

ticularly in the parieto-temporal region, whether it be fracture or fissure; if there is evidence of splintering of the inner table, or of the presence of a foreign body or of persisting intracranial hemorrhage, operative interference is warranted at the earliest possible moment. (X-ray examinations and lumbar puncture are valuable diagnostic aids.)

(2) In comminuted fracture of the skull the surgeon must decide whether or not the danger of infection is increased by surgical procedures. Surgical technique and surgical methods should be developed to such a degree that the brain and skull will be handled with as much skill as are the abdominal viscera.

(3) In all cases, but especially in those in which external injury cannot be taken to be the determining factor, the question of surgical interference must be decided on purely neurological lines.

(4) It is useless to continue the discussion of the differentiation between concussion, contusion and compression. It is much more important to decide whether the brain has or has not been tangibly injured; and if injured, whether the site of the injury is on or near the surface; in short, whether it is accessible or not. If inaccessible, simple trephining may be resorted to provided there are symptoms of increasing intracranial pressure which cannot be relieved by lumbar puncture or other simpler methods.

(5) Even if the injury is in an accessible region, it is best to adopt a conservative attitude and to determine whether we may trust to surgical skill rather than to the reparative powers of nature. Hemorrhages are often absorbed and many inflammatory processes recede more or less spontaneously.

(6) In determining the gravity of brain injury, disturbances of cardiac and respiratory action, of vesical and rectal control and the condition of consciousness are the most important symptoms. They are the manifestations of increasing intracranial pressure and of other serious injury. Recovery from coma, however slight, after twenty-four, forty-eight or seventy-two hours, is encouraging; deepening coma is of grave significance. The behavior of the pupillary reflexes is of no special value in deciding the question of operative interference.

(7) If the symptoms point to distinct focal lesion, although years may have elapsed since the initial injury, surgical measures must be adopted, providing only that the lesion be accessible.

(8) If the external injury points to one site and the symptoms to another, consider both; attack the site of external injury first but try to reach the other as well.

HEAD INJURIES.*

BY MORTON PRINCE, M.D., BOSTON.

I AM sorry that Dr. Sachs has eliminated from consideration fractures of the base. This distinction is entirely arbitrary, practically cannot

* Remarks in connection with a paper by Dr. Bernard Sachs, on "Serious Head Injuries." See p. 176.

be made, and, therefore, clinically is without value. Dr. Sachs seems to be unaware of the fact that, if we may draw conclusions from fatal cases, a localized fracture of the vault alone, at least in injuries sufficiently severe to implicate the brain, is rare,

I make this statement based on the study by Dr. Edwin W. Dwight of 146 autopsies, in which fractures of the skull were found. Dr. Dwight's paper, published in the Boston City Hospital Reports for 1894, is a very valuable one from a surgical point of view, and well worthy of study. It brings into relief many facts of importance. Out of 146 cases which came to autopsy, in only six cases was there a localized fissure of the vault alone. These, to be sure, were all fatal cases, and it is quite probable that in the non-fatal cases a localized fissure of the vault is more frequent, but, on the other hand, usually it is only through autopsies that we can determine the whole extent of the damage. The unreliability of the clinical signs is shown by the fact that in 31% of fractures of the middle fossa itself, no hemorrhage from the ear occurred.

The importance of this consideration is further brought out by the fact that in 29% of all cases, there was not only fracture of the vault extending into or through the middle fossa, but the fracture ruptured the branches of the meningeal artery, and death was believed to be due to cerebral compression.

We may say, therefore, that fractures of the vault, in the majority of cases, are fractures of the base, and we cannot, in the absence of the classical surgical signs, conclude that the fracture does not extend to the base, nor does it seem to me to be of any great consequence to make the distinction, inasmuch as it is the injury to the brain, and not to the skull, that does the harm.

Dr. Sachs has laid great emphasis upon the necessity of depending upon the neurological indications for determining the necessity of surgical interference. It seems to me that there is great danger here of creating and perpetuating a neurological tradition, just as there has been a surgical tradition as to the importance of separating fractures of the base from those of other parts of the skull.

We have been accustomed to hear, of late years, a good deal about the neurological indications in head injuries, the general implication, on the part of the neurologist, being that we can rely upon the neurological findings to determine both the character of the injury to the brain and its localization. These assumptions are usually meekly accepted by the surgeon as the dicta of a mysterious science. A good deal of this, I am afraid, has come to be little more than neurological cant. As a matter of fact, in a very large proportion of head injuries,—I mean injuries serious enough to implicate the brain,—technically speaking, there are no neurological signs of a special localizing character that give information regarding either the character or location of a lesion. I believe that anyone who has had the experience of a large general hospital, and thus has had an

opportunity to see a large number of cases, as many of us here have had, will find that this statement is borne out by his recorded experience. If he will look over the records of a large number of consecutive cases, he will find absence of localizing signs in the great majority.

