

the flavine solution, and after incubation loopfuls were sown into broth and on to agar. Results:—

Flavine solution used.	Flavine strength in mixtures.	Result after incubation of subcultures.			
		24 hours.		48 hours.	
		Broth.	Agar.	Broth.	Agar.
1: 100	1: 200	—	—	—	—
1: 500	1: 1,000	+	+	+	A few cols.
1: 1,000	1: 2,000	+	+	+	—
1: 10,000	1: 20,000	+	+	+	—
1: 100,000	1: 200,000	+	+	+	—

Here even 1:200 flavine did not completely kill the staphylococcus in the pus, judged by the agar subculture (I believe that on the whole agar is a better culture medium than broth for disinfectant experiments); or if we take the broth subcultures, then the germicidal strength lies between 1:200 and 1:1000.

All the mixtures of flavine in the foregoing experiments were incubated for 24 hours before subculturing, unless otherwise stated.

Conclusion.

From the foregoing experiments the germicidal value of flavine comes out very much lower than that stated by Browning and his co-workers. The difference between the two sets of results is probably due to the use in my experiments of a number of organisms much larger than that employed by Browning and his co-workers. The result with pus is particularly poor and many disinfectants equal or surpass it and have the advantage of a much more rapid action.

Addendum.—The above note was written before the appearance of Mr. Alexander Fleming's paper in THE LANCET of Sept. 1st (p. 341) and no alteration has been made in it. It will be seen that both in our criticisms and in the results of our experiments there is a general agreement between Fleming and myself.

THE OPEN-FLAP METHOD OF TREATING PERFORATING BRAIN WOUNDS.

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EVER since the early days of the war, and more especially before the introduction of steel helmets greatly reduced their number, the problem of how best to handle perforating wounds of the brain has been of absorbing interest. The great question following the recovery of the patient from the initial shock resolves itself into our ability to assist nature in isolating the infected area during the period of repair.

Though much has already been written on this subject, I wish to present for consideration a simple method which, so far as I am aware, has not been used outside No. 1 Canadian General Hospital. It is one which in the hands of those of us here—Major Mackenzie Forbes, Major S. R. Harrison, Captain Johnson, and myself who have used it—has given most consistently gratifying results. It is based on sound elementary surgical principles—to wit, unobstructed drainage and minimum interference with the damaged parts, not only at the time of operation, but during the subsequent weeks of healing. Major Forbes, since returned to Canada, was the first to suggest two years ago the leaving down of the flap, but the technique as developed since has been radically changed and simplified.

Description of Method.

The first step in the operation consists in the turning down of a good-sized flap of scalp with perichondrium sufficient to expose freely the whole area of bone injury. This flap should, if possible, include the infected wound of entrance.

Next, the wound in the bone is enlarged, all depressed fragments being removed, and in addition a margin of healthy dura surrounding the damaged portion of the membrane is exposed. The wound in the dura and brain is disturbed as little as possible. Foreign bodies, metal or bone, are only to be sought for if shown, by localising X rays, to be quite superficial. The opening in the dura, if small, should, when the brain is much damaged, be freely

enlarged by radiating incisions extending, if need be, to the limits of the bony opening, thus obviating any subsequent constriction of the neck of the hernia cerebri which develops.

The next step in the operation is most important. A strip of iodoform gauze is firmly inserted between the dura and the overhanging edges of the bony hole. The action of this is two-fold. It, in itself, primarily shuts off the general meningeal space from the infected wound, and subsequently stimulates the formation of the natural barrier of adhesions between the coats of the dura. A loose pad of fluffed iodoform gauze is then lightly packed over the whole denuded area.

The scalp flap may then be loosely replaced over the gauze, or it may, if considered desirable, be held down (or up) out of the way by one or two silk worm sutures. The outer dressings are of plain gauze moistened with saline or boric solution, and should be changed twice daily. The iodoform gauze must not, however, be disturbed for from five to seven days. At this date hernia cerebri will be found well developed, and not infrequently, enmeshed in the gauze, will be found small fragments of bone which at the time of operation were buried deeply in the soft substance of the brain, but which have, as Sir George Makins suggests, been extruded by intracerebral pressure along the path of least resistance.

