

THE LONG-TERM RESULTS OF INJURIES OF THE HEAD. (A
MEDICAL, ECONOMICAL AND SOCIOLOGICAL SURVEY.)*

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IN 1939 an inquiry was begun into the late results of the type of head injury which results from collisions on the roads, from accidents in industry and from falls in the home. Since penetrating injuries resulting from civilian accidents are extremely rare, the examples that were encountered have been eliminated from the final reckonings and so the following account is concerned entirely with the so-called closed type of injury. It must, of course, be realized that compounding and infection are common even in this type of injury, because cranial fractures frequently run across and open into the paranasal air sinuses.

The inquiry was designed to give the following information :

1. The time elapsing before a man was able to return to work.
2. The financial cost to the country on account of lost man-power hours and of the expense of hospital treatment.
3. The percentage occurrence of post-traumatic epilepsy.
4. The nature of the residual illness and in what way this illness prevented the man from living a normal life and how it affected the happiness of his family and dependents.
5. Whether a man after head injury became more sensitive to the effects of alcohol, so that smaller quantities rendered him incapable of driving a motor car safely.

A man's emotional and intellectual changes are neither easily recordable nor precisely measurable and, therefore, a simple factual answer of the questions set out above is not possible. By the nature of the problem some conclusions must be influenced by the variable factor of the observer's methods and by his sociological beliefs. None the less, the symptoms must be discussed and given the prominence and stress that their importance seems to merit.

METHOD.

The logical way of carrying out a survey of the long-term results of head injuries would be to assess sequelae at the end of the patient's life. As this method was impracticable it was decided that the best thing to do was to consider only those patients who had received injuries to the head during or before the year 1935 ; that is at least five years before the start of the inquiry. A questionnaire was drafted with simple questions so that the patients would be able to convey the required information with the least effort on their part and so throw light on the matter set out in the section above. Prof. John Morley very kindly put the facilities of the Research Laboratory at my disposal. Mrs. Kenneth Watkins also gave me invaluable aid in collecting and recording the data. The in-patient notes

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of the head-injured from the year 1935 backwards until a series of 1,000 had been amassed were obtained. This series was obtained almost entirely from the records of the Manchester Royal Infirmary and the Salford Royal Hospital. Access to the records of outside hospitals was very kindly and freely given to us when necessary.

After a series of a thousand consecutive hospital records had been studied, a questionnaire and a return stamped envelope was sent to each patient concerned. In spite of second letters and appeals to the police to help in tracing patients, 430 replies only were received. The poor response was probably due partly to indolence, partly to the fact that townspeople are constantly changing their addresses and largely to the abnormal conditions of war-time. That all the patients were not traceable is an obvious weakness in the survey. However, as the limits of possible statistical errors are obvious I believe that information of medical and sociological value can be derived from the figures obtained.

For various reasons I thought it necessary personally to question and examine 93 of these cases. Of these, 60 were willing to travel; their expenses were paid and full examination was made in the day-room at the Manchester Royal Infirmary. The other 33 who were unable to travel were visited by myself in their homes and these visits took me as far afield as Blackburn, Bury, Bolton and Preston. Many whole days were spent in searching out these people, but my trouble, was well rewarded because it was in the home that I got the deepest insight into the late results of head injuries.

Length of Time from the Date of Accident to the Patient's First Return to Work.

Of the 430 cases, 122 were either housewives, children or people for various reasons not gainfully employed. The remaining 308 cases who were so occupied have been grouped according to the number of months that elapsed from the date of accident to the day they first returned to work. In each group a sub-grouping has also been made on the basis of the length of time each patient was unconscious, as this gives a measure of the physical cerebral damage inflicted at the time of injury.

- (a) Patients without loss of consciousness.
- (b) " unconscious for half a day.
- (c) " " over one day.
- (d) " " over one week.

	<i>Time Off Work (months).</i>					
	1.	2.	3.	3-6.	6-12	12 months or more.
(a)	5	7	10	10	2	5
(b)	29	30	17	18	5	5
(c)	13	16	22	14	16	4
(d)	5	4	9	16	9	8
Total	52	57	58	58	32	22

Number of Cases Completely Incapacitated.

(a)	4
(b)	9
(c)	10
(d)	6
Total	29

Number of Cases Fit for Normal Life (Children, Housewives, Retired and Unemployed).

(a)	42
(b)	33
(c)	30
(d)	17
Total	122

During an acute illness and during convalescence a man is not only idle economically, but costs much work to other people and expense to the country through hospitalization. Moreover, a man commonly breaks down after a period of work and is away again ill for varying periods of time. To trace a patient's working time from the date of injury continuously over a period of five years or more is beyond the scope of this survey. In the 308 cases it will be seen that 29 people did not work again up to the time of this survey, which means that many had been permanently incapacitated for any kind of work. Of these 29 completely incapacitated cases 4 had received injuries to their heads which, from the physical point of view, must be regarded as trivial. These patients were found to be suffering from severe degrees of psychoneurosis of the anxiety type.

Even in the group of the non-gainfully occupied, many encountered indirect economic hardships. A mother's illness, for example, often necessitated her daughter's staying away from industry to carry on in the home. Child patients lost their schooling certainly for as long as they were ill, but even a few months from school often led to the child getting a whole year behind. In some cases a head injury led to complete cessation of the child's education because the parents thought it would be against the child's interests to let him continue with his studies. This occurred particularly in the duller type of child, for whom a more prolonged course of education than normal was indicated, and not a shorter period at school. Return to work in the majority of cases was made long before the patients had made a complete recovery from their symptoms, such as headaches and insomnia. Furthermore, many patients had not returned to their original employment, but were engaged in so-called light and sympathetic duties. In the whole group the economic loss, both to the family and to the state, was very great.

Incidence of Post-traumatic Epilepsy.

From the questionnaire it was found that numerous cases were complaining of fits and fainting and dizzy attacks, but from the patient's own description of these it was obvious in many cases that the attacks were not epileptic in nature. In 48 cases only was the diagnosis of epilepsy regarded as a possibility. With one exception these were interviewed and examined by myself either at the Manchester Royal Infirmary or in the patients' own homes. The untraced case was classified as non-epileptic.

From the interview it became clear that many of the attacks complained of were vertiginous or in the nature of a sensation of blackness before the eyes. After critical consideration of each case I came to the conclusion that 11, and only 11, cases could be regarded as suffering from epilepsy. In every case where the diagnosis of epilepsy was made it was ascertained from the patient himself and from an observer that there had been a period of unconsciousness during an attack.

