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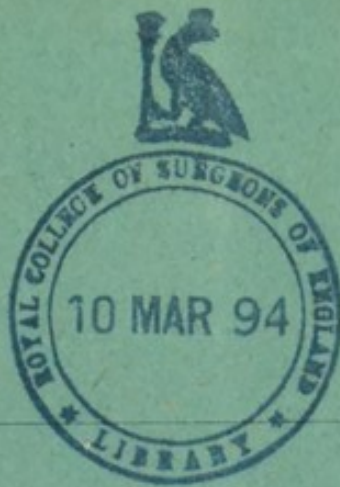


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Four Cases of Brain Tumor,

*In Three of which Operation was Done—Two Operative
Recoveries—Ultimate Death in All.*

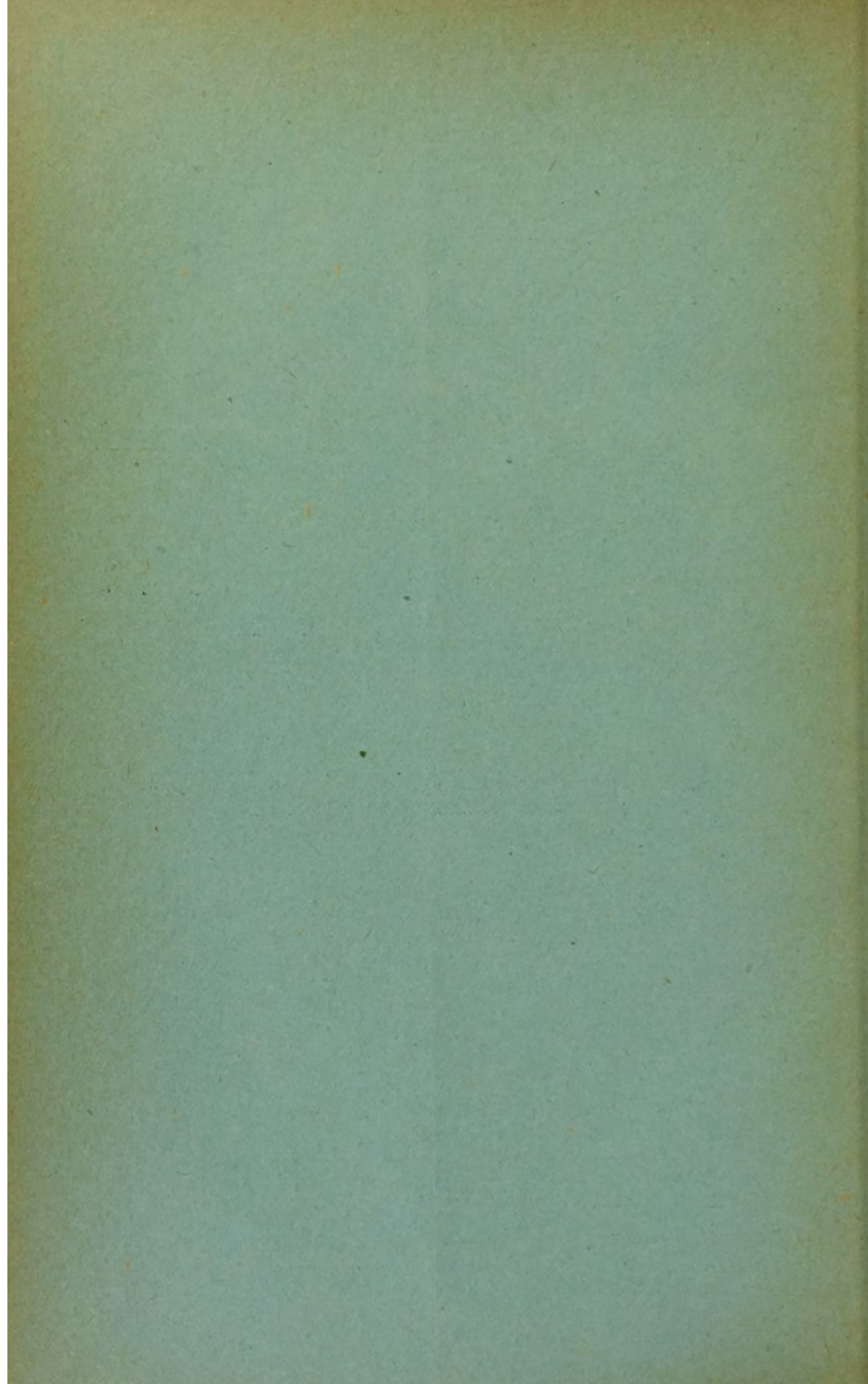
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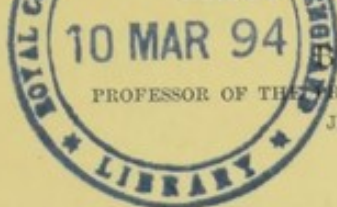
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FOUR CASES OF BRAIN TUMOR, IN THREE OF WHICH
OPERATION WAS DONE—TWO OPERATIVE RECOV-
ERIES—ULTIMATE DEATH IN ALL.



BY W. W. KEEN, M.D.,

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FROM the diagnostic point of view the present great need is the means of determining the presence and the exact location of an intra-cranial tumor; from the operative point of view, when a tumor has been found, the means of knowing when to proceed to its removal and when not to attempt it, or, if it has not been located or not found, whether a palliative exploratory operation is wise.

The following cases are put upon record with a view of adding to our means of deciding these points. In the first case, the situation of the tumor was probably located correctly and trephining afforded a very great relief to most distressing symptoms. In the second, the tumor was almost exactly located, but, from the probable size and position of the tumor, and the condition of the patient, it was decided not to operate—a conclusion justified by the post-mortem. In the third, the position of the tumor was erroneously diagnosticated, and an unwise operation was followed by death. In the fourth, the tumor was not recognized at the operation but was found at the suspected site at the post-mortem; the operation, while it could not afford relief, did no harm.

CASE I. *Intra-cranial tumor, probably of the occipital lobe; trephining followed by operative recovery, with relief of headache and mental hallucinations; death.*—R. M. B., aged thirty-one years, Abingdon, Washington Co., Va. First seen by me with Dr. George E. Wiley, March 26, 1892, at the Orthopædic Hospital and Infirmary for Nervous Diseases. Family history good; syphilis denied. Up to August, 1890, his health was good; but at that time he walked for some distance exposed to the sun on a very warm day, carrying one of his children. For several days after this he was drowsy and stupid and slept a great deal, and later complained of severe headache and pain in his head. There was no nausea, vomiting, or vertigo. About ten days later he had a convulsion, and three days after this a second attack. The attacks were not followed by paralysis or stupor. He rallied and got up again, but ever since has suffered from constant and severe headache and occasional convulsions, the headache being generally much severer before an attack.

His sight, hearing, memory, and ability to express his thoughts are much impaired, noticeably so since last autumn. His hearing was not good, however, before the convulsions. His eyesight varies, and at

times he seems to see fairly well, while at others he is apparently almost blind. He has also lost the power of writing, the loss being mental and not muscular. He walks moderately well, though occasionally both knees "give way." He sometimes has lucid intervals, and talks quite rationally. Lately there has been considerable vomiting, but his physician thinks this may be due to the medicines he has been taking. His attacks have occurred at the following times: two in August, 1890; one January 22, one April 5, one June 4, one in July, 1891; one January 20, 1892; two in succession March 6, and the last one March 24, two days ago. There has been no paralysis after any of the attacks.

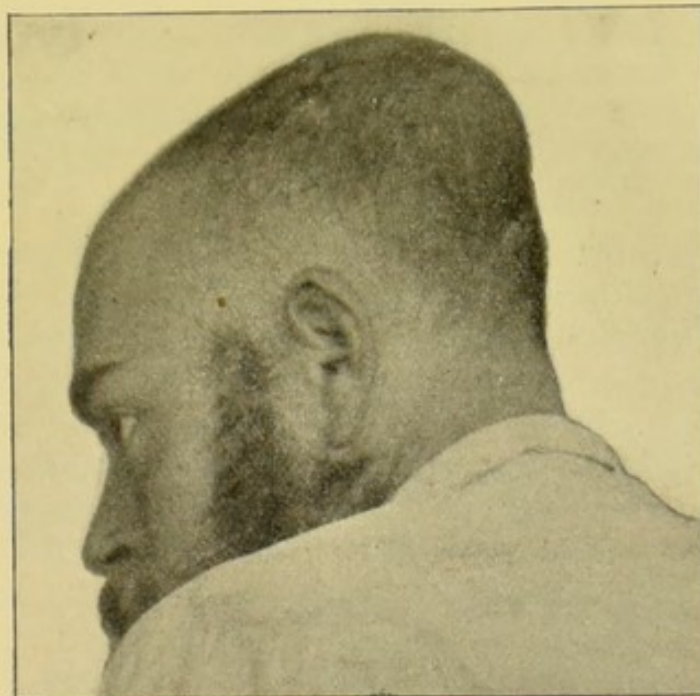
Status præsens, March 26th. A fairly well nourished man, who practically complained of but two things, blindness and intense headache. His pupils were very widely dilated, but he was only able to observe a slight difference between total darkness and three bright gas-lights directly in front of him. The headache he located just above the line of the lateral sinus and a little to the left of the middle line. Percussion and pressure at this point, as at other points on the skull, were not painful. He was able to walk when guided, though he did not seem to walk firmly. This, however, may have been due to his mental uncertainty resulting from his blindness. Absolutely no localizing symptom was present. A careful examination of the eyes showed marked double optic neuritis with other details, but unfortunately the notes, which should have been entered in the hospital case-book, have unaccountably been lost.

Diagnosis: An intra-cranial tumor, which cannot be located. Treatment: Trephining was recommended, with a view to relieving his intense headache. It was determined, after consultation with Dr. S. Weir Mitchell, to do this at the point of localized headache. If the tumor be found, such surgical measures as seem proper will be followed. If no tumor be found, or if when found it should be inoperable, the dura will be closed and the bone will not be replaced.

Operation, March 31, 1892. An inch-and-a-half button of bone was removed over the left occipital lobe, and the bone gnawed away until the opening measured 2.5 by 1.5 inches. The dura was divided semi-circularly, and the moment this was done the brain bulged very markedly. Pulsation was not very visible, but was perceptible by touch. The cortex appeared to be normal. I passed my little finger between the brain and the dura all around the opening for an inch, and believed that I felt more resistance down toward the tentorium than elsewhere. Accordingly, to search for the probable tumor, I made a small incision with a knife through the cortex and passed my little finger gently into the brain for a depth of one inch. I was still convinced that there was great resistance toward the tentorium, but no distinct tumor was perceptible to the touch. Gently withdrawing the finger, I now cautiously inserted a grooved director in the direction of the cerebellum. At a depth of an inch and a half I met with quite noticeable resistance, which was overcome with slightly greater pressure. The pressure seemed to diminish again at a depth of 2.5 inches from the surface. I believed, therefore, that I probably had to deal with a tumor lying an inch and a half below the cortex, and although I could not define its size, the amount of bulging was so great and increased so much that I came to the conclusion that the tumor was a large and, therefore, irremovable one.

