I have mentioned Porro's and Säger's methods of sterilising the mother, as well as saving the child, but I can conceive it possible that, if the time should come, as come it will in the opinion of some eminent experts, when the mortality of Cæsarean section is reduced to 10 per cent., or less, a case may now and then occur in which this sterilisation should not be carried out. Let us imagine that a nobleman's wife or a person of great estate, by whom—judging by the usual motives of human conduct—much would be endured in order to provide an heir to the title or estate, the mother might elect to encounter the repeated risk of Cæsarean section until a son and heir was born.

These various questions however, which I have opened and not attempted to decide, may well be left to time and experience to settle; there is no discredit but rather merit attaching to this avowed uncertainty, for I hold that suspense of judgment and an open mind become a duty, while evidence is conflicting and experience accumulating.

THREE LECTURES ON SOME POINTS RELATING TO INJURIES TO THE HEAD.

Delivered at the Royal College of Surgeons of England.

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LECTURE III.

MR. PRESIDENT AND GENTLEMEN,—At the termination of the second lecture I was considering the injuries to cranial nerves which sometimes accompany or follow fractures of the base; the seventh nerve was under discussion when the time expired, and notes of fifteen cases had been read, which indicated, amongst other points, the improved prognosis as to the recovery from facial paralysis that can be given when it is a late manifestation after these fractures. In nearly all it was also apparent that the hearing on the same side was impaired; usually this was shown at the time of the onset of the paralysis, but in three fatal cases the patients were unconscious until death. In fourteen other patients who presented signs of fracture of the middle fossa deafness was found, and was a cause of complaint; six developed it after hæmorrhage from the ear (it was found in two who complained when they regained consciousness, in two on the sixth day, and two on the ninth day); six after hæmorrhage, followed by watery discharge of varying amount and duration; two after epistaxis, in one of which watery discharge from the nose followed (both had hissing and other noises in the ears). As a rule the prognosis, as in paralysis of the portio dura, was better with regard to recovery if the deafness was of late onset. In many instances the membrana tympani was seen to be ruptured, but the

loss of hearing did not seem at all considerable, and did not give rise to complaint either then or later.

Mr. Leonard Bidwell has collected a series of 106 cases of fractured base, published in the columns of the *Lancet* from the first number up to the present date, and in fifteen of these there was facial paralysis. Two were fatal—one from arachnitis, the paralysis appearing on the fourth day; in the other it was noticed in a few hours, but nothing is recorded further. In one case the result is not mentioned; in four it is stated that the paralysis was permanent, and it came on the second, fourth, eighth (with paralysis of the fifth nerve), and thirty-fourth days (disease of mastoid process) after the accident. In eight the paralysis had gone or was improving at the time of the last note. In one it developed at once (lasting forty-one days); in two on the second day (in one of which paralysis of the sixth nerve accompanied, and did not afterwards improve); in the others it developed on the fourth, fifth, eighth, ninth, and tenth days, lasting for a period of fifty, ninety, fourteen, fifteen, and seventeen days respectively. The condition of the hearing is not given in all, but in some permanent deafness remained, though the paralysis of the portio dura disappeared. These cases also indicate the more hopeful prognosis when the onset of the affection is delayed. I do not propose to say anything about the cranial nerves other than those mentioned, for I can give no information beyond that contained in our textbooks, and more especially that in the excellent article on Injuries to the Head, in Holmes's *System of Surgery*, now edited by Mr. Hulke.

THE TEMPERATURE FOLLOWING SOME CASES OF INJURY TO THE HEAD.

The alteration of the normal temperature which is met with in some cases after the infliction of severe injury to the head, such as fracture of the base, is, I think, worthy of our consideration. In the larger number of instances this differs but little, if at all, from that following the infliction of an injury of corresponding magnitude to other important parts of the body. There is the depression which accompanies the shock so frequently seen in such cases, followed by a rise to 100° or 101°, then a fall again often below normal, and a rise to the usual normal line. But not infrequently the remainder of the observations indicates much nervous depression, and the record keeps below the normal at 97° or thereabouts for some days. If the injury have caused a scalp wound as well as a fracture of the base, even though this be but small, there is the possibility that such a wound may take on suppuration, and the temperature will then indicate the process. Meningitis may cause a change from the usual course, and lead to a fatal termination, accompanied by those well-known symptoms that indicate its progress. Then, again, the onset of erysipelas or pyæmia must be remembered as a possibility—and I am glad to be able to say "possibility," and not "probability;" for these diseases are certainly much less frequently causes of a fatal result after an injury than used to be the case. They are not, however, as yet completely banished from our surgical wards. There is also a rise of temperature on the second day to about 100° in some cases of laceration of the brain, and by the third day it is usually 101° or 102°, even when the accompanying injury does not include

Fig. 8.—Chart of a case of fracture of the posterior fossa of the skull, with optic neuritis, illustrating continued low temperature after fracture of the base.

a scalp wound, and the fracture, if there be one, is not compound. But it is not to the temperature after these slight lacerations of the brain substance, or to that of the complications named, that I am now desirous of directing attention but to a rise of temperature occasionally met with after a fracture of the base of the skull, a rise which commences not many hours after the receipt of the injury, which may amount to as much as 10° or more within a few hours, and is too often followed by a fatal termination.

