HEAD INJURIES IN CHILDREN AND THEIR AFTER-EFFECTS

BY

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Children form a considerable proportion of admissions to an accident service. The proportion of fatal road accidents was 1,049 children (under fifteen years of age) to 8,347 adults during the first year of the war, and 1,494 to 10,077 during the second. In non-fatal road accidents, the proportion of children to adults is slightly higher—approximately 1 to 5:

October, 1941, 2,826 children to 14,824 adults.
October, 1942, 2,097 children to 11,121 adults

(Safety News, 1942).

The material for this study is taken from a series of 320 head injuries admitted between July 1, 1941 and June 30, 1942. Among these were fifty-eight children (under fifteen years of age), including only one fatal case. To this were added two cases admitted immediately before, thus bringing the consecutive series up to sixty. In addition, six earlier cases were included, seen on account of their severity.

The admissions were not evenly distributed over the year; the figures were:

July–September . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
in the table below. Estimates were not only based on the observation in hospital, but on school attainments and school reports. Tests used were either Binet (Terman-Merrill) or Raven’s Matrices, and in some cases Kohs Blocks Designs and the Goodenough scale in addition. The figures refer only to children of school age.

<table>
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<th>Table 1</th>
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<tbody>
<tr>
<td>Tested</td>
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<tr>
<td></td>
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<tr>
<td>Estimated</td>
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<tr>
<td>Total</td>
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These figures do not bear out the original assumption, showing as they do a fairly normal distribution of intelligence.

Repeated accidents may be an indication of personal accident proneness. Five of the patients had previous head injuries, two had had injuries to other parts of their body (one patient appears in both groups). Only accidents which the mothers regarded as such were counted, i.e. not ordinary falls, and the figure can therefore be regarded as high, considering the age group and the figures in adults. However, no comparable material for children is available, and no definite conclusions can be drawn.

**Clinical picture**

(1) **FRACTURES.** The impression has often been recorded that the skull of the child is more liable to fracture than that of the grown-up. This is somewhat surprising considering the elasticity of the bones of children; but no comparative figures are available. In this series the incidence of fracture was as follows:

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed fissured fractures</td>
<td>17</td>
</tr>
<tr>
<td>Depressed, not compound</td>
<td>1</td>
</tr>
<tr>
<td>Compound</td>
<td>6</td>
</tr>
<tr>
<td>Involving sinus</td>
<td>1</td>
</tr>
<tr>
<td>Clinical evidence of fractured base (aerocele)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>26</td>
</tr>
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</table>

This incidence is compared with that in 165 consecutive adult admissions in Table 2.

<table>
<thead>
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<th>Table 2</th>
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<tbody>
<tr>
<td>Fractures</td>
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<tr>
<td>----------</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Children</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

This difference is statistically significant, being 2.26 times its standard error.

(2) **NEUROLOGICAL SIGNS.** Twenty-seven out of the total of sixty-six cases showed definite neurological signs. This figure, however, gives no accurate picture, because the incidence of neurological signs depends to a large extent on the interval between the injury and the first examination. Seen immediately after concussion, most children are liable to show bilateral extensor plantar responses which tend to disappear quickly with the recovery of consciousness. Furthermore, children seem to show neck rigidity more readily than adults with comparatively small amounts of blood in the cerebrospinal fluid.

The most striking difference in comparison with adults is the frequency of fits shortly after injury. Among the sixty children of the consecutive series five developed fits within about an hour of the accident, three generalized convulsions, and two Jacksonian fits. Figures for adults, as found in the literature, vary between 5 per cent. and 0.1 per cent., and they are difficult to compare as some writers call ‘early’ fits within the first week, others within the first month.

In the authors’ experience, there was only one early traumatic fit among 165 consecutive adult admissions. This shows that the incidence of early fits is much higher in children.

Early traumatic epilepsy is generally explained by direct cortical irritation; children are known to respond to all sorts of harmful agents by ‘symptomatic’ convulsions. It is therefore likely that the relative frequency of traumatic fits in children as compared with adults, is due to this general disposition rather than to the type of injury; this observation suggests that there are similar constitutional factors in those few adults who develop fits soon after injuries which in themselves show no conspicuous features of cortical injury such as driven-in bone, to account for this effect.