Cerebral Herniæ.

Just a word here on the subject of cerebral herniæ. Opinion is divided as to the chief causes of their formation in these cases; some claim that it is entirely due to reactionary increase in the quantity of the cerebro-spinal fluid, and advocate lumbar puncture. Personally, I do not believe that this is the chief factor, and my experience of puncturing, done with the object of expediting recession of the hernia in two of the cases which I shall presently report, was not conducive to a repetition of this treatment. Moreover, it is practically not indicated when this technique is followed, since the intracerebral pressure does not unduly rise, if one may judge from the results of frequent fundus examinations. In no case was there more than 1 diopter of disc-swelling at any stage, and usually much less. Although having no microscopic proof, I incline to the view that the hernia in these cases is largely produced by an analogous process to that which occurs in other parts of the body during the healing of a wound—i.e., local increased vascularity, inflammatory cedema, and round-celled infiltration.

Whatever be the cause, the fact remains that we can confidently prognosticate the projection of a portion of brain through the wounded dura in the form of a more or less necrotic mass of varying dimensions, except in those cases which are previously overwhelmed by the gravity of their local lesions. What, then, happens to this tumour mass if, as was often the case, the flap be re-sutured at the time of operation, with or without the use of drainage-tubes? In a large number that I have seen—not, fortunately, in all—there was a latent period of from seven to ten days' hopeful convalescence, followed by a sudden rise of temperature and early death from general meningitis. The post-mortem findings in these cases showed, beside the picture of a spreading purulent meningitis beginning from the wound margins, that the soft necrotic brain matter composing the hernia had spread out beneath the skin-flap and, being an ideal medium, had through contact with the wound margins become virulently infected, with the result that the limiting adhesions formed by nature had not been sufficient to localise the infection.

The subsequent conduct of the case is simple. The deep dressing need only be changed bi-weekly. The hernia reaches its maximum size about the end of the second week and then begins slowly to recede, so that in from four to six weeks it no longer projects above the level of the bony parts, and the whole wound will be found to be covered with healthy granulation. The skin flap may now be safely replaced. Owing to its elastic retraction it may require a little patience to loosen thoroughly both it and the opposing skin margins to effect good apposition.

Results: Illustrative Cases.

I regret that I am unable to give full statistics covering the actual number of cases that have been treated by this method in our hospital—well over 50 to my personal knowledge—but the results, both as to life-saving and ultimate

restoration of function, have unquestionably proved far better by this than by any other method adopted here.

The following four cases will serve well, however, to demonstrate what may confidently be expected if this technique be followed. They are selected because of the fact that three of them, in addition to cranial wounds, were complicated by compound fractures of the frontal or fronto-ethmoidal sinuses, thus opening up an additional tract for infection, while the fourth case is that of a rare lesion of the base of the skull involving the cerebellum.

CASE 1.—Private E. F., aged 32, was admitted on Oct. 16th, 1916, having been wounded four days previously. Examination showed a large irregular oblique perforating wound of the right forehead, starting $\frac{1}{2}$ inches above the centre of the eyebrow, and running to almost the inner end of the same. The parts around were swollen, and soft brain matter was exuding from the wound. The right eye was proptosed, out and down, with very limited motion; vision was reduced to recognition of the figure at 4 feet. Nasal breathing was obstructed. The mentality was clear, but the patient was depressed and anxious; he complained of constant frontal headaches. X-ray—two directions—showed a large hole in the frontal bone with presence of large foreign body in post-nasal cavity, which was removed with difficulty, on account of its size, through the naso-pharynx and mouth. Operation next day. A frontal flap was turned down; the frontal bone was badly comminuted, involving, in addition, both plates of the frontal sinus. The roof and inner wall of orbit, with right ethmoid cells were disintegrated. The flap was replaced on Nov. 22nd, five weeks after primary operation, and the wound healed without suppuration.

