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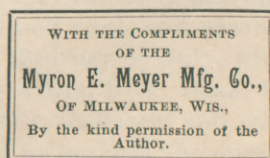
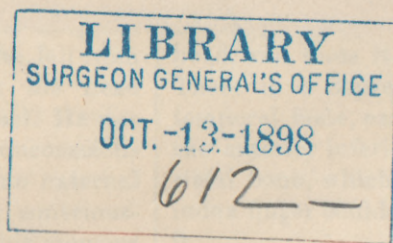
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FOUR CASES OF CRANIOTOMY.

A CONTRIBUTION TO THE SURGERY OF THE
SKULL AND MENINGES,

With some Remarks on the Antiseptic Treatment of Wounds.

BY PROF. A. C. BERNAYS,
ST. LOUIS, MO.



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A CONTRIBUTION TO THE SURGERY OF THE SKULL AND MENINGES.

Four Cases of Craniotomy with Chisel and Saw, in Old Cases of Depressed Fracture of the Skull. With Some Remarks on the Antiseptic Method of the Treatment of Wounds.

BY AUGUSTUS C. BERNAYS,

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Case I.—Mr. E. B., fifty-nine years of age, came to St. Louis on the 12th day of July, 1884, and was received as a patient in my private hospital. Four months previously he fell from an ice-wagon and struck his head against the tire of the wheel. He was taken home and remained unconscious eight days. There was no external wound. After recovering consciousness, it was observed that his memory was much impaired, regarding all occurrences of his previous life, for several weeks. This loss of memory was only transient; he gradually regained his mental power, with the exception of the names and appellations of different objects, which still bother and

confuse him in conversation. About seven weeks after the accident, he was constantly troubled with double vision. Strabismus internus of the left eye was developed, and was very troublesome at first, but slowly seemed to get better.

The objective examination which I conducted, with the assistance of the oculist, Dr. Chas. Barck, demonstrated the following condition on the day of his reception at the hospital: Strabismus internus paralyticus; memory still deficient; complains of a heavy feeling of pressure in his head, and finds it difficult to think. There is a depression over the left temporal bone, extending upwards to the anterior inferior angle of the parietal bone, which is so deep that the index finger could be easily buried in it.

I determined to cut down and elevate the depressed bone, and, accordingly, on the 13th day of July, with the assistance of Drs. D. V. Dean, L. Bremer, O'Reilly, C. Barck, and others, proceeded to perform the operation. (See Figs. 1 and 2.)

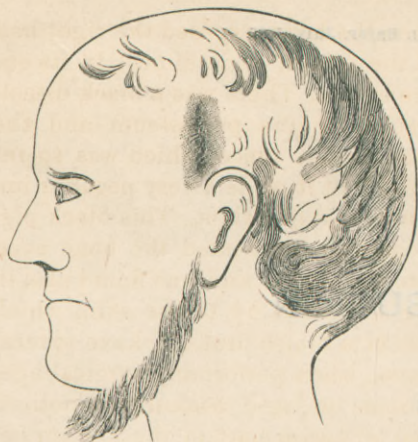


Fig. 1.—The depression just above the ear, as found in Case I.

The left side of the head was shaved, and thoroughly cleansed with five per cent carbolic acid solution. I made an angular incision, lifting the flap in the manner shown in Fig. 2.

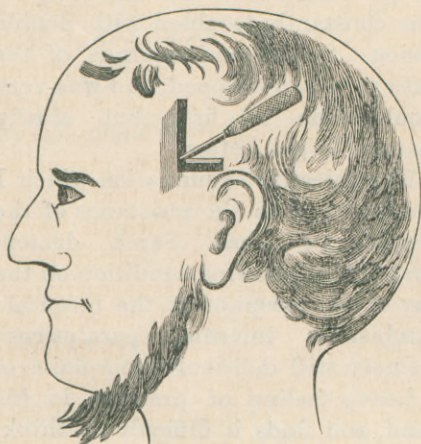


Fig. 2.—In the L shaped groove which has been made by the chisel, is seen the elevator in position for lifting the depressed portions.

The anterior margin of the fractured bone was found completely depressed under the posterior portion, and the fracture was firmly united by completely ossified callus. By means of small dental chisels, I carefully cut out about one-fourth of an inch of the callus and margin of the fracture the entire length of the depression, and by means of an elevator succeeded in

raising the depressed bone nearly to its normal position. During the entire operation, the field was kept constantly irrigated with a solution of boric acid, four per cent. I stitched the flap, which consisted of skin and periosteum, into its place by fourteen fine silk sutures. Four catgut strings were left between the edges in such a manner that they could be drawn out in case there would be any suppuration under the flap. The wound was dressed with antiseptic gauze covered with rubber tissue.

