Part I.—Original Articles.

LATE EFFECTS OF CLOSED HEAD INJURIES: PSYCHIATRIC OBSERVATIONS.*

By E. GUTTMANN, M.D.Munich.

From the Maudsley Hospital, Denmark Hill, S.E. 5.

In discussing the late stage of head injuries, it is necessary first to define the clinical stages in the treatment of these conditions. With Donald Munroe, it is considered expedient to classify cases of head injury in general into—

(a) Operative and (b) Non-operative cases.

This distinction is more important in the first, or acute, stage than later, but the differences in treatment, nursing, location within the hospital, and disposal, are often reflected in the later stages, and should, therefore, not be forgotten when considering the chronic stage. It is suggested that the acute stage should be defined as follows :

(a1) In operative cases, from the injury to the conclusion of the local surgical treatment.

(b1) In non-operative cases, from the injury to the disappearance of the initial disturbance of consciousness.

The former group will include all " open " injuries, such as gunshot wounds and compound fractures, the latter group most cases of closed injury ; but closed injuries remain surgical risks as long as their consciousness is impaired. The patient in this stage will, therefore, be the responsibility of the surgeon.

The second, or subacute stage, begins at the conclusion of the first. In the operative cases, the end of the second, subacute or convalescent stage is difficult to define generally, since the amount of cerebral damage, condition of the wound, and often concomitant injuries or infections, cause wide variation in the course of recovery. Cases in this stage will still be the surgeon's responsibility, even

---

* Paper read before the Clinical Psychiatry Sub-Committee of the Royal Medico-Psychological Association.

if their treatment or rehabilitation will not differ much from closed injuries. I do not consider it practicable to define the second stage in those cases other than—

(*a*2)—the discharge from hospital.

In the non-operative cases a more exact definition can be given, based on the severity of the injury. Discharge from hospital is no suitable criterion, since many of these cases are discharged from hospital while still convalescent.

From the study of Cairns and others* a fair estimate of the expected time of recovery can be made. It is therefore suggested that the end of the second stage should be assumed—

(*b*2) A. In mild cases   .   .   .   . 1 month after injury.
      B. In moderately severe cases   .   . 2 months ,,   ,,
      C. In severe cases   .   .   .   . 3 ,,   ,,   ,,
      D. In exceptionally severe cases   .   . 4 to 5 months after injury.

The late, or chronic stage begins at the conclusion of the second stage, as just defined.

ASSESSMENT OF SEVERITY.

In this clinical classification the assessment of the severity of the injury is of primary importance and, therefore, some agreement should be reached on the assessment of the severity of (non-operative) head injuries. It is common usage, medical and lay, to describe the severity of an injury in terms of the duration of unconsciousness, but everybody who has experience in taking histories from cases of head injury or studying clinical records will agree that this method is unsatisfactory. Assessment of consciousness is difficult, in particular if one includes states of disturbed consciousness. The recovery of consciousness is rarely observed and recorded accurately. The difficulties increase if one has to assess the clinical state in retrospect. One of the characteristics of disturbed consciousness is the amnesia it leaves behind, and Ritchie Russell was the first to draw the conclusion—which now seems so obvious—that this psychological symptom might be employed as indicator of the severity of " concussion," i.e. of such head injuries which caused un-

---

* Cairns expected, in Service patients, return to duty in cases with—
Post-traumatic amnesia of 5 mins. to 1 hour after 4–6 weeks.
  ,,   ,,   of 1 to 24 hours   ,,   6–8 ,,
  ,,   ,,   of 1 to 7 days   ,,   2–4 months.
  ,,   ,,   of over 7 days   ,,   4–8 ,,
Guttmann found, in civilians, absence from work, in the average, in cases with—
Post-traumatic amnesia of up to 1 hour   4·5 weeks ($\pm 2\cdot08$).
  ,,   ,,   ,,   1 day   5·6   ,,   ($\pm 2\cdot46$).
  ,,   ,,   ,,   7 days   8·85   ,,   ($\pm 5\cdot34$).
  ,,   ,,   of over 7 ,,   13·75 ,,   ($\pm 4\cdot65$).
Botterell and Wilson, in soldier patients actively treated, found the average time off duty in cases with—
Post-traumatic amnesia of up to 24 hours 36 days.
  ,,   ,,   of 1 to 7 days   54 ,,
  ,,   ,,   over 7 days   59 ,,

consciousness (or, in mild cases, a disturbance of consciousness). His example has been followed widely since and its usefulness has been proved in many investigations, predominantly in those which were concerned with large numbers of cases where statistical treatment permitted one to disregard minor fallacies. Like all psychological methods, this has its fallacies, with which the investigator has to be familiar, and in this psychiatric analysis it may be worth while considering these in more detail.

A common mistake is to attempt to assess the traumatic amnesia (both retrograde and post-traumatic) too early, or, to describe the same mistake from another angle, not to distinguish clearly between the assessment of disturbed consciousness and its signs and that of amnesia. Amnesia is a gap in the patient's past memory which cannot be properly assessed while he is in a state of disturbed consciousness in which his grasp, his recall, his thinking are still impaired. If one keeps this common psychiatric definition in mind, many pseudo-problems, such as the study of extremely long amnesias, simply vanish. Some general psychiatric considerations also simplify the problem of the " lucid interval." We know that states of clouded consciousness do not leave behind a complete amnesia, but patchy recollections, nor does it surprise us to hear that a patient in a state of clouded consciousness can carry out simple actions without appearing grossly disturbed to others.

