

son's cases. If the main trunk be injured, or one of its larger branches, and the blood poured out rapidly, this interval will be very brief, and coma and death will quickly supervene. It may even be absent, the secondary coma setting in before the primary unconsciousness has disappeared. But not uncommonly it will last for



FIG. 1031.—Clot in Hemorrhage from the Middle Meningeal Artery. (Jacobson.)

some hours, or occasionally even for days. But even if brief, its possible existence should always be inquired into, and if present the other signs of intracranial hemorrhage should be looked for with care. Secondly, there is hemiplegia on the side opposite to the hemorrhage. This may be progressive, the hemiplegia extending from one portion of the body to another, as the extending clot presses upon one cortical centre after another; as, for example, if the clot be effused over the face centre, the face muscles will be paralyzed first, and as the blood clot extends upward over the arm centre, paralysis of the arm will follow. Such extension is extremely significant. The paralysis, however, may exist on the same side as the injury, if the artery has been ruptured on the side opposite to the injury, as has not infrequently happened. Clark, in just such a case, trephined on the same side as the injury and the paralysis, and lost his patient, who had a clot in the side opposite to that of the injury. Sometimes, though rarely, both arteries may be ruptured, as in the remarkable cases of Hill (Cases 18 and 19, Jacobson's paper). If there be no paralysis, the dilated and immobile pupil on the side of the clot may assist the diagnosis. This was the only diagnostic sign in one of my cases. Thirdly, the pulse becomes frequent. Fourthly, the respiration becomes slow and stertorous. Fifthly, if the clot extends toward the base, the pupil on the side of the clot will be dilated and immobile, and if the clot be on the left side, aphasia also will take place. Sixthly, the temperature will probably rise, it may be quite rapidly, and up to 101°-103°, or even 104° F., especially on the side opposite to that of the clot, according to Horsley.

The importance of operative treatment is best shown by Wiesmann. Of 147 cases treated expectantly, 131 died (89.1 per cent.); of 110 cases treated actively, only 36 died (32.7 per cent.)! Besides this, in the majority of these cases ending fatally after operation, the extravasation was not reached, and the clot therefore was not removed. When, therefore, any of the above symptoms are present in a case showing a reasonable ground for believing that the middle meningeal or its branches have been ruptured, even though some doubt exist, the skull should be trephined.

As to which side of the skull should be operated upon, we should be guided by the localizing symptoms rather than by the site of the injury. Krönlein (Fig. 1032) trephined four cases of rupture of the middle meningeal, and in two of them removed the clot, and the patients recovered. In the other two he failed to find it, and both patients died. He states that in by far the greatest number of cases the clot will be best reached by trephining

at a point one inch behind the external angular process of the frontal bone, at the level of the upper border of the orbit. Should this not reach the clot, he strongly urges that another trephine opening be made just below the parietal boss on the same level as the former. By not making this last opening he lost the two patients alluded to. By the anterior opening access is had to the main trunk and the anterior branch of the middle meningeal, and by the posterior to its posterior branch. As in not a few cases there will be doubt as to whether the rupture is in the anterior branch or trunk, or, on the other hand, in the posterior branch, the need for the second opening, in case the first does not disclose the clot, is apparent. Having made one or both of these openings, the clot should be removed, and either opening, if necessary, enlarged by the rongeur forceps in order to obtain access to it. If the pupil be widely dilated, showing that the clot has extended downward toward the base, the trephine should be applied about half an inch below the level of the upper border of the orbit, rather than at its level.

Should the middle cerebral artery be wounded, it must be secured by ligature. The differential diagnosis cannot be made at present between hemorrhage from the middle meningeal and that from the middle cerebral; hence the discovery that the middle cerebral is wounded would follow a trephining at the point already indicated for the meningeal—viz., an inch behind the external angular process. If the bleeding point on the middle cerebral be not accessible here, as the artery lies in the fissure of Sylvius, the trephine opening should be enlarged by the rongeur forceps, upward and backward, in the line of the fissure, i.e., in the direction of the parietal eminence.