The wound united completely by first intention, there being no secretion of any kind, in six days. There was no elevation of pulse or of temperature. Patient declared that he felt "lighter," had lost the feeling of pressure in his head immediately after the operation.

He was dismissed on the 24th day of July, the strabismus having decidedly decreased. The symptom of double vision is not cured, but the double objects are seen closer together than before the operation. The depression in the skull is very slight.

On the 30th day of August, patient came to the city again, and we found him much improved, feeling free from the pressure in his head, memory nearly normal, and speaking without difficulty. Strabismus and double vision almost disappeared.

Case II.—Mr. E. Z., from Belleville, Ill., was injured while at work in a coal mine. He struck his head, the right frontal bone from near the glabella to the juncture with the parietal bone, lacerating the scalp and scraping the periosteum from the bone. The outer table was probably not fractured, but the inner table was cracked, as we afterwards found at the operation. After this accident he was a constant sufferer from a most dis-

troubling pressure in his head, was constantly in fear of becoming insane, and was totally unable to do work of any kind. He had no symptoms of paralysis, but a glance at his face clearly proved that he was suffering some distressing agony. He had the peculiar, restless, wild and weird expression of the countenance which so frequently accompanies certain forms of mental disease.

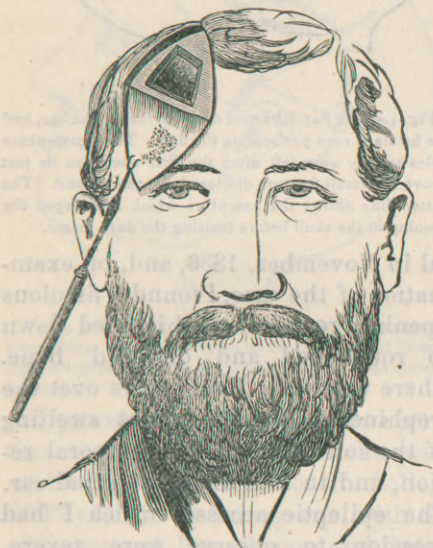


Fig. 3.—The pigmentation of the periosteum is seen on the turned down flap, as well as the size and shape of the defect produced by the operation.

About a year after the accident, in September last (1886), the patient came to the Pius Hospital for the purpose of submitting to the operation of craniotomy. I told him that the operation would be explorative, and that I could promise him nothing but that the surgical procedure would not in any way injure him.

In the presence of the senior class of the College of Physicians and Surgeons, and with the assistance of Drs. A. H. Ohmann-Dumesnil and J. B. Glancies, I made a semicircular incision around the scar on the patient's forehead, and turning the flap, which, as in the former case, included the periosteum and all soft parts, back

upon the head, exposed the right half of the frontal bone almost in its entire extent. There was a black discoloration of the periosteum and the bone at this place, which was so intense that it made a very peculiar impression at first sight. This black pigmentation permeated the bone even into the diploë, and was found also in the soft parts up to the skin, which was of a bluish tint. I have several times, when performing surgical operations on aged coalminers, noticed that whatever part of the system becomes the seat of disease, particularly of an injury the repair of which is associated with the formation of scar tissue or connective tissue thickening, will be found of a deep black color when the epidermis is removed. It is no rare thing to find the spleen, the lymphatic glands and the lungs of a solid black at post mortems of veteran coalminers. The latter condition is called *pneumonokoniosis anthracotica* by pathologists. In my case I can account for the black pigmentation on the supposition that the so-called "wander cells," which everywhere permeate the intercellular spaces of connective tissue, carry particles of pigment, which become stationary when the cells themselves assume a permanent function as spindle-shaped or round elements of scar tissue. With a chisel I worked a ditch through the outer table and diploë, of the size and shape which seemed requisite to cover the seat of the injury. After this was done, I found a soft place—a defect in the inner table—at a point near the superior median margin of the ditch, and by introducing the end of the elevator, between the dura mater and the inner table, I was enabled to lift the entire piece of bone from the dura mater, the vitreous table being very fragile. The lower surface of this rhomboid piece

of bone, corresponding to small granulations upon the dura mater, was roughened. I scraped these from the dura with a curette, leaving this membrane uninjured. The wound was treated exactly as in Case I. It healed by first intention. The result in this case was not as satisfactory as could be desired, and I do not think now, about eight months after the operation, that the patient was benefited much beyond being slightly relieved of his headache and sleeplessness.