Accordingly, I now endeavored to close the dura. This I found a task of great difficulty. I had fortunately provided myself with a teaspoon and a tablespoon, both sterilized by boiling. I inserted the handles of these under the dura, and gradually, by means of them and my fingers, was able to press back the cerebrum to a certain extent, so that I could approximate the edges of the dura, although I could not bring them into contact. In doing this about a tablespoonful of the brain tissue was necessarily lacerated and removed. During the entire operation the bulging increased continually, until when I decided to close the dura at least as much brain as would correspond in size to an English walnut was protruding. The greatest gentleness was used throughout, but in spite of this considerable laceration occurred, especially in the attempt to reduce it. The bone was not replaced. The flap was sutured in position without drainage.

FIG. 1.



Shows the peculiar shape of the head from bulging of the scalp at the site of the trephining from a subcutaneous fungus cerebri and accumulated cerebro-spinal fluid. The ends of the incision also are shown. (Photographed by Dr. Wm. J. Taylor.)

His further history was very interesting. At first there was considerable pain in the right arm, which became oedematous and congested for several days, and also in the right leg. The dynamometer showed a difference of muscular power, varying in the right hand from 40 to 60 and in the left from 80 to 90 degrees. Sensation and motion in the right arm and leg were moderately diminished, especially on the inner side of the right forearm, and were entirely absent on the extensor surface. Gradually, however, this disappeared to a large extent. His highest temperature after the operation was 99.6° . The wound itself healed by first intention throughout.

The changes at the site of operation and in his mental condition were most important and interesting. From the moment of the operation his headache entirely disappeared, and had no other improvement taken

place, this alone would have justified and have repaid him for the operation, with its attendant risks. Moreover, all his hallucinations disappeared, and he became a quiet and tractable patient. Within a few days after the operation marked bulging took place where the bone had been removed. This was presumably due to a large extent to cerebro-spinal fluid, but probably also partly to a subcutaneous fungus cerebri. The annexed photograph (Fig. 1) shows well the curious shape of his head as a result of this bulging. The bulging was so great that I feared at first the cicatrix would give way and we should have an open fungus cerebri, but fortunately the union was sufficiently firm to resist the pressure, and although about six weeks after the operation, on several occasions, a pin-point rupture occurred in the line of the cicatrix, this gave no further trouble than the discharge of two or three ounces of cerebro-spinal fluid.

The patient was discharged from the hospital seven weeks after the operation. By a letter from Dr. Gammon, his physician in Virginia, I learned that he died on August 9, 1892, four and a half months after the operation, having been relieved of his distress by it, but without the possibility of saving his life. Dr. Gammon was kind enough to send me his brain, but unfortunately by the time it reached me, the weather being excessively hot, it was in such a state of decomposition that no examination of it was possible.

There would seem in this case to be no doubt as to the diagnosis of cerebral tumor, although unfortunately the decomposed condition of the brain makes a positive assertion on that point impossible. The case is noteworthy, as, although not curative, it was exceedingly successful in palliation. The relief to the headache alone was to the patient a boon worth any risk, and when to this is added the entire disappearance of his delusional insanity, the operation becomes still more commendable. When he first entered the hospital it was necessary to keep a special nurse constantly at his bedside, lest harm might result from his delusions. After the operation he was treated as any other patient, and required only the ordinary nursing of an operative case.

The shape of his head, as a result of the operation, is very peculiar. It is due, I believe, partly to cerebro-spinal fluid, but largely to a fungus cerebri existing under the scalp. Since his case I have had another of compound fracture, with a large loss of bony tissue, in which precisely the same deformity in the shape of the head has followed, and which has thrown light on the deformity. In this latter case, some months after the injury, I was obliged to remove a large piece of necrosed bone, and in doing so was able to investigate the contents of the tumor, and found it partly liquid and partly made of the fungus cerebri itself.

Two remarks from an operative point of view seem also to be demanded: First, that tumors which are inoperable should be meddled with as little as possible. Warned by past experience, especially by one case in which death followed a too extensive interference upon my part, I made up my mind that in such a tumor as this, large and deep,

I would not attempt to do too much. The wisdom of the slight interference which I practised is, I am sure, emphasized by the result.

Secondly, I would call especial attention to the value of the amount of bulging of brain as an indication of the size of the tumor. Of course, the bulging is really only the measure of the increased intra-cranial pressure due to tumor, accumulation of fluid in the ventricles, etc., but in cases of tumor the amount of bulging will be chiefly due to the tumor itself, unless it has produced an acute internal hydrocephalus. The amount of bulging, therefore, will enable us to some extent to decide on the wisdom of greater or less interference in such cases. In another case (not yet published because not yet terminated) somewhat similar to the present one, where it was certain that there was great increase in the intra-cranial pressure, I made an initial incision into the dura only one inch in length, which I intended to enlarge if examination of the brain itself showed it to be wise to do so. Through this I explored for the supposed tumor, and failing to find it, but discovering greatly increased pressure and marked tendency to escape of the brain tissue even through this small opening, I closed the dura without any laceration of the brain tissue other than that produced by the punctures. The patient made a rapid and steady recovery, and has been free from headache and other tumor symptoms since. Had I opened the dura freely in this last case I am sure that I would have had the greatest difficulty in replacing the brain tissue within the dura, and very likely it would have been even impossible to do so. Not only one but, it desirable, two or more small openings could be made to search for such a growth. Very possibly death might have resulted had I not been so cautious.

CASE II. *Glio-sarcoma of upper motor area; no operation; death.*—N. F., aged seventeen years, was first seen in consultation with Dr. R. M. Girvin on October 1, 1889. On October 3d Dr. Morris J. Lewis saw him at our request, and was kind enough to write out the following history as obtained at our various visits: "In November, 1886, the patient fell from the roof of a stable, a distance of about twenty feet. The fall broke his right thigh and left forearm. He also struck his chin, cutting it severely, and knocked out one of his front teeth. He was not known positively to have struck his head, although he was rendered unconscious by the fall, and remained so for some time. The next day all symptoms of concussion had passed away. He was treated in the University Hospital, and made a good recovery. After this accident he became a very wild boy. Several attempts were made to find a suitable school for him, and finally he was sent to a military academy.

"His family history is as follows: Paternal grandmother died of consumption, maternal grandmother has diabetes, a maternal uncle who during the war was twice wounded in the head, involving the brain, committed suicide; his father is frequently troubled with attacks of asthma; one of his sisters has hay fever, and the patient has had several attacks of asthma and bronchitis and chronic nasal catarrh. Nothing else

worthy of note occurred in the patient's history until the above accident. He never remembered being struck on his head. Two years ago he had an abscess in his left ear; this, however, only discharged for a few days, and gave him no further trouble.

"In April, 1889, nearly two years and a half after his fall, his right leg began to feel weak, the knee at times giving way under him. This condition was not constant, but would come and go, lasting but a few moments at a time. About the same time, but certainly after the leg, the arm became affected in a similar manner the weakness being always most marked in the leg. These attacks did not occur simultaneously in both limbs, but alternated with one another. His right eye at this time was congested, and hurt him to use it, so that he read with this eye covered. Headache was also present, and was so severe that he had to apply ice-bags to his head in order to be able to study. He also had several hysterical attacks at this time. He was now seen by a well-known surgeon, who prescribed a brace for his knee. He came home in June, having completed his examinations, complaining of weakness in the leg, and dragging it slightly when he walked; his arm was also giving him occasionally more inconvenience. At one meal, perhaps, he would be unable to use a knife or fork, while at the next he would have no difficulty. After this he began to have numbness around his mouth on both sides, particularly at the corners, and occasional numbness in his leg. About the latter part of June his headache, which had been more or less constant, began to be more severe; he would awaken between 2 and 5 A.M. with intense pain in the frontal region. This would generally pass off in a few hours, and eating always relieved it. Nausea and vomiting were also distressing symptoms at this time, occurring two or three times a day. With these attacks his face would become very much flushed, and the veins would stand out prominently. Pressure seemed to give relief. About this time he had a long siege with the dentist, and seemed much exhausted by it.

"In the middle of July, 1889, he was noticed to be constantly covering one or the other eye with his hand, as if to obtain a single vision, and soon afterward awoke with marked internal strabismus of the left eye. This lasted for three or four weeks, and left suddenly. On one or two occasions in July he had transient attacks of paresis of right face, arm and leg, and had some trouble in remembering words. Hallucinations were occasionally present. By the latter part of August he had become very weak, had constant nausea, and was very constipated, once going fourteen days without a passage.

"On September 8th, after marked flushings of face and headache, he had an attack as follows: He rolled over on his right side, drew back his head and became unconscious for a moment or so; he uttered no cry, did not bite his tongue, and no convulsive twitchings were seen, neither did any part, except his neck, become rigid. He was not stupid after the attack; he could talk well, and no change in the paretic side was noticed. After this he was very weak and had extreme nausea.

"On September 17th he had a second attack; there was no warning except an increase of headache, he rolled over on the right side, uttered no cry, threw back his head, turned the face to the left, and thrust out his tongue, to which side is not known. There was also marked opisthotonos; no movements occurred in the paretic limbs, but he moved the left arm back and forth, and drew up his left leg. His face was

purple and his breathing stertorous. Heavy sleep followed this attack, and he was stupid for a week or more. During this time he took no notice, did not speak, and had incontinence of urine; there was also great trouble in deglutition. He then began to recover; his nausea stopped, and he began to talk of food. There was no aphasia.

"Since July, the time of the appearance of the squint, he has not seen well, but not much attention was paid to this symptom until September 28th, when for two days he said he could not see. It is reported that during the summer his pupils responded well to light, although they were quite large—as, in fact, they have always been. On the 27th of September Dr. Girvin found that the pupils responded slowly to light, but that two days later he could obtain no response. During the summer Dr. D. Hayes Agnew saw him and made a diagnosis of intracranial tumor, but deemed it inadvisable to operate.

"*Status præsens*, October, 1, 1889. He has just had an increase of the headache and has been vomiting freely; he is in consequence much weaker and more listless than common. His eyeballs are quite prominent and the pupils widely dilated, the left being slightly the larger. There is slight divergent strabismus of both eyes, the right eye being turned up more than the left. Slight ptosis of both lids exists, although he can move the lids with moderate freedom. When the examination began he was unable to move the eyeballs in any direction except upward, but before it was finished he could move the balls downward a little, and also outward, the left eye moving outward better than the right. There was decided paresis of the lower portion of the right facial nerve; very slight of the upper portion. He is said to have always laughed on the right side of his mouth. The tongue is thrust out perfectly straight. The right side of the palate is paretic; there is decided rigidity of the neck, an attempt to flex the head on the chest lifting the shoulders and causing pain, rigidity of the muscles being equal on both sides; almost complete paralysis of the right shoulder muscles exists. He is able to move the forearm, wrist, and fingers feebly. Dynamometer: left, 27; right, 3. Right leg almost completely paralyzed; can only flex the thigh feebly on the abdomen, with the tendo Achillis contracted, the foot extended and the toes slightly extended. Sensation and localization are but little if at all impaired. The ankle-, knee-, and elbow-jerks are absent on both sides; the plantar reflex slight on both sides, on the right consisting of extension of the toes; the cremasteric, abdominal, and epigastric reflexes are all diminished on the right side, good on the left.