This brings us to the problem of what is meant by the term "post-traumatic epilepsy," and it is a very difficult one. Strictly speaking, what is meant is, in a brain where there is not an inherited tendency to epilepsy an injury produces such physical changes that the neurones on occasions discharge their energies dysrhythmically to cause neural dysfunction. If this definition were rigidly adhered to very few cases of epilepsy following closed head injuries could be classified as being post-traumatic in origin. Focal epilepsy, which we would expect to follow trauma, is exceedingly rare. It must be realized, however, that the physics of head injuries are such that contusions of the motor cortex are rare, and this possibly explains why focal epilepsy is rare. Contusions of the undersurfaces of the frontal lobes and temporal poles of the brain, on the other hand, are common; this may explain why *grand mal* is the common type of epilepsy resulting from head injury.

Every brain, by means of suitable stimuli, can be set into a state of active epilepsy; therefore, theoretically, in every human brain there is an inherited predisposition to epilepsy. Within most brains, however, there is what might be termed an anti-epileptic reserve, so that under the normal conditions of living and within reasonable physical and emotional stresses epilepsy does not occur. Under certain conditions an injury will destroy this reserve, or in other words precipitate an inherited tendency. At what point a tendency can become precipitated into activity cannot be known. Whether a patient who develops epilepsy following a head injury would or would not have developed epilepsy under normal stresses of

living cannot be known. It is obvious that in some cases where an inherited tendency is great, epilepsy can be precipitated by a less severe degree of injury than in others where the inherited predisposition is small. Before I classified any of the following cases of epilepsy as post-traumatic I made sure, as far as was possible, that the patient did receive an injury to his head of sufficient magnitude to produce physical changes and that before the accident there was no history of epilepsy or infantile convulsions. By neurological examination it is impossible in most cases to determine the presence or the exact nature of damage that results from closed injuries of the brain. Indeed, large meningo-cerebral scars may exist without clinical signs.

The economic consequences of epilepsy in every case are considerable. For example, a man is precluded from driving a motor car for at least two or three years and often for his life. The results in each case are conditioned by the frequency and severity of the attacks; by the type of man suffering from them and by the type of work the man has to do. In the worst of my cases a man was having so many severe attacks that he had become completely disheartened and was unemployable. On the other hand, one of my patients had three major convulsive seizures in the first year following the injury and then no more for six years. I finally traced this man to his work, where I found him on a high scaffolding. The penalties of epilepsy are greater than they need be because of the reluctance of private employers to give work to an epileptic lest he should damage himself and make a claim for compensation. (This is a weakness in our community which merits further inquiry and correction.)

In the final review of this series of 430 cases of head injury there were 11 cases of epilepsy. Histories of these cases are appended.

The Residual Illness.

The assessment of disability resulting from obvious physical defects, such as unilateral blindness, deafness or hemiplegia, can be made with reasonable accuracy. On the other hand it is extremely difficult to determine how much a man is disabled by headaches or by dizziness because our judgment on these matters must depend on the man's own words, on how much his illness affects his behaviour, and on the statement of his relatives, and such indirect measurements must necessarily lack precision. The main complaints of the 430 patients themselves in this series were of headaches, dizziness and insomnia. It is difficult to assess the significance of these when trying to determine how severely a man is incapacitated.

However, the problem of the residual illness was found more complex than the assessment of severity and incapacitating effects of symptoms, such as headaches, because from the answers to the questionnaire and from personal questionings it was obvious that the symptoms of which the patients mainly complained could not satisfactorily account for so much prolonged inability to return to work and for so much delay in resuming normal and happy living.

It is very doubtful whether a cerebral injury ever does or can, in fact, produce a psychosis. On the other hand, it is firmly believed that a psychosis can be precipitated by a head injury in a predisposed person. Neither of these contentions, of course, can be proved or disproved.

That mental deterioration can be produced by cerebral injury, by destruction of sufficient neurones, is obvious. Permanent and severe grades of dementia, however, following closed head injury of the diffuse neuronal type are very rare indeed; there was one instance only in the 430 cases under consideration. Whether a finer grade of mental reduction is a common occurrence is uncertain. Elsewhere I have stated that I believe that intellectual impairment following head injury is rare. After my experiences in this review I am inclined to modify my views on this important subject. In none of the cases of the present series were formal intelligence tests carried out. The reasons for this were that such testing had not been envisaged when this survey was planned, and that on previous occasions I had discovered that the head-injured co-operated so unwillingly as to vitiate the value of such measurements. I had, therefore, to depend for my judgments of possible intellectual impairments on (i) impressions gained during conversations with patients; (ii) the behaviour of patients during detailed neurological examinations; (iii) on the attitudes of patients towards litigation; (iv) on the way patients had readjusted

themselves to their work and to their way of living; (v) on the views of near relatives; and (vi) on the comment of employers whenever such information was available. Apart from the one instance of dementia, I discovered that the ability to read, write and do simple arithmetic had not been destroyed; this, of course, does not mean that the desire to read, write or reckon had not been interfered with, and often it had. Patients had no difficulty in following simple logical arguments and most were capable of shrewd comments. Many were very slow in answering questions and few gave straightforward answers, even to simple questions. None the less, when their answers did come, the answers were sound. Many patients complained of faults in memory, but apart from the usual pre- and post-operative periods of amnesia, no gross faults could be detected in this mental faculty. What the patients meant was that they could not memorize new experiences, but this I believe was an indication merely of the loss of concentration rather than an absolute loss of the power of remembering. The impression in most cases was of mental slowness rather than of actual mental fault.

At this point it will be helpful to sketch the clinical picture commonly met with in the early stages of convalescence after a moderately severe closed head injury, and also to describe some experiences gained in a varied and extensive practice of litigation ensuing from head injuries.

Let us consider the hypothetical case of a middle-aged working man with a family who, ten years ago, received an injury to his head of the closed type, of such severity that he did not regain full consciousness until the third day. Probably he was kept in bed for another two or three weeks in hospital and then sent home to go to bed for another short period; then he would begin to get up and about. At this period it would be noticed that all was not going well; instead of trying to get better, the man would sit about the house all day with a fixed, miserable expression on his face; he would expect everything to be done for him and would have nothing to give in return; he would be entirely pre-occupied with his illness, irritable with his wife, intolerant of noise and peevish with his children. The thought of going back to work would scarcely enter his head. Moreover, he would believe that any kind of activity would be bad for him. He himself would complain of headaches, dizziness, insomnia, lack of interest, faults in memory and inability to concentrate.