I do not mean that there may not be general symptoms and other evidence that may enable us to form an opinion regarding the gravity and possible nature of the injury, but this evidence is not of that special neurological kind which may be technically called neurological. [Taking, for example, the cases I have seen within the space of a few weeks since Dr. Sachs' paper was read, nine in number, all carefully examined and noted, in only one were there so called neurological signs which indicated the seat or nature of the injury (whether hemorrhage, laceration, contusion, edema, etc.), and this one, a peculiar form of paraphasia with delirium, permitted only a doubtful localization. The neurological symptoms did not indicate the nature of the lesion. Seven of the cases were severe; six exhibited evidence of fracture of the base.]

In Dwight's collection "the question of paralysis was unfortunately raised in sixty cases" only. By this it appears to be meant that it was noted in only sixty whether or not paralysis was present. Of these, forty had none. (In seventeen, hemiplegia was found; in one, facial paralysis; in one, paresis of one arm, and in one, paralysis of the sphincters — a questionable diagnosis.) In other words, in two thirds of the fatal cases in which a record of the point was made there was no paralysis present. The proportion is probably higher than this, inasmuch as these statistics are based upon whether or not a symptom was recorded, and common experience shows that the absence of a symptom is much less likely to be recorded than its presence.

It must also be constantly kept in mind that even paralysis does not always indicate hemorrhage or laceration, but that it is sometimes due to edema, which may subside. I recall well, for instance, the case of a child which after a severe fall presented all the classical symptoms of meningeal hemorrhage. Operation was considered, but postponed, and, much to my surprise, in the course of twelve hours all the symptoms disappeared and a complete recovery was made. This could only be due to edema.

The greatest difficulty in determining the exact pathological lesion present and, therefore, the advisability of operation is met with in those cases that are unconscious from the beginning. When the accident does not result immediately in unconsciousness, or, if it does, when the unconsciousness is only temporary and then after a normal interval unconsciousness develops, the case is simple enough. Here the interval of normal consciousness is a plain indication, not only that the latest succeeding unconsciousness is due to a secondary hemorrhage, but that the brain tissue itself was not seriously bruised, lacerated or otherwise injured by the traumatism.

When, however, the injury is followed immediately by persistent unconsciousness, stupor or delirium, it is much more difficult, and often impossible to determine whether the coma and other cerebral symptoms are due to a hemorrhage or contusion or laceration or all three. To obtain data that will enable us to draw conclusions as to the exact anatomical conditions present in such cases, we are obliged to fall back upon the findings in autopsies. With this knowledge in hand, supplemented by the clinical findings and the nature of the accident, we may be able to form a fairly accurate idea of what has taken place within the skull.

The fallacy of drawing conclusions from autopsy findings, of course, is that they tell us only what has happened in fatal cases, which cannot be safely applied to the non-fatal cases. Still, as the difference must be only one of degree, the symptoms and the autopsy findings in fatal cases are instructive. Out of 138 fatal cases in Dwight's collection, in only 22 or 14% was there no laceration. Of course, in the other cases there was hemorrhage besides. This frequency of laceration explains the fact that in so many cases in which trephining is performed and a hemorrhage found and removed, a fatal result is not averted. There is so much laceration of the brain itself that the mere removal of a hemorrhage accomplishes little.

Plainly, the advisability of operation must depend upon the nature of the lesion within the skull. In deciding whether we have to deal with a hemorrhage or laceration or contusion of the brain or a combination of the three, and the extensiveness of the lesion (putting aside the classical and simple cases of meningeal hemorrhage) we must take into consideration four kinds of evidence:

First. The nature of the blow. Was the blow (meaning not to the person but to the skull) of a character which would be likely to shake and lacerate the brain, as well as rupture a vessel? A person may have a severe fall, and yet the head may not be struck severely, while the reverse may be the case. If a person should fall from a height and strike his head with violence, it would be almost a certainty that the brain would be lacerated; whereas, a blow from the fist or a slight fall on the street might only rupture an artery, without greatly bruising the brain.

Second. The general symptoms, such as coma, temperature, pulse, stertor, etc.

Third. The neurological indications.

Fourth. Surgical evidence of injury to the skull.

In many cases, the first class of evidence — the character of the blow to the head — will furnish most important evidence. All the evidence must be weighed and considered as a whole.