The clot cavity should be washed out, after the hemorrhage has been controlled, by normal salt solution. Drainage should be carefully provided for, and the wound dressed in the usual way. Weir, in May, 1885, was the first, I believe, to propose that in case the first trephine opening would not answer well for drainage,

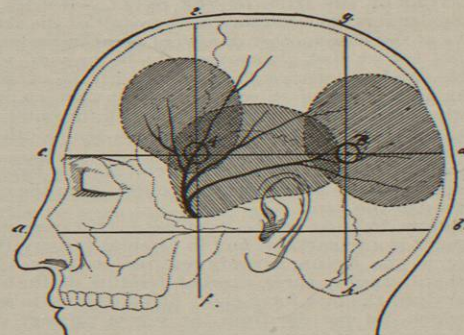


FIG. 1032.—Site of Trephine Opening to Reach Clot in Hemorrhage from Middle Meningeal Artery. (After Krönlein.) a, b, Horizontal line through the auditory meatus; c, d, line passing through the eyebrows; e, f, vertical line 3 or 4 cm. behind the external angular process; g, h, line passing through the posterior border of the mastoid process; A, the point where the anterior branch of the middle meningeal artery can be reached; and B, the point where the posterior branch of the same artery can be reached. (Esmarch and Kowalzig.)

a second one should immediately be made. In doing so, not only must the position of the clot be remembered, but the second trephine opening should be made also in such a position as to favor drainage in the recumbent posture. As a secondary measure, it was done by Noyes as early as 1882, and later by many others.

Under the head of hemorrhage should be mentioned, also, a remarkable and instructive case, reported by Dr. T. Grainger Stewart and Mr. Annandale, of traumatic pachymeningitis interna, accompanied by hemorrhage.

In consequence of a fall on the occiput, without visible lesion of the skull or scalp, in two months there were gradually developing vertigo and frontal pain, increasing optic neuritis, gradually developing stupor, right hemiplegia and aphasia, with subsequent normal temperature. Annandale trephined over Broca's convolution, and found under the dura a space extending three inches behind and two inches in front of the trephine opening, which was filled with brownish-red fluid. Temporary improvement occurred, but the patient died five days later. The autopsy showed inflammation of the cerebellum, diffused lepto- and pachymeningitis, with hemorrhage of the cerebellum on both sides and red softening on the left side. This was evidently of inflammatory origin, and it is not improbable that in such a case as this, and in those of serous apoplexy, very early trephining might result far differently.

Ceci (quoted by von Bergmann, *loc. cit.*, p. 112) also has reported a case of chronic hemorrhagic pachymeningitis, the result of a blow, in which palsy, incontinence, and coma were present. He trephined over two months after the accident, evacuated the blood, and his patient recovered and regained all the motor functions except those of the left hand (slight paresis).

In the *British Medical Journal*, March 2d, 1889, Spencer and Horsley report some remarkable experiments on the possibility of controlling hemorrhage from the middle cerebral artery and its branches by pressure on the carotid. The ingravescent form of apoplexy from such a rupture, impending apoplexy from intense cerebral congestion, and some of the severer congestive headaches may possibly prove capable of relief by this means. The reader must consult the original paper for the grounds upon which their conclusions are based. I have operated on two such cases and saved one.

INVETERATE HEADACHE.—Horsley (Case 7 of his table) and von Bergmann (*loc. cit.*, p. 113) have published two cases of relief of fixed and excessively severe localized headache by operative interference. In Horsley's case he trephined at the seat of pain and removed a piece of the parietal bone, the inner table of which had been perforated and was being eroded by a Pacchionian body. Relief from pain had continued for five months after the operation.

In von Bergmann's case, after all ordinary means had been exhausted, the bone was exposed. Its color was dark and purplish, as if extravasated blood were seen through it. It was greatly thinned, so that he was able to cut it with his scalpel. A quantity of tea-like dark blood escaped, and the pulsating dura was seen beneath. Six months before the operation a stone had struck the patient on the head, without, however, wounding the skin. This had been followed by considerable localized swelling, and the headaches began some weeks after the injury. As soon as he recovered from the effects of the anesthetic his headache was gone, and the relief had continued for certainly three years. I have operated on four such cases with resulting cure in three.