"Left calf measures $9\frac{1}{4}$ inches; right calf, $8\frac{3}{4}$ inches; left thigh measures $12\frac{1}{2}$ inches; right thigh, $11\frac{1}{2}$ inches. Lungs, normal; heart, accentuation of second sound at right cartilage, no murmur; action at times irregular, eighty beats to the minute. There is pain over the left brow, with occasional flashes of light. The veins over the forehead are prominent, particularly over the left temple. There is slight œdema of the scalp, equal on both sides. There is slight incontinence of urine, and marked constipation.

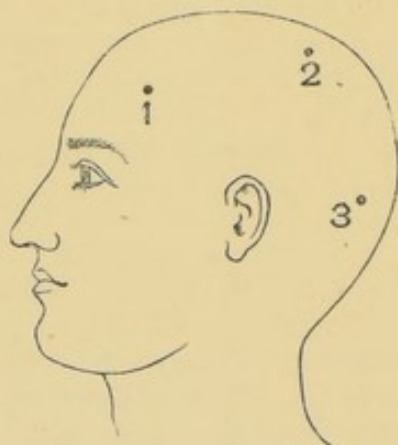
"The pulse is said to have varied from 45 per minute, to 120, the slow pulse occurring before, and the rapid after an attack. There is a tender spot on the scalp, which has only appeared during the last few days; it is situated one inch to the left of the longitudinal fissure, and about one inch behind the upper end of the fissure of Rolando. This is not the seat of spontaneous pain, but percussion causes decided inconvenience.

"October 3d, patient is decidedly brighter, talks fluently, and takes an interest in his surroundings. Attempts to flex the head still encounter resistance and cause decided pain at the ensiform cartilage. Temperature of right temple, 95° ; of left, 96° . That of the scalp cannot be determined, as the hair is long. This also interferes with the determination of the percussion note. He hears well on both sides. The sense of taste appears unimpaired. He cannot recognize the odor of vinegar, brandy, or paregoric, but notices, and after some hesitation recognizes ammonia. Mistakes alcohol for Florida water.

"He had a great deal of headache this afternoon, said to be caused by the barber shaving his head. He refused to allow anyone to talk in the room, and percussion of the skull was out of the question. No scars are visible. Just over the site of the posterior fontanelle there is a swelling the size of half a large grape, evidently a distended vein or veins, easily dispersed by pressure, but immediately returning. No signs of an opening in the skull and no tenderness at this spot.

"The surface temperature was carefully taken, the thermometer being held in position for eight to ten minutes each time; a second record was taken over the tender spot (marked 2 on diagram) for accuracy. With the exception of this spot the left side of the head is the warmer. (Fig. 2.)

FIG. 2.



Points at which the surface temperature was taken.

"Temperature, October 3, 1889: Left axilla, $98\frac{1}{2}^{\circ}$. 1. Left temple, $94\frac{3}{5}^{\circ}$ (October 2d, 96°); right temple, 94° (October 2d, 95°). 2. Tender spot near left parietal prominence, 96° ; analogous spot right side, $96\frac{1}{2}^{\circ}$. 3. Occiput, left side, 97° ; occiput, right side, $96\frac{1}{2}^{\circ}$."

Dr. Charles A. Oliver made the following report upon his eyes:

"The patient was first seen on September 30, 1889. His family gave the following ophthalmic history: On July 15, 1889, the left eye suddenly 'turned in,' and as quickly straightened three weeks ago. On September 27, Dr. R. M. Girvin examined the pupils and found that the irides responded to light-stimulus. On the following day the patient became suddenly 'blind.'

"Careful examination showed that the vision of the right eye, which was reduced to the faintest light-perception, was distinctly hemianopic in type; the blind half of the field being upon the right side. The field of

vision of the left eye, which was larger than that of the fellow eye, was also hemianopic in character; with a large double curved line separating the seen portion to the temporal side (fair light-perception) and the unseen portion to the nasal side. The pupils were evenly and fully dilated, and the irides were absolutely immobile to light-stimulus thrown from any point whatever, even from any portion of the remaining fields of vision. Although it was impossible to obtain any subjective study of the movements of the ciliary muscle, yet the catoptric test, carefully though, of course, roughly applied by the use of a moving candle-flame and a proper magnification of the reflexes, failed to show any movements or changes in sizes of the flame-images upon the anterior and the posterior poles of the lenses. The separated and the conjoined movements of the extra-ocular muscles showed that the superior recti performed the greatest excursions (about four millimetres each from a supposed primary position of the eyes); the inferior recti, about three millimetres each; associated movements of the two globes to the right, about one or two millimetres; associated movements of the two globes to the left, almost disappeared; and attempts at binocular convergence absolutely gone.

"The ophthalmoscope revealed a marked choking of the optic disks (to about 4. D.) the summit of the swollen nerve-head tissue being to the nasal edges of the disk. The swellings, which appeared soft and œdematous and extended two disk-diameters' distance into the circumjacent retinal areas, were rendered quite red by numerous vascular enlargements. They were equal in degree and density. The retinal veins were tortuous, and the corresponding arteries were narrowed and reduced in size.

"The findings may be summarized as follows:

"1. Right homonymous hemianopsia, the greater loss of vision and the lesser area of remaining field being upon the right side.

"2. Binocular total irido-cycloplegia.

"3. Binocular partial external ophthalmoplegia more marked on the left side, and more pronounced with the third and the sixth nerve groupings.

"4. Double optic neuritis (soft and œdematous in character and very vascular in type), equal in apparent degree and density on the two sides.

"The subsequent changes are as follows: On the following day he was seen by Dr. Lewis, who, in addition to the general findings, noticed that the pupil of the left eye was the larger, and that although the inferior recti could perform better excursions than upon the day before, there was a marked double divergent squint.

"Two days later paresis of both levator palpebræ muscles appeared, causing marked ptosis; the upper lids being elevated by the compensatory action of the fronto-occipitalis muscle. The action of the compensating muscle, which was more pronounced on the left side, allowed the left lid to be elevated four millimetres, whilst the right lid rose but one millimetre. The right eye was now blind, and the left eye retained a small excentric field for strong light-stimulus to the outer side. The right eye was directed not only inward, but upward. The same eye, curious to say, presented the broader rim of iris.

"These facts suggested the following probable diagnosis:

"Pressure on both optic tracts, which is more pronounced on the left side with an upward pressure on the floor of the fourth ventricle, that is

more marked on the left side, and extravasation of cerebro-spinal lymph into the intra-vaginal spaces of both optic nerves—significant of a tumor mass—occupying the lower portion of the left mid-brain.”

October 7th. The following changes were noticed in his condition: His stomach is very much improved, and he had eaten a hearty dinner; he is hungry most of the time; ordered simple but nourishing diet every two or three hours. He can move both eyeballs in every direction, but not to the full extent. His ptosis is less marked. At present his vision is unchanged. His right arm he is able to move with considerable freedom in all its segments; his right leg he drew up quite well and almost completely; he could not flex the ankle; movements of the toes existed, but seemed not to be voluntary. The habitual position of the foot was in exaggerated extension of the ankle and the toes. The ankle could be flexed passively, the contracture of the calf muscles having apparently disappeared.

The tender spot on his head was located farther front than before, over the upper portion of the left Rolandic line. It was ill-limited, but distinctly tender on pressure. Sometimes a second attempt at pressure, after an interval occupied with other examinations, would not elicit tenderness. Some tenderness existed at nearly the corresponding area on the right side. Direct percussion of the skull by the finger-tip elicited no special area of tenderness; neither mediate percussion on my own finger, nor direct percussion by the finger-tip, elicited any difference in the percussion note. Lifting him up with the hand under the occiput, the neck was found to be somewhat stiff, but the head could be flexed to a moderate extent without producing any pain at the ensiform cartilage, and only moderate pain in the neck.

I examined very carefully into the question of possible syphilis. His family and himself both denied it, he himself with a frankness which seemed to carry evidence of truth. The physical examination showed the genitals well developed, but no more so than was proper at his age. There was absolutely no scar on the penis, none in the groin, no enlarged glands at any point; nor could I find any other evidence of syphilitic infection.

14th. Up to the 12th inst. he had been steadily gaining. He was able to turn over in bed promptly and with ease, the turning to the left being not so easy as that to the right, on account of the weakness of the right leg; freedom of the movements of the arm had increased. His appetite has been almost voracious. On the 12th, possibly due to the indiscretion in diet, he vomited all day, and both yesterday and to-day he has been more or less listless and miserable; his pulse, however, has not gone above 72; his tongue is coated; bowels constipated. On lifting his head by the hand under the occiput, the post-cervical muscles are very tense, and he still complains of pain, but locates it at the midsternum and not at the ensiform cartilage; this pain does not appear when he attempts to flex his head voluntarily. There is moderate ptosis, but he can lift the upper lid voluntarily without elevation of the eyebrows. The pupils are both slightly smaller than before, especially the right one, and both respond feebly to light; the eyeballs can be freely moved in all directions.

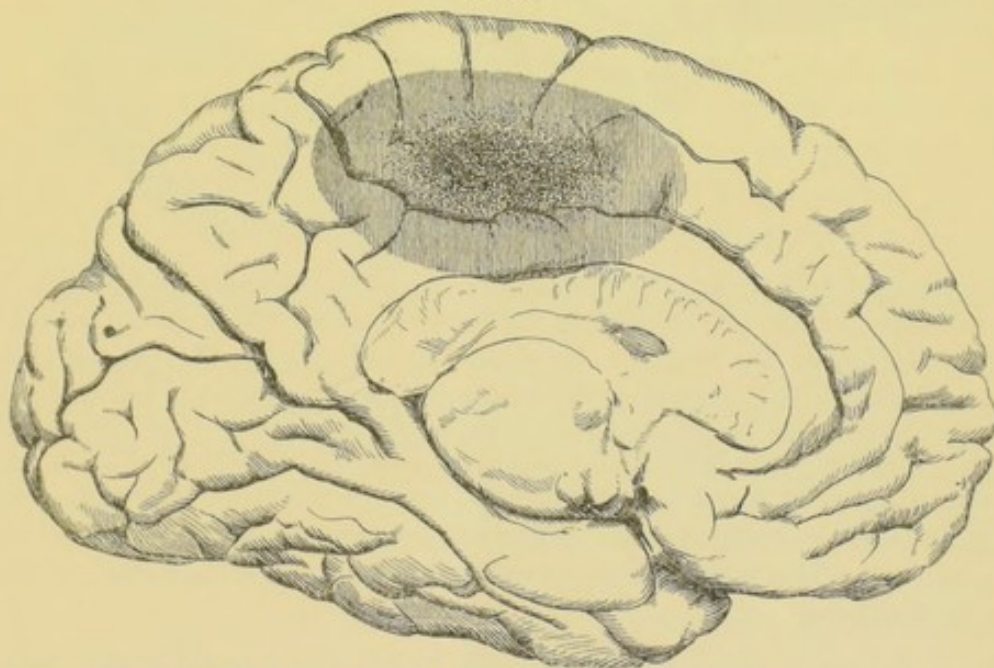
November 18th. His pulse of late has been but forty or fifty to the minute; he became more stupid, and died this morning at four o'clock.