J. P—, aged 25, a corporal in the R.A.F., was knocked down by a vehicle when cycling during the blackout. Found by the police. Got up and walked with them to the police station, waited there, sitting, until an ambulance arrived to take him to hospital. He was kept there for ten days. His injury was obviously considered trivial, and he was returned to duty (as switch-board operator) without any rehabilitation. He developed headaches, nightmares, and noticed a falling off in his work owing to poor concentration.

After admission here he gave a consistent story. He could describe the spot on the road (well known to him) where the accident happened ; his last recollection was hearing the lorry ; his first recollection after the accident was waking up in the hospital and asking for place and time. His post-traumatic amnesia was seven hours, and the injury obviously not as trivial as it appeared from an estimate of the initial, complete unconsciousness.

Whereas these difficulties are avoidable by using a correct technique of examination and assessment, drug medication during the acute stage falsifies the clinical picture, and makes the amnesia unsuitable as a measure of the severity of the injury. An anaesthetic may have been given in non-operative head injuries, where concomitant injuries required surgical treatment. Morphine is still too often given to any case of " shock " or surgical injury, disregarding the cerebral condition. There is finally alcoholic intoxication to be mentioned, which tends to prolong the disturbance of consciousness and the subsequent amnesia. Hysterical manifestations may complicate the picture; it is not uncommon to find minor abrasions or other signs of head injury in patients admitted in hysterical twilight states. Hypno-narcosis makes it often possible to demonstrate the hysterical nature of the disturbance, but failure to remove the disturbance of consciousness at the time, or the amnesia subsequently, does not prove the organic nature of the condition. A patient may conceal his real experiences or inhibitions, even under sodium amytal. One also meets falsifications of memory, conscious or unconscious,

when assessing amnesias, but on the whole, histories taken by different people at different stages, but employing the same technique and conventions, are remarkably consistent. This is probably due to the fact that the patient, once he has verbalized his experiences, remembers the verbal formula rather than the actual experience of driving, waking up, etc. Real difficulties arise only when the patient has no real "landmarks" by which to determine the beginning and the end of his amnesia.

Classification of Chronic Stage.

I propose to classify the signs and symptoms of the chronic stage into five syndromes, which may occur separately or combined. These syndromes are :

I. *Largely objective : Defect conditions.*
  (i) Sensory-motor defects, peripheral or central.
  (ii) Ideo-motor defects (e.g. aphasia, vestibular disturbance).
  (iii) Disturbance of intellectual efficiency (memory, concentration, fluency).
      Impairment of reasoning (intelligence in the strict sense of the word).
      Change of character (i.e. emotional and volitional disposition).

II. *The Epileptic syndrome.*
  Minor, major fits, twilight states, deterioration, fugues, automatism.

III. *Largely subjective.*
  The post-concussional or post-contusional syndrome in the strict sense, headaches, giddiness, fatigue, insomnia, irritability, disturbed memory and concentration.

IV. *Psychogenic reactions.*

V. *Precipitated psychoses* (of endogenous type).

The following paper, which is based on experiences in a Neurosis Centre, will not deal with defect conditions. It will attempt to show that the "subjective syndrome" and psychogenic reactions are hard, if not impossible, to distinguish, since the physiological and psychological factors causing them are inextricably mixed, and that there is not much point in keeping them separate.

The literature was recently reviewed by H. H. Merritt and E. Guttmann, and I will only quote a few recent investigations into the frequency and causation of the chronic after-effects. All increase in our knowledge is due to follow-up examinations of unselected head injuries (as opposed to studies of patients who come under observation and treatment on account of chronic symptoms). The latter obviously present a selection of cases with poor outcome, and the clinical impression based on such cases has largely (and unduly) influenced the popular picture of the late effects of head injuries.

Frequency of Late Stage.

C. P. Symonds and W. Ritchie Russell published their observations on 242 consecutive cases of acute head injuries in Service personnel, all accidental, i.e. not due to gunshot wounds and similar war injuries. Five patients died ;

of the remainder, 91 per cent. were returned to duty. A follow-up showed that a further 11 per cent. were invalided later. Thus 80 per cent. became fit for military duties, though not necessarily free from symptoms.

E. Guttmann studied an unselected group of civilian head injuries in the acute stage, and kept them under out-patient observation for at least six months after discharge. The time of recovery in his cases, as well as those of Symonds and Russell, showed a close relationship to the duration of the amnesia and was below the figures suggested above (see footnote, p. 2).

A special study of headaches, the most frequent subjective symptom, showed that, with short treatment and active rehabilitation, nearly 80 per cent. of the patients could be discharged free from headaches (and other symptoms), and this rate was the same after six months, though, shortly after discharge, the frequency of symptoms increased up to 40 per cent. Cases with short amnesia suffered more frequently from headaches than severer cases. Denny-Brown and a team of collaborators investigated a consecutive series of 430 cases of head injuries admitted to Boston City Hospital, but by excluding patients under 15 and over 55, and alcoholics and vagrants, the group was reduced to 200. 110 patients (55 per cent.) complained of symptoms in convalescence, headache and giddiness being the most frequent. The typical " post-concussional syndrome " occurred in 30 patients only.

Of the whole group, 138 complained of headache at some stage. In 59 patients the headache did not persist beyond the hospital stay. In 63 patients it lasted longer than two months, and in 11 cases the headache only started after discharge from hospital.

All the evidence goes to show that a considerable proportion of cases with head injury (between 40 per cent. and 50 per cent.) never suffer from headache ; that out of those who develop headaches, a considerable proportion lose them during the convalescent period, so that only a small proportion enters a chronic stage. From the data quoted, this proportion can be estimated at between 20 per cent. and 30 per cent.