Neurologically, apart from the mental attitude and general loco-motor sluggishness, there would be little else to detect wrong. Sense of smell or of hearing might be impaired and the deep reflexes might be very active. In simple terms, there would be little evidence of any gross lesion in any circumscribed region of the brain.

As the weeks went by the man's symptoms would improve by natural processes and, say, after two or three months a decision would have to be made regarding the man's fitness to return to work, what kind of work he would be capable of carrying out and at what period full recovery could be expected. It would be at this point that the problem of litigation would arise.

In most instances of litigation, I formed the opinion that my patients were well aware of the true consequences of the injury they had received, both to themselves and to their families. Nearly all the patients, even when they had received a severe injury, were well aware of the logic of even the most intricate financial arguments. Indeed, if a mistake was made to their detriment they quickly noticed it and wanted it corrected. On the other hand, patients often were most stupid about, and resistant to, advice which would, if followed, in the long run have been beneficial to them, even in the strictly financial sense. For example, a man would stick out for a few hundred pounds when, by the time he got it he must have lost two or three times as much in wages or in other ways. Often when pressed to accept a settlement, which is best in a long-term sense, a patient became antagonistic and would show his resentment by his unreasonable suspicion. In cases where it was obvious that the counsellor could have nothing but the interest of his patients at heart he was often told that he would talk differently if the accident had happened to him, implying that his advice was not, after all, totally disinterested, which, in fact, it was.

Even after the closest scrutiny and fortified with the awareness of the possibility, I rarely came to the conclusion that a man was a frank malingerer. This conclusion I know cannot be proved, because the English way of thought precludes any secret investigations or spying into the way an injured man lives and reacts

in his private life. On the other hand, I was often convinced that a man was exaggerating his symptoms in order to gain his end, and this end was as often an emotional as a monetary one. Indeed, it was often obvious that a man was fully enjoying the fuss and sympathy his family was giving him and had no intention of giving up easily what to him was a great and sometimes unprecedented luxury. Whilst in legal conference, and when a barrister was probing the weakness of his case it was rare that a head-injured litigant fell down before even the fiercest barrage of questions. For example, a man rarely had too little or too much to say; he rarely got angry or flushed when pressed and would often gain a point, by just the correct gesture or the correct facial expression. In the witness-box of the open court the head-injured litigant is notoriously an excellent witness. That a man is a good witness, it may be claimed, indicates the genuineness of his plea. On the other hand, I believe it also implies that his intelligence has not been seriously impaired.

The more one engages in litigation the more one is assailed with doubt in one's own mind. The doctor is always asking himself whether or not a litigant is grossly exaggerating his symptoms and whether he will not quickly recover once he is properly recompensed. In simple legal terms, is the golden ointment curative? What does a man do with the money of a lump sum settlement? Does a man ever recover completely from a severe closed head injury and what is the nature of his final disability, if any?

Let us return to the consideration of the long term review, and see amongst other things if these questions can be answered satisfactorily. Immediately following are set out in detail the records of five patients chosen to illustrate what are thought to be the dominant features that characterize the residual illness.

Negativism.

A young man, (Mr. B—), aged 29, was traced to a house in Bolton, Lancashire. On arriving there I found that he had changed his address. Fortunately it was known that he worked at the depot of a provision store. On interviewing the foreman there he told me that Mr. B— did, in fact, work for him, but for some reason or other, which he had forgotten, the man was not at work that morning. From the foreman's words and attitude it was obvious that he regarded Mr. B— as a man of little consequence. He gave me my patient's new address. I knocked at the front door, which was slightly ajar, and getting no answer I pushed it slowly open and walked into the lobby and looked through an open door on the right, which opened into the sitting-room. Here was a coffin supported on two trestles, draped with a Union Jack and covered with flowers. Standing on the far side arranging the flowers was a young woman in tears. I apologized for coming at such an inopportune moment, but on telling her my mission she told me that she was Mrs. B— and that her husband was in the kitchen, beckoning with a shake of her head. On entering the kitchen I saw a young man sitting at the kitchen table in his shirt-sleeves. He did not rise on my entering, he did not ask who I was and just said, "How do?" He was eating a piece of fried meat, drinking tea, and smoking; the fire in the kitchen grate was big, the room was hot and the wireless was blurting out some syncopated melody. I turned off the wireless and then I asked him who it was in the next room. "Oh," he said, "that is my father—he died the other day." I asked him if he would miss him. "I think I will," he said. I asked him about the arrangements for the funeral and he said his wife was doing all that. He was obviously unaware of the emotional tension in the house; his attitude was just crude. On being asked about his accident he said it was a bad one. Asked about his job, he said his employers were good to him and let him stay away whenever he was not up to it, which was fairly often. Physically he was a good specimen. Neurologically there was nothing abnormal to be found. He was quite willing to strip naked and walk about the kitchen. On simple examination there was no suggestion of frank intellectual defect. He could read and talk fluently. He could quickly work out simple sums and talk rationally and logically. He was, in fact, quite a decent and sensible type of man to talk to. He complained of occasional headaches and dizziness, and of fainting attacks, but it was obvious that none of these were seriously incapacitating him. We left on very friendly terms and he sat down to resume his meal, which he had placed on the hob to keep warm during my examination.

Next, I went to see his wife, and nodding towards the kitchen I gave the impression that I thought him a "rum sort of chap." It was obvious, at once, by the wife's expression that she thought differently. To her it was a tragedy. "That is not the man I married," she said. "I wouldn't have had a man like that." I mentioned that they looked comfortably off and she said that was due to help from her husband's parents and from the compensation her husband had received, which was somewhere between two and three thousand pounds. On being pressed to say how her husband was different, she had great difficulty in explaining. He was selfish, but not in a cruel way; just in a crude sort of way. He was without interest, without affection and without a sense of deep responsibility, either to his home or to his work; he was lazy and he expected a lot from other people, but gave nothing himself; he rarely spoke constructively and left to himself would obviously have become dirty and untidy. His wife's reactions to him consisted of a mixture of pity, loyalty and revulsion. Intellectually, the wife was well above the average.

The man was not so much indifferent to his wife's feelings as unaware of them. At times he was peevish and rude, but never violent. He never raved or shouted; indeed, his wife said she wished at times he would. He was more like a vegetable than an animal. Before his injury he was a good type of man. His father had a little business, including a shop and he was to have taken this over in the near future. He had become a passenger both from the economic and family point of view. His wife had taken over the responsibility of looking after him in every way. Moreover, an economic descent was soon inevitable, but this was not going to worry him. The man had virtually entered a negative state. His injury had occurred six years previously and had been so severe that he had not gained consciousness till some time in the third week.