The functional results in this case were particularly gratifying, both as regards sight and brain function, and for two weeks before discharge to England the man was able to do light hospital duty.

CASE 2.—Lance Corporal D., aged 20, was admitted on Sept. 19th, 1916. Examination showed a through-and-through wound of the head, entrance in front of the right ear, exit about the middle of the forehead, half an inch above the level of the eyebrow. The patient was rational, but very low-spirited—"wants to die." There was constant frontal headache, the right eye was destroyed, and soft brain was oozing from the frontal wound. X-ray of the head was negative for foreign body. In this case a single flap could not be used, so, after removing the eye, an incision similar to that used in the radical frontal sinus operation was made and the soft parts retracted.

In this case the large hernia had receded and the wound was closed six weeks after the primary operation. It is worthy of note, however, that it was found much more difficult to close than those cases where a good-sized single flap had been utilised. The functional recovery was complete except for the loss of his eye.

CASE 3.—Private W., aged 21, was admitted on Nov. 7th, 1916. Examination showed a small, perforating wound half an inch over the centre of the left eyebrow, with soft brain and fluid exuding. At the operation it was found that the wound in the frontal bone communicated with the frontal sinus, which contained a quantity of bloody offensive pus. A fissured fracture of the inner table of the frontal sinus extended down to the infundibulum. In this case, in order to determine whether lumbar puncture might hasten the recession of the hernia, on the fourteenth day after operation 15 c.c. of fluid were drawn off; no immediate result was observable, but on the next day there was marked reduction in the size of the hernia, and by the sixteenth day not only had it disappeared, but it had become a negative quantity, so that, in lieu of a tumour, there now presented a distinct cavity in the anterior lobe of the brain, the size of a pigeon's egg. The patient at this time complained of severe recrudescence of headache and his general disposition became markedly depressed. Nothing was done except to dress the cavity daily, and by the twenty-fourth day it had become almost occluded by approximation of its walls. On Dec. 7th, four weeks after operation, the flap was re-sutured. In spite of the fact that the bone over a considerable area beneath the flap appeared dry and dead-looking, primary union occurred.

CASE 4.—Private D., aged 24, was admitted on Nov. 15th, 1916. The patient had had an operation at a casualty clearing station, and the wound had been sutured. The diagnosis received was shell wound, cerebellum, right; fragment of shrapnel removed. Two days after admission he complained of increasing headache, and the wound broke down in the centre, discharging soft brain matter. In this case a posterior flap was turned backwards, and held in place by sutures. Hernia of the cerebellum, much disorganised, was found to be present beneath the skin flap. In this case, on the eighth day after operation, there was a thin fragment of bone extruded into the dressing an inch and a quarter long and a quarter of an inch wide. This patient also was subjected to lumbar puncture at the end of the second week, with similar results, though not so extreme, as in the last-quoted case. The hernia did not entirely disappear, but there was marked disturbance of the patient's *bien-être*, with recurrence of headache and leakage of serum, which I attributed to the traction on the protective barrier of dural adhesions around the bony opening. The flap was successfully closed at the end of the fifth week, at which time there were no functional evidences of cerebellar anomaly.

AMBULANCE TRAINING IN INDIA.—From a statement issued by the headquarters of the St. John Ambulance Association in Simla it appears that during the nine months ending June 30th, 1917, the St. John Ambulance Association in India and Burma instructed 11,955 persons in first aid to the injured, 787 in home nursing, 1216 in home hygiene, and 66 in sanitation. Of these 5962 have been awarded certificates, 165 vouchers, 55 medallions, and 27 labels for proficiency in first aid, 417 for proficiency in home nursing, 309 for proficiency in home hygiene, and 35 for proficiency in sanitation.

A NOTE ON MEDIASTINITIS AS A CAUSE OF HEART FAILURE.