The following small investigation confirms the infrequency of post-traumatic headache, in particular when seen against the background of the " normal " occurrence of headaches :

At the Officers' Board of the N.F.S. a health questionnaire was a part of the routine procedure, in which the following questions were included :
What accidents did you have (a) up to the age of 14 ?
(b) after the age of 14 ?
If you were unconscious, state for how long.
Describe the after-effects, if any.
And, in another context :
Are you subject to headaches ?
The analysis of 550 questionnaires yielded the following table :

	Head Injury.	Yes.	No.
Headaches { Yes	.	5 .	70
{ No	.	10 .	465

$\chi^2 = 4\cdot930$. P between $\cdot05$ and $\cdot01$. Y $= \cdot29 \pm \cdot129$.

In other words the occurrence of headaches in men with head injuries in their history is only just significantly higher than in those who never had a head injury. One of the head injuries included was a trivial fall at the age of five; another one a cycle accident with unconsciousness of ten minutes at the age of twelve. If one excludes these obviously trivial cases, one arrives again at a frequency of 20 per cent. similar to the frequency estimated before.

AETIOLOGY OF CHRONIC STAGE.

Our views on the aetiology of the post-concussional symptoms have changed gradually during the last few years. Before that there were two schools of thought, the organic and the psychological, but recently the psychiatric approach has conquered even the strictest neurologist, so that they speak about aetiological factors of various description rather than of one cause or one pathology. When reviewing the evidence one has to distinguish again between investigations which were based on consecutive admissions or un-selected samples, and those which are based on the examination of bad risks.

In my analysis of 300 unselected cases of civilian head injuries, I came to the conclusion that in most cases which complained of headaches six months after the injury, the symptom was either precipitated by psychological causes, or the patient's attitude towards it was determined by such factors. Denny-Brown in his survey of admissions to the Boston City Hospital summarized his findings :

> The symptoms associated with prolonged disability, whether the injury had been severe or mild, were predominantly anxiety symptoms. Intellectual dis-order played no significant part. Environmental factors of the injury were in total effect more important in accounting for disability than were the factors indicative of the severity of injury, and psychiatric factors indicate the possibility for lessening disability by psychiatric treatment.

This association between head injury and psychiatric factors was analysed in some detail by the same team of workers. As regards the post-traumatic headache, they were able to demonstrate the high incidence of prolonged headaches among those patients who were considered to have been nervous or neurotic prior to the accident, among those with complicating environmental factors (including compensation) likely to produce emotional stress, and among those with symptoms of a marked immediate emotional reaction to injury.

These relationships, the authors conclude, suggest the importance of both psychological and physical factors in the production of prolonged post-trau-matic headaches in the majority of cases. Even with headaches localized to the region of known damage to scalp or skull, psychological factors had high correlation.

With regard to dizziness, they found that dizziness for longer than two months was characteristically associated with pre-traumatic nervousness, complicating environmental factors during convalescence and, to a lesser degree, with immediate abnormal emotional reaction to injury. These relation-ships point to the importance of psychological factors in the production or continuation of post-traumatic dizziness.

As mentioned before, all these conclusions are based on the investigations of *unselected* cases of head injuries. Investigations of *selected* cases tend to confirm the picture. Symonds and Russell, in the investigation quoted, also investigated chronic cases, i.e. cases transferred to the head injury centre at a late stage, because their progress was unsatisfactory. Their analysis showed that the invaliding rate in the severe cases (P.T.A. more than seven days) was the same as in the acute cases, but that the percentages invalided in the groups with shorter P.T.A. was in each instance much higher for the chronic than the acute cases. They therefore sought factors other than the severity of the injury to determine the prognosis, and they found the predisposition to mental disorder of decisive importance.

The invaliding rate of those who showed signs of mental instability.in their personal history, or a family history of serious mental disorder, was twice as high as that of those who showed no such history. On the other hand, the recovery rate of flying personnel was much higher, and the authors suggest that the main reason for this good prognosis was that they are a highly selected group in respect of absence of predisposition to mental disorder.

COMPARISON BETWEEN THE CHRONIC STAGE OF HEAD INJURY AND COMMON NEUROSES.

We can now finally compare the clinical picture of chronic after-effects of head injury with that of common neurotic states. A. J. Lewis was the first to carry out such an investigation. He matched 64 post-traumatic neurotic patients with an equal number of other neurotics.

The points at which the two groups differed significantly (i.e. statistically so) were remarkably few : More men in the control group were discharged Category E ; had as adults shown signs of predisposition to mental disturbance ; had been unsociable, weak and dependent, lacking in initiative, over-anxious, hypochondriacal or obsessional. More of them complained of pain (apart from headache) and of anxiety symptoms, whereas the head injury cases included, as would be expected, more people who had been of stable, well-organized personality before their illness, and severe headache. Fainting and irritability were commoner among them. But the differences in these respects were only on the margin of statistical significance, and it was evident that the head injury series was made upon very much the same sort of people (in family and personal history, intelligence, symptoms, response to treatment, and outcome) as the non-organic group.