In the *Lancet* of 1879,¹ there is published a series of four cases of fracture of the base of the skull, which were under the care of Mr. Hulke in the Middlesex Hospital. In each of these the patient died with a high temperature, which, from the few lines of introduction to the account, was apparently regarded as an example of rise of temperature the result of bruising of the bones. The *post-mortem* examinations, however, demonstrated the fact that with the damage to the bones was associated a condition of marked cerebral contusion. A marked lesion common to all of them was contusion of the cerebral substance associated with hæmorrhage to a greater or less amount. The important question presents itself: Have we in this rise of temperature a symptom of value in diagnosing the effect of the injury which has been inflicted on the cranium or its contents? The answer to this can only be given after a larger knowledge derived from a consideration of similar cases, and I must ask you to give me your attention whilst I read brief notes of some which have been observed in St. Thomas's Hospital. The points to which I would particularly attract your attention are: the injury to the skull and its position, the duration of life after the accident, the temperature before death, and the condition of the brain at the *post-mortem* examination.

CASE I.—A woman aged 63 was under the care of Sir Wm. Mac Cormac in 1883. Unconsciousness deepened into coma, and the patient died in two days. From the symptoms during life she was supposed to have sustained a fracture of the right, middle, and anterior fossæ, and on the day of admission in the evening the temperature was 100.8° ; on the third day at 3.30, 104.4° ; ten minutes after death, 105° . (See chart, Fig. 9, No. 1.) At the *post-*

Fig. 9.—Compound chart, illustrating the temperature in Cases I, II, III, and IV of cerebral contusion. x indicates the time at which death occurred.

post-mortem examination made by Dr. Hadden, it was reported:—"The middle meningeal artery is ruptured, and outside the dura mater is a large blood-clot. The convolutions on the outer side of the right hemisphere are much flattened; there is no blood at the base of the brain; all the left temporo-sphenoidal lobe is much bruised superficially; it is soft and blood-stained. There are also a few small hæmorrhages scattered up and down, but none of any size. The puncta vasculosa are prominent, and there are a few hæmorrhages in the white matter. The blood vessels at the base of the brain are atheromatous, but not markedly so, not obstructed, not ruptured at any point.

CASE II.—A child aged $3\frac{1}{2}$ years was in St. Thomas's Hospital in 1886 for an injury to the head caused by the wheel of a cab, and died two days after the injury. Temperature at 4 A.M.

on the third day 105° . (See Fig. 9, No. 2.) At the *post-mortem* examination made by Dr. Hadden there was a very extensive fracture of the skull extending from the vault into the left anterior fossa, a second extending from the right middle to the right anterior fossa, and an isolated fracture in each middle fossa. No effusion on or injury to the convex surface of the brain. The under surfaces of the frontal lobes, chiefly the left, and the under surface and tip of the left temporo-sphenoidal lobe were soft and bruised; on section the white matter of the temporo-sphenoidal lobe was softened and bruised from an inch in depth—more bruised, indeed, than the cortex.

CASE III.—A woman aged 37 was in the hospital in 1881. She lived two days. The temperature was, on the third day at 3.30 P.M., when she died, 105.2° in the rectum, gradually falling after death until 5.40, when it was 104° . (See Fig. 9, No. 3.) At the *post-mortem* examination, Dr. Sharkey found a considerable quantity of blood between the dura mater and the surface of the brain on the left side only, and contused brain substance oozed through the membranes over the left frontal lobe. The extremity of both frontal lobes was contused, on the right side only the tip, but on the left the injury extended back as far as the anterior ascending convolutions. The red pulpy contused substance was quite superficial, and all the deeper parts were healthy and uninjured. A fracture extended from the left frontal bone across the base of the skull on the same side into the foramen magnum.

CASE IV.—A man aged 29 was under the care of Mr. Croft in 1889. On the fourth day the breathing became stertorous and he died in profound coma. The temperature at 8 A.M. on the 26th, the morning after admission, was 102.6° ; at 12, 105° . (See Fig. 9, No. 4.) At the *post-mortem* examination made by Dr. Sharkey there was no external mark of injury. On opening the dura mater it was seen to be distended with blood on the left side, and the brain showed a very thin covering of it on the right. The clot on the left was adherent to the dura mater in the temporal fossa and was so firmly attached that it was difficult to scrape it off. The brain was much bruised and broken up at the extremity of the frontal lobes, much more so on the right than on the left; the softened part was dotted with punctiform hæmorrhages. Extensive fracturing of the skull was found, two lines of the fracture, running backwards and downwards in the posterior fossa, on the right side of the groove for the lateral sinus, on the left forwards across the petrous bone into the anterior fossa.

CASE V.—A powerfully-built man aged 55, under the care of Mr. Pitts from August 5th to August 8th, 1885. The temperature rose from 98.2° at 2 A.M. on the 5th to 104.6° at 3 P.M. on the 8th. (See Fig. 10, No. 5.) The *post-mortem* examination made by Dr. Hadden showed the whole surface of the brain covered with hæmorrhages. The foreparts of the frontal lobes were much contused, and showed much hæmorrhage. The lobes of the cerebellum were greatly bruised posteriorly, the right much more so than the left. There were three separate and distinct fractures, one in the right side of the posterior fossa, one in the left middle fossa, another in the right anterior fossa.

Fig. 10.—Compound chart, illustrating the temperature in Cases V, VI, and VII of cerebral contusion.