Such operations seem, therefore, to be entirely justifiable in view of the very small risk to life from trephining; provided, of course, that the headache be really so constant and severe as to justify a reasonable risk, and that all suitable medical means have been faithfully and ineffectually tried. Very probably simple trephining without opening the dura may be all that is necessary to effect the cure. In cases of suspected syphilis, the iodides should be pushed on the American plan, if necessary, up to half an ounce a day, before a decision in favor of operation can properly be made. Just such a persistent, severe headache (of syphilitic origin) has recently been under my care, and has in this way been cured, and an operation avoided; less than three drachms a day, it was found, did absolutely no good.

MENTAL DISTURBANCES.—Macewen has reported a remarkable case of this kind. The man had received an injury a year previously, and was suffering from melancholia, with homicidal tendencies. These were attended by paroxysms of pain, which were not well located.

There were no motor phenomena, but it was discovered that immediately after the accident, for two weeks, he had suffered from psychical blindness. He could see, but what he saw conveyed no impression to him. He recognized his New Testament by touching its smooth leather cover with the deep indented letters on the back, but on opening it the printed words were unknown symbols to him. At the operation the angular gyrus was exposed, and it was found that a portion of the inner table had been detached and had produced pressure on the posterior portion of the supramarginal convolution, while a corner of it lay embedded in the anterior portion of the angular gyrus. The bone was removed from the brain and replaced in its proper position. He was greatly relieved from his mental state, though still excitable. He was at work when the case was reported, and had made no further allusion to his homicidal tendencies. This localization of a single mental process is of great importance. The fact that Macewen was able, by a careful and shrewd examination, to elicit so important a localizing symptom from a case which was obscure both in its history and in its visible lesions, is a source of great encouragement.

Besides the case just alluded to, in which psychical symptoms led to the localization of the lesion, there are a number of cases on record in which insanity has followed injury and has been cured by operation involving the brain. One is reported by Hoffman: A man, fifty years of age, was made unconscious by a blow on the head, which, however, produced neither fracture, convulsion, nor paralysis, but was followed by pain in the head and aphasia, and a tender spot above and in front of the right ear. Insanity developed after healing. The cranium was opened by a chisel over the tender spot. The dura bulged but did not pulsate. An incision evacuated a half-ounce of cerebro-spinal fluid. The brain tissue had been lacerated by the blow. The patient recovered both from the operation and from his mental alienation.

McDonald reports a case of insanity following a pistol wound. The wound was three-eighths of an inch to the right of the middle line, and at the junction of the anterior and middle thirds of the first frontal convolution. The skull was opened eighteen months after the injury. There was no bone, but only fibrous tissue, at the point of injury. At the fourth puncture by a hypodermic needle, two drachms of serum were removed. On recovery from the anesthetic the patient had regained his sanity.

Bennett and Gould report the case of a man who received a severe blow two and three-fourths inches behind the meatus, and three and one-half inches to the right of the middle line. Six weeks afterward epilepsy developed, followed by mania, so that he was placed in an asylum. Trephining was done and the brain explored, in three or four different directions, to the depth of one inch, but nothing was found. The patient recovered both from his epilepsy and from his insanity.

Rannie reports the case of a woman who had tertiary syphilis. For eighteen months she had suffered with frontal and parietal pain on the right side, with tenderness of the scalp and discharge from the right ear, all of an intermittent character. There was no evidence of disease of the middle ear. She also suffered from visual hallucinations and melancholia. Her disease finally culminated in epilepsy affecting chiefly the left side, including the face. The attacks were followed by marked paresis on the left side. She was trephined over the right pre-Rolandic convolution. The skull and the dura were thickened. On opening the dura a small quantity of purulent fluid ran out which was found to come from a small degenerating gumma in the dura. Very slight opacity of the membranes existed. Three weeks later she was walking without any droop, and the motor power of the left arm was steadily improving. The headache and tenderness of the scalp had disappeared, and her mental condition was very much improved.

A large number of similar instances have been since

reported. While there have been many failures, the successes have been considerable, quite enough to warrant surgical interference in suitable cases.

**TREPHINING FOR ARRESTED DEVELOPMENT.**—As a rule it is better to leave these cases alone. Extravagant claims and promises have been made by some surgeons, but they have not been realized in practice.

