The surgical aspect of traumatic insanity / by Herbert A. Powell.

THE SURGICAL ASPECT

OF

TRAUMATIC INSANITY

PRESENTED FOR

THE DEGREE OF DOCTOR OF MEDICINE

BY

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PREFACE

THE following Essay was not originally written specifically for publication, and it is hoped that the printed references throughout the text will be held sufficient acknowledgement of the use which has been made of borrowed matter.

HERBERT POWELL.

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THE SURGICAL ASPECT OF TRAUMATIC INSANITY.

In a large proportion of past medical literature dealing with the subject of insanity, there has been a certain dimness of outline in the treatment of that class of cases which have followed a head-injury either immediately or remotely. Merely on the large underlying question of the existence or non-existence of a connexion between injuries of the head and mental disturbance as a sequel, there has been a considerable lack of definition. A reference to the earliest medical writings reveals no mention of such a connexion. The subject of injuries to the head in its immediate aspect and immediate treatment was very fully discussed. Hippocrates devotes a large amount of space to it, but gives no hint of any remote nervous sequelae, and apparently from his line of treatment of depressed fractures, which will be shortly discussed later, expects none. Similarly Galen, Celsus, and Paullus Aegineta, though differing somewhat in their methods of dealing with this particular injury, do not, in their writings, anticipate any possibility of mental deterioration supervening. It is true that Celsus and Aegineta both mention 'loss of mind' as occurring after fractures of the skull, but it is the immediate lapse, probably delirium or unconsciousness, to which they allude. It appears strange that the connexion was not recognized, as, however greatly the estimates of the value of head-injury as a cause may differ—and it will be shown that they differ widely—a certain number of cases continually occur in which the mental deterioration follows a severe head-injury so directly and so evidently, as not to admit of a doubt of their true connexion. Probably the prevailing notions of the

insidious influence of humours, hot, cold, or black, as the case may be, in the causation of insanity in general, militated against the adoption of a gross and mechanical cause, such as injury, to account for a limited number of cases.

Down to comparatively modern times, there is an almost equal paucity of records. Such mention as is made of traumatic insanity is only in the occasional reference to isolated cases as curiosities, or to interesting recoveries as results of the removal of irritating bodies from the brain. Thus Fabricius de Hilden, writing in 1641, speaks of a case of a young girl of ten years, in whom dementia followed at a short interval after a blow on the head, which caused a depressed fracture at the level of the lambdoid suture.

More interest seems to have attached to the reverse proposition, that an injury to the head may initiate a process of recovery from a state of mental impairment, restoring healthy intelligence and developing new aptitudes. Hippocrates records a case of a boy of twelve or thirteen years, with rigidity of the jaws and limbs, suddenly regaining their use after a fall on the head: and Haller in his 'Elementa Physiologiae Corporis Humani' quotes a case with a somewhat similar bearing: 'Homo parvi ingenii dum sanus fuerat, ingeniosus ex ictu in cranio accepto, sanatus ad priorem simplicitatem rediit.'

In more modern times, the paucity of records in the domain of exact scientific observation, and of attempts at a more precise pathology, is more surprising. Dr. J. Christian[1] points to the fact that till not many years ago even traumatic epilepsy was very generally assigned to the moral effect of the injury, shock, and similar influences, rather than to any existing pathological change. As late as the year 1881 Dr. Foville[2] asks if the changes of character, which often are only temporary, are not best explained by the uncertainty of future health, and the weakness incident to convalescence; and if the epilepsy following injury is not rather determined by the 'moral impression' left by the accident, than symptomatic of any actual cranial lesion.

[1] 'Archiv. de Neurolog.' xviii. 1. [2] 'Ann. Medico-psycholog.' 1881.

There has been an evident widespread aversion to ascribe mental changes to gross lesions.

This want of sufficient recognized general propositions bearing on the subject of traumatic insanity, especially with regard to its estimated frequency as a result of head-injuries in general, and its relative proportion to all cases of insanity due to other causes, is amply accounted for by certain difficulties which stand in the way of a true estimate. The foremost of these difficulties, one which will be considered in greater detail below, is the length of time which in many cases—probably in the great majority—elapses between the receipt of the original injury and the appearance of any well-marked signs of mental disturbance. Secondary to this cause of difficulty is the apparently unavoidable result that the victim of the injury passes through several hands in the meantime, and thereby the accurate history of the case is necessarily obscured, and obscured in proportion to the length of the interval. On the subject of this want of accurate history Dr. Crichton Brown [1] makes complaint that—'Injuries of the head usually come under the care of surgeons, and are reported for surgical purposes. The state of mind is only incidentally mentioned, and but superficially examined. To this may be traced the statements that every part of the brain has been found disorganized without some consequent mental derangement.' The departments that deal with the original injury, and later with the nervous sequelae, are necessarily different, and the case that has been originally a surgical one will drift—perhaps after years—into the asylum, and this consideration affords a ground for the surgeon's complaint, that he too soon loses sight of his head-cases. The class which is most liable to head-injury, namely the labouring class, is the class *par excellence* which, as patients, passes soonest out of sight, owing often to their rapid change of home, and often to the facilities with which, in the large populous centres, they are enabled to seek continually different medical advice.

And as to the more special point of the principles of surgical

[1] 'West Riding Asylum Reports,' vol. ii.

interference, and the local or general indications of the existence of some cause, within reach of removal, though a considerable mass of scattered evidence exists, and though it is true that for many years, at long intervals in the past, more abundantly in recent years, individuals have recognized the propriety of interfering, and acted on their recognition, often with signal success, yet a general recognition of the possibilities and value of interference in a certain number of cases of traumatic insanity, based on an aggregate of cases already recorded, has been wanting. The kindred subject of traumatic epilepsy has always received much more attention, no doubt owing to its more urgent character. The relation of traumatic insanity to traumatic epilepsy will be more fully examined below, and also its relation to other forms of neuroses depending on injury, the details of which have been more fully worked out, than those of traumatic insanity: and evidence will be brought forward in the endeavour to show that the psychical symptoms have generally been assigned too secondary a place, and should with greater justice be considered on the same level as the epileptic phenomena.

The division of departments alluded to above provides in the ordinary course that the more special and detailed classification of resulting neuroses should come into the province of the expert on insanity: but the surgeon must be prepared to recognize the wide limits between which he will find the various types of mental deterioration resulting from head-injury. Writers on insanity have often tended to describe the forms as lying between narrow limits; assigning a few definite types to the definite cause. But an analysis of the cases of insanity resulting from a definite irritant, which is given as an Appendix, shows that the forms cannot be confined to a few. From the point of view of those whose experience of the cases dates from their admission into an asylum, the readiness to ascribe present symptoms of insanity to causes other than a remote head-injury, and to believe that the results of head-injuries are serious in proportion to the amount of predisposition, either hereditary or acquired—as by sexual or alcoholic excess—is easily explicable.

Several causes are in continual co-operation, tending to confirm the slowness of recognition of the important proposition that there is a considerable class of cases where a constant irritant is causing mental symptoms, and is within ready reach of operative interference.

Firstly, there is the lapse of time, already mentioned, between the injury and the onset of the symptoms. Dr. J. Christian [1], analyzing 100 cases of traumatic insanity, finds that—

In 54 cases	the	interval	was from	1–5 years.
„ 21	„	„	„	5–10 „
„ 11	„	„	„	10–20 „
„ 7	„	„	„	20–30 „
„ 7	„	„	more than	30 „

Secondly, there is the difficulty encountered in eliminating other causes. The greater susceptibility, for instance, to the influence of alcohol, so often seen after a severe head-injury, may lead directly to insanity, and thereby render the evidence from the history of a remote head-injury unsatisfactory.

Thirdly, there is occasionally an unfortunate absence of any history of an accident, in cases where in reality it was the true determining cause. In this context three cases in the Appendix, Nos. XII, XIV, XLIII, are of extreme interest, in which though there was a complete absence of any history of accident, the local evidence of injury, taken in conjunction with the general mental state, was held sufficient ground for exploratory interference, and with the happiest result.

Fourthly, the well-known anxiety on the part of the patient's friends to assign the utmost importance to an old injury causes their evidence in that direction to be held in light esteem. As a caution against valuing highly such testimony, Dr. Crichton Brown cites the amusing case of an old woman who was admitted into the West Riding Asylum in 1871. She had lived a long, reputable, and rational life, and had reached the age of eighty-one. It was her first attack of insanity; yet her friends intimated that

[1] 'Arch. de Neurolog.,' vol. xviii. p. 1. Cf. also Analysis of tabulated cases.

it was attributable to her being a twin child, and having received an injury to her head at her birth.

The following statistics demonstrate clearly the influence of the above difficulties in the estimates of various authorities. Schlager of Vienna, analyzing 500 cases of insanity in general, ascribes 10 per cent. to injury as a cause. Kraft-Ebing, out of 462 cases, lays only 1 per cent. at the door of head-injury. In the reports of the Indiana Hospital for the Insane, out of 3,034 cases admitted during the four years ending June 1, 1887, 4 per cent. are noted as being due to injuries of the head.

At the other end of the chain of events, the Surgeon is met by similar obstacles in any endeavour to compile accurate statistics of the frequency with which insanity follows the serious cases of head-injury which pass through his hands immediately after the accident. The number of cases of severe head-injury, that leave the hospital unmistakably insane, gives no clue to the total number who owe their malady to this cause. So that while the authorities on mental diseases find difficulty in estimating the proportion of cases due to head-injury, relatively to the total number of cases coming under their observation, there is an equal difficulty in the way of forecasting the total percentage of head-injuries, severe or apparently trivial, which ultimately result in mental disturbance. The difficulty of following up the patients, by reason of the sometimes considerable healthy interval, militates here also against accurate observation. Professor McEwen[1] cites four cases which he kept under observation for a considerable time, in all of which an excellent recovery was apparently made in the first instance: and yet within periods varying from eight months to a year and a half, they all four developed some more or less pronounced mental disturbance—either loss of memory, general confusion, or delusions. Various attempts have been made in the direction of estimating the frequency, but the figures generally refer to cases of deterioration following the injury with a very short interval.

[1] 'Lancet,' 1881, ii. 541.

One writer[1] analyzing 20 cases of severe head-injury, mainly complicated with fracture, finds that 13 died, 5 made good recoveries, and 2 recovered with some mental impairment.

Again[2], of 116 recoveries out of 316 cases of head-injury, 7 suffered afterwards from some impairment of mental functions, ranging from loss of memory to complete imbecility.