CASE VI.—A boy, aged 16, was admitted under the care of Sir William Mac Cormac in 1882, after a fall from a scaffold, a supposed distance of twelve feet. At 9 P.M. of the following day I made a note that he was lying on his back with a livid and congested appearance of the face, a little froth at the corners of his mouth, beyond which could be seen a dry tongue. The respiration was 60, accompanied by stertor. The pulse was very rapid and irregular. The arms were rigidly flexed on the chest, and the legs moved up and down alternately with a certain degree of regularity, whilst an occasional spasm of the muscles of the back made his appearance that of a patient suffering from tetanus. The left pupil was larger than the right, both acting to light. He was too restless to permit of examination with the ophthalmoscope, and died at 2 A.M. on the third morning. The temperature on the first day (October 27th), at 8 P.M., was 98.8°; on the 29th, at 9 A.M., it was 105°. (See Fig. 10, No. 6.) At the *post-mortem* examination Dr. Hadden found a fracture extending from the zygoma into the middle fossa, and backwards nearly to the occipital protuberance. A good deal of blackish blood was found over all the convex surface of the brain. Most of this was readily washed off, but the right temporo-sphenoidal lobe was much softened throughout its whole extent; also superficial infiltration of blood, and some small hæmorrhages in the white matter immediately subjacent to the cortex. There was also a small superficial hæmorrhage over the front half of the right frontal lobe. A laceration in a large branch of the middle cerebral artery was also found.

CASE VII.—A cabman, aged 20, was admitted under the care of Sir William Mac Cormac, and survived the injury three days. He died at 2 A.M. on the fourth day. The temperature on the 10th at 2 P.M. was 109°. (See Fig. 10, No. 7.) An extravasation in the scalp an inch or so behind the right parietal eminence covered the commencement of a fracture which ran backwards and to the left across the occipital nearly to the left petrous bone. A large black blood-clot was also found by Dr. Hadden on the dura mater, corresponding to about the posterior third of the vertex of the left hemisphere. The extravasation was circular, about five inches in diameter, adherent to the dura mater, but not involving the brain subjacent, but the convolutions corresponding were much flattened. The under surface of the left frontal lobe, tip, and under surface of the left temporo-sphenoidal lobe were much bruised, and showed extensive extravasation of blood. The left olfactory bulb was much crushed.

CASE VIII.—A man, aged 36, was under the care of Mr. Mackellar from November 1st to the 2nd, 1889. He had been insensible since a fall down some area steps on October 25th. He was admitted insensible, with foetid breath. There were bruises behind the right ear, and in various parts of the body. He had epileptiform seizures and died. The temperature on November 1st at 8 P.M. was 99.2°; on the 2nd it rose to 102.6° at 8 P.M. It is probable that had the temperature been taken for a longer period in this case, it would have registered a higher rise. (See Fig. 11, No.

half to the right and one inch above the torcula Herophili ran downwards into the right sulcus lateralis. There was some bruising of the under surface of the left parietal lobe; the convex surface of the left hemisphere was concealed by a large recent hæmorrhage, which had caused marked flattening of the surface.

CASE IX.—A jobber, aged 48, was under the care of Mr. Mackellar on July 10th, 1886, only surviving the injuries received by a fall from a cart for two hours and three-quarters. He was admitted unconscious, and had convulsions and bleeding from the right ear. On admission the temperature was 98°, and at death 107.2°. (See Fig. 11, No. 9.) At the *post-mortem* examination Dr. Hadden found fractures in the posterior fossæ on both sides of the middle line. On removing the dura mater a quantity of recently effused blood, with much staining, was seen on the vertex, mainly in front. The tips and under surfaces of the frontal lobes, especially the right, were much bruised, and showed a good deal of blood extravasation. There was a little bruising also of the right temporo-sphenoidal lobe, not of the left.

CASE X.—A similar case, that of a bricklayer, aged 31, was under the care of Mr. Sydney Jones from August 7th to August 8th, 1888. The temperature at death was 104°, rising a few minutes afterwards to 107°. (See Fig. 11, No. 10.) At the *post-mortem* examination, which Mr. Hadden made, there was much blood effused into the scalp in the left occipital region, and a fracture extending downwards, with some comminution, into the foramen magnum. The dura mater was not lacerated, and the sinuses not torn. The tip and orbital surfaces of the right temporal lobe were much contused, the bruising not extending beyond the cortex. There was no injury to the cervical spine. A moderate amount of liquid blood was found over the convolutions on the convex surface.

CASE XI.—A corn merchant, aged 25, was under the care of Mr. Pitts from August 11th to August 14th, 1887. There was a compound linear fracture of the vault three inches behind the left ear. On August 13th he was still unconscious and very restless; the left arm was the weaker and less sensitive to pain. Restlessness increased; he had fits, but no stertor. The pulse increased in rate, and the temperature was rising. Mr. Pitts trephined over the fracture and examined the condition of the parts beneath the fracture. No clot was found. Death occurred six hours later. The temperature on August 14th, at 6.30 A.M., was 108.4°. (See Fig. 11, No. 11.) At the *post-mortem* examination Dr. Hadden found that the fracture extended downwards into the posterior fossa, slightly lacerating the lateral sinus. The convex surface of the brain was stained, injected, and in many parts exhibited recent hæmorrhages into the pia arachnoid. The under surfaces and tips of the temporo-sphenoidal and frontal lobes on the right side were much bruised, the white substance being stained yellow and injected for nearly an inch subjacent to the cortex.

CASE XII.—A carman, aged 45, was under the care of Mr. Croft from February 12th to 17th, 1883. The temperature on the 16th at midnight was 104.6°, rising to 104.8° on the 17th, an hour after death. (See Fig. 11, No. 12.) At the *post-mortem* examination, made by Dr. Percy Smith, a large clot was found covering the whole upper surface of the left hemisphere. A large lacerated cavity the size of a plum was found in the apex of the temporo-sphenoidal lobe, from which the hæmorrhage had taken place into the middle fossa of the skull. On the right temporo-sphenoidal lobe there was some bruising from *contrecoup*. A fracture with comminution was found in the middle fossa of the left side, extending by one branch through the internal auditory meatus, lacerating the seventh pair of nerves.