Post-mortem, November 19th, 12 M., thirty-two hours after death.

Nothing abnormal was observed about the scalp or on the exterior of the skull. When removed, the skull-cap was extremely thin; it was transparent in a great many places, and over the longitudinal sinus posteriorly was almost perforated by a Pacchionian body. There was no meningitis; the veins were moderately full. The brain substance in the motor area looked entirely normal, but it was evidently soft and flabby over a large area.

Dr. W. J. Taylor, who made the post-mortem, passed his finger into the median fissure, without observing anything abnormal; but when the two hemispheres were separated in the left there was a mass, blackish in color, occupying the space midway between the corpus callosum and the upper surface of the brain, in a position corresponding to the paracentral lobule, and pushing downward the calloso-marginal fissure. It measured one and three-quarter inches antero-posteriorly, and one inch vertically. By the time the brain was removed from the head and placed in a basin, a tumor, of which this mass was the edge, had been spontaneously and almost entirely enucleated from the left hemisphere by the disturbance caused by the manipulations. When removed, it measured three and three-quarter inches by two and three-quarter inches, the long axis being transverse. (Figs. 3 and 4.) It occupied a position directly

FIG. 3.

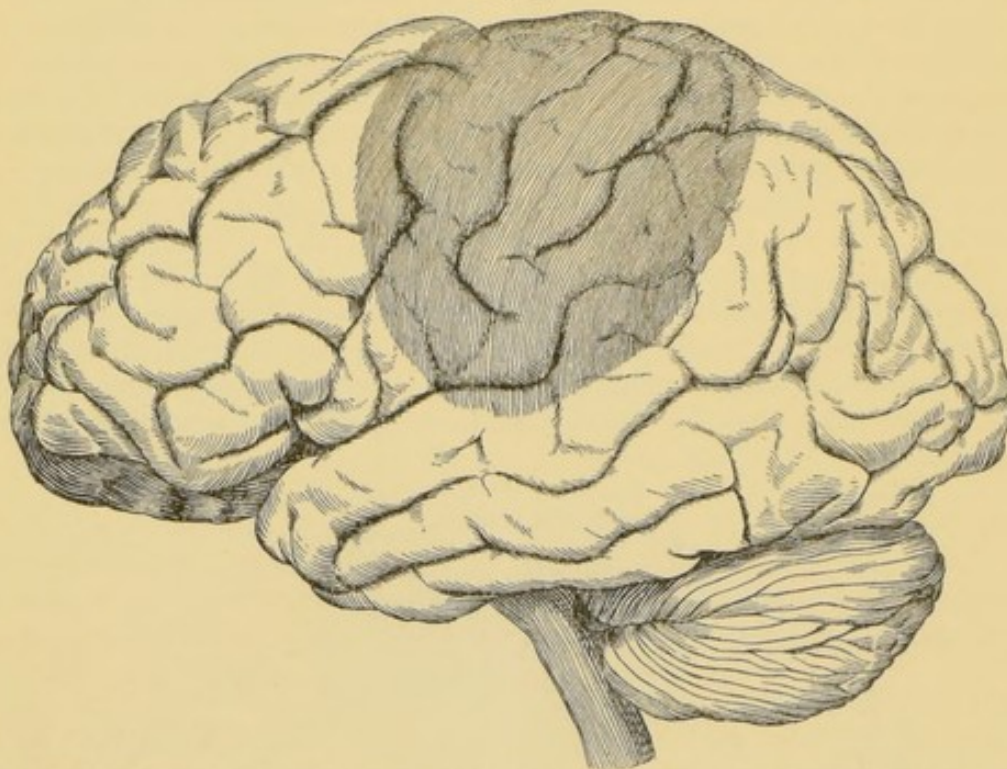


Inner surface of brain, showing site of tumor, its centre being softened and blackish in the darker area.

under the motor area; the cortex of the motor area, which lay over it, was one-third of an inch in thickness, and to the eye entirely normal. The walls of the cavity in which the tumor lay were lined with a thin layer of brownish, semi-fluid substance. No large vessels penetrated it excepting at the protruding mass next the falx, where two very large veins lay on its surface. Whether the tumor had protruded into the lateral ventricle during life, it is difficult to say. When the tumor had escaped from its cavity, this latter was seen to communicate with the lateral ventricle; but this might readily have been from a tear in handling the brain, as it was very soft in all the region bordering on the tumor

for an inch or more. Both ventricles were moderately dilated and filled with the cerebro-spinal fluid, which had in it few, if any, flakes or other evidences of disease. In the spinal canal, while removing the brain, about an ounce of fluid appeared to be present; the cord appeared to be normal. On turning the brain upside down, the floor of the third ventricle was extremely thin, and the corpora quadrigemina tore apart with great ease.

FIG. 4.



External surface of the brain, showing the site of the tumor, which lay under the cortex.

Description of the tumor. Its size is stated above. It consisted of a mass of about the consistence of normal brain tissue. Its upper extremity, where it protruded through the hemisphere on its median aspect, was of a blackish color—as also was one other spot as large as a cherry—this color being due to hemorrhages which had taken place in the interior of the tumor. The opposite extremity of it was quite cedematous. The whole tumor was nodulated. Its weight was four and one-half ounces.

Prof. W. M. L. Coplin examined the tumor microscopically, and reported as follows:

“The tumor itself is made up of sarcomatous elements differing but slightly from what is recognized as glioma. The condition of the brain substance is very interesting. The perivascular lymph channels are more or less occluded, and the nutrient vessels no longer patulous, but surrounded by areas undergoing degenerative processes. There was no infiltration of the walls of the cavity in which the tumor lay.”

REMARKS BY DR. LEWIS.

The tumor, as found at the autopsy, did not occupy exactly the position where it was thought probably to be situated. The pressure on

the optic tract and other signs of interference at the base of the brain led to the belief that the growth was situated deep in the left mid-brain, and in consequence of this belief it was advised that no operation be performed. Had the patient been operated on and the trephine placed over the motor area upon the left side it is doubtful in my mind whether the tumor would have been recognized, and even if an incision had revealed its presence it is difficult to see how a mass measuring two and three-quarter by three and three-quarter inches, situated one-third of an inch beneath the cortex, could have been removed without destroying all, or most, of the overlying motor cortex. It is also difficult to suppose that the mass could have been removed by way of the longitudinal fissure at the point where it approached most closely to the median line of the left hemisphere.

REMARKS BY DR. KEEN.

A number of points in connection with this case are instructive. The cause of the tumor was very probably the fall of twenty feet. It is almost certain from the marked unconsciousness following the accident that he struck his head, and as the post-mortem showed that his skull was very thin it is possible that this traumatism may have been more serious than to a person with a skull of usual thickness. On the other hand, it is equally possible that the thinning of the skull may have been produced later by the tumor. However this is, the lesson to be learned from the case is not to forget that such trauma may be followed by a tumor such as a fibroma, as in a case which I reported some years since (*AMERICAN JOURNAL OF THE MEDICAL SCIENCES*, September, 1888),¹ or sarcoma, as in this case.

The long time which elapsed after the fall before the brain trouble began is also a caution to us not to forget the remoter effects of such injuries. Even much longer periods than this have elapsed in cases of abscess, and the present case shows that we ought to remember such possibilities in all instances of traumatism. Moreover, had this been borne in mind the error of diagnosis as to the beginning trouble with his leg, for which a brace was ordered, would have been avoided.

We debated very seriously the question as to whether the tumor was a sarcoma arising from the traumatism, or a tubercular tumor or tumors, or possibly a syphilitic gumma. The latter, both from the history and therapeutic tests, was rejected, and the question lay between tubercle and sarcoma. The early involvement of all the various centres on one side, such as leg, arm, and face, convinced us that the tumor was either multiple or else was very extensive, and this, as well as the supposed position of the tumor, deterred us from any operative procedure,

¹ This patient is still alive, with somewhat better sight and very infrequent epileptic attacks. He has gone as long as a year without any.

especially as his condition, when I first saw him, was such that we judged his life would not be long, and the effect in case of operation was not hopeful. Had we trephined we should have come down upon normal brain tissue. The tumor lay one-third of an inch below the cortex, was nearly of the consistence of the cortex, and would scarcely have been discovered by puncture. Reflecting upon this and some other similar cases, I have thought that we might sometimes use to advantage in the brain the procedure we constantly employ elsewhere, viz.: Make an incision, one to two inches long, and, say an inch deep, and draw asunder the edges of the opening in order to see whether there is anything abnormal beneath the cortex. I have never yet done so, but shall certainly try it in the first case suitable for such a manœuvre. Had we been able to reach it, through a large opening, it is doubtful whether its enucleation would have been a feasible step, in spite of the brown semi-fluid *débris* which prevented any connection between the tumor and the surrounding parts—so that at the post-mortem it dropped from its cavity like an egg from its shell. Prof. Coplin especially examined the question of infiltration of the neighboring brain tissue, which constituted the wall of the cavity in which lay the tumor, and was satisfied that there was none. This, of course, is rare in sarcoma, but should not be forgotten in other cases, as it would influence our determination to attempt a removal.

The variations in the degree of paresis in the arm and leg, *inter se*, and of the arm at various times, and the variations in the strabismus and sight are all extremely interesting and instructive.

Ferrier has already pointed out that pain on percussion over the site of a tumor is of more value as a means of locating such a lesion than spontaneous pain. Although in this patient this varied to some extent, yet, as a rule, pain on percussion was much more noticable over the site of the tumor than spontaneous pain.

A curious fact which Dr. Lewis tells me he has observed in another case of cerebral tumor, and which Dr. Thomas G. Morton has also observed in other cases, is the pain either at the ensiform or at the mid-sternum, particularly upon flexing the head. How to explain this I do not know. It may prove hereafter to be a sign of some value.

CASE III.—*Supposed cerebellar tumor; operation; death; glioma found in floor of third ventricle.* S. L. S., aged fourteen years six months. Seen in consultation with Drs. S. Weir Mitchell, D. D. Stewart, H. C. Wood, C. A. Oliver, and Morris J. Lewis, February 26, 1889.

Dr. Stewart has kindly furnished me with the following facts in the case: "There is no history of tuberculosis on either side, excepting in the paternal grandfather, who died at the age of fifty-three, with supposed tuberculosis pulmonum. No specific history in the parents. His mother has had no miscarriages. The boy's head has always been large since birth. He has been ailing since the summer of 1888, but

attended school until November of that year. He then first noticed headache, which was chiefly frontal. In November he had nausea and vomiting for about a week, without convulsions. His eyesight has failed until he cannot read unless the print is large. Not uncommonly he has nausea on rising in the morning. There is no ankle clonus. The knee-jerks, especially the right, are exaggerated."

