as set out in the careful reports from America, where some 10,000 patients are being treated with it. Lennox (1945a, 1947) reported that of 166 patients 31% had been entirely freed of attacks, and in 32% attacks were less than a quarter of their previous number; 83% in all had fewer seizures. Furthermore, in many cases the distinctive paroxysmal spike-and-wave pattern of the electro-encephalogram was restored to normal. He emphasizes that the drug is wrongly described as an anticonvulsant, for not only is it ineffective against convulsive seizures but it may increase these if they already exist.

This remedy is given in capsules of 0.3 g., and the usual dose is three capsules a day for children over 5 years, and four capsules a day for adults, taken with meals. For small children the contents of a capsule may be given with food. The effect on attacks may be immediate, but the maximum effect is usually seen in one to four weeks; the longest period of waiting for relief was six months.

Toxic effects were soon noted. About one in seven patients develops a rash, either a papular rash on the forehead or a morbilliform eruption; if the latter is generalized it is advised that the drug be stopped for a few days and resumed gradually. About one-third of the patients complain of intolerance of bright light; the degree of this symptom, the nature of which is unknown, varies, and it seldom necessitates stoppage of the remedy. No evidence of injury to the retina or optic nerves has been detected. Such toxic effects are rarely serious, but in 1946 two reports (Harrison *et al.*, 1946; Mackay and Gottstein, 1946) were published simultaneously of fatal aplastic anaemia and agranulocytosis due to this drug. It had been given for six months and ten months respectively, when the blood changes appeared suddenly and could not be controlled by any measures. Including these two, Lennox has learnt of four fatal cases. Two further cases have been reported in this country. One (Braithwaite, 1948) had a transient urticarial rash on the 25th day; on the 51st he developed gingivitis and pyrexia. The drug was stopped on the 53rd day, but he died three weeks later with agranulocytosis and an aplastic marrow. The second died, after four weeks' treatment, from exfoliative dermatitis without any blood changes (Kerrin, 1948). These fatalities may reasonably be attributed to idiosyncrasy, and are perhaps no more frequent than with some other drugs, but such drugs are seldom administered for long periods, while remedies for epilepsy have usually to be continued indefinitely. It is therefore important to learn that withdrawal of tridione, unlike phenobarbitone and epanutin, is not followed by an early return of attacks, and in many cases

they have not returned at all. Lennox advises that if attacks have been absent for three months the drug should be reduced gradually and finally discontinued. He believes that if monthly blood examinations are done danger can be averted by stopping the drug if the polymorph count falls below 1,600 per c.mm. In 127 patients who had taken tridione for periods up to two years he found that the count fell to this level in 6%, in all cases returning to normal when the drug was stopped. My own experience, though limited to 9 cases, is favourable: in all attacks have been reduced and toxic effects absent except for some complaint of the glare phenomenon. The leucocyte count has not fallen in any case, but tended to rise. In three of these patients attacks have now been absent for three months and the drug is being withdrawn.

Summary of Medicinal Treatment

It may be said that, if a patient suffers from grand mal only, the choice lies between epanutin and phenobarbitone. In young subjects, in whom it is desirable to bring the attacks under control as quickly and certainly as possible because of the danger of mental deterioration, the more powerful remedy epanutin should in my opinion be used provided the necessary observation can be maintained. Alternatively, phenobarbitone may be used in the first instance. If after due observation attacks are not controlled, epanutin should be added gradually without reducing the dose of phenobarbitone. In such cases it is probably best to continue the two drugs together, but reduction in the amount of phenobarbitone may be tried.

When the patient has both grand mal and petit mal control of the former is the more important, but if attacks of the latter are frequent tridione should be used as well as an anticonvulsant. In this event phenobarbitone should be chosen, since epanutin tends to increase petit mal.

For psychomotor attacks epanutin is much the most effective agent. For pure petit mal the evidence I have indicated points to the use of tridione with the appropriate precautions.

Status epilepticus calls for urgent control by full doses of sedative. Probably the safest and most effective method is the intramuscular injection of 5 to 10 ml. of paraldehyde, repeated if necessary. Alternatively, soluble phenobarbitone may be injected in 3-gr. (0.2 g.) doses.

Finally, in this connexion I would quote the words of Blair (1940), that with the remedies now available there are few epileptics who cannot expect reasonable control of their fits, and hope should never be abandoned until these treatments have each been patiently and efficiently tried out.