I made similar investigations in a somewhat larger material ; 350 cases (all male Forces patients)* were collected, in which a head injury, mild or

---

* All the cases admitted to Mill Hill had been seen by psychiatrists, and many by neurologists before admission, and were sent there, as a rule, only " if no organic causes for their complaints had been found." A few cases in which this statement was proved not to be correct were excluded from this study. They included two patients who, two or three months after a severe head injury, were still in Korsakoff states, a man whose mental symptoms following operation on a post-traumatic abscess were considered largely organic and indicated re-operation, two epileptics, and some cases of localized cerebral injury sent for rehabilitation to Mill Hill on special grounds.

severe, was considered part of the illness for which they were admitted to Mill Hill, and I compared them with 700 cases (used by Eysenck in his study of "Types of Personality") which had no history of head injury, organic illness or other complications, and with an analysis of 5,300 unselected male service neurotics. The data were taken from the statistical cards which are kept for every patient at Mill Hill. The following points were compared :

Social Data.

There was no significant difference in age or marital state between the head injury and the control group ; in the distribution of skilled and unskilled occupations ; in the frequency of job changes ; in the amount of unemployment.

History.

A family history of psychosis, neurosis, or psychopathy was insignificantly less frequent among the head injuries (53·5 per cent.) than in the control group (56·4 per cent.) (C.R. 1·05). An unsatisfactory home atmosphere was less frequent in the head injuries (23·7 per cent.) than in the controls (32·3 per cent.) (C.R. 2·9). A history of mental breakdowns or neurotic symptoms clearly indicating predisposition was less frequent in head injuries (53·6 per cent.) than in the controls (65·3 per cent.) (C.R. 4·3).

Personality.

The head injuries are insignificantly less intelligent than the controls ; they are significantly less unstable, less dependent, less inert, less cyclothymic, and less hypochondriacal ; they are insignificantly less schizoid, and show no difference in obsessional traits.

Symptoms.

Headaches are more frequent among the head injuries (83 per cent.) than in the controls (60·1 per cent.) (C.R. 10·8). More frequent are also irritability, apathy and fainting attacks (P < ·01).

Less frequent are anxiety, somatic anxiety, depression, dyspepsia, sexual anomalies (including impotence), pain (other than headache), and hysterical conversion symptoms.

Aetiology.

Among the chief psychological factors the stress of exposure to bombardment, etc., was equally frequent in head injuries and in the controls ; the same is true of the stress of domestic problems ; whereas the stress of wartime separation and regimentation was significantly less among the head injuries than among the controls (P < ·01).

Outcome.

The invaliding-out rate of the head injuries (51·4 per cent.) was insignificantly lower than in the controls (54·2 per cent.) (C.R. 1·0).

The following table compares the subsequent history of the men returned to duty with that of 1,124 control cases :

	Invalided out during first 3 months.	Next 3 months.	Next 6 months.	Within 12 months of discharge.	During second year after discharge.
170 head injuries	14	23	13	50	12
1,124 controls	123	79	109	311	107

In other words, the invaliding-out rate of the head injuries during the first year after return to duty is insignificantly higher than that of the controls, so that the total result can be considered much the same in both groups.

There is no doubt that these results could be further improved by intensified individual treatment.

On the first 50 consecutive admissions treated by myself at Mill Hill, 32 were returned to duty, 17 invalided, and 1 (an acute case) was transferred to another hospital and subsequently invalided. Three of those returned to duty could not be followed up. Of the remaining 29, the following numbers were ascertained as still giving satisfactory service :

At the end of 3 months	.	.	.	.	.	28
,,	,, 6	,,	.	.	.	.	. 24
,,	,, 12	,,	.	.	.	.	. 18
,,	,, 24	,,	.	.	.	.	. 8

The losses include not only those invalided out subsequently, but also those not accessible after an increasingly long period of service with the usual drafting overseas and postings from unit to unit.

When conclusions are drawn from the comparisons of history and clinical picture, allowance must be made for the possibility that the physician in charge, concentrating his attention on the head injury, may not have recorded other factors with the same impartiality and completeness as in the control cases, but even with such an allowance, some of the differences are too marked to be disregarded. They tend to show that the post-concussional group has less predisposition expressed in home atmosphere, personal history and marked character traits than the controls and less environmental (domestic) stress, but shows the same outcome ; the head injury balances the relationship between stress and predisposition. A similar relationship is demonstrable in the symptomatology. The frequency of headaches and irritability is counterbalanced by an infrequency of other neurotic symptoms. Most surprising is, perhaps, the frequency of fainting and apathy as symptoms. Most of the cases of fainting had EEGs done, and none showed characteristically epileptic tracings. Apathy might deserve closer investigation in regard to its possible organic origin ; it may be one of those organic symptoms which we are not very efficient yet in diagnosing in its mildest manifestations.

Symonds and Ritchie Russell observed that in their group of " chronic " cases the prognosis depended on constitutional factors rather than on the duration of the post-traumatic amnesia.

In my own cases exact data about the amnesia were available in 136 cases ; 59 cases were classified as mild (P.T.A. up to one hour), 43 as moderate (P.T.A. up to 24 hours) and 34 as severe (P.T.A. on 24 hours), and these groups were compared with each other on all the points mentioned before. None of these comparisons, of which some examples are given in Table I, yielded statistically significant differences ; only the age distribution showed some accumulation of older patients among the severe group (P. just above ·05). This would

TABLE I.

	Mild.	Moderate.	Severe.	Chi square.	P.
Age above 30	20	15	20	5·89	·10–·05
Positive family history	28	18	21	2·76	·3–·2
Positive personal history	25	14	19	4·15	·2–·1
Irritability	23	15	18	2·78	·3–·2
Fainting	6	8	8	2·90	·3–·2
Somatic anxiety	20	19	16	1·99	·5–·3
Lack of drive	13	3	5	4·84	·1–·05
Bombardment among main causes	6	10	8	3·34	·3–·2
Invalided	25	18	16	·2	·7–·5
Totals	59	43	34		

confirm that, in these chronic post-concussional states, the duration of amnesia loses its prognostic value, but the comparison fails to demonstrate any factor showing an inverse relationship to the severity, and thus likely to account for the equal prognosis in mild and severe injuries. To elucidate the point further, 151 cases returned to duty were compared with 142 discharged from the army, with regard to various aetiological factors.