Laziness.

Mr. C— was a man aged 45. Before his accident, which occurred several years ago, he had been a casual labourer. He had often been out of work because of unemployment, but was always keen to accept work when it was available. I was able to discover from a council authority that his working record had been good and that the man himself had been regarded as a good workman. He was injured while working on the road by a passing motor-car. The man was rendered unconscious immediately at the time of the accident and was removed by ambulance to the neighbouring hospital, where he was admitted as an in-patient and detained for three weeks. He was in semi-coma for 12 hours. The skull was fractured, but there were no serious injuries elsewhere in the body. When I first saw him five years later he told me he had not done a day's work since his accident and had never even tried to do so. He stated quite frankly that he believed that his accident had incapacitated him permanently even for the lightest form of employment. He had, in fact, refused all offers of light employment. He lived partly on his weekly compensation and partly on the Public Assistance Committee, and intended to do this for the rest of his life. He was a man of a slight, wiry build.

Neurologically I could not detect a single abnormal sign. Intellectually I could not demonstrate any frank impairment and his wife thought that there was nothing wrong mentally. On the other hand, the man himself stated he was quite incapable of thinking clearly. He complained of loss of concentration, faults in memory, dizziness, headaches and irritability. However, none of his own complaints prevented him going out each day to the park, to his club and to the public house. He was quite generous to his wife financially and was quite interesting when recounting what he had been doing during the day. I came to the conclusion that this man was perfectly capable of carrying out a reasonable day's hard work; indeed, it was my conviction that the man's disability was laziness. I made it clear to the man that it was my belief that he was lazy. This opinion did not anger him; he merely smiled and answered that he wished me no ill, but if by chance I did meet with a similar accident to my head I would change my opinion about him.

Emotional Lability.

Mr. J— received an injury to his head in 1932 which rendered him unconscious for 24 hours and confused for several days. He was detained in hospital for 2½

weeks. His skull had been fractured and as far as can be judged he had received an injury to his brain of medium severity of the diffuse neuronal type. On his return home he complained of headaches, dizziness and inability to sleep. Later he became aware of a sense of dizziness in himself that prevented him from concentrating on a single job for more than a few minutes at a time. Then he began to complain of faults in memory and of loss of interest. This information was forthcoming from his wife, who was a particularly intelligent woman.

Three months after his injury he returned to his work which was of a clerical nature. The office staff was kind to him and gave him a warm and sympathetic welcome. Soon he was able to carry out his full duties, but was under an enormous strain the whole time. Occasionally, for no special reason, he would burst into tears to the embarrassment of the rest of the office staff. He was extremely sensitive to any remark that was made about him. The silliest and most trivial joke might cause him to laugh inordinately. At home his behaviour was even more unbalanced than when at his work. One hour he would be whistling and singing about the house and the next he would be weeping and moaning about his future. He was irritable, but not actually bad tempered. The man stated that everything seemed to affect him emotionally one way or the other. On the whole he was unhappy. He himself was well aware of his own emotional lability and it upset him very much. His wife's reaction was that of anxiety. Before his accident her husband was normal in every way. Now she felt that he had become emotionally unsound. There was no deterioration of his work at the office. Neurologically, apart from a general increase in the deep reflexes, there were no abnormal physical signs detectable.

Unhappiness.

This account concerns a man, aged 45, who was injured five years ago, when he received an injury to his brain that rendered him unconscious for 1½ days.

Before the accident he was a draper by trade. He started in a small shop in a back street, but by dint of careful working he had soon established a flourishing business in the main street. He was, his doctor told me, always the fussy little type of man, but always very courteous and very correct in his manner. If anything, he was little obsequious. On the other hand, he was a diligent worker, giving a great deal of care to the details of his business. Also, he was ambitious and hoped one day soon to open a second shop in another part of the town. He had married rather above his own social status, and for his wife's sake had set up an attractive house in the suburb. He was a man of poor physical build, but, on the other hand, was an ambitious man in a successful way, living an apparently happy and contented home life.

After his head injury he had completely changed. In the words of his wife and doctor he had become "transformed into a little dithering old man." Always small in stature, he had now become more stooped than ever. He had lost weight and in every way his general health had deteriorated. His complaints were of headaches, dizziness, lack of concentration, lack of interest, depression and insomnia.

When he first came to see me he was accompanied by his wife and by his general practitioner. He looked an intensely miserable little man. He walked slowly, having to be helped along. He was perspiring profusely and, in the vernacular, was "putting and blowing." He was placed in a chair, his forehead wiped and given a drink before the performance of examination could begin. On being asked simple questions he appealed to others to answer for him; to get even simple information from him demanded a tedious effort on the part of the examiner. When asked to undress, both his wife and doctor stepped forward to undo his collar and boot laces. At this stage I sent his wife to another room and asked his doctor to sit still. On pressing the man to do something for himself he burst into tears and collapsed into his chair in a state of complete abjection. Having seen this I allowed his doctor to undress him. On being stripped, the man on request walked about the room trembling all over his body and when asked to stoop or rotate he made grotesque attempts to do so.

Neurologically, apart from hyperactive knee jerks there were no abnormal physical findings; the special senses were unimpaired. Intellectually the man was

normal as judged by simple tests. He was aware of the devastating effect his illness was having on his business. He could read and write, carry out simple arithmetical problems and appeared to be well in contact with his environment. Though not at work, he was very worried about the welfare of his business, but felt unable to do anything about it. He had completely lost his nerve and was afraid of meeting, not only strangers, but his friends too. He was extremely worried when his wife went out and was always begging her to come back as soon as possible. He was always much better when he was alone in his house with his wife, and on those occasions when she had expressed no necessity of having to go out in the early future. The whole picture was pathetic; the man was profoundly unhappy.

Bad Temper.

A man, aged 47, received a serious injury and for many weeks afterwards behaved like a raging lunatic. Indeed he was so difficult to control that certification and transfer to a mental hospital were seriously considered. He was detained in a general hospital for 12 weeks. On his return home his temper was atrocious and for months his wife was afraid he would do her some violence. For little reason he would stand and shout and gesticulate as if he had gone mad. His complaints, in the early stages of his illness, were of headaches, giddiness and inability to think and sleep. Gradually his temper improved and his complaints became less strident, but he was always to be humoured and pacified. Anything happening to cross him would send him into a violent temper.