Case III.—George Köhler, aged sixteen, received a compound fracture of the temporal and parietal bones, by the teeth of a cogwheel, while at work in a nail-mill in Belleville, Ill. The wound was dressed and attended to in the usual manner by some of the best physicians in that city. Soon after the accident, the boy, a good steady worker and a favorite with his employers, was seized with maniacal attacks, and by very frequent and severe attacks of screaming epilepsy. These attacks were sometimes as many as twenty per day, and he was sometimes delirious, or in a state of frenzy, for several days and nights at a time, during which he became almost unmanageable, very violent, and refusing to take food or medicine.

During this condition the boy was trephined, two buttons being removed. These buttons were small, not much larger than a silver dime. The operation was performed by Dr. Perryman, of Belleville, I am told. The operation of trephining was undoubtedly justified and indicated by the symptoms. After this operation a slight improvement seems to have taken place for a few hours, but the patient soon relapsed into his former condition, the epileptic seizures being very violent and frequent.

He was brought to the Pius Hospi-

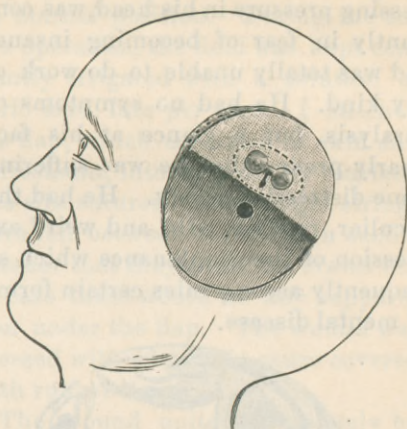


Fig. 4.—The flap is turned down covering the ear, and the fistula is seen perforating the flap. The two trephine holes as they were left after the first operation lie just above the small fracture disclosed by the second. The dotted line shows the extent to which I enlarged the opening in the skull before incising the dura mater.

tal in November, 1886, and, on examination of the case, I found a fistulous opening remaining, which led down to roughened and diseased bone. There were two linear scars over the trephine openings, a slight swelling of the soft parts in the temporal region, and in that of the external ear. The epileptic accesses which I had occasion to observe were severe, throwing the boy into violent convulsions. He complained of a constant severe headache, and was troubled with painful cramps in his hands and feet almost every two or three hours. His general health was beginning to be impaired; he became paler and weaker day by day. Before attempting to give relief by a surgical operation, I called in the well-known neurologists, Drs. Wm. B. Hazard and Ludwig Bremer, to see the case, and kept the boy under careful supervision for about ten days. The two experts, independently of one another, came to the conclusion that a further and more thorough exploration of the injury should be made; both said that they could see no other hope of curing the case. They also recommended

opening of the dura mater, in case no cause for the trouble could be found in the more external parts, and both thought that there might be a blood-clot or a brain-abscess, which might only be gotten at by opening the dura mater and searching for it.

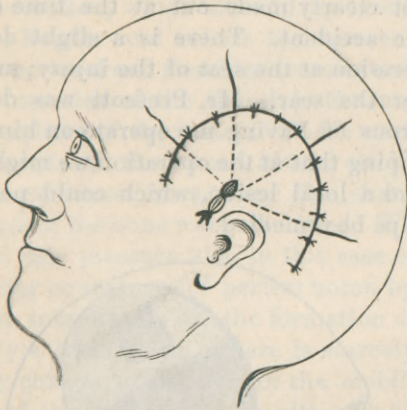


Fig. 5.—The flap is replaced and fixed by sutures. Four catgut drains are drawn under the flap and twisted together after they were conducted to the outside through the fistula.