And amongst more special forms of head-injury, in a series of 135 fractures of the base[3], chiefly from gunshot, and generally with accompanying wound of the brain, at least 12 had impaired mental faculties, either at once or within a few months of the injury.

Out of 328 cases of contusion of the cranium, occurring in the War of the Rebellion[4], 104 recovered with persistent headache, vertigo, disordered sight or hearing, irritability, epilepsy, aphasia, paralysis, or mental aberration.

Taking a wide view of all cases from all kinds of injury, there can be no doubt that among the resulting nervous phenomena, mental disturbance does hold a place, real, but, owing to the above-mentioned causes, ill defined. It will be discussed later whether, granting that a considerable proportion of all the cases, owing to the seat of the lesion and other causes, must from the beginning be beyond anything but hope, yet a certain section may be capable of being placed on a more or less sound pathological basis.

At no age can exemption from injurious results be claimed. Though the estimation of the value of injury as an assignable cause in the production of mental changes in early life, eventually resulting in idiocy, varies widely with different authorities, it is admitted on all hands that it is an important factor in many cases. In so far as the changes are general changes, affecting a large part or the whole mass of the intra-cranial contents, this section of the subject is only indirectly germane to the matter of this

[1] 'Ann. of Anat. and Surg.,' Brooklyn, 1881, 258.
[2] 'Phila. Med. Times,' lx. 497.
[3] 'Amer. Journ. of Med. Sci.' lxxxi. 335.
[4] 'Surg. Hist. of War of Rebellion.'

paper, which deals mainly with local lesions, within reach of removal; and it will be only shortly discussed, especially as such principles of surgery relating to it as have been propounded (the reference is to craniectomy in microcephalus) have only lately seen the light, and may possibly prove to be premature. Although cerebral haemorrhages, due to congestion from delayed birth, may account for many of the intracranial lesions, which are themselves accountable for the subsequent arrest of mental growth, yet a definite proportion are probably due to mechanical injuries directly acting through the cranium [1]. It is a consideration full of interest, as bearing on this question, that increase in the average dimensions of the cranium runs directly parallel to the increase in idiocy, and the tendency in general to other nervous diseases. The European skull [2] has an average capacity of 92·3 cubic inches, the American (native) 87·5, the Asiatic 87·1, the Australian 81·9 cubic inches.

Skulls from nineteeth-century Parisian graves have greater cubical contents than those from twelfth-century Parisian vaults, in the proportion of 1,484 to 1,426. And concurrently, insanity and idiocy are much more prevalent in civilized than in barbarian communities, and, it is believed, in modern times than in the middle ages. The trifling excess in the size of the male over the female head at birth, entails a greater liability to injury, and consequent mental and nervous diseases; and arguments have been brought forward to show that this tendency persists throughout life.

But idiocy and minor forms of imbecility and moral insanity have been asserted undoubtedly to follow the use of instruments at birth. The mark of the forceps may be borne physically through life, as shown by permanently distorted heads; and the depressions in the parietal bones occasionally seen may eventually be shown to come within the classification of local lesions, within reach of surgical interference and relief. Winkler and Ballan [3], of Utrecht, found at the post-mortem examination of an idiot, sixty years of age, depressions in both parietal bones corresponding to cerebral lesions.

[1] Little, 'Obst. Soc. Trans.' 1861. [2] Dr. Barnard Davis.
[3] 'Centralblatt f. Nervenheilk.' 1890.

In ten subsequent post-mortems on idiots they found the same condition once, and have found similar depressions of the skull in six out of twenty-five living idiots.

The occurrence of microcephalus as a sequel is instanced by the case[1] of a girl who had a severe fall on to the head at two years. She was lively and intelligent before that time; but grew up idiotic and ineducable. Her head at 15 years measured only $16\frac{3}{4}$ inches in its greatest circumference, and she had the typical narrow face and vaulted palate.

In adult life the effects are very widespread and multiform. Putting aside certain results of head-injury which may be ranked as pathological curiosities, namely of mental improvement following a blow on the head, sometimes in the direction of one definite aptitude, such as musical talent—the supervening mental change is in every case one of deterioration. The period immediately following the accident is not unfrequently marked by a suspension of all mental faculties, usually of comparatively short duration, but which, under the influence of a persistent irritant, may be of phenomenally long endurance, and may be described as the highest degree of amentia. It was for a complete suspension of consciousness, of a year's duration, following immediately on a fall on the head, that Cline trephined in the case of a sailor: the removal of an area of depressed bone was followed by a satisfactory recovery of faculties.

The delirium, which frequently accompanies the reactionary stage, may be very difficult to differentiate from a temporary insanity, and its end may be impossible to forecast. A case like the following[2], reported as one of recovery from traumatic insanity, in which an adult male on the second day after a fall on to the occipital region suffered from delusions, and being restless and unmanageable was consigned to Hanwell Asylum, where he quickly recovered—a case such as this is strictly analogous to not a few cases, met with from time to time in hospital practice, in which temporary signs of mental disturbance are hardly held to merit the name of

[1] 'West Riding Asyl. Rep.' ii. 133.

[2] 'Journ. of Ment. Sci.' xxx. 393.

insanity. Instances of such are two cases[1] of maniacal delirium lasting respectively eight days and one day, beginning eighteen days and three days after fracture of the base: or a case recorded in last year's 'Reports of St. Bartholomew's Hospital,' of a woman who, after a depressed fracture of the right parietal bone, passed through a period of six weeks of nearly complete unconsciousness, which was succeeded by another period of restlessness, delusions, and hallucinations, which it would be hard to call by any other name than insanity. Complete recovery followed. Some, like those just mentioned, tend towards recovery: others, perhaps the larger number, persist into chronic dementia, and it is this type of case, too well known to need illustrating by particular instances, which form the greater bulk of that section of traumatic insanity which is delivered over to asylums, with from the first an unfavourable prognosis.

More important, because the connexion between the injury and the symptoms are less easy to recognize, are those cases where the early psychical changes are so insidious, that it is difficult to decide at what point the morbid process has become sufficiently marked to justify the question of the possibility of relief from active interference: and secondly, those cases where a considerable lapse of time, or the absence of a reliable history, has allowed the true cause of the change to be lost to view.

All the phenomena may be grouped under the term 'nervous instability'; and they may display either a generalized character, or, the main area of nervous action remaining unaltered, one particular aptitude or moral trait may be turned into a different channel. An instance of the more general changes is the greatly increased influence which even a small quantity of alcohol is well known to exert on the subjects of head-injury. Striking changes in character, such as exaggerated restlessness, with mental hyperaesthesia and irritability, may form a marked result: and in these days, when the connexion between insanity and crime is actively discussed both by medical and legal experts, and the discussion may

[1] 'Lancet,' 1879, i. 664.

produce practical fruits, perhaps the idea of a corresponding connexion between head-injury and subsequent criminal developments may be provisionally entertained. The Report of the medical officer of the Woking prison for female criminals (1883) calls attention to the fact that, from a series of examinations, a notable number of female convicts have previously suffered from fractured skulls. And Mr. Drew [1], from an experience of the Millbank Convict Prison, notes the frequency of depressed fractures of the skull in relation to crimes of violence, and the very common occurrence of scalp wounds in convicts of the lower classes. From 100 indiscriminate cases he found only eight without some evidence of old head-injury. Three cases are cited by him as striking ones:—

1. A well-educated sailor, with a depressed fracture of the frontal bone, caused many years before by a fall on a nail, had been sentenced to penal servitude for shooting at another sailor. His conduct in general was excellent, but on several occasions he broke into paroxysms of frenzy. He showed some other signs of mental derangement under close observation, and was removed to a criminal asylum.

2. A man with intellect of a low order had a deeply depressed fracture of the skull (locality not mentioned); he made a murderous attack on a warder.

3. A soldier, with a depressed fracture of the frontal bone: he was most insubordinate, with an uncontrollable temper.

Read in the light of the accompanying collection of cases in which operative interference was carried out, may not the question be justly raised, whether these were not cases, especially the first of the three, in which an exploratory operation would have been justified? The morbid influences may only result in a limited change, such as an irresistible craving for alcohol, or as in a report of a case, an aggravated stuttering following a blow on the head [2]. Some very curious forms of deterioration rather constantly follow, where the prominent feature is loss of memory, generally for events that occurred a few hours or days immediately before the accident.

[1] 'Brit. Med. Journ.' 1883, i. 559.

[2] Osler, 'Canada Med. and Surg. Journ.' 1879-80.

The memory may be recovered, or the blank become permanent. In case No. XXXI. of the Appendix, there was an immediate loss of memory, after a compound depressed fracture, for the particulars of the whole previous life: eight years later the depressed bone was removed by trephining, and the memory of details up to the time of the accident was restored, the original lapse being thereafter replaced by a permanent blank covering the eight intervening years. This was an extreme form; but less marked temporary forms are not unfrequently recorded, either as the only sign of mental impairment, or accompanying other and distinct evidence of deterioration.

These minor and more special forms of affection pass insensibly by connecting links into the more pronounced forms of moral or intellectual perversion or general mental decay. Not a few authorities have inclined to set up a definite type, under the term 'traumatic insanity.' Dr. Skae described the type as 'characterized at the commencement by maniacal excitement succeeded by a chronic condition, often lasting for years, during which the patient is irritable, suspicious, and dangerous to others: in many cases a distinct homicidal impulse exists: the characteristic delusions of this form of insanity are those of pride, self-esteem, and suspicion; melancholia being rarely present': and he adds that this form of insanity is rarely recovered from, but has a tendency to pass into dementia, and terminate fatally by brain disease. Schlager and Kraft-Ebing lean in the same way towards limitation, though not so definitely. But the forms of insanity following head-injury are so nearly commensurate with the whole field of idiopathic insanity, that the last position is scarcely tenable. 'The full history of the effects of cranial injury on mental health would be coextensive with that of insanity. The forms of disease which are most often produced are idiocy, recurrent mania, dementia, mania e potu, dementia with epilepsy, senile dementia[1].' The same author gives[2], out of 42 cases, 18 of mania of various types, 13 of dementia, 5 of dementia with epilepsy, 3 of general paralysis, and 3 of melan-

[1] Crichton Brown, 'West Riding Asyl. Rept.,' vol. ii.
[2] Ibidem.

cholia. Dr. J. Christian [1] gives out of 104 cases, 16 of dementia, 29 of mania, 47 of general paralysis, and 12 of epilepsy. The frequency of moral changes after head-injury is particularly emphasized by Eccheveria [2], who of 19 cases gives 2 of satyriasis, 1 of nymphomania, 1 of kleptomania, 3 of pyromania, and 16 of homicidal impulses. And a reference to the cases collected at the end will show that homicidal tendencies figure largely, and also that, in insanity due to a local irritant, melancholia holds a not unimportant place. The large proportion of cases of general paralysis in some of the preceding statistics will have been noticed: and it is now generally recognized that a certain number of cases are due to head-injury. Out of 341 cases of general paralysis in the Devon County Asylum from 1845 to 1870, of 103 cases in which the cause was well ascertained, 12 were due to head-injury —that is about 12 per cent.