**TAPPING OF THE LATERAL VENTRICLES AS A DEFINITE SURGICAL PROCEDURE.**—In November, 1888-89, I first

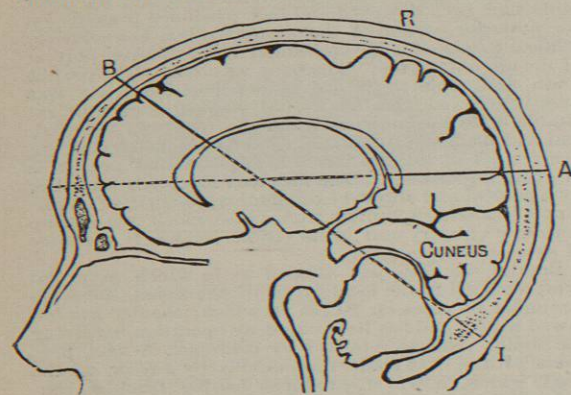


FIG. 1033.—(Drawn by Dr. John M. Taylor.) Antero-Posterior Section of the Head One-Half Inch from the Middle Line. B, Fissure of Rolando; I, inion; A and B (solid), the lines of puncture, the dotted lines showing their imaginary continuation to the opposite fixed points.

proposed the tapping of the lateral ventricles as a definite surgical procedure. Since then it has been done scores of times and as a rule with benefit. I had hoped that it would serve the same purpose as coeliotomy for tuberculous peritonitis. The few cases in which this fatal disease has been thus treated have proved that it is of little use. But it has been of great use as a palliative measure for the relief of the intense headache accompanying especially tumors pressing on the veins of Galen and the straight sinus. Moreover, the operation has dispelled the idea that opening the lateral ventricles is necessarily fatal. In a paper read at the International Medical Congress in Berlin in 1890 (*Lancet*, September 13th, 1890, New York *Medical Record*, September 20th, 1890), but unfortunately published only in abstract, as the original was lost by the secretary, I quoted many cases of such a lesion followed by recovery.

**Operative Technique.**—In doing the operation it is clear that we must avoid the motor zone, Broca's centre for speech, and any other well-defined centres for the special senses, and also the regions of the large blood-vessels of the brain, the middle meningeal, and the middle cerebral arteries. A number of experiments on the cadaver led me to point out three practicable routes for the purpose. They are all, of course, only provisional, until experience shall show us a better one.

First, from a point from one-half to three-fourths of an inch on either side of the median line, and one-third of the distance from the glabella to the upper end of the Rolandic fissure. This is high enough to avoid the frontal sinuses, and is in advance of the motor area. A three-quarter-inch trephine opening having been made and the dura having been incised crucially, a grooved director should be thrust slowly into the brain tissue in the direction of the inion. The director will traverse the first frontal convolution. At a depth of two to two and one-fourth inches the normal ventricle will be reached. Should it be distended, it would be reached at a less depth.

Secondly, trephine, etc., as before, midway between the inion and the upper end of the Rolandic fissure, one-

half or three-fourths of an inch from the median line. This is high enough to avoid the cuneus, the wounding of which would produce hemianopsia. The director should now be slowly thrust into the brain toward the inner end of the supraorbital ridge on the same side. The director will traverse the precuneus, and the normal lateral ventricle will be reached at a depth of two and one-fourth to two and three-fourths inches from the scalp. A distended ventricle will, of course, be reached at a shorter distance.

Thirdly, trephine, etc., as before, at a point an inch and a quarter behind the external auditory meatus, and one inch and a quarter above Reid's "base line." This will expose the second temporal convolution. It is possible that this may be the site for hearing of the opposite ear, but it has been punctured in a number of cases of abscess in the temporo-sphenoidal lobe without apparent injury to hearing. The director should be carefully thrust into the brain in the direction of a point vertically over the opposite meatus, and two and one-half or three inches above it; when at a depth of two or two and one-fourth inches the normal lateral ventricle would be reached, either at the beginning or in the course of the descending cornu. I have advised the use of the director rather than the hypodermic needle, for the reasons already stated in the section on abscess of the brain. The fluid having been found, a bundle of horse hairs or a drainage tube should be inserted for a suitable length of time. In order to prevent possible loss of the drainage tube in the cranial cavity, it may be passed through a button-hole opening in the flap, and, if necessary, be secured to the flap by a stitch. To regulate the amount of drainage through the tube it may be closed by a disinfected wooden plug. In this a V-shaped slot may be cut, and the size of the slot will regulate the rapidity of the drainage. Whether the drainage shall be continued for more than twenty-four hours, a longer experience must decide.