I proceeded to perform this operation on November 14th, in the presence of the senior class of the College of Physicians and Surgeons, with the assistance of Drs. Graves and Ostertog. The incision was made along the temporal line, beginning near the mastoid process and extending entirely around the temporal muscle, and was over six inches long. The periosteum and all the soft parts were pushed down, exposing the *planum temporale*, which was the seat of the injury. The holes left by the two buttons which had been removed were now readily seen, and were partially filled up with granulation tissue; the bridge of bone separating the two had been partially removed. Just below these there was a depressed and fractured piece of bone, which had been overlooked at the former operation. I chiseled this away, and also enlarged the trephine holes with the chisel, and scraped away the granulations

from the dura mater. This being done, the dura was seen to bulge out considerably through the opening in the bone, and the bulging portion gave a clear sensation of fluctuation to the fingers. I next made an incision about an inch long through the dura. This was followed by a phenomenon which I have never seen before, and which was most alarming. The flow of cerebro-spinal fluid was so copious that for fully ten minutes the entire field of the operation was flooded with this clear liquid. The flow was uncontrollable by sponges. The brain was seen to be normal; the pia mater not opaque, thickened or hyperæmic. After perhaps ten ounces of the cerebro-spinal liquid had escaped, the brain receded into the cavity, and actually appeared much too small to fill out the skull. The clear liquid still oozed out, and I succeeded in stopping it only after a very careful suture of the dura mater with seven sutures of the finest catgut.

At this time, the patient being deeply chloroformed, his pulse was 120—regular, but weak; respiration 24. I used a 1-2000 bichloride of mercury solution, with which I flooded the whole wound for fully ten minutes after the opening in the dura was sutured, and while I closed the flap wound. I drained it through the little fistulous tract, which was thoroughly curetted, in the manner shown in Fig. 5, by means of four thick strings of catgut.

The wound was dressed with bichloride gauze covered with rubber tissue, the whole held in place by a ten-yard gauze bandage. The object of the rubber tissue, which was carefully adapted and covered the moist gauze on all sides, was to keep out the air, prevent drying of the dressings, and thus insure drainage along the catgut strings into the moist gauze.

The external gauze bandage, of course, soon became dry, thus making a very secure and comfortable dressing for the head. This kind of dressing should be employed in all scalp wounds, especially if there is a suspicion of an injury to the bones of the skull.

This boy made a splendid recovery from the severe surgical operation. There was absolute union by first intention. His cramps in the hands and feet were relieved; his headache much improved; but, unfortunately, his epilepsy continued at intervals of a few days for several months.

On Sunday, June 7th, 1887, I last heard from the boy, and his mother reports that he has been at work for three months without having an attack of epilepsy at all. She thinks he is improving in many ways. The fact is undeniable that at the present time the boy is better than at any time since he was injured; but I dare not offer an explanation or try to account for the cure, as this would be mere guesswork, considering the very complicated factors in the case.

Case IV.—Mr. Prescott, a highly educated gentleman, teacher of telegraphy, fell down a high flight of stairs, while going to his room on a dark night, striking his head on the left side, near the vertex. He was in good health up to that time, sometimes a little jovially disposed, fifty years of age, single, and gives a good family history. Since this fall, symptoms of progressive muscular atrophy are developing in him in a marked manner. The muscles affected are chiefly the pectoral muscles, the extensors of the hand and fingers, and the interossei, also the extensors of the leg and of the toes, as well as some other muscles of his lower extremities in a less marked degree. He

can not walk without assistance, nor can he use his upper extremities even sufficiently well to put on a shirt. His right side seems to me slightly more affected than his left.

The injury to his scalp healed up well, and a fracture of the skull was not clearly made out at the time of the accident. There is a slight depression at the seat of the injury, under the scar. Mr. Prescott was desirous of having me operate on him, hoping that at the operation we might find a local lesion, which could perhaps be remedied.

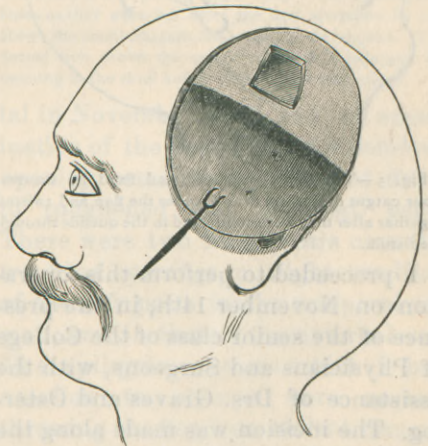


Fig. 6.—The size and location, as well as the shape of the defect in Case IV, are seen above the deflected flap.