I first saw him eight years after his injury. I found him to be a broad-shouldered healthy-looking man, of powerful build. Before I had spoken to him he lurched suddenly forwards and glared at me in an aggressive sort of way. Then he sat back and snorted. He attitudinized and gesticulated. Before answering even a simple question he would cock his head and raise his eyebrows in a whimsical sort of expression. He rarely answered even a simple question in a straightforward way. His wife, however, had learned by experience that "his bark was worse than his bite." For years he had threatened her with violence, but had never actually struck her. The worst he had done was to shake her by the shoulders. In the early stages of convalescence the wife stated that her husband could not sleep and would roam noisily about the house in the middle of the night, knocking things over. She was of the opinion that her husband was not "mental" defective, but was "driven off his head" when his headaches or dizzy turns were bad. He had not worked since his accident, and as far as I could judge never would. This man was not frankly demented. Indeed, he attended cricket matches and had a good eye for form. He was quick enough to recognize any mistake that might be made to his disadvantage. All his arguments were logically sound.

On physical examination I could not find a single abnormal sign. Before his accident his intelligence was that of a normal working man, who had left school at the age of 14 years. There was little doubt that since his accident he was a changed man.

This is an extreme case, but it serves to illustrate that findings of irritability and peevishness tend, in some degree, to run through the majority of these cases.

Intellectual Deterioration.

This case concerns a man, aged 23. Before his accident he was training as a motor salesman and was a very keen motor-cyclist. Indeed it was when racing his motor-cycle five years previously that he had met with his injury. According to the evidence of his family he had before his accident been a normal energetic man; healthy both in body and mind. At the time of his accident his brain must have been very severely injured because he was deeply unconscious for a week and still confused at the end of a month. The questionnaire we sent had been filled in by his sister-in-law. On being asked to come to the infirmary for examination it was stated by his relations that he was incapable of travelling unaided and that no one on the farm could be spared to come over with him. Therefore, I made a personal visit to see him. It was in the afternoon when I arrived and found the address to be a small farmhouse. The man was living with his brother, who was farming in a small way.

I first met his sister-in-law, who took me into the kitchen at the back of the

house, where her brother-in-law was sitting in a corner of the room. He took little notice of me; he just nodded when I said, "Good afternoon," to him, and continued to stare blankly in front of him. I asked his sister-in-law to leave him to me and to go on with her work in some other part of the house. The man had the greatest difficulty in answering the simplest of questions. He knew his name and where he lived, but he had difficulty in naming the day of the week and hadn't the slightest idea of the date of the month. He never spoke unless spoken to, and then usually answered with a muttered grunt. He was quite genuinely uninterested in my interest in him. He made no complaints and even on direct questioning only admitted having occasional headaches. Physically he was sparsely built, but healthy.

Neurologically I could find no abnormal physical signs. From his family I learned that he slept perfectly well and his appetite was good. His sister-in-law told me that since the accident he was in a state which was akin to hibernation. He made no complaints. He spent most of the day in the warm back-kitchen. Only occasionally would he feed the hens for her and then he would do it untidily. He never listened to the wireless, never read the paper and only spoke when spoken to. His habits were clean and he had given no trouble whatever. He seemed to be in a perpetual dream. His family's impression was that nothing was going on in his brain. For at least three years there had been no change in the man's condition. There was no insanity in the family; indeed the family stock was very good.

These six cases are, of course, extreme examples of the features they were chosen to portray. As can well be understood, all degrees of these characteristics from one extreme to the other occur. Not every feature, of course, appears in each case. The possible combinations of each feature in their differing degrees are manifold and so, therefore, are the possible clinical pictures.

It is from wives and near relatives that the best insight into the residual illness can be obtained. With very few exceptions, wives and mothers I interviewed stated frankly that whatever money their husbands or sons had received in litigation had in no way recompensed them for the way they themselves had suffered as a result in the changes of personality of their loved one. It was chiefly in the home that the effects of injury are felt. The man often loses his good temper, his tenderness, his sense of responsibility to his loved ones. Emotionally he expects far more than he can give.

Out of the 30 employers whom I interviewed, 25 told me that the change they had noticed in head-injured men was that they needed constant supervision. To some extent they had lost their initiative and sense of responsibility. Also, they seemed to have slowed up both mentally and physically.

In 50 instances detailed inquiries were made into what happened to the monies of lump-sum settlements. On the information given in this inquiry I can state firmly that even adequate compensation does not cure a traumatic cerebral illness. On the other hand, lump-sum settlement in the early convalescent stages often gets a man back to useful employment earlier than otherwise, because a man now feels that the onus is on him to readjust himself to the best of his curtailed ability. In other words, compensation clears up a patient's exaggeration, but not his true medical disability. To solicitors it therefore can be said that the "golden ointment" is not curative, but useful.

In four instances the monies of a lump-sum settlement were rapidly squandered in lavish generosity to relatives and friends and in the expenses of parties, racing and alcohol. In no instances were there any regrets by the man himself regarding the way the money had been spent.

In six instances attempts had been made to establish little businesses with something like success in two only. In these two successful cases it was the other party who had taken on the hard work and the responsibility of making decisions. The idea that a little business is easy to run if the initial financial outlay can be covered is a very erroneous one ; to make a small business pay demands hard work, sacrifice and long hours of personal attention.

Forty (80 per cent.) of the patients put their newly acquired wealth into safe investments. Medically, this is probably the least useful of all the ways of using the money, for the interest, in most cases, derived from the investment is so small as to make little difference to one's standard of living. As one man put it, the interest on his £2,500 scarcely paid his cigarette bill.

My advice would be for patients to spend their money freely in seeking good health, in holidays and in improvements in their houses and in other amenities of living.

From what has been said before, it is abundantly clear that persistent deteriorations in personality and in emotional stability are very common after injuries to the head. On the other hand, frank dementia is exceedingly rare. Few relatives are of the opinion that the injured have lost their wits. When approached regarding their financial affairs they are very quick to appreciate any decision or suggestion that affects their interests either disadvantageously or otherwise ; they are well aware that someone else is responsible for their disability.