Underlying these outward manifestations of nervous disturbance is the consideration of the greatest interest, and, from the point of view of practice, of the first importance, namely, whether they have been preceded and are still accompanied by any well-defined gross lesion, and further, whether the lesions, if existing, lie within reach of any reasonable surgical procedure. That head-injuries in general which have been severe enough to produce signs of concussion have in almost every case caused gross lesions within the cranium, if only minute multiple extravasations, is in the present day much insisted on. Sir Prescott Hewett was strongly of this opinion, and Hilton taught 'that we ought to consider a concussed brain as a bruised brain.' Neudorfer from his experience of Austrian military practice, and Fano from his of the French, uphold the same proposition. In the medical records of the last twelve or thirteen years, there appear only two notices of deaths presumably resulting from head-injury, in which some naked-eye lesion was not discovered at the necropsy. That the lesions produced at the time of the injury leave permanent changes, whether in the brain itself or the membranes, has been lately urged by Mr. Bryant [3], who quotes several

[1] 'Arch. de Neurol.' xviii. 1. [2] 'Arch. Générales de Méd.' vol. 142.
[3] 'Hunterian Lectures,' 1888.

cases in support of the statement, cases in which death followed at a long interval after a head-injury, from causes unconnected with the accident. The intervals range from a month or two to nine years; the lesions discovered were in three cases adherent membranes, in two dilated ventricles, in one a superficial cyst, in one merely discolouration of the surface. In one of these there had been a fractured base, and loss of memory with fits followed. In many cases there is a bony lesion of the vault of the skull, which gives no external evidence of its presence. Much of the importance of fracture and splintering of the inner table, without fracture of the outer table, is due to its latency. Ambrose Paré narrates a fatal case, which he verified post mortem. Lidell[1] records three post-mortem examinations at which was found splintering of the inner table only, death being due in one case to intracranial haemorrhage, in the other two to meningitis.

Inferences more germane to the special subject in hand may be drawn from post-mortem examinations on insane persons, whose insanity was believed on good evidence to be due to a head-injury. The results may be either a local or a general change, the latter being either a primary result, or secondary to an originally local lesion. Local changes may consist in adherent membranes, arachnoid membranes, arachnoid cysts; more general changes are—dilatation of the ventricles, puckering of the cerebral substance and scattered haematoidin crystals from different capillary haemorrhages, and, of greater importance, a general sclerosis of the brain-tissue, accompanied by white softening—illustrated by a case of Dr. Crichton Brown's[2], where dementia followed immediately a blow on the head, and the right hemisphere was found softened and smaller than the left. The development of general changes from a local focus is illustrated by a case[3] in which general meningitis and coma supervened three years after a head-injury which had caused traumatic epilepsy, and in which after death a splinter from the inner table was found to be imbedded in the *falx cerebri*: also by two cases which came under Dr. Mickle's[4] notice; in one of

[1] 'Amer. Journ. of Med. Sci.' 1882, vol. i. 325.
[2] Ibidem. [3] Lidell, ibidem. [4] 'Journ. of Mental Sci.' xxvii. 12.

which he found after death atrophy of the grey matter, and underlying induration of the cerebral substance, which he believed to be purely secondary to an overlying piece of depressed bone, which had for five years acted as a constant local irritant: in the other case he found wide meningitic changes which had apparently spread from a focus of adherent dura mater involved in the scar tissue of an old fractured skull. Both these last cases had suffered before death from mental deterioration. And two cases are recorded as having occurred at St. Bartholomew's Hospital, one in March, 1875, and the other in November, 1878, in which meningitis and death, after some symptoms of mental impairment, followed at a considerable interval after a blow on the head, which had left local evidence in the shape of adherent dura mater.

Post-mortem examinations on infants dying in or shortly after tedious labour, even without the use of instruments, have revealed tears of the dura mater, subcranial haemorrhages, ruptured sinuses, and punctiform capillary haemorrhages on the surface of the brain; and though some of these are referable to apoplexy from congestion, yet where the forceps have been used, and where bony lesions are demonstrable, as in the cases of Winkler and Ballan already quoted, the evidence of their connexion with a mechanical force, acting locally, is more definite.

Analogous to these results, and of more special bearing, is the evidence derived from the examination of lesions found during life in cases in which surgical interference was held justified, either entirely on account of mental symptoms, or where these symptoms only formed a part of the general indications, as in cases of combined traumatic epilepsy and insanity. The most frequent lesions discovered in this way have been, besides a depression in the bone, adherence of membranes either to the bone or to the surface of the brain, and osteophytes projecting from the inner surface of the skull, or fragments of the inner table pressing upon or wounding the membranes or the cerebral substance. Of course the most frequent lesion which has determined the operation has been depressed bone, and the other lesions are mainly subsidiary to this, though also found in cases where no depression in the bone could

be felt, where perhaps only a cicatrix or some evidence of old contusion existed. It is important to give full value to these lesions or secondary affections of the inner table, of which no external evidence can be got. They can at best be only suspected, but their comparative frequency has been abundantly proved. Splintering of the inner table without manifest damage to the outer has been long recognized as a fact. Garengeot, La Molte, and Bilguer, all trephined suspecting this lesion, and verified their suspicion. Samuel Cooper met a similar case after the battle of Waterloo, and successfully trephined. In all, Guthrie collected 18 and Otis[1] 38 examples of this lesion reported by European surgeons. Lidell[2] records six more, occurring in America in recent years, in one at least of which the inner table seemed to have necrosed as a result of the injury, probably not having been splintered at the time. A similar necrosis of the inner table—the outer being intact—is recorded in the 'British Medical Journal' for 1880 (ii. 844). The frequency of osteophytes, or excrescences of bone from the inner surface of the skull, raises the question of their method of formation. Where there is manifest depressed bone, it may be difficult to draw an accurate distinction between fragments isolated at the time and secondary formations. But of 14 of the cases collected at the end, which showed symptoms of insanity after a head-injury styled only 'scalp-wound' or 'contusion' without depression of bone, of these 14 cases osteophytes were found at the operation in two at least. It appears probable that the force which causes a local splintering or necrosis of the inner table may in other cases cause only a local meningeal inflammation, under the influence of which the dura mater may take on an osteoblastic action. This inflammation is likely to be more severe when a depressed portion of bone is acting as a chronic irritant to the membranes, and the increased frequency of osteophytes in the cases collected, where there was a depressed fracture (they occurred in 13 out of 45 cases), tends to bear out this view. Other lesions discovered have been thickened and hyperaemic bone, diseased bone, serous cysts in the membranes,

[1] 'Amer. Journ. of Med. Sci.' 1873, 63. [2] Ibidem, and 1882, i. 325.

adherent pericranium; and in one case a foreign body, unsuspected, was found embedded in thickened membranes. The serous collections occurred in four cases, and always immediately beneath the bone, that is in the membranes, an important point as will be seen, when the 'meningeal influence,' as it may be called, as a causative factor in the insanity, comes up for discussion. A serous cyst, in a similar situation, seems also to have been the determining cause of insanity in the following case[1], in which chronic mania succeeded, after an interval of two and a half years, a gunshot fracture of the right frontal bone, from which the ball was extracted at the time. Pressure on the scar produced great pain and violent mental agitation. An exploration needle was thrust through the fibrous tissue which closed the old bullet hole, with the hope of detecting a foreign body: at the fourth introduction, serum appeared in the syringe, and two drachms in all were withdrawn. The patient recovered from the anaesthetic quite rational, and remained so for the six months he was under observation.

Further, Dr. Bastian[2] has stated that 'the occurrence of intracranial tumours after blows on the head is a sequence of which it would be possible to collect many cases. The liability may be greater in children—with active formative processes. The blow may lacerate tissues in the brain, and the reparative process may start a growth. Internal lacerations of tissue do undoubtedly take place' (as in a case occurring in 1891 at St. Bartholomew's Hospital, in which a fall on the head was the cause of a laceration of the anterior half of the corpus callosum). 'Or the blow may cause a modified meningeal inflammation, leading in one case to the formation of lymph, in another to widespread meningeal growth.' And he quotes a corroborative case of cerebellar sarcoma following a fall on the back of the head.

All this detailed evidence has been brought forward to show what a multiplicity of lesions may be produced by violence applied to the skull from without, and what a large number of the forms

[1] 'Amer. Journ. of Med. Sci.' xci. 433.

[2] 'Lancet,' 1880, i. 988.

have actually been found, during life or after death, associated with symptoms of mental derangement; and a point, which seems worthy to be brought to the front, as it is common to a large proportion of the lesions, is their superficial nature. In a very small proportion of cases examined, or of the operative cases tabulated below, is there any mention of change in the cerebral tissue. The stress has in almost every case fallen on tissues superficial to the cortex, namely, the bone and the membranes. A summary of the results shows the following to be the most frequently encountered forms: cicatrices of the scalp—osteosclerosis with thickening, either diffuse or localized—depression of bone—necrosis—osteophytes and splinters—adherent membranes—cystic collections. And this list tallies sufficiently well with the gross pathology of insanity from other causes; for here too, where there exist well-marked changes, the superficial parts have usually suffered as much or more change than deeper structures, as witnessed by adherence of the dura mater to the skull, often over a wide area—by pachymeningitis—by thickening and irregularity of the bones of the vault—or by ossification of the dura mater (more extensive than mere osteophytes).

In this connexion a discussion of the importance of the rôle played by the dura mater in the production of psychical symptoms falls best into place. Duret, in his well-known Essay[1], has arrived at the following conclusions, based on investigations carried out in great detail, concerning the nervous phenomena resulting from lesions of the dura mater.

1. That the dura mater is abundantly supplied by sensory nerves from the fifth pair, by anterior, middle, and posterior branches. He suggests the possibility of special terminal organs, which increase the delicacy of the sensibility of the membrane, and account for the marked 'physiological' troubles ensuing on their irritation.