(3) **MENTAL STATE.** It is much more difficult in children than in adults to assess unconsciousness, unless it is actually observed. In milder cases in which the patients are alert at the time of admission, it is therefore often open to doubt whether they have been unconscious or not. The post-traumatic amnesia is no reliable guide in smaller children. Definite evidence of unconsciousness, viz. observation in hospital or by reliable witnesses, or amnesia, in suitable cases—was present in thirty-eight cases. The duration of unconsciousness or of the post-traumatic amnesia was:

- under 1 hour . . . in 23 cases
- 1 to 24 hours . . . . . 8 . .
- over 24 hours . . . . . 7 . .

As the standards were not uniform, the distinction between the groups is too vague for any statistical application.

The demonstration of clouded consciousness is still more difficult than the assessment of unconsciousness. During the recovery from unconsciousness children present a different clinical picture from
HEAD INJURIES IN CHILDREN

that seen in adults. Emotional symptoms prevail, and it is impossible to say whether they are the only ones, or whether they mask the intellectual disturbances characteristic of the clouded consciousness in adults.

During this period the children, left to themselves, are quiet and apathetic; when talked to, they turn away. During the physical examination they resist and cry. They are irritable, fretful and morose; they do not respond to the usual little bibes. Now, all sick children tend to behave like this, and this behaviour may be understood as the childish reaction to being sick, perhaps intensified by the sudden awakening in strange surroundings. It is peculiar, however, that this emotional state ends suddenly, as a rule, and this change does not look like the adaptation of the child to new surroundings.

The child wakes up one morning as a 'different child'—very reminiscent of the adult's waking up from a state of clouded consciousness. Time and again when it seemed that the patient was a shy, resentful or stupid youngster, it was surprising to find, a few days later, a nice, cheerful and well-behaved child. Thus it began to be apparent that this emotional state was an equivalent of the adult's clouded consciousness. This syndrome, more or less marked, was present in seventeen out of sixty cases. Blau (1936) has published cases of mental disorder after head injury (in children) so severe that admission to a psychiatric ward was required: the picture he describes could well be regarded as that in the present observations, intensified to an extreme degree. The following is an example from the cases under discussion:

Marjorie B. (R.I. 22040), aged ten years, admitted March 31, 1942. This girl attends a village school a mile and a half away from her parents' house. On the way home she was knocked down by a motor cyclist. Admitted one hour after the accident she was deeply unconscious. She had bilateral compound fractures of tibia and fibula, a lacerated wound on the right side of the forehead, and a compound depressed fracture in the left parieto-occipital region. The legs were operated on the same day; the scalp wounds were excised the following morning. The occipital wound was enlarged, the depressed bone removed, a small hole in the dura stitched and the wound closed in layers without drainage. The patient remained unconscious for a week, though she gradually began to respond to painful stimuli, to swallow fluid, to pull her bedclothes up. On April 10, she appeared awake, but was still mute and did not carry out verbal requests. She resented interference, cried when touched, and for no obvious reasons frequently started screaming. On April 14, she was still disinclined to co-operate at any examination; she threw away a pencil put into her hand, and made no active effort to feed herself. She was very irritable, and burst out screaming at the slightest interference. On April 21 she began to speak to other children and to the nurse who looked after her, but was still irritable, resentful, unco-operative and rude. She tried to get out of bed and to go home, though both her legs were in plaster up to the hip. She snatched another child's dinner, tried to take the doctor's fountain pen and other children's toys. She kept on asking for the same things. Early in May her behaviour changed; she was homesick and cried she wanted to go home. She still had bouts of irritability, but in the intervals she behaved much more normally. Towards the end of May she became nice and polite, and perfectly co-operative at physical examinations and mental tests. The only definite neurological sign she had was a left external rectus weakness (her lower extremities were in plaster all the time). Results of tests, carried out in the last week of May; Binet (Merrill Terman) I.Q. 83; Raven Matrices 25 percentile; reading age (Burt) between 9 and 10; arithmetic age 9; spelling age 9; drawing (Goodenough scale) age 7.