January 19, 1889. There has been a gradual increase of vertigo and vomiting, with unsteady gait. Headache is slight. For six weeks the urine has passed involuntarily. He eats inordinately. He can walk forward and backward as well without as with the guiding sense of vision, but his gait is undoubtedly unsteady. His pupils are dilated and react to light, the right less than the left, and the right is permanently larger than the left, both in shadow and in bright light. There is double optic neuritis. His intellect is dull and his movements slow. Temperature normal, pulse rather irregular, the right being somewhat the stronger. Hearing, smell and taste are normal on both sides. Tactile sensation is everywhere normal. Urine: sp. gr. 1020; no albumin; no sugar. He is taking iodide of potassium.

29th. He vomited the entire day on the 25th without any nausea, the vomited matter containing a little blood.

February 8th. He is somewhat brighter, and can follow conversation connectedly. A tendency to fall backward and to the left when walking is now very pronounced, especially as soon as he becomes tired. The backward tendency is most marked on halting or turning. In walking or sitting there is also a marked tendency to stoop, with his head and shoulders thrown forward. He still has no control over the bladder. He is markedly constipated. There is objective vertigo, the movements being always in a reverse direction to the hands of a watch. Occipital temperature, on the right side, 96.5° ; on the left, 95° . Hard percussion over various parts of the head and especially the occiput elicits no tenderness.

13th. He had severe vomiting all day on the 9th, without having taken any iodide to account for it. Occipital temp., right, 94.8° ; left, 96° ; the thermometer being held by a strap to the head for eight minutes.

19th. All the morning of the 17th he had again continuous vomiting, and in the afternoon was dull and stupid. This continued during the next day, the 18th, on the afternoon of which he was delirious. His sight is steadily failing and his gait has become more uncertain. He cannot take even two or three steps without stumbling, and with a decided tendency to fall to the left. His stumbling is due to the fact that he does not lift his feet, but drags his toes, yet in a sitting posture he can flex and extend the feet. Over the left occipital bone the percussion note seems to be decidedly tympanitic, as though air were beneath it.

25th. He has been unusually dull for the past week. His head seems to have increased somewhat in size since I first saw him. The veins of the head show very distinctly. Yesterday the head was shaved and a consultation held with Dr. S. Weir Mitchell. Evidently the boy was sinking, his sight having entirely failed and the tendency to coma being marked. His gait had grown exceedingly uncertain. His body was rigid and his neck muscles stiff. The scalp shows two slight scars on the upper occipital region. They are said to have been present from early boyhood. No symptoms seem to be due to them. The scalp temperature was carefully taken, Séguin's thermometer being used. The

thermometer was carefully held in place with equable pressure until it entirely ceased to rise. The smaller number indicates the higher temperature.

						Right.	Left.
No. 1.	Occipital	.	.	.	.	—3	—3
No. 2.	Occipital	.	.	.	.	—3	—2
No. 3.	Occipital	.	.	.	.	—2	—2
No. 4.	Parietal	.	.	.	.	—4½	—3
No. 5.	Bregmatic	.	.	.	.	—2	—3
No. 6.	Rolandic	.	.	.	.	—3	—3½
No. 7.	Frontal	.	.	.	.	—6½	—5
No. 8.	Frontal	.	.	.	.	—4	—4

26th A consultation was held with the gentlemen already named. The following measurements were taken by Dr. Keen: Circumference of the head, 22½ inches. When the halves were measured separately a slightly different measurement was obtained, the right measuring 11½ inches, and the left 11⅔ inches, the difference in total circumference being evidently an error of measurement. From the glabella to theinion measured 14 inches.

My own opinion was, by exclusion and presence of a few signs, that there was probably a tumor in the middle lobe of the cerebellum, growing into the right lobe or, at all events, exerting pressure upon it. There seemed to be absence of signs implicating other parts of the brain. The ataxic gait, with a tendency to fall backward and to the left, marked double optic neuritis, signs of ventricular distention, stupor, the last being relieved by free purgation and digitalis, all pointed to the presence of cerebellar tumor. On the whole this diagnosis was accepted at the consultation, although not without some doubts, especially by Dr. Wood, who was himself disinclined to operation. As, however, without operation the boy had absolutely no chance, and operation, although giving a small chance only, was the one possible means of escape, it was accordingly decided to recommend an operation."

Dr Chas. A. Oliver reported on the ocular condition as follows:

"The patient was first seen on the 27th of February, 1889. In August of the previous year his eyes were examined for glasses by a physician who stated that the retinæ were temporarily 'clouded,' and that this was dependent upon local disturbance. Dating from October of the same year, sight was gradually lessened; this defect of vision being associated with sudden attacks of blindness—the last one having occurred on the evening before the examination. The patient claimed that the sight of the left eye had always remained the better.

"At the time of the examination the pupillary areas were equally and evenly dilated to 6 mm. each, except at four minute points caused by narrow posterior synechiæ. In the left eye there were two small posterior synechiæ situated up and in and up and out, the former being the larger. In the right eye there were two narrow similar tags situated down and in. Intra-ocular tension was normal in each eye.

"Although vision was reduced to the faintest light-perception in each eye, a typical left homonymous hemianopia could be readily determined by careful study with two candle flames, the double bow at the macular portion of the remaining fields of vision being easily obtained. The retained area of the field of the right eye was about one-fifth larger than that of the remaining field of the fellow eye.

"Ophthalmoscopically, there was a pronounced choked disk on both

sides, this being the greater on the right side (three dioptries as compared with two and one-half dioptries in height). The tissues of the swollen nerve-heads were undergoing atrophic changes, these having advanced to a greater degree to the temporal halves in each eye, and having become more pronounced in the left eye. On both sides the surrounding retinal oedema was confined to narrow areas around the disks. In the right eye, numerous capillary feathery hemorrhages extended in the fibre layer of the retina, this being accompanied by a number of fine cholesterin crystals and clump-like extravasations in the substance of the nerve-head swelling. To the outside of the right disk, and seemingly fixed, there was a rounded whitish amorphous-like mass which extended as far forward into the vitreous as the swollen disk itself. Both macular regions seemed to be devoid of any gross pathological changes. The retinal arteries and veins were diminished in size, especially the arteries, they being the more reduced in the left eye.

"With the exception of a slight paresis of the left inferior rectus muscle, the action of the extra-ocular muscles seems to be intact.

"Repeated studies for the production of the hemianopic pupillary inaction sign, after proper and prolonged periods of rest and exposures to narrow pencils of peripherally situated beams of concentrated artificial light, seemed at times to evidence this special sign (especially in the right eye), but just as frequently failed to show anything that was characteristic. Sometimes, however, the irides, which were tied down to the anterior capsules at their most important places by narrow pigment tags, seemed feebly to respond to light-stimulus when thrown from any portion of the periphery.

"The ocular symptoms (which were far advanced before any proper ophthalmic study was permitted, and only after the motor groupings had become quite vague, confusing, and almost valueless) were markedly significant of a gross intra-cranial lesion situated in the posterior base, causing both ventricular and basilar pressures and extravasations, which were very marked on the right side.

"Evidently, by reason of the easy fatigue of the patient, the almost complete blindness (faint light-perception alone in the remaining half-fields), the pronounced pupillary dilatation, the almost infinitesimal and interfered-with movements of the irides, and the necessity of beams of strong light-stimulus from the very imperfect apparatus then in use to produce any movement at all (thus at times producing strong side glares of diffused light), the Wernicke sign was so uncertain as to render this important localizing symptom to be conscientiously negatived.

"For these reasons, the sudden attacks of almost total blindness, with the intense double optic neuritis, the retinal and iridic evidences of probable tuberculous deposition, in association with the general symptoms of cerebellar lesion, made probable the existence of a similar mass in that situation. This tumor, pressing forward on the fourth ventricle, could thus give rise to internal hydrocephalus with consequent disturbance of the nuclei of the left inferior rectus and both iris muscles, and allow extravasations of infected lymph into the sheaths of the second nerve, thus producing peripheral inflammation in the optic nerve-heads and circumjacent retinæ; and finally it could thus indirectly produce upward, inward, and forward pressure against the basilar ganglia and outgoing nerve strands, so as to produce the right tract lesions and the series of doubtful sensory-motor arc disturbances.

"NOTE.—From the results of more recent studies of similar cases it is quite certain that had this case been studied earlier, the ocular symptoms would have been so sure and so easy to differentiate, that almost positive assertion as to the exact position of the intra-cranial neoplasm, as found post-mortem, could have been vouchsafed by the ophthalmic signs alone."

Operation at St. Agnes Hospital, March 2, 1889, by W. W. Keen. Pulse normal—85. At beginning of operation, under ether, it rose to 120. A reversed U-shaped incision was made from just over the right mastoid process down into the muscles of the neck, terminating an inch above and to the left of theinion. The incision was rapidly carried deep into the muscles, and the flap turned down. Very abundant hemorrhage took place from a large number of vessels, requiring a great many hæmostatic forceps. Two small vessels emerging from the bone on each side of the occipital crest were exceedingly troublesome. They could not be caught with forceps; plugging with disinfected matches was not effective, but they were finally controlled by the Paquelin cautery. The muscles below the flap were now scraped off the bone until the foramen magnum and the sheath of the cord were easily seen and felt.

The centre-pin of a three-quarter inch trephine was now applied, as suggested by Mr. Lloyd (*Lancet*, October 1, 1888) at a point midway between theinion and the tip of the mastoid. A few turns of the trephine sufficed to penetrate the bone, which was so thin that the centre-pin penetrated the dura before a groove was cut into the bone sufficient to allow of the withdrawal of the centre-pin. When the button of bone was removed a jet of cerebro-spinal fluid spurted through this small opening in the dura to a distance of several inches. The opening in the bone was now easily enlarged in any direction until it reached within a half-inch of the groove for the lateral sinuses and the same distance from the foramen magnum. Internally it reached to a quarter of an inch of the middle line, and externally almost to the lateral sinus again. Escape of the fluid made the dura somewhat loose, so that tapping on it caused it to flap to and fro, and the same effect was caused by pulsation of the brain. In fact, this motion at the upper border of the opening at one time caused me to think that it was a venous pulse in the sinus. When the cerebellum was exposed by a flap with the base upward toward the sinus its appearance was healthy. There was slight œdema of the pia. To the touch the cerebellum seemed soft.