2. That irritation of the dura mater, especially of its inner surface, causes pain.

3. That irritation of its nerves causes reflex movements in both voluntary and involuntary muscles, but not so local or definite as

[1] 'Sur les Traumatismes cérébraux.'

those caused by irritation of the cortex. They are not more localized than those caused by irritation of peripheral sensory nerves.

4. His cases of purposely produced depressed fractures of the skull in animals showed all the reflex results, as of irritation of the dura mater, both on the same and on the opposite side; and not as of direct cortical irritation: and he made this clear by finding, post mortem, the cortex uninjured. If a superfluous amount of violence was used, the symptoms were rather those of cerebral commotion.

5. That the secondary contractures, which follow injury, are due to dura mater reflexes; appearing almost indiscriminately on the same and opposite sides.

6. That reflex vasomotor disturbances are also the result of irritation of the nerves of the dura, consisting in spasm or paralysis of cerebral and ocular vessels; and that light is thus shed on the causation of secondary effects of cerebral traumatism, through the agency of cerebral vascular conditions.

And elsewhere he says of the complicated nervous relations of the dura mater—'Their varied, and so to speak protean, manifestations tend at each step to complicate the whole symptomatology by superimposing themselves on the phenomena due to lesions of the nerve centres proper.'

It is true that Duret's work was directed mainly towards the elucidation of what may be called the more physical of the phenomena resulting from perverted nervous action, such as contractures, spasms, and convulsions; and he speaks not at all, or very subsidiarily, of psychical manifestations; but his conclusions would seem to apply equally well to the less material morbid consequences. The analysis of tabulated cases shows an overwhelming majority in which the membranes were in some way irritated or involved: out of the 67 cases, in 27 depressed bone was distinctly pressing on the dura mater, in 15 cases there were osteophytes or splinters, sometimes in combination with depressed bone, piercing the dura mater, in 4 cases there were cysts involving the dura mater, and in 7 cases the dura is definitely stated to

have been adherent. Even in the cases where either nothing abnormal was discovered, or the dura mater was stated to have appeared healthy to the eye, there is nothing to contradict the belief that the symptoms were a reflex result of its constant slight irritation; indeed there is everything to warrant that belief, since of 8 cases, where bone and dura mater appeared quite natural at the operation, 6 were cured of their insanity, and one was much relieved. And the fact of the high degree of reflex influence in infants would confirm the hypothesis that idiocy might be readily explained by reflexes kept constantly working through the irritation of such a sensitive structure as the dura mater. The absence of changes in the true cerebral tissues, already noted, points strongly this way. The same absence was noticed by Fletcher[1], after a series of 8 cases of trephining for traumatic insanity. Indeed considering the rapidity with which recovery ensued on operation in many of the tabulated cases, it seems impossible to hold that pathological changes did exist in the brain itself. Besides the tabulated cases at the end, other cases could be brought to press home the theory that the dura mater is the important structure, and that pressure on the brain has little or no share in the production of mental symptoms in at least a large proportion of the cases. For instance, two cases[2] of insanity in men have been recorded after gunshot fractures of the cranium. Both cases were characterized by want of control over the passions. Both died rather suddenly, and in each case the bullet was found imbedded in the membranes, immediately beneath the frontal bone, and in contact with it. This view also sheds light on the undoubted fact, that insanity may result from injury to any part of the head. Probably the reflexes from all parts of the dura mater would be similar in character. And it also accounts for the fact that the injured part will be found no guide to the character of the insanity. A reference to the tabulated cases will prove that all forms of insanity followed indiscriminately on injury to any part of the skull. In the American War of the Rebellion, of

[1] 'Amer. Journ. of Insanity,' xliv. 218.

[2] 'Trans. Intercol. Med. Congr. of Australasia,' ii. 117.

12 cases[1] of fractures of the base, which were followed by mental deterioration—

In 3 the middle fossa was affected.
„ 4 „ anterior „ „
„ 1 „ posterior „ „
„ 1 „ anterior and posterior fossae were affected.
„ 1 „ middle and posterior „ „
„ 2 „ anterior and middle „ „

In the tabulated cases injury to the regions roughly termed the parietal regions largely preponderate as causes: of the 56 cases in which the locality is stated, 41 were injuries to the parietal regions, while the frontal, occipital, temporal and fronto-parietal regions only claim 15 cases. This great preponderance of the parietal regions is of course largely due to their great area, and to their including the larger part of the top of the head.

It has been widely thought that injury to the frontal region of the head would be most likely to stamp itself upon the future character and intellectual capacity; but if local cerebral lesions were responsible for the change, the insanity would be complicated by phenomena proper to the part of the cortex underlying the injured spot. And in practice this is not found to be so with any degree of generality. The few cases, in which localized paralyses or spasms have accompanied the mental symptoms, only serve to emphasize their absence in a far larger number of cases, and to suggest that a cause which, very rarely, tends to involve the cerebral cortex in morbid action, usually stops short at irritation of the membranes only.

All principles of surgical procedure, to be sound, must rest on a sound pathological basis. It is not enough that in a certain number of cases an operation of a certain kind, more or less tentatively undertaken, has met with an amount of success perhaps unlooked for. Definite ideas of lesions likely to be encountered, and their mode of morbid action, must be entertained, if a definite result is to be expected from interference. The manifold forms

[1] 'Amer. Journ. of Med. Sci.' lxxxi. 335.

of possible lesions have already been enumerated, and in the complex and sensitive nervous organization of the dura mater has been sought the agency through which the irritating body initiates and keeps in action the consequent morbid processes. If the dura mater can be with truth recognized as the agent, the operation for relief will be placed at once upon another and less dangerous level. It is without doubt in the opening of the closed box of membranes that the greatest danger of such operations exists, and if the procedure can be brought under the term 'cranial surgery' instead of the more alarming term of 'cerebral surgery,' less hesitation may be experienced in undertaking it.

All authorities agree in the gloomy forecast attaching to traumatic insanity in general from whatever cause, and certainly those cases which are due to a local irritating lesion have not been found to falsify it. The occasional recoveries which have been noted after decided establishment of the symptoms, as in a case of Arellan's, where a depression in the right parietal bone followed a blow in a girl of 14 years, causing almost complete imbecility, from which the girl recovered on the spontaneous resumption by the bone of its normal level, such occasional recoveries do not relieve the hopelessness of the prognosis in general, if the cause is not dealt with. The mental symptoms either persist indefinitely, as in a case of a policeman, who was struck in 1863[1] in the frontal region; the depression which resulted was followed in six months by a mild form of insanity which persisted unchanged for twenty years. Or the symptoms progress from bad to worse, and end in dementia—or further inflammatory changes ensue after an indefinite period, and result in coma and death, as in the two cases of Dr. Mickle's before quoted[2], in both of which several depressed fractures of the vault of the skull were followed by mental disturbance, and by death from meningitis after an interval of some years. In both cases depressed bone was found post mortem. A man, going about the world with an unrelieved depressed fracture, has been rightly compared to Damocles living under a sword suspended by a hair.

[1] 'Trans. Amer. Surg. Assoc.' 1883, i. 94.
[2] 'Journ. of Ment. Sci.' xxvii. 12.

The lamentable character of these results—however long deferred—emphasizes strongly the important bearing they have on the question of early preventive interference at the time of the injury. There have always been two schools with conflicting opinions on this subject, the one urging, the other deprecating interference, without definite symptoms of local compression or irritation. But though Sir Prescott Hewett and Mr. Bryant in this country and Mr. Ashurst in America agree in denouncing active measures, yet the increasing recognition given to the frequency of deferred results is reducing the numbers of those who stay their hand till the appearance of those results. Professor M^c^Ewan notes the frequency of serious mental defects exhibited by patients after apparently complete recoveries, and gives a warning against relying too much on the statistics of recovery in head cases where the surgeon's observation ends on their exit from the hospital. He quotes[1] an instructive series of four cases which he showed at the Clinical and Pathological Society of Glasgow, as examples of excellent results accruing from non-interference. Two were compound depressed fractures of the vault, one a fractured base, the fourth a fracture of the base with a depressed fracture of the parietal bone. All those patients, within periods varying from eight months to a year and a half, showed signs of mental impairment. It is true that early operative interference is not an absolute guarantee against the supervention of mental symptoms at some later time: in 6 of the 67 tabulated cases it is distinctly stated that fragments of bone were removed at the time of the accident, or depressed bone elevated. But in most of these cases not enough had been done, and at the later operation some depressed bone was still present. The old surgeons of the school of Hippocrates apparently did not anticipate remote nervous sequelae from depressed fractures, since some, as Hippocrates himself, deprecated elevation or removal of fragments, and some, as Celsus, while removing the fragments, do not mention specifically the danger of leaving them. Hippocrates[2] says:—'Fragments of bone which are depressed from their native site, and much displaced or splintered, give rise to less danger [than simple fissured

[1] 'Lancet,' 1881, ii. 541. [2] 'Treatise on Injuries to the Head.'

fractures] so long as the membranes be untorn. And the more numerous and extensive the fractures, the fewer the perils that wait on them. None of them should be trepanned, nor any risk faced by attempting to extract the fragments, till such time as they rise up of themselves, when the swelling goes down. . . . And when both tables of bone are driven upon the membranes, the wound under the same treatment will soon heal, and the depressed bone shortly rise up.' There is little indication here that the dura mater was thought capable of initiating complex nervous phenomena. The only suggestion that the nervous system might be left unstable is contained in Celsus:—'After a fracture of the skull, the patient must avoid sun, wind, too much society' —if one may so paraphrase 'frequent bathing'—'and a too great measure of wine[1].'