CASE XIII.—A man, aged 23, was found in a stable, having been kicked by a horse, and brought to St. Thomas's Hospital. He was admitted under the care of Mr. Mackellar on August 26th, 1881, and died on the 28th. There was a compound and comminuted fracture of the left parietal bone. Mr. Mackellar removed loose fragments the same evening. The patient answered questions on recovery from chloroform, and the pupils became equal. The temperature on the 27th at 6 A.M. was 105.8°. Venesection was performed, and at 7 A.M. there was a marked improvement; instead of tossing about he was fast asleep. At 10 A.M. he was again restless; temperature 105.2°; at 5 P.M. 106°, when there were profuse sweating and twitching of the limbs. At 10.15 the temperature was 106.2°, the patient being slightly convulsed; venesection to 7 ounces. On the 28th at 12 the temperature was 106°, and at 12.50 P.M., five minutes after death, 106.4° in the axilla and 108.8° in the rectum. (See Fig. 12.) The brain was found considerably lacerated at the point corresponding to the fracture.

Fig. 11.—Compound chart, illustrating the temperature in Cases VIII., IX., X., XI., XII., and XIV. of cerebral contusion.

8.) At the *post-mortem* examination, made by Dr. Hadden, there was no scalp wound. A linear fracture starting two inches and a

Fig. 12.—Chart of compound comminuted fracture of the skull, with cerebral contusion. (Case XIII.)

At the apex of each frontal lobe there was a slight amount of laceration and hæmorrhage, apparently from *contrecoup*. Beneath the dura mater at the point of fracture was a slight amount of clot (a thin layer). Brain substance generally congested. The fracture extended into the middle fossa on the left side.

CASE XIV.—A labourer, aged 40, under the care of Sir William Mac Cormac, on July 6th, 1885, after a fall, only survived his injuries (a fracture in the middle fossa on the right side and a fracture of the ribs) five hours and a quarter. He was unconscious, and had almost constant epileptiform seizures. At 4 p.m. the temperature was 104.8°, and after death it rose to 110°. There was no *post-mortem* examination. (See Fig. 11, No. 14.)

Here, then, are fourteen additional cases of fracture of the base in which there was a high temperature; in thirteen of them a *post-mortem* examination was made; in not one was there any meningitis or evident cause for the temperature, excepting the condition of the brain which had resulted from the injury. And this condition was essentially the same in all of them—that of a contusion with laceration of the brain substance at the base, varying but slightly in position and extent, and of the kind so commonly met with from *contrecoup*. Fig. 13 is from a specimen in the

Fig. 13.—The bruising of the under surfaces of the frontal and temporal sphenoidal lobes, from a case in which the posterior fossa of the skull was fractured. The specimen is in the Museum of St. Thomas's Hospital. The left side of the cerebellum was bruised and lacerated, and it will be noticed that the right frontal lobe is most severely injured. museum of St. Thomas's Hospital, which indicates the condition extremely well. It was removed by Dr. Gulliver from a man

aged 33, who had died under the care of Mr. Mackellar eleven days after a fall from a tram. This is an important preparation, indicating as it does severe contusion of the brain substance, as met with in *contrecoup*, and shows what an amount of damage to the frontal and temporo-sphenoidal lobes can be borne without producing death either from shock or hæmorrhage. Amongst the series of fatal cases which form part of the material on which these lectures are founded there are of course others which presented this condition of the brain when a *post-mortem* examination was made. I have notes of several such. If we consider those cases which presented a marked rise of temperature during life, we obtain the following result:—Of those living under twenty-four hours after the receipt of the injury, we find that in two of them no *post-mortem* examination was obtained; in one instance (Case XIV), the temperature might have been due to hæmorrhage into the sheath of the cord, as in a third where such a condition was found (see Fig. 14.) In two there was laceration,

Fig. 14.—The rise of temperature in a case of fracture of the base associated with hæmorrhage under the dura-matral sheath of the spinal cord.

of brain substance with hæmorrhage, one having a temperature of 103°. Of those who survived for a period longer than twenty-four hours, marked pyrexia was present in twenty-one, who showed no sign of inflammation at the *post-mortem* examination. I have already read notes of twelve which come into this group, and in all there was contusion or laceration of brain substance. Four others lived one day, and the temperature was rising at death; in one it was 104°, but no necropsy was held; in one it was 102.8°. One lived two days, and had convulsive seizures and a temperature of 101.4°, but there was no *post-mortem* examination. One lived four days, the temperature at death being 105.4°, and there was hæmorrhage from the middle meningeal as well as slight contusion of the brain. Two lived nine days; in one there was great bruising of and hæmorrhage into the anterior part of the brain, the extremities of both frontal lobes and both temporo-sphenoidal lobes being crushed, soft, and covered with hæmorrhages. The patient had symptoms of delirium tremens, and at death a temperature of 102.6°. The temperature record is lost in the second case. One lived ten days; at the *post-mortem* examination there was cerebral injury of the kind under discussion and a rupture of the kidney. One man lived eleven days, dying apparently from delirium tremens. He had fits and often irregular temperatures, as high as 103° on more than one occasion during the last two days of life; it was 105.8° at the last. In this case there was an extravasation of blood leading from the surface of the right præ-frontal lobe for about an inch and a quarter into the white matter. The medullary substance around was stained yellow. Cerebral contusion with hæmorrhage was proved to be present in ten cases living under the twenty-four hours, but in only two was there any unusual rise of temperature. Of those surviving for a longer period, a similar condition was attended with marked alteration of the temperature curve in every case. The conclusion to which we must come, then, is that this rise of temperature is dependent upon the injury to the brain and not to the bones, and whether it will be manifested or not depends upon the rapidity with which death follows. If the hæmorrhage resulting from the injury is quickly poured out, the patient will not usually manifest any marked disturbance of the heat-regulating centres, but die comatose within a few hours. This conclusion agrees with observations on the temperature in cases of cerebral hæmorrhage which is not dependent upon traumatism.