The little finger was now passed over the entire upper surface of the cerebellum, and the tense tentorium was felt. The projection of the middle lobe was moderately appreciable. Below the cerebellum the same sweep of the little finger showed nothing abnormal. No appreciable vessels were felt passing from the cerebellum to the tentorium, but each time on withdrawal of the finger a considerable gush of venous blood followed. This, however, ceased spontaneously. The cerebellum was now incised posteriorly, and the little finger introduced gently into it internally to a depth of an inch and three-eighths. This caused the pulse, which had risen to 164 on exposing the brain, to rise suddenly to 184 at the time of the incision and manipulation of the cerebellum, but in half a minute to fall again to 160. No tumor was found after most careful and gentle search. The wound in the dura was closed by sutures, and the external wound, after suitable drainage, was closed by

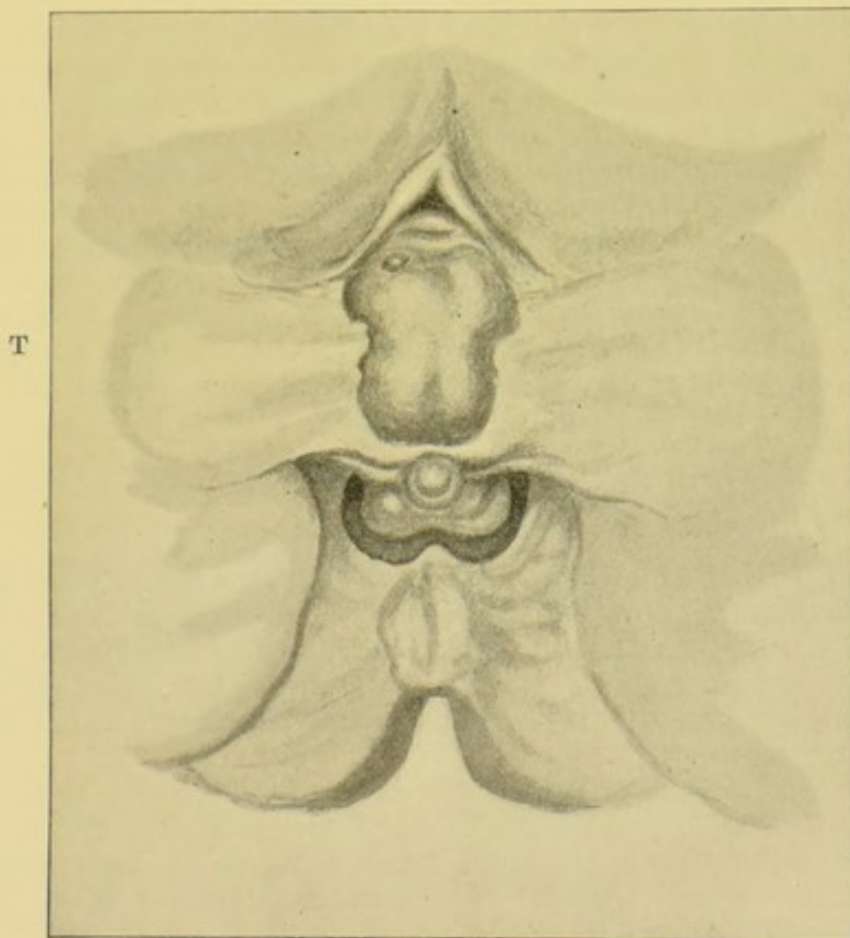
a number of deep sutures through the muscles, as well as by a few superficial sutures.

The operation lasted for nearly an hour and a half, the greater portion being taken up by the obtaining of a dry field for operation before the brain was opened, and by the closure of the dura and the external wound after the operation proper was terminated.

The patient was placed in bed surrounded by hot bottles, his pulse being 156 and of very fair strength. He recovered consciousness and recognized his father and the resident, speaking to them rationally.

After a few hours he was attacked with rigidity of the muscles and universal tremor. Horizontal nystagmus was very marked. He gradually sank, and died nine hours after the operation was completed.

FIG. 5.



Tumor (opposite T) in the floor of the third ventricle. (Drawn by DR. J. MADISON TAYLOR.)

Post-mortem by Dr. William J. Taylor. Skull: Over the parietal eminence and in several other places it was elastic and depressible, but not papyraceous. It was very thin at all points, so that a few strokes of the saw penetrated the interior. The sutures were widened but the bones not separated. It was a typical hydrocephalic skull. There was a very small cord-like post-mortem clot in the right lateral and superior longitudinal sinuses, none in the straight sinus. The Pacchionian bodies were normal.

On inspecting the base of the brain the floor of the third ventricle presented a marked hemispherical projection, producing pressure on the optic tract and chiasm, and to a less extent on the optic nerves. (Fig. 5.)

The optic tracts and the chiasm were attached to the tumor, and the tracts were spread out into bands on the right and left sides respectively, 12 to 10 mm. wide. The chiasm also was flattened. The angle of divergence between the crura cerebri was increased. The fourth ventricle was not distended. The insula and everything in the Sylvian fissure were normal. There was no tumor in the cerebellum.

Both lobes of the cerebrum fluctuated. The lateral ventricles were six inches long antero-posteriorly and were filled with cerebro-spinal fluid amounting to about twelve or fourteen ounces. The foramen of Monro was dilated, and through it a grayish translucent tumor was at once seen in the third ventricle. When this was exposed the tumor was found to extend from the anterior commissure to the posterior. It was fused with the anterior commissure, and pressed upon the posterior commissure and corpora quadrigemina, but was not fused with them. The aqueduct of Sylvius posteriorly and the pillars of the fornix anteriorly were widely separated by the tumor. Posteriorly the peduncles of the pineal gland were also widely spread out on the two sides of the tumor. Laterally the tumor fused with the optic thalami.

The tumor had pushed down the floor of the third ventricle and had also elevated its roof, the fornix. On the surface of the tumor anteriorly was a small brownish-green, almost black, cyst, which on being opened discharged twenty minims of yellow fluid, resembling bile. Next to it, but deeper, was another cyst filled with almost perfectly black fluid. The interior of the tumor showed several cysts, giving it a sponge-like appearance on section. The tumor was somewhat denser than the brain substance.

The following report as to the microscopical appearance was made by Professor William Osler:

"A small portion from the superficial part of the tumor when teased showed innumerable fibres, the majority of which represent the tail-like extensions of spindle cells; some of these are of extraordinary length. Certain of these fibre cells have a curious translucency. Among these, in considerable numbers, are irregularly-shaped cells, somewhat larger than ordinary leucocytes.

"The deeper portion of the growth is denser, the fibres being more closely set, and among them are many large cells with and without processes, which resemble in a remarkable degree ordinary ganglion cells. The tumor corresponded to the neuro-glioma of Klebs, a not uncommon growth in this situation."

This case is only another added to the many of a wrong diagnosis of the location of a cerebral tumor. Certainly, to me, at least, and to the majority of the consultants, it seemed most likely to be in the cerebellum, though some doubted it very much. Of course, if a correct diagnosis of its location had been made, no operative interference would have been undertaken. I have placed it upon record, both as an error of diagnosis and as a means of correcting such errors, possibly, in the future. From a surgical point of view, although the operation was a mistake, yet it was at the same time a merciful one, for the poor boy was suffering to such a degree that death was a blessing.

CASE IV.—*Tubercular tumor in the motor area; operation; operative recovery; death; autopsy.* W. M., aged fifty-two years, Scotchman, was admitted to the Infirmary for Nervous Diseases, under the care of Dr. Morris J. Lewis, August 6, 1890, who furnishes the following history: "He is a button-maker, and calls himself a 'moderate drinker,' taking about three glasses of beer daily, and getting drunk every Saturday. He smokes excessively; denies syphilis; admits gonorrhœa. His family history is unimportant, except that his mother had some nervous trouble, which compelled her to stop when she had walked about 100 yards, before being able to proceed further. At five years of age he received a blow above the right eye, but no ill effects have followed. A scar marks the site of the injury. Has never had rheumatism except once, after exposure to wet.

"His present trouble began seven or eight weeks ago, with tingling on the inner side of the index finger of the left hand, extending to the whole hand and lasting five minutes. Immediately after this there was twitching of the left side of the mouth, lasting for a minute. Speech was lost for a few seconds, and then was 'thick.' Four weeks later he had clonic spasm of the head, which turned to the left. The attack lasted for five minutes, and speech was lost for a few moments. He knew what he wanted to say but was not able to move his tongue. Two weeks later the same sensation recurred in his hand and lip, attended with gradually increasing weakness on left side, beginning in the arm."

Status præsens. He has had but very little headache, but to-day it is very bad in the frontal region. He sleeps badly; appetite poor; bowels constipated. Passes the average amount of urine, with a specific gravity of 1020; no albumin, no sugar. When in repose his mouth is straight, the left naso-labial fold being less marked than the right. Eyes shut well; can whistle well. On making grimaces there is some drawing of the mouth to right. Pupils equal, and react well. Tongue protruded straight. Dynamometer: R., 135; L., 120. Knee-jerk, elbow-jerk, and muscle-jerk exaggerated on both sides. Scrapes his left foot slightly in walking. Sensation good, heart normal. There is no tenderness or oedema of scalp; no vomiting; does not now miscall words.

August 27. Dynamometer: R., 130; L., 90. Sometimes in swallowing, liquids "go the wrong way." He is suffering much from headache. Knee-jerk is most marked on the right side.

September 24. He has had violent headache for two weeks, although the iodide of potassium, which he had been taking in increasing doses, had been stopped for a week. Dynamometer: R., 135; L., 100. No tenderness.

October 1. His headache has improved under bromide of potassium. There are indistinct choreic movements of the hands. Dynamometer: R., 110; L., 85.

November 26. Six days ago he had a convulsion, beginning in the index and little fingers of the left hand, with clonic spasm in flexion and extension, then clonic spasm of all the fingers of the hand on this side, followed by severe headache, so that he had to go to bed. On the next day after the above attack he had two similar attacks, beginning in the left hand, and he became very rigid, with great pain in the loins. Dr. de Schweinitz reported on his eyes as follows: "O. D., round, slightly oedematous disk, full central lymph-sheath, slight epithelial chorioiditis. H = 3 D. O. S., oval disk, margins veiled, full lymph-sheath, marked

absorption of the pigment epithelium; pupil actions normal, form field uncontracted; central vision normal, and external ocular muscles unaffected.

December 3. He has clonic movements of the arm in certain positions. This appears to be in the muscles of the shoulder only, and the vibrations are slow. There is noticed a tendency to reduplication of the first sound of the heart. The valves of the superficial veins of the head and neck are markedly prominent. The epigastric and abdominal reflexes are less marked on the left side than the right, but both are exaggerated. Left testicle reflex diminished; none on right side.

17th. Dynamometer: R., 125; L., 35. Speech thicker. He is getting listless and losing interest. His left hand is cold and blue. The eyes show somewhat more of a retinal haze.

February 22, 1891. He has never noticed any asymmetrical sweating nor flushing, nor any unilateral subjective sensations. Temperature sense equal and well preserved in face and hands. Sensation to pain good and equal on both sides in face and hands. Localizing power good on both sides of face. *Æsthesiometer*—two points differentiated: R., $1\frac{1}{8}$ inches; L., $1\frac{1}{4}$ inches, on dorsum of hands; on both cheeks, $1\frac{1}{2}$ inches. No chin-jerk. Tendon-jerks and muscular irritability greater on the left than the right side. Temperature sense on dorsum of both feet good. *Æsthesiometer*—two points recognized: R., $1\frac{1}{8}$; L., $1\frac{3}{8}$ inches. Sensation to pain good and equal in both feet. Localization good in both feet and legs. Pressure-sense equal and normal on the two sides in hands, arms, feet and face.