In all countries and at all times, even where primary trephining of the skull for fracture has been common, secondary trephinings for subsequent indications have been either unknown or infrequent. A. Védrénes collected statistics of 953 trephining operations performed by 'professional trépaneurs[2]' among the inhabitants of the province of Constantine in Algeria—professedly without mortality. The great majority of them were primary operations, only a few being secondary, the indication being fixed pains in the head. Similarly in Montenegro[3], the office of trépaneur descends from father to son, and many operations are done, the proportion of secondary trepannings being greater here than among the Algerians; the indication again being fixed pain in the head. Insanity as an indication is not mentioned. In the mining districts of Cornwall the frequency of trephining not many years ago is notorious[4], but they were all primary operations. It is on record that La Motte trephined for traumatic epilepsy in 1705; and 99 years later Cline repeated the operation. Whether primary or secondary, the operation of trephining in general has been in and out of vogue many times. It was employed by Hippocrates and his followers

[1] Celsus, Liber viii. cap. 4, last words. [2] 'Revue de Chirurg.' 1885.
[3] Védrénes, 'Revue d'Anthropol.' 1886, i. 648.
[4] 'Brit. Med. Journ.' 1877, ii. 76.

for several hundred years. In the middle ages it was performed sometimes by physicians, sometimes even by mountebanks (circulatores), who bored the skull for trivial causes, yet in recorded cases often without fatal results. In more recent times it has been advocated by Hunter, Pott, Velpeau, and denounced by Bell, Cooper, Abernethy, and Desault, and the subject of debate with Quesnay, Dupuytren, and Nélaton. Though isolated cases of secondary trephining occurred in more or less continuous succession, it was not until 1879 that what may be called a distinct revival of the whole question took place. It originated in a case published [1] by Mr. West of Birmingham, in which he trephined for traumatic epilepsy and dementia with signal success. Much attention was directed to the case, and considerable discussion followed. In 1881 Mr. Walsham [2] argued from analysis of all cases reported up to that time, that trephining in itself is not attended by a high degree of danger, and this paper he followed up by one [3] dealing with trephining in cases of traumatic epilepsy. Some of the cases tabulated at the end in which epilepsy and insanity coexisted, are taken from his tables, which dealt only very subsidiarily with the mental symptoms.

This preference given to epilepsy, as the more noticeable and more important of the nervous phenomena following injury, has been the rule at all times. The phenomena of insanity have been regarded chiefly as subsidiary to and caused by the epileptic convulsions, and have been relegated to a very secondary place. Eccheveria [4] remarks that 'once declared, epilepsy caused by injury to the head leads to early insanity or feebleness of intellect,' evidently regarding the epilepsy as the causative agent. And in case No. LVII, although epilepsy evidently was not the cause of the mental impairment, being posterior in time, yet the operation of trephining was deferred till the appearance of convulsions. It has been said [5] that 'the insanity due to epilepsy is as incurable as the epilepsy itself': it is more to the purpose of this paper to inquire whether the insanity associated with traumatic epilepsy is as curable as the epilepsy is shown to be by Mr. Walsham's tables published in 1883.

[1] 'Med. Chir. Soc. Trans.' 1879. [2] 'St. Bartholomew's Hosp. Reports,' 1881.
[3] Ibid. 1882. [4] 'Arch. Gén. de Méd.' 1878. [5] Dr. Hack Tuke.

But the relation between them is apparently not that of cause and effect; and it is more consistent with the phenomena exhibited by the cases quoted, to regard the two affections as standing side by side, yet distinct. Modern opinions of non-traumatic epilepsy similarly incline to regard it as akin to insanity, and the insanity following epilepsy to be rather a further product of the same cause, than supervening as an effect of the convulsions themselves. Their close relation is illustrated by 'masked epilepsy,' 'l'épilepsie larvée' of French authors, in which the epileptic convulsion is said to be replaced by a kind of mental 'seizure.' And in traumatic cases, just as, where there are epileptic attacks, convulsions may occasionally be produced by pressure applied to a sensitive scar, or painful spot in the head, so, when there are delusions or mental defects, the psychical phenomena may be momentarily called into existence by like pressure. The two series of phenomena run, in fact, so parallel to each other, that very much that has been written about traumatic epilepsy might with equal justice be reproduced about traumatic insanity. This construction of the true sequence, or rather relationship, between the two is fully borne out by the analysis of the tabulated cases. There will be found on reference cases which illustrate all the following combinations and sequences. Firstly—insanity may be the earliest resultant phenomenon, and epilepsy may follow after a definite interval. Secondly—insanity may follow the epilepsy with an interval. This seems the commonest sequence where the two come to coexist. A good instance of the former sequence of events is the case of an officer in the American civil war who received a gunshot fracture of the left temporal bone, and whose memory became impaired by 1865, a year later. By 1880 he was reported to have acquired epilepsy. Thirdly—insanity and epilepsy may both begin and proceed concurrently. In many of the cases where the sequence is not actually noted, the two states are indefinitely coupled, as if there was no marked time-separation in their respective appearances. Fourthly—insanity may exist alone, and for many years, without epilepsy ever making its appearance. This is so in 29 of the tabulated cases. Fifthly—the mental defect has in some few cases been relieved by operative removal of the irritant, while the

patient has been still liable to convulsive attacks afterwards. It is impossible in the state of our present knowledge to ascertain what determines the onset of convulsions in one case, mental defect in another, and their combination in a third. One thing is certain, that the locality of the injury is not the determining factor. It seems that a constant abnormal stimulus can hold in check normal nervous processes, and set in action certain abnormal nervous processes, and it depends largely upon the idiosyncrasy of the individual, especially with regard to his reflex paths, which of these influences preponderates, and in what proportion they are combined.

That traumatic insanity has a definite claim to be considered as a result of injury, dependent on a persistent local irritant, and independent of any other sequela, is already abundantly in evidence, by a sufficient number of cases, whether of post-mortem proof, or proof by surgical interference. Of the former a case is reported by Mr. Gay [1], in which a man received an injury to the parietal region, followed by some necrosis. He was for the following five years despondent and suicidally inclined. He was brought into the hospital after an attempt to drown himself. An additional interest is lent to the case by the fact that he was to have been trephined for the relief of his mental symptoms but committed suicide in the hospital by cutting his throat, before the day of the operation. At the necropsy the inner table was found driven in and adherent to the dura mater, which itself was connected to the cicatrix through a fissure in the bone. The brain was natural, only slightly depressed under the depressed bone. During life pressure over the cicatrix always caused hallucinations of the same type.

Some of the cases relieved by surgical operation are very striking, and may be considered as more instructive than mere surgical curiosities—rather as containing pathological evidence in a more than usually forcible shape. Two such cases, Nos. XII and XIV of the Appendix, are here given in fuller detail.

The first is a case [2] of a Swedish man, 35 years of age, who was in the Arizona Penitentiary for a term of four years for man-

[1] 'Medico-Chirurg. Soc. Meeting,' Nov. 25, 1879.
[2] 'Pacific Med. and Surg. Journ.' 1884.

slaughter. The medical officer—Dr. Price—saw him there first in January 1883, and found him in a state of dementia, with periods of wild mania. He could get no history of the man, but was told that he had been admitted in this condition. On examining him he found a depression in the left parietal bone covered by a cicatrix $2\frac{1}{2}$ inches above and rather behind the ear. No history of the cause of this depression was forthcoming from the man. After an attack of small-pox in February of the same year he grew worse. This downhill progress, accompanied by refusal of food, continued all the following winter, and he was considerably wasted. On March 24, 1884, he was trephined as a last resource, and depressed bone, $2\frac{1}{8} \times \frac{7}{8}$ inches in area, was removed. Shortly after his recovery from the anaesthetic, he said in English, 'I'm hungry—I want something to eat.' It was not before known that he could speak English. Food was given and eaten with relish. He talked quite rationally with his attendants and seemed cheerful. Twelve days after the operation he gave his own history. He was working in a mine in May 1880, and some falling stone fractured his skull. Seven small pieces of bone were removed at the time. When the wound was nearly healed he left off attending his doctor. Afterwards he had a very confused idea of events, not understanding his incarceration in prison. Apparently the committal of manslaughter followed this period.

The second case [1] is that of a man, whom Dr. Hunter McGuire found in the Asylum of the Freedmen's Bureau at Richmond in the United States. He had been in the institution for a year, and had generally sat crouched in a corner, and never spoke a word. An examination of his shaven scalp revealed the scar of an old injury to the skull, with a slight depression in the bone. He was trephined at the site of the scar, and the button of bone removed showed an exostosis on the under surface, piercing the membranes, and imbedded in the convolutions. Next morning the patient said 'Good morning' and 'Where is the army to-day?' It transpired that he had been with the army nine years before; he could recall events

[1] 'Philad. Med. Times,' xv. 587.

up to the time that he was struck on the head with a boat hook—but the interval of nine years was an entire blank.

Both these cases, to which others, similar in the main lines, might be added, bring into strong light the immediate nature of the recovery often witnessed after such operations. It seems that there can be no organic change in nervous tissue, for that could only undergo gradual amelioration ; but rather a suppression of mental faculties, caused reflexly from a local irritant. Such a general result could not arise directly from a local pressure, but is much more in character with what is known of the habit of reflexes in general. And evidence has already been given that the dura mater is the more likely starting-point of the reflexes than the cerebral cortex.

It is almost superfluous to add that it is only a limited proportion of cases of traumatic insanity that is open to relief by operative measures. The limits are fixed by certain incontestable considerations. In the first place, though the evidence points strongly to a large preponderance of local agencies in the causation of the insanity, yet the locality cannot always be within reach of reasonable interference. It has already been shown that fracture of the base is not infrequently the originating injury ; and although there is nothing to contradict the possibility of the resulting insanity being due to some persistent irritant affecting the dura mater (indeed from the more than usually close attachment of the dura to the bones of the base it would more readily become involved in any bony lesion), it is evident that no justifiable measures could free it from irritation.

Again, the original damage to brain tissue proper may have been so extensive, that the probabilities are that its functions have been directly and permanently interfered with. Or when general intracranial changes have resulted, without any localizing indication (such changes being indefinite, and probably far less often primarily present than is usually supposed), it is obvious that there is neither indication for nor advantage in a local exploratory operation.

It is essentially the existence of some local indication, in a spot readily reached, that characterizes that class of case in which operative measures are justifiable. And when pronounced mental impairment follows an injury which has left permanently such a

local lesion, these measures are not only justified but demanded, and the demand is strengthened if at the same time there is any sensory or psychical phenomenon connected with the injured spot, such as pain in the scar, or tenderness, or mental agitation or hallucinations excited by pressure on it.

The operative surgery connected with idiocy and general paralysis of the insane, namely, craniectomy in the former case, and, in the latter, drainage of the subdural space, whether by trephining the vault of the skull, or, as more recently proposed, a lumbar laminectomy, rests on a very limited basis at present, and in any case does not bear directly on the special subject here under consideration, especially as it is not directed more to the relief of cases following injury than of those due to all causes combined.

With regard to the success of the operation of trephining in these cases, and therefore of its *a priori* advisability, they may be measured by its risk to life, and by its ultimate effect on the mental condition.