Of the three proposed routes my preference is for the lateral opening. This route has a great advantage in that by it we can explore for abscess of the temporo-sphenoidal lobe, and also for effusion into the ventricles, by the same trephine opening. The drainage could be

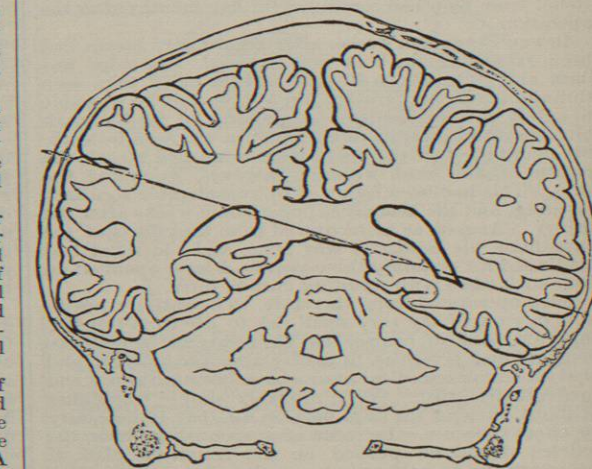


FIG. 1034.—(Drawn by Dr. John M. Taylor.) Transverse Section of the Head One Inch and a Quarter Behind the Meatus. The continuous line shows the line of puncture, the dotted line its imaginary continuation to the opposite side of the skull.

either favored or hindered by the patient lying with the operated side down or up. Should prolonged drainage prove to be wisest, the posterior route might be the best one. The anterior route would hinder drainage, and as an additional disadvantage there would be a

visible scar. As to a choice of which side it is best to operate on, we should select the side of the diseased ear, if there be such disease, or if not, then that side which is tender to either pressure or percussion, or both.

After the above was written my attention was called to the fact that Wernicke, so long ago as 1881, proposed to tap the ventricles, and that Zenger renewed the proposal. At the time of writing my paper I was wholly unaware of their propositions, and in referring to them I find that, while I must disclaim priority for the suggestion, I may claim that I have established exact rules for the operation and described its precise technique.

January 11th, 1889, in my clinic at the Woman's Hospital, I first performed the operation. I found it easy, and the rules I laid down proved to be correct. The patient was a fat and hearty boy, of four, suffering, it was thought probable, either from tumor or chronic meningitis with effusion, most likely a tumor of the cerebellum pressing on the straight sinus or the veins of Galen. There were no symptoms by which it could be more accurately located. His head had begun to enlarge about the early part of December, 1888, and measured twenty-one and three-eighths inches in circumference (exactly the measurement of my own head), with a biparietal diameter of six and one-fourth inches. At Christmas he became blind. For this he was brought to Prof. George Strawbridge, to whose courtesy I owe the case. There was great choking of both discs and threatened blindness. The general health was good, and the temperature was normal. As the approaching blindness from the increased intracranial pressure was the immediate danger, I decided, with Dr. Strawbridge's assent, to tap the ventricles, and selected the lateral route. I removed a one-half inch button of bone, one inch and a quarter behind the left meatus and one inch and a quarter above Reid's base line. The dura pulsated and bulged. In the dura as in the skin, I made a small crucial incision. I then slowly introduced a hollow needle (of the size of No. 5 of the French catheter scale), into which I had already pushed three doubled horse hairs nearly to the end. I introduced it toward a point two and one-half inches above the right meatus. At a depth of an inch and three quarters from the dura I suddenly felt a marked diminution of the pressure, and said to the class that I believed I had entered the ventricle, and in a moment the fluid began to escape. This fluid was found to contain sugar and albumin. It was slightly turbid, with small flakes in it.