The larger one's experience, the more conservative, I think, one tends to become in advising operation. This is explained by the great frequency of laceration which undoes any good that might come from the removal of a hemorrhagic clot, as well as the difficulty in finding it.

In many cases it is impossible to decide whether we are dealing with pure hemorrhage or not; but, as with appendicitis, we shall often have to operate unnecessarily in many cases, that is, in cases which would have recovered without operation, or without doing good, in order to make certain of not letting a patient die for lack of operation. The fact I have already mentioned, that in 29% of Dwight's fatal cases, the fracture of the vault in extending to the base had ruptured the meningeal artery, and that death was believed to be due to compression from clot, must make us dread lest we should lose a life by neglecting to operate. And yet the conclusion that death might have been averted by removal of the clot, if it had been possible, in the 29%, is hardly tenable, considering the presence of laceration in 140 out of 146 cases.

INDICATIONS FOR OPERATION IN HEAD INJURIES.*

BY WILLIAM N. BULLARD, M.D., BOSTON.

In speaking of the indications for operation in head injuries only certain general lines of treatment can be laid down. There must be exceptions to the general rules in certain cases, to some of the rules in many cases. Each doubtful case must be considered by itself and acted upon as seems wisest when all the special circumstances have been duly weighed.

The following are the rules which I have found useful from my practice and experience in cases of fracture or suspected fracture of the skull.

Wherever we have absolute evidence of fracture by sight or touch our course is comparatively plain. It is in those cases in which we cannot be certain as to the existence of fracture, although the injury or condition is a serious one, that the greatest difficulty arises in determining our course.

We will first consider the cases in which we have absolute evidence of fracture by sight or touch.

Compound fracture of the outer surface of the cranium. I believe that operation in these cases in adults is always advisable, assuming that there are no serious contra-indications from the general condition of the patient, the condition of the heart or kidneys or injury or disease in other portions of the body. Hereafter, throughout this paper, I shall assume that such contra-indications are understood not to exist.

In compound fracture of the external surface of the cranium in adults, *operate*. Probably even in long linear fractures where there is no displacement or depression of bones, it is wiser to operate. The operation under proper conditions should not be serious and the risks which are run in the non-operated cases cannot at the present time be estimated. While probably most of such cases show no serious sequence, we never can be certain that epilepsy or some other serious consequence may not follow such an injury.

* Read in connection with a paper by Dr. Bernard Sachs, in "Serious Head Injuries," p. 176.

SIMPLE FRACTURE OF THE EXTERNAL SURFACE OF THE SKULL.

In adults it is safer to operate in all cases where there is clear external evidence of fracture. In children it is sometimes permissible not to operate in cases of fracture of this kind where no symptoms exist.

Depressed fractures. In adults depressions rarely or never occur without fractures. All depressed fractures should be operated upon.

CASES OF HEAD INJURY WHERE FRACTURE IS SUSPECTED OR MAY EXIST.

Cases in which the question of operation is determined by the existence of symptoms other than the existence of the fracture itself.

There are certain symptoms or groups of symptoms which when they accompany or follow serious head injury have great weight in determining the question of operation.

Operate (a) in all cases where symptoms of middle meningeal hemorrhage exist. We should as a rule operate in any case where unconsciousness comes on after an interval of consciousness following injury to the head.

Operate (b) in adults whenever the unconsciousness after a severe head injury lasts more than twelve hours and where it seems clear that the unconsciousness is due to the injury and not to alcohol or other causes or complications. This rule is not universal. It is true that a certain number of these cases recover without operation and even may have no further symptoms, but operation is usually the safest plan.

(c) As a rule it is wise to operate where persistent unilateral convulsions follow injury to the head in an adult, provided that such convulsions have never occurred previous to the injury and that no other cause for them, such as uremia, exists.

(d) When cerebral or meningeal paralysis occurs immediately following a severe injury to the head, the question of operation often arises. Hemiplegia or monoplegia under such circumstances do not absolutely indicate operation. They may be due to hemorrhage or other injuries in parts of the brain which are out of reach. This condition may have been the cause of the fall or injury and not the result.

(e) Inequality of the pupils occurring immediately or shortly after injury is indication in favor of operation.

(f) Temperature: Immediate and persistent rise of temperature (not otherwise accounted for) occurring after severe head injury suggests contusion or laceration of the brain. Rise of temperature within twenty-four to seventy-two hours after injury, especially if the patient is unconscious, suggests secondary encephalitis or inflammation of the brain.

(g) Pulse: Slow pulse suggests compression, hence, with other symptoms, is an indication for operation. Rapidity of the pulse in itself does not contra-indicate operation. Weakness of the pulse may be a contra-indication.

The *third class* of cases to be considered is that