The risk to life is difficult to estimate, but may be measured by the risk attending secondary trephining in general. The class of case under consideration is *par excellence* one in which the results, if favourable, are likely to be published in far greater proportion than if unfavourable. A case, if successful in relieving the symptoms, would almost certainly see light in one of the contemporary journals: if the operation proved fatal, it would at once become merely a case of death following trephining, and therefore of comparatively little interest to the profession in general, and only of value to the statistician. The percentage of deaths, therefore, among the cases collected below, namely, five out of a total of 67 cases, or two out of 45 cases reported in the last 13 years, may be taken for what it is worth as evidence.

With regard to the ultimate effect on the mental condition, a reference to the analysis of the 67 cases will show that the data are more complete and satisfactory than in the case of the relative fatality of the operation. Of the 62 cases, in which a fatal result did not follow, there are noted 41 cases of mental recovery, 12 cases of great mental improvement, 5 cases of slight improvement, and

only 4 cases in which no permanent effect on the mental state was registered; in two of these 4 cases there had been temporary improvement after the operation, followed by a relapse, perhaps partly owing to subsequent bad surroundings. In one of the cases, cited as recoveries, the mental improvement took place only after an interval of five months from the operation, and being at the same time rather an acute case of mania, very probably owed neither the insanity to injury, nor the cure to the operation. For acute insane states are comparatively uncommon as the result of a head-injury.

The rest of the cases, cited as recoveries or improvements, bore such a very obvious relation, in the matter of their amelioration, to the operations undertaken for their relief, that there can be little doubt that, in the great majority at least, the operation and the cessation of the symptoms stood to each other in the relation of cause and effect. These conclusions fully bear out what Fletcher [1] remarked of his series of eight cases of trephining for traumatic insanity, that 'whereas all before the operation were melancholic, suicidal, and profane, and four destructive to clothing, none were so after the trephining.'

Even making a suitable allowance for a certain proportion of unreported deaths and unsuccessful cases, the results cannot but be considered to be highly encouraging, if it is considered that in the last thirteen years alone there have been reported 63 cases of complete or partial restitution of sanity. And in one out of the 4 cases in which no effect was produced on the mental condition, the operation was vaguely exploratory, with apparently insufficient evidence of the locality of the irritant, if irritant there was. In many cases a very slight indication may be found sufficient; even the knowledge merely of the originally injured spot. And the importance of noting accurately the details of a head-injury at the time, and following the case up for a long period, is thus amply illustrated. For the history of an injury, as a cause of mental defect, must not be lightly judged of, because the original blow was apparently a slight one. A fracture

[1] 'Amer. Journ. of Insanity,' xliv. 218.

of the inner table alone is almost always produced by a slighter blow than is necessary to fracture the outer table either with or without the inner. And it has been fully demonstrated how large a part these bony splinters play in the production of secondary nervous phenomena.

Again, the lapse of time is no bar to the operation. Briggs of America has said—'An individual may have all the predisposing circumstances necessary to place the reflex centres in the highest degree of susceptibility, and this susceptibility may lie dormant for years, unless an exciting cause comes into action. In many cases no peripheral irritant can be discovered. That the exciting cause cannot be ascertained is no argument against the existence of such.' These statements, applied originally to epilepsy, may be held equally true for traumatic insanity. It is a practical fact, highly worthy of notice, that in 6 of the collected successful cases nothing abnormal was discovered in the bone or dura mater, in some cases no definite scar even being present: and in one of the successful cases actual trephining was not carried out, as the bone underneath the cicatrix was not depressed; merely the freeing of the superficial cicatrix apparently proving accountable for the relief which followed.

The success, which has already been won, cannot but act as a stimulus to the undertaking of an operation in other similar and as doubtful cases, an operation which must always be to a certain extent exploratory, but which, by a continually accumulating mass of clinical and pathological evidence, will be placed on a sounder basis, and approached with a hesitation the less, as it is more firmly established that it will prove rather a piece of cranial than of cerebral surgery, and as it is directed to the relief of a state, which, though not in general immediately dangerous to the life of the individual, is yet incompatible with that mental life which is necessary to complete his individuality.

ANALYSIS OF CASES.

Although many of the details of the points illustrated by the following 67 cases for trephining for traumatic insanity have been already dealt with in various contexts, a short analysis will serve to collect under appropriate headings the most important of the considerations involved. They will be discussed under the following headings.

1. The cause, nature and situation of the head-lesion to which the mental symptoms were ascribed.

In all of the cases except 3, there was a clear history of the head-injury, and in those 3 there was plain physical evidence that an injury had been inflicted. In the great majority the injury was at the time a serious one, and in the great majority also there was enough evidence to warrant the belief that the injury stood to the symptoms in the relation of cause and effect. The actual causes of the injuries were very various, and for present considerations immaterial.

In 45 cases the lesion was a depressed fracture of the vault, and in 18 of these the fracture is definitely stated to have been compound. In 1 case there was a compound non-depressed fracture. In 9 cases the injury is described as a scalp wound with no fracture, in 4 as a contusion, in 2 as a blow, in 1 simply as an injury.

In 41 cases the parietal region (including the interparietal) was the seat of the lesion, in 7 the frontal region, in 5 the fronto-parietal region, in 2 the occipital region, in 1 the temporal region, and in 3 the 'vertex.' In 7 cases the locality is not stated.

2. The interval between the injury and the onset of symptoms.

In 20 cases the interval is not stated. Of the 47 in which it is given, some symptoms appeared immediately in 8, in 13 in the first 12 months, in 11 between 1 and 5 years, in 8 between 5

and 10 years, in 4 between 10 and 15 years, in 2 between 15 and 20 years, in 1 beween 20 and 30 years.

3. The interval between the onset of symptoms and trephining.

This varies from a few days to 43 years, and no definite relation between the length of the interval and the prospect of recovery can be inferred, though on the whole the cases where the interval was short seem to have done rather better than where it was much prolonged.

4. The character of the mental change.

All types of change are illustrated. Mania of many forms, melancholia, dementia, and idiocy are all included. If there is one individual character which seems to prevail, it is a suicidal or homicidal tendency. In 11 of the 67 cases there is definitely stated to have been an impulse to suicide or homicide or both.

Of the 38 cases complicated with epilepsy, the sequence of the phenomena is only stated in 7. Of these 7 the epilepsy appeared before the mental change in 4 cases, the insanity appeared first in 3 cases. In one other case the convulsions had ceased for 3 years before mental change supervened; in another similar case convulsions of a few weeks' duration ceased, and gave place almost at once to insanity.

5. The local indications calling for operation.

Of the cases where this is stated, in 47 there was a distinct depression in the skull to be felt, with or without a cicatrix. In 11 there was a cicatrix without depression. In 3 there was merely evidence of old contusion. In one case the history alone was an indication, no external lesion being detected (this case did not do well). In 1 there was merely a tender spot: in 2 a sensitive spot.

Of the above cases, in 6 the cicatrix was tender to pressure, and in 4 pressure on it produced nervous manifestations.

6. The actual lesions found at the operation.

Of the 45 cases of depressed fracture, besides the depressed bone there were found—in 13 cases osteophytes or splinters from the inner surface of the bone; in 9 cases thickened bone; in 3 cases cysts in the dura mater containing serous fluid; in 1 case diseased bone; in 1 case a bullet lodged on the dura mater. Of the 18 cases

where there were only cicatrices, or tender or sensitive spots, in 2 cases splinters or osteophytes were found; in 5 cases thickened bone; in 1 case a cyst with serous contents; while in 8 cases nothing abnormal was discovered: of these 8 cases 6 made good mental recoveries.

Of all the cases collectively, the dura mater was stated to have been adherent in 13, and the pericranium adherent in 2. In 7 cases no particulars are given.

In 1 case as no depressed bone was found under the cicatrix, it was merely freed, and trephining not done. The result was good.

7. The results of the operation.

Of the 67 reported cases, 5 deaths occurred. Of the 47 cases reported in the last 13 years, only 2 died.

Of mental recoveries, 41 cases are noted; of great improvement, 12 cases; of slight improvement, 5 cases. In 4 cases there was no ultimate change. Of these 4, two had showed temporary improvement before relapsing, and in 1 there had been no local indication for operation. One of the cases, noted as recoveries, recovered only 5 months after the operation: the benefit from the operation is therefore doubtful.

Of the 38 cases of combined insanity and epilepsy, in 24 recovery from both conditions is noted. In 8 cases the intelligence was improved, but some liability to convulsions continued. In 1 case there was no change.

These 67 cases have been collected from British, Irish, American, Colonial, and some European periodicals, published from 1878 to 1890—with the exception of the first 18 of the series of cases of combined insanity and epilepsy, which have been taken from Mr. Walsham's tables[1] of traumatic epilepsy.

[1] 'St. Bartholomew's Hosp. Reports,' 1883.