Operation, February 24, 1891, by W. W. Keen. Before the operation, extract of ergot f3ij and $\frac{1}{4}$ gr. of morphine were administered. Just as he was about to be etherized a convulsion occurred, the first one that Dr. Lewis or I had seen. There was absolutely no effect upon consciousness, and the convulsion was limited to the left arm, with clonic extension of the left forefinger, slight clonic extension of the forearm (it lay on the arm of the chair in which he sat). This flexion of the forearm was not due to the action of the biceps, but may have been due either to the flexion of the brachialis anticus or the flexion of the hand at the wrist, which lifted the forearm. The convulsion only lasted a half-minute. The patient was placed semi-recumbent on a lounge and kept from slipping down by a sheet passed between the thighs, the two ends being fastened to the head of the lounge.

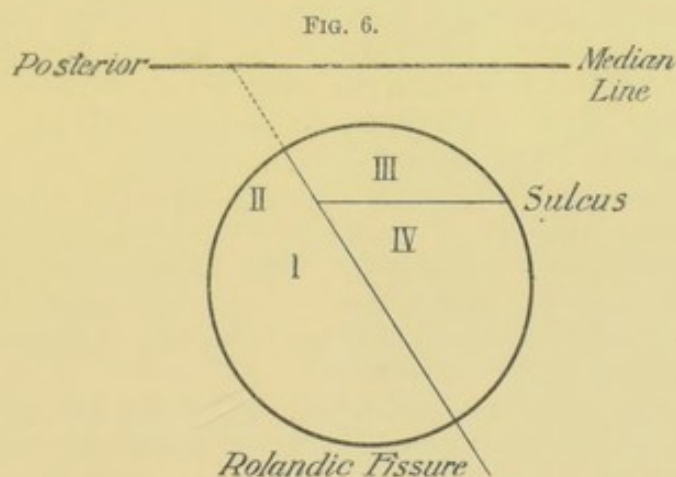
His cranial index was 71, and therefore the angle of the fissure of Rolando was 67° . From the glabella to the inion was 14 inches. It was decided to trephine over the right elbow center, and the fissure of Rolando having been marked out, a point 2 inches along this line and $1\frac{3}{8}$ inches to the right of the middle line was fixed upon as the probable point. A button an inch and a half in diameter was then removed, the line of the fissure of Rolando having first been fixed at the two extremities of the fissure by nicks in the bone. The button removed was normal externally and internally, excepting as to its thickness. At the thickest point it measured three-eighths of an inch, and at its thinnest a little over a quarter of an inch. On opening the dura the brain pulsated. Its color seemed to us slightly yellower than the normal. The fissure of Rolando ran precisely in the centre of the opening. The pre-Rolandic convolution was divided by a sulcus running from behind forward and a little upward. A large vein lay in the fissure of Rolando,

and in this fissure and in the little sulcus just mentioned, the membrane was slightly œdematous and yellowish. The Faradaic battery was then used to locate the centres (secondary current coil $1\frac{1}{2}$ exposed). The cortex was touched at four points, I., II., III., IV., in order named. The patient was not fully under ether during this test. (Fig. 6.)

I. Post-Rolandic convolution, $1\frac{3}{4}$ inches from the middle line. Right forefinger and right leg lifted (thought to be due to the imperfect anesthesia at the moment). Extension of left forearm followed by clonic flexor spasm, with extension and flexion of the left wrist, slight motion of lower lip to the left, and protrusion of tongue between the teeth to the left (possibly due to imperfect etherization).

II. Post-Rolandic convolution, $1\frac{1}{4}$ inches from the middle line. Left shoulder lifted, left arm carried over the chest, elbow at a right angle. Clonic convulsive movement of abductors of left shoulder, decided movement of the lower jaw and lip.

III. Pre-Rolandic convolution, $1\frac{1}{4}$ inches from the middle line. Clonic convulsive movements of the left arm across the chest, with forearm flexed, ending, as before, in tonic extension of the wrist. Two slight twitchings of lip (the side was not noted).



Showing the points at which the brain was stimulated.

IV. Pre-Rolandic convolutions, $1\frac{5}{8}$ inches from the middle line. (All these measurements are taken in straight lines at a right angle with the middle line, with the exception of the location of the centre, which is two inches along the line of the fissure of Rolando.) Extension of left fore-, middle- and ring-fingers, followed by clonic movements of extension of the wrist. No response of the face. By touch there is no difference in resistance in the pre- and post-Rolandic convolutions. Both of them give an impression to the finger similar to a floated patella in effusion into the knee-joint; that is, the pressure of the finger seems to depress a layer of less density, and further pressure is arrested by greater resistance.

At point I. in the post-Rolandic convolution an incision about 1 cm. long and 1 cm. in depth was made, but nothing issued but a little blood. The blunt point of Allis's dissector was then pushed in 2 cm. in depth, but nothing was revealed by it. The escaping blood diminished slightly the bulging of the brain, which, from the moment of opening the dura, had been progressively increasing, and now had reached slightly above

the external surface of the skull. No further interference was deemed wise.

The dura was then sutured with catgut. One small vessel in the cerebral substance and two in the dura were tied with catgut by a ligature passed under them with a curved needle. The scalp was sutured with silk, and no drainage was used. A sterilized dressing was then applied. The bone button was not replaced.

March 5, 1891 (tenth day). Surgically speaking, he did remarkably well after the operation. The sutures were removed on the fifth day. His highest temperature was once 99.6° , most of the time being 99° . Yesterday, however, his temperature rose to 101.6° . It was found that the flap was somewhat swollen, and on making a slight opening at one point, about two drachms of thick, black blood were pressed out from the lower anterior end of the incision. His temperature fell at once, to 98.6° by this morning. Two days after the operation he was unable to move his fingers or wrist, but could slightly flex and extend the elbow. Sensation seemed to be unaltered, but his mental condition made the determination of this unsatisfactory. On the fourth day after the operation his elbow movement was lost, and the only movement of the arm was in the flexion of the fingers. Two days later the left knee seemed to be a little stiff and adduction of the left leg a little sluggish. The elbow movements began to return on March 3d, eight days after the operation.

10th (fifteenth day). The power of movement in the left arm has gradually improved. His forefinger, however, cannot be flexed or extended, nor is there any adduction or abduction of the thumb. He is out of bed and walking about the ward. To-day slight left facial palsy was noticed as before the operation. His mental condition bad; he is very despondent and his sleep is poor. The discharge of thick, black blood has continued in a gradually lessening amount until the present time, but has now ceased.

22d (one month after the operation). All power of movement in the left arm is now lost saving slight flexion of the fingers. His mind is markedly dull. The left leg is slightly paretic, and there is complete paralysis of the left face.

26th. The catheter has had to be used at intervals ever since the operation. To-day he has had involuntary evacuation of urine. He is very weak, and his voice has fallen almost to a whisper. He is quite stupid mentally, and has to be fed like a child. Paralysis of left arm and left face complete, but he can still move his left leg.

31st. Much brighter; retains and passes his urine.

July 1st. Dr. de Schweinitz examined his eyes and reported as follows: "O. D., marked papillitis, apex of swelling + 7 D. O. S., similar condition; general fundus + 3 D. No hemorrhage in either eye the pupils and form fields normal."

September 5th. Since the last date he has gradually lost strength, and finally took again to his bed. By August 6th his temperature ran up, until September 3d it attained 102.8° , falling on the 5th to 101.4° , shortly before his death that evening.

Post-mortem notes, by Dr. Charles W. Burr, September 6, 1891, nineteen hours after death:

Body much emaciated. Abdomen very green. Slight rigor mortis.

There was marked sinking-in of the scalp at the trephine opening.

The scalp itself was normal throughout, the flap having healed so as to leave a very insignificant scar. There was a slight adhesion between the scalp and the membrane, filling the trephine opening.

The skull was normal throughout. The trephine opening was filled by a thin, translucent, fibrous membrane closely adherent to the dura. A line drawn from ear to ear over the skull passed almost through the centre of the trephine opening, the highest point of which was on this line at a distance of $5\frac{1}{4}$ inches from the upper junction of right ear and scalp and $\frac{3}{4}$ inch from the sagittal suture. Diameter of opening, $1\frac{1}{2}$ inches.

On removing the skull-cap, the dura was found adherent for a short distance around the trephine opening, and to the membrane filling the opening. The dura was also thickened here, and adherent to the brain, so that the latter was torn. The remainder of the dura was normal. Under the trephine opening, and involving the ascending parietal and ascending frontal convolutions, the brain-matter was softened, mush-like, reddish in color, and, indeed, completely disorganized. There was no apparent œdema of the brain. The convolutions were of average appearance.

The optic nerves were swollen and reddish. The papillæ were swollen and semi-translucent. The central arteries of the retinæ were not visible at their entrances from the disks, but on the retinæ, at a little distance from the disks, several swollen and tortuous bloodvessels were seen.

Spinal cord. On opening the dura, quite a large quantity of clear fluid escaped. The membranes and cord appeared normal.

Thoracic cavity. The left pleural cavity contained a quart of clear, straw-colored fluid, in which were flakes of lymph. Pleura thickened, and strong bands of fibrous tissue passed between the lung and parietal pleura. Within the left lung, at the posterior part and below the apex, was a cavity about the size of an orange, with thickened walls and arteries crossing it. In the right pleural cavity there was a little clear fluid, slight adhesions existed at the apex on several old scars, and the lung tissue was crepitant throughout and but slightly congested.

Heart. Size normal. A little blood in either ventricle. Valves normal.

Kidneys. Left slightly enlarged, lobulated. On the surface were two small cysts, one filled with a dark, thick fluid, like broken-down blood; the other with a clear watery fluid. Capsule stripped off with some difficulty. Cortex and medulla well differentiated, the former being slightly thicker than normal. The right kidney, except that no cysts were present, was like the left.

Stomach dilated with gas.

Liver, spleen, and intestines showed nothing pathological.