As will be seen from Table II, most of the differences are negligible, and only the differences in family history are statistically significant (P < ·01).

TABLE II.

	R.T.U.	Cat. E.
Positive family history	105	73
Positive personal history	80	77
Stress of bombardment	30	34
Stress of separation and regimentation	79	78
Stress of unsuitable work	36	25
Stress of domestic difficulties	44	36
Totals	151	142

It is most surprising to note that the positive family history seems to have a favourable effect on the outcome ; I do not think it is possible to give a definite interpretation to this observation. It may be equally surprising that personal history of neurosis or of marked neurotic traits shows no demonstrable effect on the outcome. However, if one singles out the severe cases, one finds a slightly, though not significantly, worse prognosis in cases with a positive family history.

TABLE III.—*Severe Cases.*

	R.T.U.	Cat. E.
Positive family history	8	11
Negative family history	10	5

χ^2 (corr.) 2·05. P between.

Another aspect may be worthy of comparison, viz. intelligence. Using the Matrices tests, the occurrence of intelligence below the average does not differ significantly from chance in the mild, moderate, and severe groups. In 172 (more recently admitted) cases the Mill Hill vocabulary test was also employed. The results are tabulated on p. 12. They show that in more cases the Matrices score was higher than the Vocabulary group than vice versa. Although the procedure is not sufficiently refined, the distribution certainly does not point to an intellectual deterioration in the group (which would lead to a higher score in the Vocabulary, as compared with the reasoning test). A random sample of 256 non-head injury cases was equally tabulated, and the differences between the two shows that a superior Matrices score is more frequent among the head injuries than among the controls.

CONTRIBUTORY FACTORS.

It has been mentioned before that these late cases of post-concussional states show no demonstrable neurological signs, or, where they show any, they do not account for the clinical picture, as shown by the fact that the vast majority of equally injured patients do not develop these chronic symptoms. The same is true for psychological signs of organic kind.* They are rarely found; they are hardly discriminative, and, again, where they are demonstrable, they can be considered only as one contributory factor. Even if we admit hypothetical structural changes to account for an alteration of reaction type and threshold of response, and if we allow for a constitutional predisposition (demonstrated in Symonds' and Russell's material), we have to look for those additional factors which precipitate and maintain these chronic pictures. There is little doubt, even among diehard neurologists, that these factors are environmental, social and psychological. Moreover, it is agreed that these factors are the important ones, since they are modifiable, i.e. susceptible to treatment.

This aetiological pattern is not very different from that seen in the common neuroses, and the more the psychological factors are important in a late post-concussional state, the more it will approximate the clinical picture of a neurosis. The material sent to a neurosis centre (like Mill Hill) was obviously a selected one; the more psychogenic features a man showed, the greater was his chance of being sent there rather than to a head injury centre.

Calling these states neuroses for short, my clinical material can be classified into:

(1) Accident neuroses.
(2) Incidental neuroses.

Needless to say, many cases are mixed. The two main classes may be subdivided into any number of types according to the predominant causative mechanism; very often several factors are of equal importance.

* This aspect of the problem was discussed by Surg.-Lt.-Cmdr. G. Tooth at the same meeting.

HEAD INJURIES.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	34 .	9 .	6 .	49
Average	34 .	29 .	11 .	74
Above average	7 .	20 .	22 .	49
Totals	75 .	58 .	39 .	172

CONTROLS.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	26 .	35 .	7 .	68
Average	31 .	63 .	21 .	115
Above average	6 .	43 .	24 .	73
Totals	63	141 .	52 .	256

	Head injuries.	Controls.	
Vocabulary higher . . .	26 .	63 .	89
Matrices higher . . .	61 .	80 .	141
Totals	87 .	143 .	230

x^2, 4·58.   P, between ·05 and ·02.

The same procedure can finally be applied to compare those cases of head injuries that returned to duty with those invalided out of the Service.

R.T.U.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	13 .	5 .	4 .	22
Average	20 .	15 .	9 .	44
Above average	3 .	12 .	13 .	28
Totals	36 .	32 .	26 .	94

INVALIDED.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	21 .	4 .	2 .	27
Average	14 .	14 .	2 .	30
Above average	4 .	8 .	9 .	21
Totals	39 .	26 .	13 .	78

	R.T.U.	Invalided.	
Vocabulary higher . . .	18 .	8 .	26
Matrices higher . . .	35 .	26 .	61
Totals	53 .	34 .	87

x^2, 1·26.

This shows that the difference between Matrix and Vocabulary score is of no prognostic importance.

1a. Neuroses due to fear, shame or guilt connected with the accident.

R. Y—, a private in the R.A.S.C., driving a lorry in convoy, had to pull up sharply, because the vehicle in front stopped suddenly. He hit his head against the windscreen, was dazed for a second, and had a trivial bruise. He complained afterwards of dizziness and intolerable headache. Thorough physical investigation showed no cause for his complaint. Prolonged rest had no effect. During the psychiatric interview he related that the sudden stop of the convoy was due to an accident; a vehicle further forward, driving round a hair-pin bend, had crashed over a parapet and the patient had seen it overturn and somersault down a steep hillside. The patient and others went to the rescue, but found the driver killed. He was thoroughly shaken and developed his present symptoms. He improved with explanation, after he had been promised a transfer to a non-driving job.