CASES OF SIMPLE TRAUMATIC INSANITY.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
I. Male, 44. Lockhart Robinson.	Depressed fracture of post. sup. angle of right parietal, from fall at 13 years.	Not stated.	Insane for 31 years.	Depressed bone removed by trephining. Recovered soundness of mind.
II. Boy (Cline). West Riding Asylum Rep. ii. 72.	Blow on head from a ruler.	Not stated.	Mental derangement: moral insanity: maliciousness and erotic tendencies.	Trephined: spiculum of bone removed. All mental disturbance disappeared.
III. Male, 38 (Wherry). Journ. of Mental Sci. xxvi. 551.	Wound over left parietal at 36 years, from falling hammer.	1 year.	Pain under scar: morose: irritable: suicidal.	Trephined $1\frac{3}{4}$ years after injury: nothing abnormal found except cicatrix. Became lively and cheerful and went to work again.
IV. Male, 32. Med. Times & Gazette, 1881, i. 516.	Fall on back of head: no wound: unconscious 6 hours.	Soon.	Pain in back of head: hesitating speech: general mental impairment. Right paresis.	Trephined over left occipital: nothing found: no improvement.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
V.				
Lyon Médicale, xxxvi. 485.	Comp. depressed fract. left parietal. Unconscious 24 hours.	At once.	Violence: restlessness: hallucinations of smell; incoherence.	Depressed fragments removed at the end of 5 weeks leaving unwounded dura mater: quite sane in a month.
VI.				
Male, 19. Dublin Journ. of Med. Sci. lxxii. 376.	Gunshot wound of frontal: some loss of bone.	6 months.	Irritability passing into delusional insanity. Under control 9 months after injury. Quasi-hysterical fits.	Trephined 2¼ years after injury: skull very thick: inner table much depressed. Next day rational and intelligent: remained sound.
VII.				
Male, 18 (Alexander). Med. Times & Gazette, 1884, ii. 146.	Cicatrix over right parietal bone, with depression.	Not stated.	Had been vagrant all his life. History obscure. Admitted to asylum after heavy drinking bout. Left-sided paresis. Dirty, stupid, drivelling.	Trephined at site of scar: skull very thick: dura healthy: immediate improvement: much mental recovery in six days. Became fairly competent and cleanly.
VIII.				
Male (Briggs). Phila. Med. News, xlv. 119.	Broad depressed fracture of right parietal, from a stone.	Not stated.	Gradual sinking into imbecility. Sometimes gloomy and listless: sometimes wildly maniacal.	Trephined 5 years after injury: did well for a time, then rigor and sudden death.
IX.				
Little boy. Ibidem.	Depressed fracture.	Not stated.	Violent mania: constant endeavours to escape attendants.	Trephined and recovered his faculties.
X.				
Male. Ibidem.	Gunshot wound above ear: fracture and displacement of bone.	Not stated.	Lunacy.	Removal of irritating bone restored his faculties.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XI. Female, 31 (Byrd). Ibidem.	Depressed fracture of right parietal from a horse's kick.	13 years.	Insanity: incessant talking, very obscene.	Trephined over scar: 3 crowns: bone nearly ½ inch thick: after 3 weeks of rationality relapsed into old state.
XII. Male, 35 (Price). Pacific Med. and Surg. Journ. 1884.	Compound depressed fracture of left parietal by falling stones: 7 small pieces of bone removed.	Few months.	After wound was nearly healed very confused idea of events. Committed manslaughter. In penitentiary demented with periods of wild mania: refused food and was wasting.	Trephined 4 years after injury as last resource. Depressed bone removed 2⅛ by ⅞ inches: same day spoke rationally: recovered quickly: intelligent and cheerful.
XIII. Male, 23 (McCormick). Amer. Practitioner, 1883, 207.	Compound depressed fracture at junction of coronal and sagittal sutures. Unconscious several hours.	8 years.	Pain at site of wound and acute maniacal periods. Depression 1 inch in diameter.	Trephined at 23 years old. Depressed bone removed: recovery from mania.
XIV. Adult male (McGuire). Phila. Med. Times, xv. 587.	Compound depressed fracture from boat-hook.	At once.	Demented: never spoke: sat crouched in corner of asylum ward.	Trephined after 9 years. Bone removed: showed spiculum imbedded in convolutions: spoke rationally next morning. The 9 years' interval an entire blank in the memory.
XV. Male, 47 (Fletcher). Amer. Journ. of Insanity, xliv. 212.	Blow on vertex from 'stove-lid lifter.' Unconscious 6 hours.	6 months.	Became negligent, dirty, finally melancholic and suicidal.	Trephined 1 year from injury, over sagittal suture. Slight depression of bone: adherent dura: spicula of inner table had punctured dura. Left hospital a 'new man.' Under observation 2 years.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XVI.				
Male, 23. Ibidem.	Depression at anterior part of left parietal. No history of the injury.		Committed to prison at 17 years for burglary. Never moved or talked in cell. At 20 demented. Only spoke 2 or 3 times, from 20 to 23, and that irrelevantly.	Trephined at 23: depressed bone removed: a few hours later talked sharply and rationally. Great improvement, but not a complete cure. Dura mater adherent.
XVII.				
Male, 44. Ibidem.	Struck by fragment of burst shell on left parietal.	Not stated.	Morose and melancholy. Pain in scar, which apparently covered depressed bone.	Scalp reflected: no depression in bone found, so no trephining done: pain and melancholy disappeared: health much improved.
XVIII.				
Male, 41. Ibidem.	Depression over left parietal from a blow at 12 years.	Not stated.	At times violent. Suicidal and homicidal mania.	Trephined 29 years after injury. Depressed bone removed: dura mater adherent. No effect on mental condition.
XIX.				
Male, 27. Ibidem.	Fall from train. Scalp wound near fronto-parietal suture.	Not stated.	Destructive and suicidal. Great pain in scar.	Trephined 2 years after injury. No fracture found. Spells of pain shortened, but not mentally restored. Dura mater adherent.
XX.				
Male, 27. Amer. Journ. of Med. Sci. xci. 433.	Comp. fract. right frontal, from suicidal gunshot wound, when drunk. Ball extracted.	2 years.	Transferred from reformatory to criminal asylum 2 years later as chronic maniac. Mysterious: violently maniacal: refusing food. Pressure on scar produced violent mental agitation.	Needle thrust through old bullet hole withdrew two drachms of serum. Recovered from anæsthetic, quite rational and remained so. Under observation 6 months.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XXI. Female, 28. Trans. Internat. Congress of Med. 1887, 601.	Compound depressed fracture at junction of sagittal and coronal sutures from falling brick. Bone elevated.	10 years.	Acute mania.	Trephined 10 years after injury. Bone thick, hard, slightly depressed. Dura adherent. Gradually recovered mental powers: 4 months later memory and intellect good.
XXII. Male, 70. Med. & Surg. Reporter, lxiii. 10.	Fall on to left occipital, at 27 years. Unconscious several days.	At once.	Amnesia for 1 year. For 42 following years spells of despondency. Finally suicidal.	Trephined 43 years after injury. Some depressed bone removed: dura very adherent. Immediate improvement. Under observation 4 months: gaining in every respect.
XXIII. Male. Indiana Hosp. for insane.	Depressed fracture of skull from a piece of iron. Unconscious 10 days.	1½ years.	Loss of memory: inattentive: irritable: destructive.	Trephined 3 years after injury: small area of depressed bone removed with subjacent splinter as big as a small tack. Immediate relief from unpleasant past sensations. Cured.
XXIV. Female, 37. Amer. Journ. of Insanity, xlv. 43.	Depressed fracture at sagittal suture from falling stone at 18 years. Depressed bone removed.	19 years.	Acute mania.	19 years after injury some depressed bone removed. No improvement for 5 months: then gradual mental recovery.
XXV. Boy, 16. Boston Med. and Surg. Journ. 1882, i. 370.	Fall on to head at 12 years. Unconscious for a time.	4 years.	Liable to fits for 1 year: then complete recovery. Three years later sense of oppression and tenderness at a spot near vertex: increasing insanity: memory and temper impaired: mania.	Trephined 4 years after at sensitive spot. No cicatrix: nothing abnormal in bone or dura mater. Complete recovery: under observation 7 months.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XXVI. Male, 26.	Depressed fracture at right parietal eminence from falling slate.	Not stated.	Some convulsions and left hemiplegia for a few weeks: clearing up and giving place to mental impairment.	Trephined 9 years after injury. Thickened and depressed bone removed: 10 months later reported slightly better in all respects.
XXVII. Girl, 23 (Guthrie).	Blow on left parietal from falling stone.	1 year.	After progressive paresis of arm and leg, and impairment of sight and hearing on the same side as injury, for 1 year—loss of memory supervened. Countenance heavy and somnolent. Acute fixed pain.	Trephined over seat of pain. Shortly after operation paralysis began to pass off, and mental symptoms disappeared simultaneously. Nothing abnormal discovered.
XXVIII. Male, 23. Gaz. Médic. de Paris, 1848, 377.	Depressed fracture of parietal from fall on head.	At once.	Immediate acute mania: remained violent and unmanageable.	Trephined 11 years after injury. Some depressed bone removed: dura mater adherent. Entire recovery from all symptoms.
XXIX. Adult male (Cline).	Depressed fracture of left parietal from fall on head.	At once.	Loss of all voluntary motion: wide anæsthesia: loss of speech and memory.	Trephined 1 year after injury. Depressed bone removed: recovery of all functions in two months.