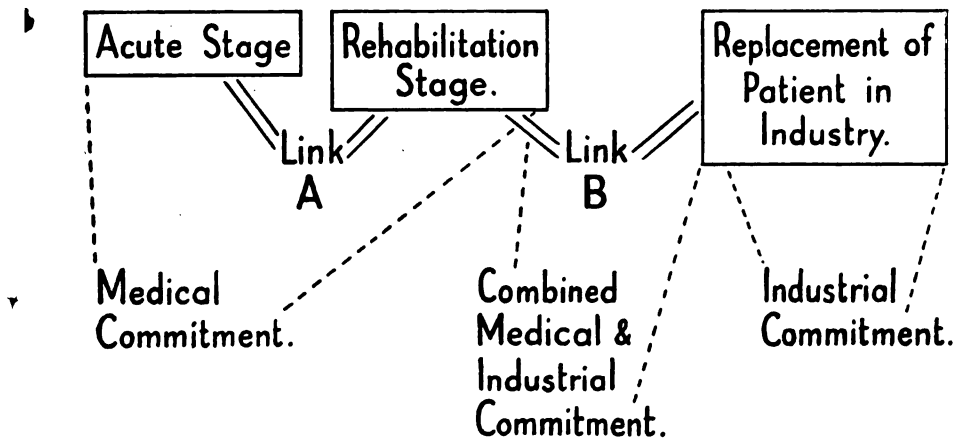
The physics of closed cerebral injury, sufficiently violent to render a patient unconscious, are such that all the neurones in the brain are subject to stresses and strains and, therefore, the residual illness may result from neuronal destruction or from alterations in the neuronal pattern. In other words the residual illness may in many cases have a physical basis.

On the other hand, it is well-known that minor injuries of the head, that could not have inflicted lasting physical damage to the brain, may produce persistent illnesses which are apparently indistinguishable from those produced by severe violences. It may be questioned whether severe or minor injuries do or do not produce illnesses which are absolutely identical. It is possible, of course, that they do not. However, by the clinical tests that are now available, it is impossible when examining a patient a long time after his injury to judge accurately whether or not he received a severe injury to his brain. Indeed, many patients who received no injury to the head of any kind may complain much of the same symptoms. However, even in minor traumata it must be remembered that the injury has been transmitted by the physical pathways of sight and hearing. Very rarely does a man break down because of the frightening thought of an imagined accident.

In comparing long-term results of different surveys an important criterion is the death-rate in the series concerned. In this series the patients were drawn from the types of injury where the death rate lies between 16-20 per cent. The majority of the cases in this series did not pass through skilled neurosurgical or neurological hands and were not formally rehabilitated ; they also returned to work when economic conditions were adverse and when there were far more workers for the job than there was work available.

Finally, let us consider what lessons can be learned from this survey and what can be done to mitigate the ill-effects, once the damage has been inflicted.

If the sequels of closed head injuries are to be minimized then it is obvious that the patients who receive this type of trauma will have to be treated adequately in the acute stages of their illness. To do this a sufficient number of surgeons will have to be specially trained. One of the weaknesses in the past has been that far too many patients have been under the care of surgeons who are not interested in the problem. The problem resolves itself into the phases depicted in the following diagram.



Medical rehabilitation consists of a system of graduated mental and physical exercises carried out under favourable conditions and under the guidance of a doctor who fully understands the underlying problem.

The link between the acute stage and the rehabilitation stage is an important one and there must be the closest co-operation between these two phases of treatment. Indeed, the doctor who is responsible for treatment in the acute stage must see his head-injured patient right through the medical rehabilitation stage until his patient returns to work. Rehabilitation and replacement in industry is being planned but, of course, its success to a large extent is governed by economic conditions. It is important that medical personnel in charge of the rehabilitation stage should go out into industry and make a study of the nature of the jobs that the men they have rehabilitated are supposed to go back to. Ample facilities are given in industry for this kind of observation and I myself have found it most interesting to visit the heavy industries of mining and of shipbuilding.

What I wish to speak about in particular is link B, the link between the medical phase of treatment and industrial replacement. Efforts are being made by the Government through the Ministry of Labour Offices to let the medical practitioner know what kind of work is available for the injured. It is true that the medical profession is being asked to fill in Ministry of Labour forms which will give detailed medical knowledge about patients who have been injured and who are seeking work. The medical and industrial liaison

is still, in many cases, very unsatisfactory and this is largely a medical fault. Let us consider how this liaison can be improved. Let us assume that a group of patients has been adequately treated both in the acute stages and in the stages of medical rehabilitation and that link A is a satisfactory one; in other words let us assume that there have been no medical faults up to the close of the rehabilitation stage. The patients that finally issue from the rehabilitation centre to be received in industry will be of different types and different grades of physical fitness and of mental intelligence. To understand this final complex it is necessary to review the factors which govern prognosis. These are three in number and are as follows:

- (1) The nature of the injury.
- (2) The type of man who was injured.
- (3) The nature of the job to which the man must return after convalescence.

In the following tables a diagram is made to express in graphic form the influence each factor has on the final result of treatment.

TABLE I.

Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

From the tables it will be seen that there are three streams issuing from the rehabilitation centre.

All that remains to be done is to make absolutely clear what the figures of this survey mean. The 430 patients' records concerned here are not from consecutive cases. Therefore, it is impossible to say that out of every 100 cases of head injury so many patients were left with headaches, giddiness or similar symptoms.

TABLE II.

Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

} Stream II

TABLE III.

Degree of cerebral damage.	Type of man.	Post-accident working conditions.	Result.
Slight	Good	Good	V. Good to Good
Medium	Average	Average	Good to Fair
Severe	Poor	Poor	Poor

} Stream III

On the other hand, the 430 cases collected were fairly representative of head injuries, since the injured were of all ages, of both sexes, busy with all kinds of different occupations and had received cerebral injuries of differing magnitudes. The absolute number of people traceable in one area suffering from sequels to their head injury is in itself enough to give this subject importance apart from possible percentage occurrence. In any case, it was the lasting disturbance of the emotions which came clearly to light, and this discovery of the true nature of the residual illness in no way depends on mere percentage deductions. Regarding the percentage occurrence of epilepsy following head injury, all I have shown is that in my series it was $2\frac{1}{2}$ per cent.

This figure, I believe, would be the same in a consecutive group of cases, because my cases were clearly representative of any head-injured group.

To Prof. Geoffrey Jefferson I am grateful for the generous use of his material and for his encouragement. Dr. Raymond Whitehead, of the Pathological Department of Manchester, has given me invaluable help in the preparation of this paper. I also thank my friend, Mrs. Kenneth Watkins, for all the hard work she did in the early stages. Finally, I would like to thank my secretaries, Miss Hilda Huddleston and Miss Norma Harvey, for their patient help.