Is a rise of temperature of this character met with in hæmorrhage following rupture of the middle meningeal artery and the

formation of a clot within the cranial cavity yet outside the dura mater? For the purposes of this inquiry we may take two papers on the subject of middle meningeal hæmorrhage, the one by Mr. Jacobson² and the other by Dr. Weismann, of Zurich. In the series of seventy cases by the former, there is one (Case 54, Sir Joseph Fayrer's) in which the temperature was 102° the night before death. A second (Case 56, Mr. Le Gros Clark's), that of a man who survived twenty-six hours after a fall on the head from a height of thirty feet, in which the temperature was 101.8° two hours before death. A third (Case 63, Mr. Davies-Colley's) in which a temperature of 103° was noted before the operation. In all of these there were laceration and contusion of the brain at the base, probably as the result of *contrecoup*, in addition to the hæmorrhage between the bone and dura mater which was the direct cause of a fatal ending. There are two or three cases recorded by Mr. Jacobson in which the temperature ran up to a remarkable extent after operation and removal of the greater part of the clot. In Mr. Beck's case (No. 27) this was 106.4° twenty-four hours after the operation and half an hour before death, rising to 108.4° five minutes afterwards. There had been no apparent injury to the brain. The cause of the excessive temperature in these cases does not, however, come within the scope of our present inquiry, as it occurred after operation. Dr. Weismann,³ who collected a series of 273 cases of hæmorrhage following rupture of the middle meningeal artery, describes amongst them, besides the cases referred to above as included amongst those given by Mr. Jacobson, or as published by Mr. Hulke, twelve others; of these, in six one recovered, and there is no mention of the condition of the brain or no *post-mortem* examination was made in the other five. In six where the condition of the brain is given, it was contused in four. Of the other two, one had a temperature over 102° before operation and died from pneumonia, a second a temperature over 106° without apparent contusion of brain.

Of other instances of rupture of the middle meningeal artery under my observation, in which there was no fracture of the base there is the well-known case under the care of Mr. Croft,⁴ which recovered after operation, in that there was no rise of temperature. In another, where the late Mr. Francis Mason trephined on the third day, the temperature three hours and a half before operation was 102.4°, it then fell to 101.4°, and rose to 103° at death, ten hours after the trephining. In this case, a man aged 62, there was a compound fissured fracture of the parietal, and, in addition to the lacerated middle meningeal artery, there were contusion and laceration of the prefrontal and temporo-sphenoidal lobes from *contrecoup*. We cannot, then, say that there is no rise of temperature in all cases where unconsciousness is due to hæmorrhage after laceration of the middle meningeal artery dependent upon an injury to the head; but we may, I think, conclude that if there is an excessive rise of temperature in a patient the subject of intracranial hæmorrhage, there is a strong probability that the hæmorrhage is subdural, or if between the dura mater and the bone, that there is accompanying contusion and laceration of the brain substance—a circumstance which renders the prognosis much more serious.

I would submit to your judgment the following propositions, which express my ideas somewhat differently. If within three days after an injury to the head a patient passes from a condition of unconsciousness or semi-consciousness to one of increasing coma, or after a period of return of consciousness a similar condition of coma supervenes, and with the coma there be a rise of temperature of or above 103°, the condition is the result of cerebral contusion with some laceration, and this is most likely dependent on *contrecoup* and associated with hæmorrhage from the damaged brain. This injury has probably affected the frontal or temporo-sphenoidal lobes or both, and this is rendered all the more probable if the injury has been inflicted on the back part of the head; further, a similar condition supervening on injury to the side of the head, though in rare cases, caused by hæmorrhage from rupture of the middle meningeal artery, in the absence of local depression of bone is most likely the result of injury to the cerebral substance at the base, but it must be remembered that both conditions may be present in the same patient.

The fact that so many patients in whom cerebral injury has caused hæmorrhage die within 24 hours afterwards without any rise of temperature makes the temperature record of less value

as a means of diagnosis than it would otherwise be, but there remains a large number of cases in which the observation may be of assistance. Rarely do we find acute meningitis developing and running its course to a fatal termination within 24 hours, with coma and unequal pupils. I have notes of one such case, that of a girl 8 years of age, in whom such a condition supervened after fracture of the vault. There was, however, no rise of temperature, such as that which we have been considering.

THE DIAGNOSIS OF BASAL FRACTURES.

As a result of careful analysis of the cases contained in these tables I think we may say that in fractures involving the anterior fossa of the base of the skull the patient has usually received a blow in the frontal region, either from a weapon of some kind, or as the result of a fall. That the injury has produced bruising or wound of the part struck, and there is considerable epistaxis, and the appearance of ecchymosis under the conjunctiva, either immediately or at a later date. Sometimes the amount of blood effused into the orbit is sufficient to cause protrusion of the eye, and interference with the action of the muscles. Loss of vision may supervene in the eye of the injured side; loss of smell is rarely noticed. There may be paralysis of the third or sixth nerve. In fractures of the middle fossa the patient has usually fallen from a height, from a vehicle, or been knocked down in the street, and there is a wound or contusion over the parietal or fronto-parietal region. As a rule he bleeds profusely from the ear on the side injured; there may be, however, a free watery discharge from the first, or this may supervene on the cessation of the hæmorrhage. Facial paralysis, with or without deafness, is occasionally met with, and is an important sign of fracture; if it be present from the first, it will probably become permanent. The super-vention of suppuration in these cases, or the presence of middle ear disease at the time of the accident, is a most serious complication. Fractures of the base having their origin in the posterior part of the skull are most frequently met with in big, heavy people, and result most commonly from a fall backwards on hard pavement from a vehicle, from a height, or down steps. There may be a contusion or wound of the part struck. The latter is seldom extensive, rarely exposing the bone. The former is often very evident; it frequently overlies the commencement of the fracture. If the middle fossa be not involved, the only reliable sign of the fracture is the appearance of ecchymosis over the mastoid process; and, as this does not usually appear for some days, great care must be taken with patients who come under notice after injuries of the occipital region, as fractures in that part of the base are very fatal. The fractures are not uncommonly followed by double optic neuritis. Epileptiform convulsions are more common than after fractures in the other fossæ of the skull.