When she was re-examined on September 26, 1942, her mother reported that she behaved perfectly normally at home. She took up lessons at home and made good progress. She was fit now to go back to school (this involves a one-and-a-half mile walk). On examination she showed a slight inequality in knee and ankle jerks on the two sides, otherwise no neurological signs. Her behaviour during the interview was unexceptional. She was co-operative in tests. Her mental age, in Kohs block design test was 9-8 corresponding to an I.Q. of 93.

The Head Teacher of her school reported on December 10, 1942:

'Although she was absent from school for nearly seven months, she was on her return able to take up her work where she left off. She has made good progress, and there are no changes in her attitude towards school life, or in her behaviour. The only difference I have noticed is that she is a little more quiet in manner.'

(4) HEADACHE. This has not been mentioned before, because this symptom is of greater importance as an after-effect than in the acute stage. It has often been said that children do not suffer, or suffer less frequently, from headaches than do adults. It seemed worth checking this impression in the present series. Notes on headaches were taken at least at the first thorough examination and on discharge from hospital, and later on at each follow-up visit; in the earlier cases at least three times, in some of the more recent ones only twice. If on any occasion the child reported headache, the case was recorded as positive; the figures are therefore bound to be on the high side. The results were:

<table>
<thead>
<tr>
<th>In hospital</th>
<th>After discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>16 (35 per cent.)</td>
</tr>
<tr>
<td>Negative</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
</tr>
</tbody>
</table>

The figures during hospital treatment are slightly lower than those for adults, the figures after discharge practically the same. They are, however, not strictly comparable owing to the different procedure in collecting the material. Considering this, it can only be stated that headache as a symptom of the early stage is of comparatively small importance. The significance of persistent headache as an after-effect will be discussed later.
Hospital treatment

The children were not treated with prolonged rest, as even modern text-books still recommend: but they were given the same active rehabilitation, as is the routine in adult cases. They were not kept in the horizontal position, unless they themselves felt like lying flat, and they were encouraged to get up, as soon as their general condition permitted. In a considerable number of cases the duration of inpatient treatment was determined by injuries to other parts of the body. The actual figures, without making allowances for this, were:

<table>
<thead>
<tr>
<th>Up to 1 week</th>
<th>2 weeks</th>
<th>3 weeks</th>
<th>4 weeks</th>
<th>5 weeks</th>
<th>6 weeks</th>
<th>7 weeks</th>
<th>8 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>18</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Both the twelve-week cases were kept so long on account of extensive injuries to other parts of their bodies. Excluding them, the average stay is 1.5 ± 0.14 weeks. It gives, however, a clearer picture to say that three-quarters of the patients were discharged in under two weeks.

After-effects

Out of the sixty-six cases, twenty were below school age, and four had left school at the time of the accident. Of the forty-two school children, in four cases no exact information about the date of their return to school could be obtained: two were still away from school six months after the accident; one patient died. The remaining thirty-five cases were distributed as follows:

**ABSENCE FROM SCHOOL**

<table>
<thead>
<tr>
<th>1 week</th>
<th>2 weeks</th>
<th>3 weeks</th>
<th>4 weeks</th>
<th>5 weeks</th>
<th>6 weeks</th>
<th>7 weeks</th>
<th>8 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

In a few cases the absence from school was longer than necessary owing to vacations.

In no case without associated injuries to other parts of the body was it found necessary, as Ford (1937) suggests, to keep the child away from school for six months or more.

The table shows that a quarter of the cases lost two weeks or less: half between two and seven weeks: and a quarter more than seven weeks. No allowance was made in the table for prolonged absence owing to injuries to other parts of the body.

In the 'over-seven-weeks' group were two patients who had had lacerations of the brain with aphasia, one child in poor general health who had attended school irregularly before, a boy who, since he was an evacuee, had to be sent to a convalescent home on discharge from hospital, the other a neurotic girl. Mary J. (see below): the length of absence in the last case was due to the school holidays.