Sgt. N. B—, a regular soldier in an infantry regiment, was in the fighting near Dunkirk. He was thrown against a wall by the blast of a shell. He was unconscious for an indefinite period, but able to make his way to the beaches and was evacuated by destroyer. For two years afterwards he suffered from headaches and forgetfulness and felt increasingly irritable. Various periods of rest and treatment did not improve his condition. No psychological factors could be elicited in several interviews. He was given sodium amytal by injection. With violent emotion he reported the following story:

" During the retreat he was in charge of a platoon; most of the men came from his own village. Owing to his injury he was separated from his unit. After he returned he learned that most of his men had been lost. He was afraid to return to the village and to answer all the questions that would be put to him, since he felt responsible for his men."

He reported sick with his present symptoms.

The fear of having been injured, permanently damaged, is a variant of the other fear reactions. The significance of the head in the body-image, and the impressiveness of unconsciousness and confusion, the popular views of the seriousness of concussion (as opposed to knock-out), all combine to produce the psychological attitude which has been called head-consciousness. No man readily admits to himself, or to others, that his mental functions have been impaired, and if he has reason to suspect such an impairment, the hypochondriacal preoccupation and the repression of his anxiety can form the nucleus of a neurotic reaction. This mechanism is of very striking importance in cases of mild impairment of intelligence, or mild aphasic and similar defects (not covered in this series), but it also occurs in recoverable and recovered cases, when they have become aware of such defects during their convalescence.

Prophylactic explanation and reassurance can do much to prevent such reactions; on the other hand, unskilful management and treatment can be a potent precipitating factor of such neuroses.

1b. Reaction to treatment (or mismanagement), in fact, may be classified as a special type of accident neurosis following head injury. Prolonged bed rest is a factor strongly suggestive of seriousness of the injury; in particular, if the patient feels subjectively well, he is liable to conclude, when kept in bed for several weeks, that the doctor must fear serious consequences, and this fear is easily transferred to the patient himself. Such apprehensions, or rather, misapprehensions, are often expressed to the patient, who cannot fail to be impressed and to start watching for after-effects.

N. I—, a soldier, aged 20 (A.5099), employed as despatch rider, lost control of his motor cycle on loose ground, and ran into a tree. He had a retrograde amnesia of a few seconds, a post-traumatic amnesia of under 24 hours. He was treated at a eception station and felt all right after 10 days. Now he was sent to the nearest hospital for X-rays. He was duly impressed when 8 or 10 pictures were taken. He assumed everything was all right, though he was not told so. He was back in the ambulance, to return to his camp, when suddenly a nursing orderly ran after him ; a fracture had been discovered after all, and they wanted to take a few more pictures. The fracture was a doubtful, and certainly trivial, fissure, but on that evidence he was admitted to the hospital and kept in bed for five weeks, in a convalescent home for a further three weeks, and then sent to a convalescent depot. He was put on a strenuous hardening course, but nobody ever talked to him about the seriousness (or otherwise) of his injury. His symptoms developed during his enforced rest in bed. He improved with simple psychotherapy and graded exercises, and his C.O. reported him as doing full duty efficiently and willingly twelve months after his discharge from Mill Hill.

Another case, A.4322, with a much more complicated psychological background, who suffered from intolerable headache two years after a motor-cycle accident, was admitted to a surgical ward for investigation and treatment. He was told he might have a clot on his brain, and that air would be put into his ventricles. However, nothing happened until he was transferred to Mill Hill, still under the impression that he had " a clot on his brain." This man, who had been a " chronic head injury " for 18 months, was successfully treated, passed a W.O.S.B., completed his O.C.T.U. training, was commissioned in a parachute unit, with which he went to France on D-day (12 months after his discharge).

1c. *Reaction to the social and environmental effect of the accident.*—This is a further type of accident neurosis. This type is not uncommon in peacetime; it has its specific colouring in Army patients, but it is perhaps most impressive in flying personnel after comparatively mild physical injury, but marked psychological reaction which leads to being grounded or boarded unfit for flying duties.

Sgt. A. P—, R.A.F., aged 22, admitted in January, 1945, complained of headaches and giddiness. Volunteered for air crew in 1940, trained as W/Op. A.C.; 320 operational flying hours. While on patrol over the Gulf of Biscay the aircraft was attacked; the pilot took evasive action, got into difficulty and ordered the bombs to be jettisoned. Patient was thrown through the opened bomb doors, but clung to the aircraft and was rescued. He got many bruises all over his body, including his head, and was badly shaken. He was taken off flying duties and developed his present symptoms. When put on non-operational flying he was nervous and jumpy, and finally he was boarded unfit for flying duties. This made him consider himself a complete failure, and his symptoms became worse and worse. Reasons for the intensity of this reaction were discovered in his personality and past history. He lost his symptoms with psychotherapy, but since there was no chance of his being returned to flying duties, he had to be invalided.

2. *Incidental Neuroses.*

An injury to the head, like any injury, may be the last straw to a man in a life situation of stress, just short of causing a breakdown. Among our soldier patients there were a good many who were in a state of sub-neurosis when they met with such an accident. The browned-off soldier at home, the soldier

abroad who suffered under the long separation from home with all the con-
comitant anxieties, are obviously in a state which made them susceptible to
any neurosis-producing stress. The period of contemplation in hospital is
liable to increase their anxieties, and produce frank anxiety symptoms and
escape mechanisms.