Surgical Treatment

Epilepsy *per se* is not an indication for surgical intervention. If it can be shown that attacks are arising from a local brain lesion, operation may be justified in the hope of removing the epileptogenic focus. If this is a tumour, relief of fits is only an incidental aim of operation. Non-progressive lesions may be manifested solely by epilepsy; such lesions are meningocerebral scars resulting from traumatic, vascular, or inflammatory changes. Their presence may be suspected because of local epilepsy or generalized epilepsy with consistent focal onset, together with indications from the history of the manner in which they might have originated. Any persistent evidence of impaired function, such as minimal signs of hemiplegia, would of course be decisive evidence of a local lesion. But attacks of both these types occur commonly in idiopathic epilepsy, and a negative exploration may make the patient worse. In these circumstances radiographs after the introduction of air by lumbar puncture provide evidence of the greatest importance (Childe and Penfield, 1944). To this method may now be added the demonstration of a focal lesion by the electro-encephalogram.

Decision about operation if a local lesion has been demonstrated is by no means simple. It has to be remembered that epileptic attacks do not arise directly from an area of cortical fibrosis but are the result of instability produced by the scar in neighbouring but intact cortical cells. Therefore attacks may continue in spite of a clean excision, and anticonvulsant treatment must be maintained. Excision of such an area means replacing one scar by another and possibly converting a discharging lesion into a destroying lesion. In each case the frequency of attacks, the effects of a full trial of medicinal treatment, and the risks of injury by the operation have to be taken into account.

Social Problems of Epilepsy

The social consequences of epilepsy are peculiarly severe, and it is our duty to mitigate them so far as lies in our power. Nothing can alter the fact that a liability to sudden and unpredictable attacks of loss of consciousness or of uncontrolled behaviour is a grave handicap to any human being. In this respect epilepsy is much more serious than any other of the paroxysmal disorders, and this is a reason for a separateness and not a unity of these disorders.

Two fears fill the minds of the parents of a child with epilepsy—the fear of accident and the fear of mental deterioration. That dreadful accidents can occur we all know, but when we consider the immense aggregate of fits which occur among epileptics in the community we must recognize that serious accidents from this cause are relatively very few. The danger of mental deterioration when attacks begin in childhood is real enough, but is usually much exaggerated in the parents' thoughts. Though there are exceptions, this danger is on the whole proportionate to the frequency and severity of attacks: the risk is therefore diminished by the improved methods of treatment now available. Children with pure petit mal, and the great majority with only occasional grand mal, are in little danger of mental change. Presentation of these facts is of incalculable value to the parents, and is to be preferred to vague promises and hopes.

The first serious social decisions are concerned with education. Frequent major seizures are incompatible with ordinary school life. Petit mal attacks, even if numerous, are almost devoid of risk and should not prevent attendance at school. Infrequent major seizures should not be a barrier. The welfare of the children as a whole must be the first consideration, but if the attitude of teachers is free of fuss and anxiety the witnessing of an occasional attack by other children does these children no harm. Few if any of the school activities should be denied to the epileptic boy or girl. To exclude games for fear of head injury is to provoke greater risks to the child's physical development and peace of mind. Swimming is more doubtful, and must be under supervision; but each case must be considered on its merits, frequency and time of attacks being all-important. To prohibit cycling may cause much unhappiness and is by no means always necessary. Examinations should be taken in the ordinary way. Nothing must prevent the regular supervision of medicinal treatment.

Interesting studies have been made of University students subject to epilepsy. In one such study of 93 students (Himler and Raphael, 1944) 76% were classified as of the idiopathic group; the rest had some evidence of cerebral injury or defect: 65% to 70% did creditable work and took up jobs of all kinds, including medicine. Of 70 epileptic students at another University (Lennox, 1946) the number graduating equalled the record for all students.

Such facts have a bearing on the important question of choice of occupation. Essentially a decision depends on the degree to which attacks are controlled by treatment.

Short of complete control, however, infrequent attacks should seldom be held to prevent a young man from adopting the occupation of his choice. Certain callings are clearly unsuitable. They include contact with dangerous machinery, work at heights or in the mines, or any post in which an attack might involve danger to others. It is not in our discretion to give permission for a patient subject to epilepsy to drive a motor vehicle, for this is his own responsibility. The law, being unsatisfactory (Symonds, 1948), is in fact widely evaded.

Medicine, law, the arts, and many office occupations need not be regarded as closed, for there are branches of these which can be pursued with success and safety, though others are barred. For those with no special ambitions more specific advice may be given, and I have been accustomed to suggest work on the land, which is healthy, active, and satisfying, and involves little restriction apart from possible avoidance of agricultural machinery.