I recollect on one occasion, when going round the wards of a large London hospital, to have heard a surgeon tell the members of his class that fractures of the base were always accompanied by unconsciousness, that it was impossible to have an injury to the head sufficient to produce a fracture without it. This, if it were true, would be a most useful means of diagnosis, between slight and severe injuries of the cranium; but unfortunately it is not true in every case, and from time to time patients are sent away from hospitals and infirmaries who are afterwards proved to have suffered fracture. There were patients amongst them which I have observed who were not only not unconscious, but were able to walk into hospital with slight assistance; but the majority were suffering from shock, and it was evident that they had received a serious injury, and they were admitted without hesitation. There is a group of much importance in which slight injury to the head is followed by meningeal hæmorrhage and compression of the brain, but these are seldom met with, and there may be absolutely no signs to indicate the impending danger. The difficulty presented in the diagnosis of fractures of the posterior fossa of the base before the appearance of ecchymosis over the mastoid process has already been mentioned, and I think that these form the most important section of cases occasionally sent from our hospitals as drunk and not suitable for admission. They have not uncommonly been dosed with brandy or other stimulant, the usual immediate popular treatment in this country for all accidents, but the fall itself is often due to indulgence in alcohol to an excessive amount a short time before; hence the breath smells of alcohol. Again, such patients sometimes show a curious, half-silly expression, are mentally confused, drowsy, complain of headache, and sometimes vomit material smelling of

² *Guy's Hospital Reports*, vol. xliii.
³ *Zeitsch. für Chirurgie*, 1885, Bände xxi und xxii.
⁴ *Lancet*, vol. i, 1889.

the beer or spirit which they have taken. The injury to the head is not found unless careful search be made, having been inflicted on a part thickly covered with hair, and the blood, if there be a wound, is rarely in large amount. The period of unconsciousness may be very slight or absent, and, as it is supposed by his friends that the man was "only stunned" it may be some hours, or even days, before there is an application made for medical aid. More than this, unless a house surgeon is on the look-out for mastoid ecchymosis, the case, if admitted to the wards, may be allowed to remain as one of concussion of unusual severity, until his attention is drawn to the discoloration of the skin over the mastoid process by a more careful observer. Before the appearance of this ecchymosis there are symptoms which make one suspect the nature of the injury. The patient when seen by the surgeon will usually be found lying in bed on his back with the sheet drawn up to the forehead, so as to cover the eyes; drowsy, but easily roused to answer questions; complaining of severe headache in the frontal region, and possibly over the occiput; manifesting a desire to escape from the light. If the occipital region is carefully examined, especially when the head has been shaved, there will probably be found a contused area, easily denting on pressure, or a small scalp wound with contused edges, out of proportion to the apparent effect of the injury to the brain. The headache is severe, and if the patient live beyond the fourth day the examination of the eyes is not unlikely to reveal the presence of optic neuritis. These symptoms can hardly be mistaken for those of cerebral irritation, as described by Mr. Erichsen.⁵ Only one or two patients were in that condition after fracture of the posterior fossa, and the state is fully described in the notes which were made at the time, but as the patients recovered it is not possible to give the pathological condition on which the symptoms depended. This cerebral irritation may be met with after blows producing concussion of the brain, in whatever region of the skull they have been inflicted. In the large number of cases of concussion of the brain observed during the years over which these observations were spread, it was met with much more frequently than the condition which I have attempted to describe, and which was probably due to accompanying contusion of the base of the brain, whilst after fracture of the base cerebral irritation was rare. I would not have it understood that the condition to which I have directed attention is only found associated with fracture in the posterior fossa, for I have seen it after blows in the occipital region where no fracture was present, judging by the absence of further proof.

Want of space prevents my giving the cases which bear out these remarks, but the following account illustrates many points which several of those in the fatal and non-fatal groups corroborate:—

A stout woman, aged 55, was admitted to the Royal Free Hospital on December 24th, 1888. She was said to have been knocked down in the street by a passing cab. Was not insensible, but appeared silly and partly conscious, answering when spoken to loudly. There was some vomiting, which ceased after admission, and the vomited matter emitted an odour of alcohol. Her appearance was said to have been that of a drunken woman, "stupidly drunk." She lay in this condition until the evening of the 26th, when she seemed a little better. On the 28th, when I first saw her, the following note was made: "Patient lies in an apathetic half-conscious state, with her eyes closed; when spoken to she answers slowly and rationally, and then either rambles on or keeps quiet until another question is asked. Sometimes she suddenly makes some statement. She complains of headache on the right side of the forehead, but will not admit that she has had an accident." She was lying on her back with the sheet pulled over her face, and soon replaced it if it was moved. There was slight swelling and grazing of the skin over the bridge of the nose, and ecchymosis at the inner angles of the orbits. No subconjunctival hæmorrhage. Ecchymosis was noticed for the first time over the left mastoid process, there was also a swelling with a depressed centre about the posterior superior angle of the left parietal bone. No effusion at the back of the neck, and no other evidence of injury excepting a bruised thigh. Mr. Mackinlay kindly examined the eyes on more than one occasion. On the 31st he reported: "In the right eye I find no optic neuritis, the veins of the retina are rather too full and tortuous. Cataract extraction has been done in this eye, and there is some thin capsule in the coloboma. In the left eye the lens is cataractous, and no examination of the