On Sunday, May 15th, 1887, with the assistance of Dr. Dalton, the superintendent, and the staff of the City Hospital, and of my private assistant, Dr. W. V. Kingsbury, I removed a portion of bone about an inch and a-quarter square from the skull, at the seat of the injury. The incision of the soft parts was made as in the former case, but in this instance I used a circular saw, mounted in a dental engine, for the purpose of making the incisions in the bone. This instrument works admirably, and I have used it for trephining in cases where there was no traumatism as a cause of brain disease, in several instances, with good

effect.* The instrument can not be used to finish the removal of the piece of skull, but after sawing through the diploë the fine chisels must be used to finish the division of the bone down to the dura mater. We found some few little granulations on the dura mater, over the ascending parietal convolution, which are said by Horsley, Ferrier and others to represent the pectoral and shoulder muscles and the muscles of the thumb in the motor sphere of the cortex. These were scraped off, the wound closed as in the previous cases, after the sharp edges of the bone were smoothed. We had the pleasure also in this case of seeing an instance of perfect union by first intention, with the formation of only a linear scar. There is scarcely any change perceptible in the mobility of the patient's limbs, although he himself fancies a slight improvement. Only five weeks have passed since the operation, and it is too early to judge of the effect of the operation.

The four* cases above briefly related are instances of what the old surgeons called capital operations. These operations were considered to be very dangerous, and, indeed, from the statistics and mortality tables of trephining in civil cases in European hospitals, it is found to be quite formidable. In a list of sixty cases of trephining, on account of epilepsy, done between 1858 and 1868, I find that ten died from the effects of the operation, either pyæmia, phlegmonous inflammation or erysipelas being given as the causes of death.

In commenting upon the result of my own cases from a surgical point of

view, the question of the influence of the "Antiseptic Method" very naturally comes up. During the past ten years I have been practicing surgery with the especial intention of testing and comparing, in my practice in chosen cases, the results to be obtained by following conscientiously two different methods. In one set of cases I employed as a dressing and as a wash during the operation only water and such substances as had been thoroughly cleansed by the use of hot water, the instruments being cleansed by means of steaming hot water, and my hands also being purified by water only, such as can be drawn from any hydrant in this city. The other set of cases were operated upon with perfect antiseptic precautions, the instruments, sponges and dressings, as well as my hands, being thoroughly cleansed before the operation in the carbolic acid or the bichloride solutions. The operating room was also subjected to the strictest kind of antiseptic processes of purification, using the most approved methods and the most powerful disinfectants. While studying in Europe, from 1872 to 1878, I had ample opportunities of learning the antiseptic methods in their minutest details, and I often employed the original Lister dressing, having been taught its application in Heidelberg by Mr. Lister himself, who visited the surgical wards of my teacher, Prof. Simon, during the spring term of 1875. The experiments of Pasteur, and, in fact, all that was known about putrefaction and the spreading of disease by means of germs, were studied and practically demonstrated by me in such a thorough manner that I may say I had the qualifications which are necessary to properly conduct the practical series of experiments indicated above.

* Besides the four cases here related, I have performed craniotomy four more times in cases of obscure cerebral diseases not due to traumatism. In all of these the operation was successful, the wound healing up in every instance. In one case, only, death followed within a month, and was due to the original cerebral disease.

Without entering into details, I will state the conclusions to which I have arrived :

1. *By the use of the antiseptic method an open wound can be made to resemble a subcutaneous one, in several respects; especially can it be made to behave like a subcutaneous wound during the process of repair.*

2. *The advantage of the use of antiseptics in surgery is in exact proportion to our ability to make wounds subcutaneous, or like unto subcutaneous lesions, by this means.*

3. *The results of different operators with the antiseptic method will depend on the greater or less ability and ingenuity, which each surgeon can bring to bear, towards fulfilling the desideratum expressed in the previous propositions.*

4. *The use of antiseptics in the practice of surgery is not an essential element of success, since success can be achieved without their use.*

5. *The use of antiseptics in the treatment of surgical cases, by general practitioners of medicine, is to be commended, since there is greater danger of infection of a wound by the general practitioner than by a person devoting himself exclusively to a specialty.*

The following simple directions, if followed carefully, will be sufficient as a guide for the application of an antiseptic dressing to any ordinary wound, such as, for instance, an amputation of the leg.

The cheapest and best antiseptic fluid is a solution of bichloride of mercury. This should be used profusely on the limb before the operation, in order to cleanse the skin and hair of all dirt and blood or other extraneous material which may be present. The simplest way to prepare a solution is by using the antiseptic tablets which have been prepared by some of the manufacturing chemists.