As a fact the great majority of adult epileptics outside institutions earn their living in every variety of calling, and many have achieved fame in every walk of life. These people form by far the largest group of all sufferers from epilepsy. They are a relatively stable group and do not deteriorate as the years pass, but rather tend to improve. The more serious cases beginning in childhood have been weeded out. But though they are at work for the most part, they suffer serious social disabilities. Many conceal their liability to fits and go in fear of an attack at work which will lead to loss of their employment.

Hitherto probably the greatest deterrent to the securing of work has been the liability of employers for accidents arising out of and in the course of employment. Replacement of the Workmen's Compensation Act by the National Insurance (Industrial Injuries) Act should greatly assist in the employment of epileptics in common with other partially disabled persons. The need for full use of man-power, as well as an increased sense of social responsibility, led to the Disabled Persons (Employment) Act of 1944, under the provisions of which a proportion of disabled persons must be accepted by all employers of more than twenty people. The Act provides for registration as a means of identifying those who are qualified for its benefits, and responsibility for finding suitable employment is in the hands of Disablement Resettlement Officers (D.R.O.s) working at the Employment Exchanges. For those judged unfit for ordinary employment, work may be found in sheltered workshops maintained under the Act by the Disabled Persons' Employment Corporation: eight of these factories have been established throughout the country and fifty more are planned. Special provision for epileptics has been made in certain of these factories.

Apart from official help, voluntary organizations, including the hospital almoners' service, are ready to assist epileptics to get and keep jobs, and are endeavouring to overcome prejudice and ignorance on the part of employers and the public in regard to this disease. In this country Tylor Fox (1939, 1947), and in America Lennox (Lennox and Cobb, 1942), have in particular been tireless in their efforts to improve the lot of epileptics in the community. The success of all plans depends entirely on the initiative and co-operation of those in medical charge of the patients. We alone know when it is reasonable to ask employers to accept such persons in their factories or offices; school and University authorities look to us for guidance in the difficult decision whether to accept a student or pupil known to be liable to fits. To recommend unsuitable patients is to do harm to them and to epileptics as a whole. No two cases are exactly alike; frequency and character of attacks are clearly the main considerations, but favourable points are

the occurrence of attacks chiefly or solely during sleep or in the early mornings, the existence of a warning long enough to enable the patient to avoid heavy falls, and a satisfactory degree of control by medicinal treatment.

One further social problem is that of marriage. On the basis of the evidence about the heredity of epilepsy formerly noted, the chance of a child of an epileptic also becoming epileptic has been variously estimated as from 1 in 10 to 1 in 40 (Brain, 1926; Lennox, 1945b). The risk of transmission is probably much less still if attacks begin in adult life, or if the patient has no family history of epilepsy; also if attacks are the result of a definite brain injury. A family history in both partners greatly increases the risk. Electrical records of epileptic type in either partner or both partners have probably the same significance. The prospect of producing epileptic children is therefore far less than is generally believed, and this we can conscientiously explain to those concerned. The real risks in marriage are the anxieties and dangers caused in the home and at work by the attacks themselves: these known risks can be calculated and faced. Nevertheless, so great is the dread of epilepsy that many patients decline marriage or refuse to have children. Both decisions are probably wrong, but they are understandable.

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DIABETIC FERTILITY, MATERNAL MORTALITY, AND FOETAL LOSS RATE

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Fertility

Pregnancy in diabetic women in the pre-insulin era was a rare event. Skipper (1933) credits Bennewitz (1826) with the first recorded case. Amenorrhoea due to uncontrolled diabetes accounted for the low fertility rates of 2–6% quoted by Lecorché (1885), von Noorden (1909), and Skipper (1933). The diabetic control that followed the introduction of insulin in 1923 largely abolished the amenorrhoea and produced a concomitant increase in fertility.

Skipper (1933), reviewing the records of the London Hospital, noted a fertility rate of 15% amongst 177 diabetic women between 1923 and 1931, compared with a rate of 2% amongst 190 comparable diabetic women between 1893 and 1922, while Eastman (1946) observed a fertility rate of 28.6%.

The rate of diabetic to non-diabetic pregnancies admitted to large obstetric hospitals has shown a similar rise. Williams (1909) saw only one pregnant diabetic during his thirteen years in charge of the obstetric service at Johns Hopkins Hospital, and in his review of the literature found only 65 recorded cases, whereas Mengert and Laughlin (1939) quote a ratio of 1 in 276, Barns (1941) 1 in 930, and Eastman (1946) 1 in 282. There were 70 diabetic pregnancies among the 20,438 confinements at the Simpson Memorial Maternity Pavilion of the Royal Infirmary, Edinburgh, between 1943

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