CASE REPORTS

Name.—Harry B—.

Age at time of accident.—23 years.

Date of accident.—1934.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious 6 hours; in hospital for several weeks; off work 4 months; fractured skull.

Time from accident to first fit.—Two months later.

Nature of first fit.—Without warning he dropped unconscious into a generalized convulsive seizure, but recovered in half an hour or so.

Frequency of fits.—They have occurred on and off at irregular intervals since, and he was discharged from the services on account of major epilepsy.

Other complaints.—Headaches, dizziness and changes in disposition.

Examination.—He was a man of slow mentality and obviously very concerned about his physical health. Neurologically no abnormality was found to point to any residual focus of organic damage in his brain. The special senses and cardiovascular system were normal.

Capacity to work.—He is able to work under sympathetic conditions as a packer doing light work at the Co-operative Wholesale Society.

Remarks.—The epilepsy in this case was not the main sequel. The main disability was his personal changes and severe headaches.

Name.—Norman P—.

Age at the time of the accident.—15 months.

Date of accident.—1930.

How accident occurred.—Fell off table on to back of head.

Severity of accident.—Unconscious for 15 minutes; in hospital for 7 days; no fracture of the skull.

Time from accident to first fit.—A few hours.

Nature of first fit.—In the first fit the child suddenly went unconscious; there were no convulsions.

Frequency of fits.—After the first attack the child had numerous seizures and, as far as I can judge, at least once a week. These slowly became less frequent, ultimately occurring at monthly intervals. He now goes for as long as six to eight months without a seizure. His mother states that for no reason he will suddenly

become still, stare vacantly in front of him and obviously lose consciousness for a few moments. He has never fallen, but his mother thinks he would do so if there was not someone there during an attack to help him down into a chair. On no occasion has he been convulsed and his mother states that his limbs do not become stiff.

Other complaints.—He has no other complaints.

Examination.—He is a boy of good average, intelligence and the following is a final report from his schoolmaster: "Norman P— has been taught by me over the past year, and I report that from what I have seen of his work and conduct he is an average boy. A keen scholar, he enjoys games and is well mannered. He is clean and a regular attender."

Capacity to work.—This boy is still at school and is doing satisfactorily.

Remarks.—There is no history of epilepsy in this family. On the other hand, it is very likely that there was a distinct tendency to epilepsy in this case. There was a definite injury to the head and it was shortly after this that the first epileptic seizure occurred. There is no doubt here that we are dealing with a true case of epilepsy and we shall have to regard the injury as being, at least, a precipitating factor. It is doubtful whether these are major or minor epileptic attacks.

Name.—Frederick S—.

Age at time of accident.—47 years.

Date of accident.—1931.

How accident occurred.—A fall from a ladder.

Severity of accident.—Unconscious 3 weeks; In hospital for 17 months; has not worked since accident; fractured base of skull.

Time from accident to first fit.—7 months.

Nature of first fit.—He suddenly jumped up, grabbed his wife by the shoulders; his mouth was drawn over to the left side, and then he fell unconscious to the ground twitching all over his body and frothing at the mouth. It took about 20 minutes for him to recover consciousness. In this first attack he was incontinent and also bit his tongue.

Frequency of fits.—Too numerous to enumerate.

Other complaints.—Headaches, dizziness, insomnia, and bad temper.

Examination.—On examination he was a man of slow mentality, facetious and aggressive. He was also emotional and unstable; at one moment he would laugh and the next he would weep. His gait was firm; co-ordination of movement tremulous and his general balance was unsatisfactory in rotation and in stooping. Hearing was impaired on the left side. Sense of taste was present, but sense of smell was dulled. The cardiovascular system was normal.

Capacity to work.—He has not worked since the accident, and apart from his epileptic seizures is completely incapacitated and probably will remain so for the rest of his life.

Remarks.—A true case of post-traumatic epilepsy. There are other disabilities besides his epileptic seizures.

Name.—William S. W—.

Age at time of accident.—18 years.

Date of accident.—1934.

How accident occurred.—Fell off motor-cycle.

Severity of accident.—Unconscious for a week; in hospital for two months; off work for five months; fractured skull.

Time from accident to first fit.—2 weeks.

Nature of first fit.—One day during his convalescence, when sitting up in bed and talking to his father he fell back unconscious but did not, as far as we can ascertain, twitch or become stiff in the limbs.

Frequency of fits.—Has had many attacks since then and was discharged from the services after full investigations as suffering from *petit mal*. In many of these attacks he loses consciousness for a few moments only and remains standing in his tracks. He does not fall and does not convulse.

Other complaints.—No other complaints apart from a feeling of anxiety as a result of his discharge from the services.

Examination.—He is a man of good intelligence, but obviously is highly strung and now worried about his present illness. His gait is firm; co-ordination of movement is a little tremulous and general balance is satisfactory in rotation and stooping. Hearing is impaired on the left side. The other special senses are normal. There are no positive pyramidal signs and no sensory loss. The cardiovascular system is normal.

Capacity to work.—He is now training to be an architect and intends to carry on with his work.

Remarks.—We shall have to accept this as a case of *petit mal*. Moreover, this boy did receive a severe injury to his head, and there is no doubt that this injury was accidental and not due to a seizure.

Name.—Clifford W—.

Age at time of accident.—23 years.

Date of accident.—1934.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for three weeks; in hospital for two months; off work for 13 months; fractured skull.

Time from accident to first fit.—3 or 4 years later.

Nature of first fit.—Whilst at work as a cinema operator, without warning he fell to the floor unconscious and according to an observer he had a convulsive seizure. In an hour or so he had completely recovered and was able to go home.

Frequency of fits.—He had another attack, similar in character to the first, two years later. Since then he has had peculiar attacks in which he becomes confused for a few moments and is unable to carry on with his train of thought. In these attacks he does not lose consciousness and does not fall.

Other complaints.—He is a man of good average intelligence and is in no way unduly emotional. His gait is firm; co-ordination of movement smooth and general balance satisfactory. There is slight deafness in the right ear and a complaint of tinnitus in the same ear. The sense of taste is good, but the sense of smell is impaired. There are no pyramidal signs, no sensory loss and no inco-ordination of movement. The cardiovascular system is normal.

Capacity to work.—For the last few years he has been working regularly as a plumber and on many occasions has ascended scaffoldings and worked for long periods at a height.

Remarks.—This man received a severe injury to his head and there is no doubt that this is a true case of post-traumatic epilepsy which is of the major type. This man almost certainly has got a meningo-cerebral scar, but it is impossible to demonstrate its presence by simple clinical means.