The 'seven-weeks' group included one case of subdural haematoma, one case of compound, depressed and infected fracture, two severe injuries to other parts of the body, and one neurotic girl.

Regarding two to seven weeks of absence from school as the 'normal' time according to the table, four to five weeks can be considered as a reasonable maximum in cases without special complications.

**Late signs and symptoms.** The impression gained from the literature about frequency and severity of after-effects is necessarily biased, as severe and unusual results are more likely to be published than ordinary cases. Starting from surgical material (of which however not more than half could be followed up) Stone and Brams (1927) found headache in 20 per cent. of the cases. Beckman (1928) who made a very thorough follow-up study of a large and unselected group found some after-effects in 23 per cent. of the cases, but only in a very few of these (less than 5 per cent.) were the symptoms permanent.

In the present consecutive series of sixty cases seventeen patients (or their mothers for them) complained of nervous or mental after-effects at some time after discharge from hospital: so did two out of the six earlier cases which made up the series.

Several syndromes can be distinguished among the after-effects:

(a) **Post-conclusional syndrome.** Six patients complained of headache and or giddiness. All these except one, were thirteen or fourteen years of age. The sixth case, a boy of nine (Donald B. R.I. 17644) after a previous head injury treated elsewhere, developed petit mal attacks which he described as sensations in his head. The accidents of all the children in this group were comparatively mild, and all cases showed psychological or social features which seemed adequate to account for the continuation of the symptoms. In other words, children of this age behave similarly to adults, but the picture is more coloured by the influence of home environment. The following case is an example:

Mary J. (R.I. 22509), age twelve years, admitted April 25, 1942, after colliding with a lorry while cycling. She was unconscious for a few minutes, but recovered consciousness on admission. Her post-traumatic amnesia was about thirty minutes. She had a few bruises in the face, on the shoulders and knees, no bleeding from nose or ears, no neurological signs. X-rays showed a fissured fracture in the left temporal region. She complained of no headache, nausea or vomiting. During the next few days she complained of some headaches and some giddiness, when first getting up. She also developed some pain in her right ear, in obvious imitation of another girl in the next bed, who had been involved in the same accident, and had had a fracture through her left mastoid process with bleeding and deafness. With some suggestion and the usual active management she improved and was discharged free from symptoms on May 11, 1942.
When seen again on July 25, 1942, she complained of headache, poor sleep and failing concentration. She had returned to school a fortnight before this consultation, but she started vomiting and feeling unwell, so arrangements had been made for her to have breakfast in bed, get up at ten, and attend school in the afternoon only. On examination she looked a perfectly healthy child. She was over-carefully dressed, very ladylike and artificial in her behaviour. Her hair was elaborately curled (done every morning by her mother who commented—"The only thing I can do for my child"). The neurological examination was entirely negative, and the child's description of her complaints was vague and inconsistent. The mother regards her as a martyr and an invalid, although she herself points out how unreliable the child's statements are. The family doctor thinks the concentration required at school is too much for the child and told her so: the mother repudiates the suggestion that the patient's recovery could be comparable to that of other children; she is so sensitive and highly strung that she could not be expected to recover in the normal time.

The mother herself is a highly-strung, over-anxious woman. She had the main responsibility for her children's early up-bringing as her husband was at sea.

Patient is the younger of two children. She is described as unusually artistic, and she has had dancing lessons since the age of three. She has raised 'hundreds of pounds' for charity by her public appearances. As long as she went to Junior School, she was taken in the bus by her mother four times a day and was not allowed to mix with the 'rough' children in the neighbourhood. She was teased a lot as 'Shirley Temple.' She had suffered from bilious attacks and colitis, had had her tonsils out and some operation on her ear. She has been subjected to several medical examinations for an insurance company since the accident, and the claim has not been settled yet (December, 1942).

(b) NEUROTIC SYNDROMES. One boy, a defective, developed an hysterical limp. Three children developed nightmares or fear of the dark; two of them were described as highly strung before, though nightmares were not mentioned in their previous histories.