CASES OF COMBINED TRAUMATIC INSANITY AND EPILEPSY.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XXX. Female, 16. Amer. Med. Times, 1861, i. 45.	Simple fracture of left parietal from a fall at 11 years.	Few hours.	Epileptic fits increasing: partial paralysis of left arm: mental deterioration.	Trephined at end of 2 years. Spicula of bone removed. Fits ceased, and mental recovery inferred.
XXXI. Male, 23. Amer. Practitioner, June, 1883, 343.	Compound depressed fracture at junction of sagittal and coronal sutures: stunned: blow from hammer.	7½ years.	Epilepsy and mania: pain and tenderness in scar: loss of memory of whole previous life.	Trephined 8 years after injury. Depressed bone removed: dura not injured. Memory of details before injury restored, but intervening 8 years a blank. He did not even know he was married, his marriage having taken place after injury.
XXXII. Female, 15 (Eccheveria). Arch. Gén. de Méd. 1878, ii. 543.	Simple depressed fracture of right parietal from a blow.	Not stated.	Some convulsions same day: later epilepsy, and rapid deterioration of intellect. Pressure over depressed spot caused vertigo.	Trephined 6 months after injury. Depressed bone removed: inner surface rough and adherent to dura mater. No more fits: intellect restored. Under observation 6½ years.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XXXIII. Male, 21. Amer. Journ. of Med. Sci. 1828, 489.	Compound depressed fracture of left parietal from a blow.	9 years.	Epilepsy: failure of memory and intellect: speech stammering.	Trephined 16 years after injury. Depressed bone removed: a fragment had penetrated dura: memory, intellect, and speech improved in a few days: no more fits.
XXXIV. Female, 24. Brit. Med. Journ. 1869, ii. 327.	Depressed fracture at right parietal eminence from a fall.		Epilepsy: giddiness: could not remember names, nor count to five. Depressed spot painful.	Trephined 17 years after injury. Dura congested and bulging. Punctured: clear serum escaped. No more fits: memory tolerably good a year later.
XXXV. Male, 28. Brit. Med. Journ. 1862, i. 144.	Depressed fracture of parietal from a blow.		Epilepsy and mental deterioration: cramps and numbness of arms.	Trephined 1 year and 9 months after injury. Splinters removed, pressing on dura and brain: complete recovery from epilepsy and mental incoherence. Under observation 3 months.
XXXVI. Male, 46. N. Amer. Med. and Surg. Journ. 1826.	Compound depressed fracture of left frontal.	Short time.	Epilepsy. Dementia shortly followed.	Trephined 14 years after injury. Depressed bone removed: piece of inner table pierced membranes: brain hyperaemic: 1 fit after: memory restored. Under observation 9 months.
XXXVII. Boy. Amer. Journ. of Med. Sci. xxxix. 281.	Compound depressed fracture above ear from kick of horse.	At once.	A few immediate convulsions: then insanity.	Trephined 4 weeks after injury. Depressed bone removed. Immediate relief.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XXXVIII. Male 26. Journ. of Ment. Sci. xix. 552.	Compound depressed fracture of left frontal, from falling coal.	4 years.	Alteration in disposition: then homicidal tendency: later epilepsy.	Trephined 4 years and 2 months after injury. Depressed bone removed. Complete recovery in all respects.
XXXIX. Male, 50. Gaz. Méd. de Paris, 1848, 377.	Depressed fracture of temporal bone.	Some years.	Epilepsy: dementia.	Trephined 11 years after injury. Depressed bone removed. Steadily improving 1 week later.
XL. Male, 16. Lancet, 1873, i. 799.	Wound over left parietal eminence from a fall: no known fracture.	1 week.	Epilepsy: mental hebetude: memory failing. Cicatrix sensitive: painful at times.	Trephined 4 years after injury. No fracture found: bone thickened: less number of fits: able to return to work. Under observation 1½ years.
XLI. Adult male. Journ. of Ment. Sci. July, 1874.	Wound of scalp from a fall: no fracture.	6 years.	Epileptic fits followed by acute maniacal attacks: pressure on scar caused rigidity of right arm.	Trephined. Bone thickened. One maniacal attack afterwards: epilepsy continued: remained sane with small exceptions.
XLII. Male, 26. St. Louis Med. and Surg. Journ. May, 1870, 205.	Blow on right parietal eminence.	11 years.	Epilepsy: loss of intellect: some paralysis.	Trephined 16 years after injury. Immediate improvement of intellect. Paralysis disappeared.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XLIII.				
Male, 15. Brit. Med. Journ. 1863, 199.	At 3 years found unconscious: injury unknown: depression found on left side of head.	5 years.	Epilepsy came on at 8 years: progressive imbecility at 11 years.	Trephined 11 years after injury. Bone somewhat thick: no depression: dura healthy. Mental condition much improved: fits less: 2 years later P.M. old clot and cyst found beneath dura at site of trephine hole.
XLIV.				
Male, 33. Gross, Syst. of Surg. ii. 177.	Depressed fract. of frontal and parietal at 8 years.	14 years.	Epilepsy: later loss of memory and affection of speech.	Trephined 25 years after injury. Death in 5 days from intracranial haemorrhage.
XLV.				
Female, 16. Brit. Med. Journ. 1865, 611.	Compound depressed fracture of left parietal from blow with coal-pick.	5 years.	Mental deterioration: irritability: loss of memory: followed by epilepsy.	Trephined 10 years after injury: splinters found projecting through dura and arachnoid. Death on 6th day from meningitis.
XLVI.				
Male, 41. Amer. Med. Times, 1862, 319.	Depressed fracture at vertex from a blow.		Epilepsy: memory and intellectual faculties destroyed: some right-sided paralysis. Cicatrix tender.	Trephined 7 years after injury. Great haemorrhage. Mental faculties regained in 3 days: secondary haemorrhage: relapse into imbecility: death in 7 weeks.
XLVII.				
Male, 22 (Eccheveria). Arch. Gén. de Méd. cxlii. 535.	Depressed fracture of right parietal.	6 months.	Progressive frequency of fits, with progressive idiocy.	Trephined. Depressed bone removed with underlying old clot: became quiet and rational: occasional nocturnal fits, but no more mental disturbance.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
XLVIII.				
Arch. Gén. de Méd. cxlii. 539.	Blow on left parietal.	At once.	Attacks of vertigo and mania.	Trephined. Bone thick and sclerosed. Vertigo and maniacal attacks gradually ceased.
XLIX.				
Ibidem, 541.	Fall on head in infancy. Depressed fracture of parietal.		Epilepsy supervened very shortly: at 17 years violent attacks of homicidal mania.	Trephined. Depressed bone removed: no further attacks; under observation a very short time.
L.				
Ibidem, 542.	Depressed fracture of right parietal.		Headache: vertigo: nocturnal fits: advancing mental stupor.	Trephined some months later. Depressed bone removed: dura very adherent. Perfect cure in all respects.
LI.				
Male, 30 (Roberts). Amer. Practitioner, 1883, 337.	Gunshot fracture of left parietal.	2 years.	Headache: convulsions: dementia.	Trephined. Bone and lead removed, pressing on dura mater. Recovery from epilepsy and mental impairment.
LII.				
Boy, 11 (Briggs). Nashville Journ. of Med. Sci. 1880, 14.	Fall on head; depressed fracture. Unconscious 6 days.	10 months.	Dementia and violent convulsions.	Trephined. Depressed bone removed: 1 month later improvement in all respects.
LIII.				
Male, 26 (Sands). Annals of Anat. and Surg. 1883, 99.	Depression of right parietal from a piece of slate.	Few weeks.	Left hemiplegia for 7 months. A few weeks after injury, epilepsy and some dementia.	Trephined 9 years after injury. Bone thick and hyperaemic. Both conditions only ameliorated.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
LIV. Male, 12. Lancet, 1886, i. 243.	Compound depressed fracture of right frontal.	6 years.	Epileptic convulsions with impairment of intellect.	Trephined at scar. General thickening of bone at that place. Dura healthy. 2 years later was mentally vigorous, and had only had 4 fits.
LV. Female, 7. Med. and Surg. Reporter, 1886, ii. 298.	Wound over left parietal from a fall.	At once.	Convulsions appeared at once: 2 years later mental powers rapidly failed. Pain at depressed spot.	Trephined 2¾ years after injury. Bone thickened: much projection from inner table. Became more rational and talkative, but relapsed again in bad surroundings.
LVI. Male, 30. Ibidem, 1886, ii. 298.	Fall on right side of head and scalp wound.	6 weeks.	Epilepsy in 6 weeks—followed by violent maniacal attacks, lasting several hours or days. Pressure on scar caused bright light and occasional unconsciousness.	Trephined 6 years after injury. Complete recovery. No change in bone or dura: cicatrix not adherent. Under observation 5 months.
LVII. Male, 40. New York Med. Journ. xlvi. 152.	Blow from axe on left parietal. Slow but eventual recovery.	Many years.	30 years after injury occasional complete failure of memory: anxious expression: hesitating speech: later epilepsy: pain on pressure over scar.	Trephined 31 years after injury. Much depression, and inner surface of button rough: dura healthy: 2 months later no fits, and mental faculties better than for some years.
LVIII. Male, 35 (Fletcher). Amer. Journ. of Insanity, xliv. 212.	Depressed fracture of right parietal near occipital.	Not stated.	Headache: asomnia: at times suicidal and homicidal: some convulsions.	Trephined 6 years after injury. Slight depression: diploe necrosed: dura mater adherent: next morning free from pain and mental aberration, Under observation 5 months.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
LIX.				
Male, 37 (Fletcher). Amer. Journ. of Insanity, xliv. 212	Blow on head at 13 years.	7 years.	Epilepsy at 20. At 23 years violent and homicidal: killed his child in a frenzy.	Trephined 24 years after injury. 12 months later had had very few fits: none in following 6 months (mental restoration is inferred).
LX.				
Male, 50. Ibidem.	Fragment of burst boiler struck right parietal. Unconscious several days.	7 years.	Muscular twitching and paralysis: 4 such fits, with loss of self-control: melancholia. Sometimes suicidal.	Trephined 8 years after injury. No fracture. Dura tough and adherent. Punctured and two drachms of serum escaped. Recovery: under observation 4 months.
LXI.				
Male, 26. Glasg. Med. Journ. xxix. 376.	Depressed fracture of parietal from blow from crane-handle. Bone not elevated.	Few months.	Epilepsy and increasing loss of memory.	Trephined 7 months after injury. Bone very thick: dura mater caught between depressed fragments. Gradual disappearance of symptoms. Under observation 2 years.
LXII.				
Female, 12. Bost. Med. and Surg. Journ. cxxii. 313.	Compound comminuted fracture of left parietal. Some bone removed. Unconscious a week.	4 years.	At 8 years epilepsy and mental impairment: increasing for 4 years.	Trephined 8 years after injury: cyst in dura, which was adherent to bone: sharp spicula pierced dura. Complete recovery: under observation 1 year.
LXIII.				
(Fenoglio). Bologna Rivista Clinica, 1887.	Injury to right fronto-parietal region.	Not stated.	Psychical disturbances and epilepsy: left-sided paresis and rigidity: gloom and melancholy.	Trephined at injured spot. Complete mental recovery. Symptoms could be reproduced by pressure over trephine-hole.

Sex, Age, Reference.	Cause and Nature of Injury.	Time before Symptoms.	Condition before Operation.	Clinical and Pathological Results.
LXIV.				
Male, 30. Trans. Amer. Neurol. Assoc. i. 171.	Right parietal wounded by shell. Piece of bone scooped out in 1863.		Serious mental disturbance. Epilepsy later.	Trephined 2 years after injury. Nothing abnormal found: 18 months later mental condition had steadily improved: no more fits.
LXV.				
Girl, 15 (West. 1878).	Depressed fracture of right parietal at 8 years.	Not stated.	Epilepsy: increasing fatuity: finally imbecility.	Trephined 7 years after injury. Outer table much more involved than inner. Became at once bright and cheerful: no more fits. Under observation $2\frac{1}{2}$ years.
LXVI.				
Male, 29. Journ. of Nerv. and Ment. Dis. xiii. 488.	Depressed fracture of right parietal from blow on head in 1880.	3 years.	Admitted to New York State asylum as acute mania: excited with delusions of persecution and poisoning. Dec. 7–14, 1883, convulsions.	Trephined $3\frac{1}{2}$ years after injury. Rudi-osteophytes to which dura was adherent: dura thick. 6 months later no more fits: loss of control and irritability disappeared.
LXVII.				
Male, 28.	Depressed fracture, at 14 years, of left parietal from fall. Elevation of bone not allowed by parents.	7 years.	For 7 years increasing epilepsy: gradual loss of memory: range of mental operations limited.	Trephined 14 years after injury. Peri-cranium adherent: bone very thick: wedge-shaped piece of bone $\frac{3}{4} \times \frac{1}{4}$ inch piercing dura and cortex. Death in 3 days after delirium.