fundus can be made." On January 7th the disc was rather hyperæmic and the margin blurred. On the 19th undoubted optic neuritis was reported, and on the 28th the margin of the disc was much clearer. During her residence until January 26th she complained occasionally of headache, was most frequently drowsy and very talkative during the day and very anxious to get up. She remembered what occurred before the accident, but nothing since. Recognised her friends, but soon forgot the visit which they paid her. There was now no discoloration over the mastoid, but there was some oedema over the process and also over the site of the bruise, where it was more evident. On the 29th she was talking much more frequently both day and night and invented stories. No pain anywhere. After this she continued in much the same condition mentally until discharged on February 10th, 1889, her condition being that of a very weak-minded person, garrulous to a degree, and her memory very bad. Beyond a rise to 99.8° on the morning of December 30th, the temperature was always below 99°, and during the second and third weeks it was subnormal.

Some patients were sent away from hospital in the first instance and afterwards readmitted; occasionally their injuries proved fatal. In the following case the result was unfortunate, as the patient died at home after having been sent away, and the hospital authorities were censured.

On February 3rd of this year a patient, aged 42, who applied at one of the large London hospitals, having been taken there by the police, was refused admission by the dresser on duty because he thought she was drunk. At the inquest which was held subsequently he said she was suffering from a wound at the back of the head, as well as from symptoms of intoxication. She was proved by others to have been sober before the accident, but to have had a little gin. In the police station to which she was taken she was "obstinate, and acted just like a drunken woman." She became unconscious during the night, and I am indebted to Dr. H. E. Richardson, who attended her later, for notes of the case. He saw her at 8 A.M. on February 4th; she was in a state of coma with stertor, dilated pupils, and a dark-coloured serous discharge from the mouth. There was a lacerated and contused wound one inch and a half long, just above the occipital protuberance, completely dividing the scalp. The periosteum was not separated, so that no fracture could be detected. She remained comatose until her death next day. At the *post-mortem* examination a fracture was found running vertically (as shown in Fig 15, which is as

Fig. 15.—Fracture in the posterior fossa of the skull. (After a sketch by Dr. Richardson of the bones in his case.)

marked by Dr. Richardson) from about an inch above the wound and across it; here it was a mere fissure, which could only be seen by separating the periosteum. As it extended to the base of the skull it separated to about one-eighth of an inch, and, dividing, passed on either side of the foramen magnum. There was a clot at the lower part of the fracture about the size of a walnut. The whole of the surface of the brain was intensely congested. The frontal lobes were severely bruised.

If we search for confirmatory evidence, we find other cases of a similar kind.⁶ A curious phenomenon, and one to which I should hardly direct your attention were it not very marked in the case in which it was observed, is the coughing up of a very large amount of frothy mucus, which the patient has much difficulty in getting rid of, the mouth becomes clogged and the respiration embarrassed. The first case in which it excited my attention was in 1886; it then occurred on the second day after the injury, in another case it occurred on the twelfth day, in another on the third day. Two similar ones are recorded in the *Lancet* of 1847 and 1868. In none

⁵ Dr. Hunter (Littleport): *The Lancet*, vol. ii, 1881, p. 788. Mr. Spanton: *Ibid.*, vol. ii, 1877, p. 313. Mr. Hunt: *Ibid.*, vol. i, 1869, p. 671. Dr. Heuston: *Ibid.*, vol. ii, 1887, p. 119. Dr. Basham: *Ibid.*, vol. ii, 1842-43, p. 945.

⁶ *Science and Art of Surgery*, vol. i., p. 752.

was there any evidence of bronchitis. Four were fatal, and in these there was a fracture of the posterior fossa in each instance, but no mention is made of any injury to the eighth nerve.

§ *Cause of Death.*—I have had a table constructed [not here reproduced] showing the cause of death in fifty-four cases of fracture of the base. The shock of the injury proved fatal in four; that the shock of the injury, combined with that resulting from other injuries, such as fractured ribs, was fatal in six. One patient died in convulsions within the hour after admission; four with arachnoid hæmorrhage at varying periods; thirty-two from cerebral contusion, with laceration and hæmorrhage; three from meningitis at the end of the second week; one, aged 4, from uncontrollable vomiting; whilst the impaction of partly digested food in the pharynx produced asphyxia in another; delirium tremens proved fatal in one case; and only one, a patient with compound comminuted fracture of the skull, died from septic disease. Thirty of the cases died within a day after admission to the hospital. The most striking fact shown by this table is the large proportion of cases dying as a result of injury to the brain, more than half of the total number; and it is of interest to observe that of the eleven cases in which the fracture of the base was strictly limited to the posterior fossa (if we include one accidentally omitted from the table), all presented a similar condition of contused brain, with hæmorrhage as the cause of death. And I would ask you to give your attention to another fact, and that is the extreme fatality of these fractures in the posterior fossa, exactly one half of the series of twenty-two proved fatal, a proportion far beyond that met with in other fractures of the base, which, as shown by these tables, is 25 per cent. for the anterior, and about the same for the middle, fossa. In this series of cases, both fatal and non-fatal, the proportion of fractures in the posterior fossa, with regard to fractures in the other fossæ of the base, is larger than that usually observed.