The horse hairs were now pushed in as the tube was pulled out. About three ounces of fluid escaped during the operation. An ample sublimate dressing was applied. During the first week from two to four ounces escaped daily, and the choking of the discs diminished from 2.30 to 1.09 mm. in each eye, the decrease being measurable from day to day. At the end of the first week I explored for a possible tumor by thrusting a probe in two directions into the left occipital lobe to the depth of three and a half inches. Finding no tumor I made a small opening, by a simple gouge, in the occipital bone, below and to the left of the inion. Through this I probed the left lobe of the cerebellum to a depth of two inches, and then obliquely across into the right lobe two and a half inches, but found no tumor. There was no reaction from these procedures, and the wound healed promptly. At the end of the second week the choking was reduced to 0.96 mm. As in spite of the drainage the swelling was subsiding very slowly, and Dr. Amy S. Barton, who kindly examined the eyes for me, reported that there was beginning atrophy of the nerves. I removed the horse hairs and introduced a small rubber tube into the ventricles. For a week this gave vent to from four to eight ounces of fluid daily. Except a temporary rise of temperature, no reaction followed. At the end of four weeks, as the boy's general condition had deteriorated, especially when from choking of the tube the drainage was poor, I removed another similar half-inch button at a corresponding point above and behind the right ear. I then explored the right occipital lobe as far as to the

tentorium and falx, but found no tumor. I therefore tapped the ventricles from the right side by a drainage tube. Following this, there was a brief but sharp rise of temperature to 104° F., which, however, quickly subsided. Four days later I washed out the ventricles from side to side by eight ounces of a warm boric acid solution (gr. iv. to  $\frac{3}{4}$  i.), evidently to the boy's comfort, and with no results of a deleterious character. The boy died fifty-two days after the first operation. The autopsy showed that at the site of the drainage tubes, even after so long a time, there was not the slightest trace of inflammation either on the cortex or in the ventricular cavities, and the cerebro-spinal fluid evacuated at the autopsy was less turbid than that evacuated at the operation. There was not any perceptible trace of the various punctures. The cause of death was a tumor of the cerebellum. The probe had penetrated it, but as its density was about the same as that of the brain, its presence could not be appreciated.

The case showed clearly that the rules which I formulated for the operation are exact; that the procedure is easy and safe; and that the ventricles may not only be drained, but even irrigated, without causing any deleterious results. (For bibliography see Note at end of volume.)

**W. W. Keen.**

**BRAIN: SYPHILIS.**—Syphilis of the brain may develop as the result of inherited syphilis, or during the secondary or tertiary stage of the acquired disease.

In hereditary syphilis the evidences of an affection of the brain are manifested, as a rule, during childhood. According to Fournier the disease begins generally between the ages of three and eighteen years. In rare cases, however, it is observed in early childhood. Foreexample, marked arterial changes were presented by a girl of fifteen months suffering from hereditary syphilis. In this case the dura mater was smooth and pale, the pia mater presented numerous circumscribed patches of thickening over the cerebral lobes. There was slight thickening around the large arteries at the base of the brain, and most of these vessels were thickened and hard. The basilar artery was completely plugged, and the upper part of the vertebral arteries contained tolerably soft thrombi.

On the other hand Ljunggren reports a case, beginning at the age of thirty-three years, which he attributed to hereditary syphilis.

In any event, however, hereditary syphilis is a comparatively rare source of cerebral disease. It was formerly held that, in acquired syphilis, nervous manifestations were observed almost exclusively among the very late symptoms. Many neurologists now hold the very opposite opinion, and this view is also gaining ground among syphilidologists. So far as our knowledge goes, the earliest development of cerebral symptoms was observed by Brasch, who reported the following case: The patient, aged forty-three years, was infected with syphilis in the early part of August, 1893. In the middle of September, 1893, he had an attack of right facial paralysis and headache. In the beginning of November, 1893, he suffered from dizziness and headache and the paralysis was unchanged. In the beginning of December there was difficulty of hearing on both sides, and examination showed that this was probably due to labyrinthine disease. On February 19th, 1894, he was discharged, free from symptoms. In March, 1894, there was a return of the headache, vertigo, and difficulty of hearing. May 30th, left hemiplegia developed, but improved under antisyphilitic treatment. Then the condition grew worse, bulbar symptoms set in and the patient died on October 30th, 1894.

The autopsy showed purely vascular disease most marked at the base, but also present in other vessels. The hemiplegia was due to softening in the anterior part of the right half of the pons. The microscope showed advanced endarteritis syphilitica; secondary degeneration of the right pyramid from the pons lesion down to the cord; degeneration of both acoustic nerves in their extracerebral course, and disease of both ventral nuclei; both