In one pre-pubescent boy who had nightmares only when sleeping in the same room with his elder sister, the psychogenesis was fairly obvious; in the other cases there is not much reason to assume that the physical injury in itself had much to do with the symptom. The fact of having had an accident, and perhaps maternal over-concern, are probably sufficient explanation. The same considerations are valid in two cases in which mothers complained of fidgetiness in children, who admittedly had been fidgety before.

(c) EMOTIONAL SYMPTOMS are most difficult to assess. Irritability was complained of in six cases. Three of the six were small children between three and four. Irritability, fretfulness and difficulty in managing them were the only symptoms the mothers noticed, and nothing was found on examination.

A boy of six had had cerebral laceration with aphasia, and he had had headache at the same time. A girl of twelve had had an extradural haemorrhage; she was a pleasant, well-adjusted child, well observed and sensibly managed by her mother who noticed her slight irritability as the only symptom.

This was a case in which there could be little doubt about the organic origin of the symptoms, slight as the disturbance was.

A boy of twelve was very different. He was found in the road in a semi-conscious state; the circumstances of the accident were never quite clear, as everybody tried to hush them up. A strange bicycle was found near the site of the accident, and it was suspected that the boy had 'borrowed' it, though he professed complete amnesia and wondered whether somebody had knocked him out. His irritability manifested itself only in quarrels with his mother who thought that he complained of morning headache only in order to get his breakfast in bed. He also wanted to have his roller skates which she took away from him, as she thought that they were too dangerous. The boy had never had any neurological signs, no fracture of the skull, and only a small haematoma in the occipital region, and the retrospective history showed him to be a highly-strung boy, whom the mother indulged and scolded by turns.

It would seem, in the light of the last case, that irritability and other emotional symptoms require closer analysis before they can be regarded as the result of cerebral injury; the severity of the injury, the neurological signs, the patient's age and disposition and the social and psychological setting in which the symptoms occur, all have to be taken into account before any definite conclusion can be drawn. The separation from home, and the return after some absence, may bring into play psychological factors, the importance of which is seen in Child Guidance cases. It seems justifiable to say that in children in the late as well as in the early stage after injury emotional symptoms are a more common and a more characteristic sign of disturbed cerebral function than is intellectual loss.

(d) CHANGE OF CONDUCT. The most serious after-effect of cerebral injury in childhood is a change of conduct, a behaviour disorder, often described as 'change of personality' or 'deterioration' of character. Strecker and Ebaugh (1924) have drawn attention to this clinical picture which is similar to the mental changes described in the late stages of epidemic encephalitis. The main features are over-activity, restlessness, impulsive-ness, cruelty, emotional instability, temper tantrums, truancy, delinquency. Kasanin (1929) and later Blau (1936) have described such cases. The condition is obviously rare, and much criticism has to be applied to the evidence in cases seen at long intervals after the injury, before one can accept the traumatic aetiology of the condition. This is particularly true in court cases, but in ordinary hospital practice allowance must be made for the general tendency to ascribe to falls or head injuries all sorts of ailments and defects of intellect or character.
In this series there were only two cases where the question of traumatic behaviour disorder had to be seriously considered, one a court case and the other a case of wetting and soiling. It may be worth quoting the histories in brief:

**Case 1.** John H. (R.I. 17553), aged thirteen years, admitted August 23, 1941, after having been knocked down by a car. He had a laceration of his forehead, but no fracture of the skull; he was conscious on admission, and his traumatic amnesia was a few minutes only. The neurological examination was negative. He recovered very quickly; his behaviour in the ward during the six days he was an in-patient was somewhat different from that of other children; he was lively, talked to everybody, shouted across the ward. In the subsequent months he had a short period of headache, and also complained of sleepiness, but this was probably due to luminal which he was given for a period.

In January, 1942, he ran away from home once; he stayed away for five days, and was finally found by the police, camping in an empty house.

In February, 1942, his mother complained for the first time about his outbursts of temper.

In May he was brought before the Juvenile Court. In the absence of his parents he had taken 10s. and had gone off, hitch-hiking to Reading. There he was found sleeping in somebody's car and was handed over to the police.

His behaviour disorder was thought to be due to the injury.