These tablets* are so arranged that by dissolving them in a given quantity of water they make a solution of a certain strength. For general use, 1-4000 is the proper strength, and large quantities of this should be prepared before beginning the operation. Three basinsful, each containing a gallon or more, will usually suffice. The sponges should be immersed in one, the instruments and silk or catgut in another, the third being kept for use during the dressing after the operation has been finished. It is a good plan to keep the whole wound constantly irrigated with the bichloride solution during the operation, the object being to let the fluid penetrate into all the recesses of the wound and fill up the spaces between the muscles and the sheaths of the tendons, etc. After the flaps have been united by sutures and a drainage tube introduced in a proper manner, the stump should again be thoroughly washed with the bichloride. No matter what may be the method of treating the hemorrhage during the operation, let the whole stump or wound, before and after the bleeding has been controlled, be constantly irrigated with the bichloride solution. This irrigation is best accomplished by letting the solution constantly flow out of a fountain syringe (irrigator), or by constantly squeezing it out of sponges into the wound.

The dressing is begun by applying an eight-fold layer of moist gauze over the wound, so as to entirely cover

* Parke, Davis & Co., of Detroit, have prepared some tablets, which, for ready solubility in ordinary well or hydrant water, are the best known to me. They are prepared by triturating the bichloride of mercury with citric acid, the object being to make the solutions permanent, so that the bichloride will not be precipitated by the salts of lime usually contained in the water.

it up.* I have dispensed with the use of the protective silk strip, as being useless, and can not recommend it at all. The whole wound, which is covered by the gauze, is now to be carefully covered by a piece of rubber tissue which has been thoroughly immersed in and disinfected by the bichloride solution. This rubber may be supplanted by oiled silk or Mac-Intosh cloth, but in all cases the essential point is that the impermeable tissue be larger than the gauze and overlaps it several inches on all sides. The whole is held in place by bandages so applied as to hold the rubber tissue down upon the healthy integument all around the parts covered by the gauze. (Fig. 7.) This acts so as

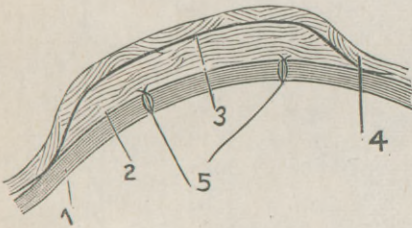


Fig. 7.—This shows a simple antiseptic dressing as recommended by the author for general use. 1: the skin. 2: the layers of gauze. 3: the rubber tissue. 4: external bandage. 5: stitches in the skin.

to exclude the air and keep the wound in an aseptic moist chamber, thus securing perfect drainage and an equal temperature all the time. The dressing may be left untouched for several days; in fact, I have, upon several occasions, applied plaster of Paris splints over this kind of dressing, in compound fractures, and have waited six days before cutting a fenestrum into the splint.

* I take pleasure in recommending to the profession, for this purpose, the gauze prepared by the *Myron E. Meyer Manfg. Co.*, of Milwaukee, Wis. All the antiseptic goods made by this firm are of superior excellence. Their antiseptic gauze is superior to any now on the market, both in the quality of the gauze itself, which is white and absorbent, and because it is put up in sealed cans, so that it is always moist, and the antiseptic qualities of the chemical used are sure to be active in their full strength.

After a surgical operation I find my thermometer the most indispensable instrument, and I rely entirely upon it to guide me as to the time when a change of the dressings becomes necessary. A rise of temperature above $101\frac{1}{2}^{\circ}$, in my estimation, is an imperative indication to change the dressing, whether the patient complains of pain or not. The pulse is not a reliable guide in this respect, and is only of importance when it rises simultaneously with the temperature.

After the first dressing has been removed, an exactly similar one should be reapplied, the wound having been thoroughly irrigated with bichloride solution. The tablets above mentioned will be found most convenient and time-saving for making the necessary solution, especially in private practice.

The four cases above described, all of which healed by first intention, without fever or pain, were treated according to the method given, and I feel sure that no better results could have been attained by any other. All of the four patients are living, and those that were not greatly benefited directly by the operation, were at least not injured. From my own experience, I am led to the conclusion that: The operation of explorative craniotomy by means of chisel and saw, with antiseptic precautions, ought to be recognized as a perfectly justifiable procedure, where a diagnosis can not be made without it, in many cases of obscure brain disease. This operation will most assuredly be the source of saving life, and is certainly not more dangerous than explorative laparotomy.

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