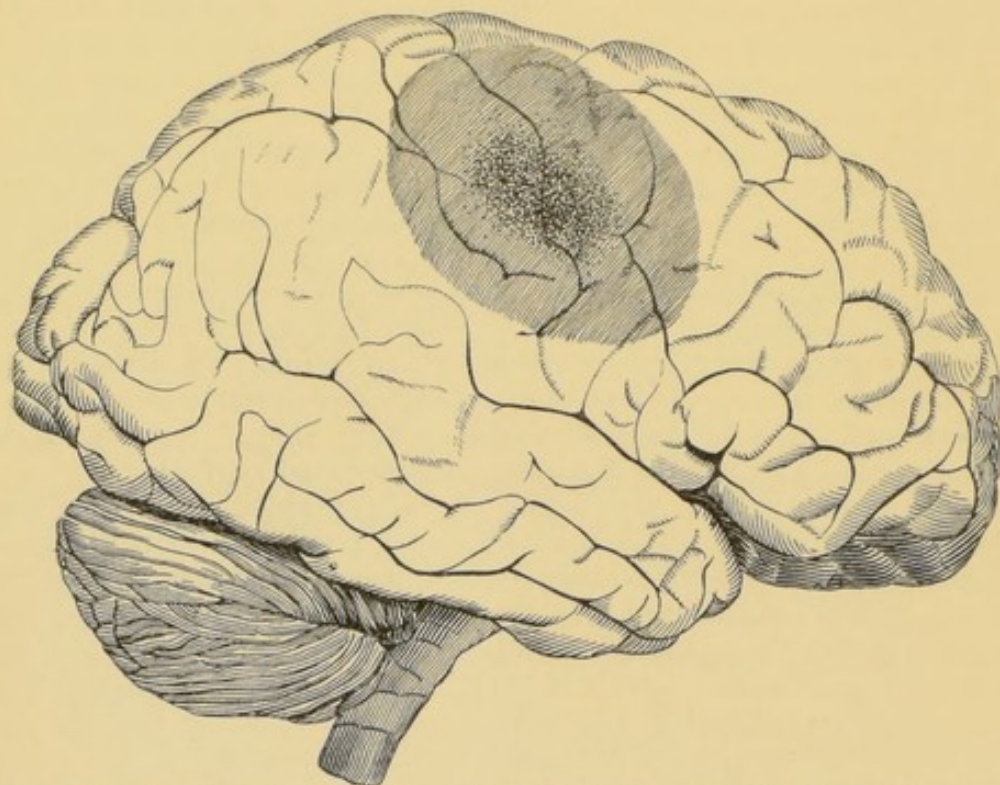
October 25, 1893. *Examination of the hardened brain*, by Dr. Lewis: The entire brain had been hardened in Müller's fluid and alcohol. The dura was found to be adherent upon the right side over the upper portion of the fissure of Rolando. An area of destruction existed upon the right side of the brain, with its centre over the middle of the fissure of Rolando, extending upward to within three-quarters of an inch of the middle line, and downward to within an inch of the fissure of Sylvius. Laterally this invaded the whole of the ascending parietal and the ascending frontal convolutions to the points previously mentioned, thus leaving the upper and lower portions of these two convolu-

tions intact. The destruction of tissue was deepest in the centre of this area, extending well into the white substance, and becoming shallow toward the periphery, where the gray substance only appeared invaded.

The convolutions immediately above this area, that is, between it and the middle line, appeared sunk a little below the surface of the brain, as if the destroyed portion had allowed them to sink down.

Perpendicular sections made at half-inch intervals from the front of the brain backward showed that this area was the only portion diseased (at least macroscopically). The basal ganglia appeared to be perfectly normal upon section.

FIG. 7.



Tubercular tumor involving the cortex. The darker area is that of softening.

The portion of the brain described as "mush-like" in Dr. Burr's notes of the autopsy (the area of destruction mentioned above) (Fig 7) had undergone considerable shrinkage in the process of hardening, and no structure could be detected by the naked eye to indicate its nature, as it had the appearance of being disorganized brain tissue. A portion removed for microscopical examination, which was made by Dr. Burr, proved it to be a tubercular tumor undergoing secondary softening and caseation.

REMARKS BY DR. LEWIS.

During the patient's life no more accurate diagnosis seemed justified than that a focus of irritation, in all probability a growth, existed, either cortical or subcortical, in the immediate vicinity of the arm centres upon the right side, the following *résumé* of the symptoms appearing to justify this view, viz.:

Sensory disturbances in left hand, followed by local convulsive move-

ments in left hand and arm, and also in slight degree in the lower left face, followed by gradually increasing paresis of the arm, face, and leg, these parts being affected, as to degree, in the order named, the most marked paresis being in the arm. No choked disk existing seemed to indicate that most likely there was not a great degree of intra-cranial pressure present, at least not sufficient to cause marked intra-ventricular effusion.

As medical treatment had failed to ameliorate the symptoms, and as the patient was slowly growing worse, it was decided to operate. The convulsion occurring just as the patient was being etherized, which was confined strictly to the left hand and arm, seemed to justify the conclusion arrived at in regard to the seat of the irritative process.

The tumor was not recognized at the operation, nor any condition to justify the diagnosis made, the only abnormal condition recognized being the yellowish color and the cedematous appearance of the brain tissue, and the increased tension of the skull contents.

The case is very interesting and instructive from several standpoints. The tubercular tumor in the brain was in all probability secondary to the condition found in the lung. The latter trouble had evidently advanced much farther than was supposed to be the case. Subsequent to the operation the interest in the case centred in the "nervous" symptoms, which seemed difficult of explanation; the condition of the lung, although previously recognized, received but little attention, yet there must have been rapid progress made in the disease in this locality during this period. Under the new light thrown by the autopsy, it is evident that this point should have been more fully considered; the points which then seemed so difficult of explanation now appear clear.

The tumor was not detected at the operation, as previously mentioned, and this naturally raised doubts as to the accuracy of the diagnosis.

The appearance of pronounced papillitis which had not existed prior to the operation, and the subsequent increase of the paralysis after this had lessened two weeks after this period, are now readily accounted for by the probable increase in size of the tumor, the further involvement of the affected motor area, and the subsequent degeneration of the part affected.

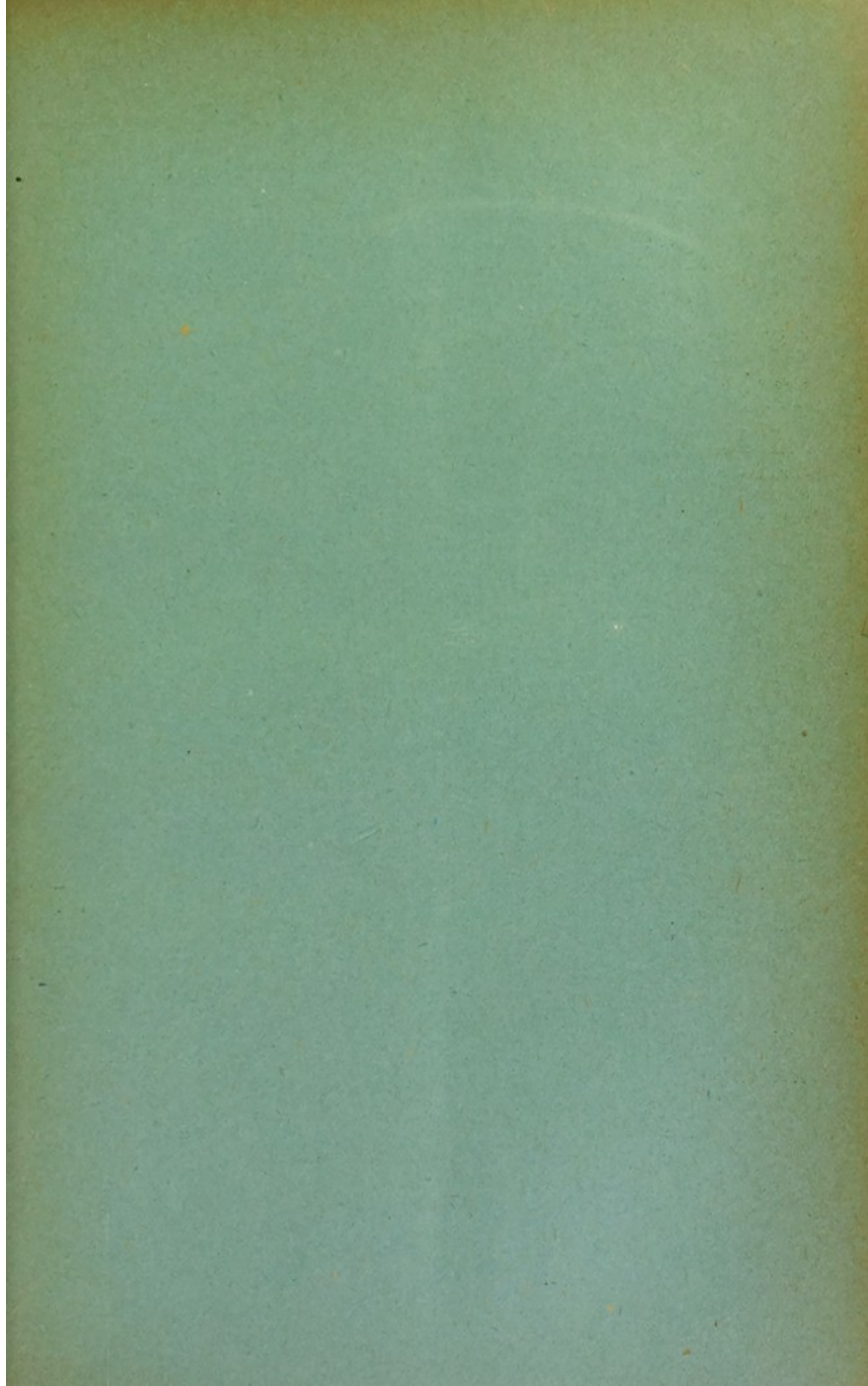
No benefit, naturally, followed the operation, although the removal of the button of bone must have given relief to the intra-cranial pressure. The examination of the area exposed by the trephine, which the autopsy proves was correctly placed, was as thorough as was deemed wise, and in the retrospective view of the case it does not appear how the non-recognition of the tumor could have been avoided. The true condition of affairs was not even recognized at the autopsy, nor was it patent at

the naked-eye examination of the hardened brain. Prior to the final microscopic examination, the doubt existed whether the disorganization might not be dependent upon secondary troubles following the operation and in consequence of it, a doubt which the discharge of black blood lasting until the fifteenth day seemed to strengthen.

Finally, it may be said that the localizing symptoms were properly interpreted and the trephine correctly placed to uncover the diseased area, the recognition of the mass being prevented by its character, which at the time of operation was in all probability one of infiltration of the tissues, giving to the naked eye the appearance previously described; the incision made at the time dispels the idea that the tumor was then subcortical only. Had this especial tumor been detected it is not likely that any benefit would have accrued to the patient, as, considering its nature and the general condition of ill health of the patient, it is doubtful if his life would have been prolonged had the mass been removed.

REMARKS BY DR. KEEN.

There is little to add to what Dr. Lewis has said. The indications for an exploratory operation seemed to be amply sufficient, and the progressive bulging of the brain as soon as the dura was opened confirmed the diagnosis of tumor. Unfortunately, though we fell upon the exact spot where it lay, the macroscopic appearances misled us, and the punctures did not reveal its presence. Had a small portion of the brain been removed for microscopic examination at the time, great light would probably have been thrown upon the case, and the later symptoms more correctly interpreted. In this case it is doubtful whether, even if the tumor had been recognized, I could have removed it, as it had no recognizable borders, and was not hard enough to give any resistance to touch, and thus guide me as to the area which should have been removed.



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