Name.—Bessie G—.

Age at time of accident.—4 years.

Date of accident.—1931.

How accident occurred.—Knocked down by motor-cycle.

Severity of accident.—Unconscious for three days; in hospital for three weeks; fractured skull.

Time from accident to first fit.—2 years.

Nature of first fit.—In the first attack she felt sick and experienced a peculiar feeling in the stomach and then remembers no more. Her mother was told that she had dropped down in a faint and remained unconscious. There was no history of convulsions. After this first attack she was very well apart from repeated nose bleedings. At the age of 13 years the attacks changed a little in character. Each seizure was preceded by a state of mental confusion in which she would say and do queer things and then she would sit and become absolutely vacant, staring in front of her. Her mother states that on some of the occasions she would certainly have fallen had she not been there to help her sit down in a chair. There has been no history of incontinence.

Frequency of fits.—There have been six attacks in which she has lost consciousness and fallen. There have been numerous occasions on which she has lost her thoughts for a few seconds, but has not fallen.

Other complaints.—There are no other complaints, such as headaches or dizziness.

Examination.—On examination she was a girl of average intelligence and

though perhaps a little highly strung was not unduly emotional. Her gait was firm ; co-ordination smooth and general balance satisfactory. All the special senses were normal. There were no abnormal neurological signs.

Capacity to work.—At the age of 14 this girl lost her first job in a chemist's shop because of one of her fainting attacks. She is now working as a machinist and is granted concessions by her employers who understand her illness.

Remarks.—This girl shows no residual signs whatsoever of her head injury. Moreover, the classification of her epileptic seizures is difficult. It is difficult to know whether to regard them as major or minor epilepsy. The attacks are undoubtedly epileptic.

Name.—Frederick B—.

Age at time of accident.—56 years.

Date of accident.—1932.

How accident occurred.—Motor car.

Severity of accident.—Unconscious for two hours ; in hospital for six weeks ; off work for eight months ; fractured base of skull.

Time of accident to first fit.—Several years later.

Nature of first fit.—Without warning he fell back off his chair on to the floor in a convulsive seizure.

Frequency of fit.—He had several less severe attacks in the following few months, but has had none over the past few years.

Other complaints.—None.

Examination.—A man of good intelligence and of good physique for his years. There is no evidence of past injury and no evidence of any metabolic disease.

Capacity to work.—He is doing a full-time job as a plumber, including climbing up on to a scaffolding.

Remarks.—He is an excellent type of man. He is undoubtedly suffering from epilepsy, probably as a result of the accident.

Name.—Reginald R—.

Age at time of accident.—27 years.

Date of accident.—1930.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for 14 days ; in hospital for 7–8 weeks ; has not worked since accident ; fractured base of skull.

Time from accident to first fit.—Within a year.

Nature of first fit.—He was found unconscious in a field. The man remembers nothing at all about the first attack.

Frequency of fits.—Frequent attacks of major convulsive seizures over irregular periods of time. He has no warning and falls heavily into a state of generalized convulsions.

Other complaints.—Headaches, dizziness and general nervousness.

Examination.—He was a poor type of man mentally. Physically there was no evidence to point to a discrete focal lesion of organic damage in his brain. The special senses were normal and the cardiovascular system was normal.

Capacity for work.—He has not worked since the accident and probably will remain completely incapacitated for the rest of his life.

Remarks.—A true case of epilepsy preceded by a severe injury to the head and presumably, therefore, the epilepsy is traumatic in origin.

Name.—Arthur D—.

Age at time of accident.—21 years.

Date of accident.—1931.

How accident occurred.—Motor-cycle.

Severity of accident.—Unconscious for 10 days ; in hospital for a month ; off work for 18 months ; fractured skull.

Time from accident to first fit.—5 years 9 months later.

Nature of first fit.—This was a generalized convulsive seizure not preceded by a warning.

Frequency of fits.—Frequent convulsive seizures without warning and most of the attacks occur in bed.

Other complaints.—Headaches and dizziness.

Examination.—He is a man of good average intelligence and in no way unduly emotional. There is no evidence of any residual organic damage in his brain. The cardiovascular system is normal.

Capacity to work.—He is working full-time as a gardener.

Remarks.—He is a good type of man who received a severe injury to his head and almost certainly his epilepsy is due to the trauma.

Name.—Fred S—.

Age at time of accident.—38 years.

Date of accident.—1933.

How accident occurred.—Fall.

Severity of accident.—Unconscious for 36 hours; in hospital for four weeks; off work for six months; fractured skull.

Time from accident to first fit.—18 months later.

Nature of first fit.—On the first occasion after uttering a scream, which he does not remember, he fell down into a convulsive seizure.

Frequency of fits.—Since the first seizure there have been repeated attacks coming on at intervals as short as 14 days or as long as 6 months. Apart from a peculiar feeling in the stomach there is no warning of the onset of a fit.

Other complaints.—Headaches, dizziness and nervousness.

Examination.—He is a man of average intelligence, but very highly strung and worried about his present state of health. There were no abnormal neurological signs to point to any residual damage in the brain. The cardiovascular system was normal and there was no sign of disease in any of the other metabolic systems.

Remarks.—This is an undoubted case of major epilepsy and probably due to the head injury.

Capacity to work.—He had been discharged from work on many occasions on account of the epileptic seizures.

Name.—Harold W—.

Age at time of accident.—21 years.

Date of accident.—1930.

How accident occurred.—Motor accident.

Severity of accident.—Unconscious for 7 days; in hospital for 14 days; off work for 10 months; no fracture of skull.

Time from accident to first fit.—15 weeks later.

Nature of first fit.—First of all he felt a peculiar feeling in the left temple which radiated down the arm into the trunk and as the pain developed he dropped unconscious.

Frequency of the fits.—On many occasions he has experienced an aura of pain spreading over the left side of the body, but only on very few occasions has he lost consciousness.

Other complaints.—Headaches, irritability and general nervousness.

Examination.—He is a man of fair intelligence, but obviously very worried about his present state of health and what the future is going to show. Neurologically there is nothing to point to any residual organic damage in the brain. The cardiovascular system is normal.

Capacity to work.—Apparently he is greatly incapacitated and can only carry out light employment under sympathetic conditions.

Remark.—This is almost certainly a true case of post-traumatic epilepsy, though he is a poor type of man and his personality changes are more disabling than the epileptic seizures.