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AFTER a massive gunshot wound of the neck, resulting in a gangrenous cavity which involves most of one or both anterior triangles, the possible causes of death are obvious; such are secondary hæmorrhage, septicæmia, or, if the air-passages are involved, septic pneumonia. In these cases it is not necessary to invoke a spreading infection in the cervical fascial planes to explain the result. In a second class of case a cellulitic spread of infection must be admitted, and is indeed apparent. I refer to small wounds which, communicating with the retropharyngeal space, initiate a retropharyngeal infection with or without a macroscopic abscess. In such an event a spread by the fascial planes is prevented and combated by surgical drainage. And drainage at this level, in the upper and mid-cervical region, is fairly easy. But it is otherwise lower down, as we approach the thorax. And there is another, third, class of case, much more distressing and difficult to deal with, to which this present note has reference.

A patient arrives with a truly insignificant wound anywhere about the neck—so insignificant that, at first glance, surgical intervention would hardly be considered. There are no signs, local or general, of inflammation. But, consistent with an increasing difficulty in swallowing or breathing or both, stereoscopic skiagraphy shows a foreign body, which, though quite small, is very deeply placed. The signs of pressure persist and increase, and so the foreign body is removed. In less than 48 hours the pulse and respiration rate have increased alarmingly, and in fits and starts. This, with an erratic temperature, is the only sign that things are going wrong. But adequate surgical drainage and cardiac stimulants are unavailing. And in a day or two, without having even looked ill or lost his colour, the patient dies.

The medical officer, before he sees the autopsy, would excusably explain such a clinical history by assigning the cause of death to (1) shock, (2) septicæmia, or (3) heart failure. Let us briefly consider these.

1. *Shock*.—Due to what? If to the injury, it may be asked why the patient was so well when first seen. If to the operation, it may be stated that this was neither extensive nor lengthy enough to cause shock, which, moreover, is hardly consistent with the fact that his tachycardia and rapid breathing alternated with periods of nearly normal pulse and respiration rate, that until the end his colour remained good, and that his temperature was irregular, not consistently low.

2. *Septicæmia*?—The patient may have died before there has been time to search for organisms in his blood, so this explanation is supposititious.

3. *Heart failure*?—That this has occurred is clinically obvious; but why should the heart have failed?

Of the following three cases the salient features are quoted, without details, to illustrate the onset of vagitis.

CASE 1.—Private, admitted August, 1916, with a small clean incised wound 1 inch long over the thyroid cartilage. Except for this the whole neck was, and remained until death, normal. Temperature was intermittent up to 101° F., pulse up to 100. Respiration rate hovered around normal, but dyspnoea and hoarseness were constant and increasing. Lungs and heart were normal. Aided by skiagrams, a piece of shrapnel casing, 1 inch by $\frac{1}{2}$ inch, was easily removed from over the left lobe of the thyroid gland, just below the level of the cricoid cartilage, deep to the infrahyoid muscles, at about the point where the recurrent laryngeal nerve passes beneath the inferior constrictor muscle. The operation wound was dressed with very light packing of ribbon gauze and resulted in instant relief of symptoms. On the second day pulse and respiration rate rose so fitfully that it was difficult to chart. Cardiac stimulants proved useless; he died on the third day.

The operation wound down to the oesophagus was found to be quite clean. In the prevertebral space there was a layer of purulent lymph from the thyroid cartilage to vertebra D. 2 involving both vagi.

CASE 2.—Private B., admitted August, 1916. A shrapnel bullet which had entered behind the angle of the left mandible and traversed the mouth and palate was removed from the right antrum. The entrance wound, which was directed inwards to the prevertebral region, was kept dressed with saline; the patient's condition precluded any exploration under an anæsthetic. Temperature was intermittent up to 102° F. Pulse varied from 100 to 140. Respirations varied with startling suddenness from 20 to 60. From the second day until his death the left pupil was widely dilated to 12 mm. with no reaction to light. Lungs and heart were normal. He died on the fourth day.

There was a thin layer of purulent lymph in the prevertebral region of the left side from the pharynx to vertebra D. 3; this involved the left vagus and sympathetic. There was no macroscopic retropharyngeal abscess.