Sgt. L. P——, aged 25, ·A.4814, was hit by a football on the back of his head.
He had an amnesia of one or two minutes, and developed severe headaches after-
wards. He was always highly strung, a seclusive, home-tied young man, extremely
conscientious at his work, a worrier by nature. He volunteered for the Army in
1939 because he considered it his duty. He had little military training, was soon
employed on clerical work and was considered a highly reliable worker. He
gained quick promotion and was posted to the War Office. He was given more and
more responsible work and started worrying about it. Four weeks before the
accident his superior officer went sick ; his responsibility and worry increased ;
he developed diarrhoea, but did not report sick, since there would have been nobody
to do his job, but following this accident he was sent to a reception station, and
his headaches prevented him from returning to duty. He improved with a period
of rest and modified insulin treatment, which saved his face. He accepted explana-
tion and reassurance, and returned to his previous duties. He was doing full
duty efficiently and willingly twelve months after his discharge.

Many cases in this group are chronic or recurrent neurotics in whom the
post-concussional state is only an exacerbation of this condition.

W. J——, aged 32, A.5638, complained of headache following a motor-cycle
accident in which he was stunned for a few minutes. His mother suffers from
cerebral arteriosclerosis, his brother from a chronic psychosis ; the patient's sister
is nervous. He was a nervous child, was frequently off school on account of eye
trouble (twitching of lids). He worked as a painter for his father first, later had
numerous jobs elsewhere. He had frequent periods of depression, in which he felt
like killing himself. Following the accident he developed headaches ; he was so
worried about his health that he thought his life was finished. He improved, and
was called up at that time, though his headaches still persisted. When he had to
wear a steel helmet the headaches became intolerable ; he became obsessed with
his health, kept on thinking about his head injury, and feared he would go mad
like his mother. He improved, but was considered unfit for further service.

In some of these cases one can suspect that the accident itself is a neurotic
symptom, a subconsciously motivated self-injury or suicidal attempt, but it is
difficult to prove this in the individual case.

SUMMARY AND CONCLUSION.

The stages in the treatment of head injuries have been defined and a classifi-
cation proposed.

A number of observations on the frequency of late effects showed that
prolonged after-effects after non-operative injuries occur in about 20 or 30 per
cent. of the cases. There is evidence to show that constitutional predis-
position is an important contributory factor in their aetiology ; others are
psychological and environmental stress. In that respect the chronic cases
do not differ much from neurotics, though their predisposition is slightly less,
their symptomatology slightly different. The prognosis is very similar. The
psychological and social factors, susceptible to treatment and environmental
manipulation, are of the greatest practical importance. The inevitable con-

clusion is that psychiatric methods, if not a psychiatrist, should be employed at an early stage of the treatment and rehabilitation of head injuries.

PRECIPITATED PSYCHOSES.

The pre-war literature was reviewed in the *J. Ment. Sci.*, Special Number, 1944. No war experiences have yet been published. 'Only very few psychoses were admitted to Mill Hill; this material, therefore, is not representative. Among 5,000 admissions the diagnosis schizophrenia was made 37 times. In two of these the head injury was considered a precipitating cause; one of them (A.3476) was a man, aged 24, who had had a schizophrenic attack at the age of 17. He recovered and worked satisfactorily as an engineer, but remained solitary and morose. Seven weeks before admission he was knocked out in a quarrel at work. He became anxious and depressed, and complained of lack of concentration. He attended out-patients and was later admitted. He showed severe thought disorder, was slow and depressed, and showed a paranoid attitude towards his workmates. His depression and paranoid attitude improved, and six months after the injury he was considered recovered and returned to the same work with a different employer.

The second case (A.7956) was a soldier, aged 25, of low average intelligence, who had no history of earlier mental disease. He was always shy and solitary. He joined the Regular Army, served in Egypt and Palestine before the war, and took part in the landing in Sicily in 1943. In October he was wounded in action; he was found unconscious, and his mandible was fractured by shrapnel. His post-traumatic amnesia could not be assessed exactly. He was evacuated to N. Africa, and by stages returned to the U.K. Whilst at home on disembarkation leave, about three months after the injury, he began to feel queer and reported sick. He was recommended for admission; on arrival he complained of dizziness (no headache), peculiar thoughts, difficulty in thinking, depression with self-reproach and suicidal thoughts, and ideas of reference. He was reticent and unco-operative, and had auditory hallucinations.

There was a considerable number of depressive reactions among the 350 cases, but the vast majority were clearly reactive in kind. In some cases the problem arose whether the patient's emotional reaction developed on the basis of some permanent change of emotional disposition due to cerebral (frontal) injury.

A.5777, aged 28, Cpl. R.C.S., was described as a cheerful and sociable personality, keen on games and sports, an ardent motor-cyclist, a happily married man who had never shown any signs of emotional instability. He had worked for the same firm all his life, working up from butcher's boy to manager of a shop. He joined in 1940, was stationed in the U.K. until he took part in the N. African campaign; was employed as a linesman. Injured in an accident of which he has no recollection. Amnesia cannot be exactly assessed owing to lack of landmarks. He was taken to hospital in a dazed condition. During his in-patient treatment he noticed the loss of his sense of smell and taste, with " nasty " sensations of taste and smell. He also complained of terrible headaches. During his repatriation and disembarkation leave he became increasingly depressed, morose and disgruntled. He was worried about his memory and concentration, though tests showed no signs of intellectual deterioration. The EEG was abnormal. He did not improve with treatment and was invalided.

In the following case the picture was that of a severe state of depersonalization in the setting of a severe suicidal depression :

B.16, aged 32, admitted to Mill Hill on 14.ix.44.