It appeared, however, that something similar had happened before his accident. He had stolen a bag out of a car; he was going with a 'gang' of other boys, about whose activities no more details could be obtained.

A cursory examination showed some factors to account for his behaviour.

His father was away in the Army, and his mother did not find the right approach to him. Though highly intelligent and a first-class scholar, he disliked school, and wanted to be a farmer. He had become dissatisfied since plans for him to go to Canada had not materialized. Circumstances prevented a fuller elucidation of the involved emotional situation.

**Case 2.** Stanley S. (R.I. 17061), aged eleven years, admitted July 31, 1941, following a road accident; he was hanging on a milk van, which backed unexpectedly and he fell off. He was conscious on admission, but had amnesia for a few minutes after the accident. He had a right external rectus palsy, and was bleeding from his right ear. X-rays showed a small amount of air in his middle fossa, but did not demonstrate the fracture of the base which must have been present. Within the next two days he developed signs of meningeal irritation, with 300 white cells in the cerebrospinal fluid. He was rather drowsy for a week, but he recovered with sulphanilamide treatment. He was fit for discharge to a convalescent home three weeks after the injury, the only remaining sign being the oculomotor palsy.

He is one of five children; prior to the War he had been in a home on account of undernourishment. He was billeted with a decent woman who prided herself on her 'way with boys' and who made it her job to win his affection. Though she described him as a nice, willing and sociable boy, it did not surprise her that he did not get on so well with the nurses in hospital. Three weeks after the boy's return to her, she complained to the billeting officer that 'he was not the boy he used to be.' She found him sullen and unresponsive and not so willing as formerly to do things for her. He forgot things on an errand, and there was some quarrel because she did not want him to go on a lorry with other boys for potato-picking. There were many indications that she was treating the boy as an invalid which he much resented.

He returned to school where his attainments were as good as before.

There was no complaint about his behaviour there, but his foster-mother reported in January, 1942, that he had soiled and wet the bed at night. More detailed inquiry showed, however, that the boy had visited his own home, and had brought back extra pocket money, most of which he had spent on ice-cream. On another occasion, having had his usual tea he had gone to a Sunday School tea party, and on return had been sick, as also was the other evacuee in the household.

Further inquiry six months later confirmed the opinion that the symptoms which were complained of by the foster mother were of a temporary nature only, and were not in any sense attributable to the injury as such.

(e) INTELLECTUAL SYMPTOMS. Deterioration of intelligence or disturbance of intellectual development are the most serious after-effects of cerebral injury one might anticipate in children. To supplement the follow-up examinations it seemed, therefore, important to follow the children's school career subsequent to their accidents. School reports were available in thirty-five cases. In all cases of serious injury or doubtful outcome contact was made with the teacher personally by letter or visit. In thirty-two cases the reports stated definitely that the children's performance had not fallen off; in two defective children the results could not be accurately assessed. In one case only did the comparison of school reports before and after the accident show a definite deterioration in school performance. This was the case Donald B. (vide, p. 142) who suffered from traumatic epilepsy, the deteriorating effect of which on intelligence is well known.

**Summary**

Sixty cases of head injury in children are reported. The incidence was higher in summer than in winter. Boys were more numerous than girls. Two-thirds of the cases were due to road accidents. The intelligence of the children was average and did not give any indication of their accident liability. Fractures of the skull were more frequent than among adults. In the acute stage emotional symptoms were more impressive than clouded consciousness and intellectual loss. The incidence of headache did not differ much from that in adults. Two-thirds of the cases were fit for discharge after two weeks' treatment in hospital. The absence from school due to the accidents was two to seven weeks...
in half of the cases, in one-quarter less, in one-quarter more. The post-concussional syndrome was observed in 10 per cent. of the cases; its incidence depended to a large extent on environmental factors. Irritability was the most common after-effect. Persistent behaviour disorder was rare in this series, as also was intellectual impairment.

Thanks are due to Professor H. Cairns and Mr. J. C. Scott for allowing the use of their case material, and to the Rockefeller Foundation which supported this investigation.

REFERENCES