Justice could not be done to the question of treatment in the short time at my disposal, and I would merely impress on some of my auditors the importance of keeping patients at perfect rest after these injuries to the head, and of employing the routine treatment by purgative, etc., and remind them that the administration of purgatives is not enough; they must see that the bowels act, and act well, for the wellbeing of the patient depends largely on this fact.

With regard to venesection, this plan of treatment has gone out of use very largely during the last forty years; but, in the earlier part of the century, it was employed in cases of fracture of the base to an extent which to us appears startling. Thus, in 1823, we find a surgeon severely criticised for not having bled a patient on the second day instead of on the third; the man had received a large scalp wound and fracture of the vault extending into the base. In 1827, we read that a man under the care of Abernethy was bled to the extent of 120 ounces in the twenty-four hours, and recovered, and that surgeon speaks highly of venesection and the administration of calomel. It was a common custom to bleed the patient to a considerable extent daily, and one is not surprised to find that the recorded cases of fracture of the base of the skull were usually fatal ones. But we are now, I think, too much inclined to neglect what in suitable cases appears a most valuable remedy, especially when the patient is a big, strong robust man and is suffering from great restlessness. Under such circumstances the abstraction of ten or twelve ounces of blood from the arm may effect a marked improvement in the condition of a patient from tossing about and kept in bed with difficulty to a state of quietude and repose; and although this improvement was not usually continued for many hours in cases in which it was employed, it was a great contrast to the previous state. The application of leeches behind the ears or to the temples, or the local abstraction of blood in some other way in certain of the cases where severe headache was complained of during the first few days after the injury, often gave great relief to the pain. In the more chronic forms of headache the use of a seton in the nape of the neck appeared to effect marked improvement in the course of a few days.

When we regard the large number of patients who die from cerebral injury with hæmorrhage from the part of the brain lacerated, the question presents itself most strongly for answer as to the advisability of using the trephine more often in an attempt to relieve them. The improved methods of operating, the slight increase of risk that is caused by the operation itself, and our enlarged knowledge as to the local condition in such cases urge the performance of the operation, and at an early date. True, there

are many factors against success, both in the condition of the brain and the general condition of the patient; but I would suggest that the cause of death is usually the presence of the blood-clot, and not the contusion of the brain. We are hardly in a position to state what extent of contusion and laceration of the frontal and temporo-sphenoidal lobes is incompatible with life. The operator must be guided by his knowledge of the effect of these injuries on the brain substance, and recollect that the fatal hæmorrhage will usually be over that part of the brain directly opposite to the part struck, and not immediately underneath it.

And now, in concluding this my last lecture, I thank you for the kind attention you have given to what I have had to say, and would remind you that if there is anything in the lectures that you have heard of more than fleeting interest, and I think there is, your thanks are due not to me, who am merely the mouthpiece, but to those gentlemen who kindly gave me permission to use the cases that have formed the foundation of the lectures, without which it would not have been in my power to bring before you for consideration these points relating to injuries to the head.

CASES OF NEPHROLITHOTOMY, AND A CASE OF REMOVAL BY LUMBAR INCISION OF THE LOOSE AND CRUSHED-OFF LOWER EXTREMITY OF THE LEFT KIDNEY AFTER A WAGGON ACCIDENT.

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CASE I.—SUPPURATING KIDNEY; LUMBAR INCISION AND DRAINAGE; REMOVAL OF CALCULI BY SECONDARY OPERATION; ULTIMATE RECOVERY AFTER RATHER PROLONGED CONVALESCENCE.

(House-Surgeon, Mr. BONTOR.)

G. D., aged 12. Admitted into Hull Ward, West London Hospital, May 2nd, 1888.

Family History.—She had lost her father (of phthisis?). Mother had had eight children and three miscarriages. Three of the children died, two of whooping-cough, one "in childbed."

Patient's History and Present State.—Scarlatina eighteen months ago; has not been strong since; is losing flesh rapidly. Has had pain in left side and loins off and on for six months; pus in urine; tumour in left loin.

May 5th. Temperature 102° last night and this morning; rose at 3 P.M. to 103.5° and at 6 P.M. to 104.6°. Her bowels not having been opened since admission, an enema of castor oil now acted freely. Much pain in tumour and all over left half of abdomen and lumbar region. Pulse 140, full and firm. Ice-bag to head; 5 grains of quinine. In the evening Mr. Keetley came and opened the kidney through a lumbar incision anterior to the edge of the erector spinæ. The tissues divided chiefly consisted of a dense white fibrous substance. The puncture into the abscess cavity was dilated with forceps, and ultimately an examination made with the finger. The pus (about 3 or 4 ounces) was thick greenish white, with white curdy flakes, and horribly offensive. The cavity was freely syringed with warm boracic lotion. The interior of the kidney felt loculated, and as if traversed with soft trabeculae. Care was taken not to break these down lest hæmorrhage should occur, as it was not desirable to have to pack this cavity in its putrid state; a thorough search of the kidney was therefore deferred, nor were the three silver sutures tightened, but merely left ready to close the wound when it sweetened. Two drainage-tubes, only one into kidney.

May 6th. Fairly comfortable. Only 4 ounces of urine (thick, with urates and some pus) passed. Highest temperature, 99.6°.

May 7th. Urine 8 ounces this morning. Wound dressed. Much foetid pus clogging tubes. Several times in the course of the next fortnight the temperature rose to 101°. Urine about 18 ounces a day, and getting clear.

May 24th (20th day). A small phosphatic concretion $\frac{1}{2}$ inch $\times$ $\frac{1}{4}$ inch, quite black externally and white internally, found in the mouth of the wound to-day. During the next week the patient was taken out of doors daily. Temperature still frequently rose to 101°.

June 2nd. Temperature up to 103.2°. Restless and in pain in