Complaint.—Loss of all feeling, " as if he had lost his soul." When looking to the right things appear wobbly and he has multiple vision—five to six objects instead of one. Never any headaches, except after encephalogram.

Family history.—Nothing relevant.

Personal history.—Elementary school till 14. Left from Standard 6 (7). Casual labourer for many years. Road sweeper for Lambeth Council, seven years. Last wages £3 6s.

National Service.—Called up August, 1940 ; P.C. Transferred to C.M.P. ; vulnerable points. Home service only.

Previous health.—Rheumatic pains on and off since aged 20. Nervous dyspepsia all his life.

Personality.—Always nervous and highly strung; uncomfortable in the dark. Interested in motor cycles, but could never afford one of his own, Loves wireless sets. Since the days of the crystal set he kept building sets from bits and pieces he could get hold of. Happily married since 1935. Wife had operation for ectopic pregnancy. One child died of marasmus. Two alive.

Present condition.—On 11.vi.44, while guarding a road block, he was hit on the right side of his face by a piece of steel tubing. He was knocked out, retrograde amnesia for a few seconds. Woke up in Ipswich Hospital. Post-traumatic amnesia indefinite—probably about a fortnight. Unconscious on admission. Fracture of right maxilla and infra-orbital margin. Fracture of the right side of the convexity. C.S.F. blood-stained. Right antrum opened—orbital flow elevated. (?) Rational on 20.vi.44. On 23.vi.44 mental conditions still rather strange. He was sleepy and childish. Air encephalogram on July 18 ; depression of roof of right anterior horn. On July 2 he said he had a terrible experience, when everybody seemed far away and things seemed unreal. He was lethargic, childish and anxious, afraid of leaving his children and of dying. Transferred to convalescent home on August 5, still depressed and complained of loss of interest and double vision. States now that his present condition started suddenly on the journey from hospital to convalescent home.

On admission.—Very little emotional expression. Complete anosmia. Right eye slightly lower than left. Other cranial nerves N.A.D. No weakness or ataxia of extremities; deep reflexes brisk and equal. No pathological reflexes. Orientated in time and space. No gross disturbance of attention. Co-operative and reasonable. Mildly depressed. Considerable emotional lability in spite of his continuous complaint of complete loss of any effect—" If you gave me a new radio-gramophone all for myself, it would not give me pleasure."

Deterioration tests.—Marked deterioration.

X-rays.—Fracture right vault, temporo-parietal, right maxilla, zygoma, floor of orbit.

Progress.—Transferred to facio-maxillary unit for repair of orbital floor. There his depression increased; he was considered seriously suicidal and transferred to a mental hospital. He was discharged improved in April, 1945.

He was visited in August. He was still depressed, though able to carry on his previous work as a labourer. He still complains of loss of interest ; his initiative is poor. He gets irritable and worries about himself.

REFERENCES.

ADLER, A. (1945), " Mental Symptoms Following Head Injury," *Arch. of Neurol. and Psychiat.*, **53**, 34.

BOTTERELL, E. H., and WILSON, K. E. (1944), " The Active Management (Non-operative) of Cranio-cerebral Injuries," *Canadian Med. Ass. J.*, 498.

BRENNER, CH., FRIEDMAN, A. P., MERRITT, H. H., and DENNY-BROWN, D. E. (1944), " Post-traumatic Headache," *J. of Neurosurg.*, **1**, 379.

DENNY-BROWN, D. (1945), " Disability Arising from Closed Head Injury," *J. Am. Med. Ass.*, **127**, 429.

EYSENCK, H. J. (1944), " Types of Personality," *J. Ment. Sci.*, **90**, 851.

FRIEDMAN, A. P., BRENNER, CH., and DENNY-BROWN, D. (1945), " Post-traumatic Vertigo and Dizziness," *J. Neurosurg.*, **2**, 36.

GUTTMANN, E. (1943), " The Prognosis in Civilian Head Injuries," *Brit. Med. J.*, **1**, 94.

Idem (1943), " Post-contusional Headache," *Lancet*, **1**, 10.

Idem (1944), " Psychiatric Aspects of Head Injury," " Recent Progress in Psychiatry," *J. Ment. Sci.*, **90**, 328.

LEWIS, A. J. (1942), " Discussion on Diagnosis and Treatment of Post-contusional States," *Proc. Roy. Soc. Med.*, **35**, 607.

MERRITT, H. H. (1943), " Head Injury," *War Medicine*, **4**, 61.

RUSSELL, W. R. (1934), " The After-effects of Head Injury," *Edin. Med. J.*, **41**, 129.

SYMONDS, C. P., and RITCHIE RUSSELL, W. (1943), " Accidental Head Injuries," *Lancet*, **1**, 7.

ADDENDUM.

Electro-encephalographic Findings.

Electroencephalograms were carried out in 112 cases at Hill End Hospital by Mrs. Arundel. The tracings were classified into normal (49), doubtful (19), and abnormal (44). The groups were compared in all the points employed before and the significance of the differences calculated.

The doubtful and abnormal groups contained significantly fewer men above the age of 30. Family, social and personal history showed no significant differences. As regards previous character traits, the abnormal group showed an excess of men described as seclusive and lacking drive. In symptomatology, the abnormal group showed more frequently hysterical conversion symptoms. The doubtful and abnormal groups were less frequently below average in intelligence. The boarding-out rate was the same in all three groups.

Comparing mild and moderate cases on the one hand, and severe ones on the other, as regards the EEGs, a definite preponderance of abnormal EEGs in the severe group was found.