FURTHER CASES OF PERFORATING GUNSHOT WOUND OF THE SKULL.

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The following notes of cases and comments thereon constitute a continuation of the two cases reported by me in the August number of this Journal.

Case 3.—Private P. C., Nesbitt’s Horse, wounded at Philippopolis on October 22, 1900, at a range of about 100 yards, with a Mauser bullet. Remained semi-conscious and did not speak for three days. Admitted to No. 12 General Hospital, at Springfontein, five days later, when he was found to have motor paralysis of the right arm and leg, with paresis of the right side of face and exaggerated right knee-jerk. These symptoms were accompanied by Jacksonian seizures, commencing in the right side of the face and involving all the right side of the body. He had ataxic aphasia, understanding all questions, but giving wrong answers. The entrance wound was 1 inch posterior to a vertical line CD (see fig. 1), drawn from the apex of the left mastoid to a point $\frac{1}{2}$ an inch behind the centre of AB, viz., at C, and...
4 inches above the mastoid apex. The exit wound was 3 inches above the external occipital protuberance, and 1 inch to left of the median line. No depression of bone could be felt between these wounds, which were septic. On October 31 the scalp was divided between the wounds, and another incision carried across at right angles. No fracture was found to exist. A trephine disc was removed from under the entrance wound, and the hole enlarged with Hoffmann’s gouge. The dura was blue from presence of a clot beneath; after incision about two ounces of clot were removed. The brain then pulsated.

The parts were cleaned and the dura sutured; the wound was closed except at one point, where a small tube was inserted. The patient slept for five hours after the operation, but had two fits the next day. Owing to his becoming violent in the evening chloroform was administered, after which he slept for eight hours and had no fits subsequently. The tube was removed in forty-eight hours and the stitches on the eighth day, the wound being then closed. All paralysis disappeared and speech returned, the man making an excellent recovery. He was sent to the coast on December 12, apparently in good health.

CASE 4.—Private V. B., of the 9th Lancers, was wounded near Dewetsdorp, on April 16, 1901, at an unknown range, by a bullet, probably a Mauser. He recovered consciousness in ten minutes, but found he could not use his right arm. When admitted to
No. 12 General Hospital, Springfontein, on April 18, he was quite sensible, but had complete motor and sensory paralysis of the right arm; but the face and legs were normal and the tongue was protruded straight. He complained of slight headache. The wound was slightly septic and ragged, 2 inches in length, and ran horizontally over the left Rolandic area, slightly above the parietal eminence, from E to F (fig. 2), the point E being 2½ inches vertically above the apex of the mastoid. The scalp only was divided, the bone not being bare. The diagnosis lay between a depressed inner table and a sub-dural clot.

On April 22, 1901, a crucial incision was made over the wound, and a disc of bone removed. A very small clot lay between the bone and the dura mater. The opening was enlarged and the dura divided; about two drachms of blood clot were found beneath and removed. No fracture or depression was visible. The parts were cleaned and the dura mater sutured. A small drain was put in and brought out through the scalp incision, which was then united. The progress of the case was good. On April 23 the arm could be moved voluntarily, and sensation had returned in it; the temperature was normal, and he slept well. The tube was removed in forty-eight hours and the stitches on the seventh day. The wound healed soundly, and progress was uninterrupted. The arm had nearly recovered on May 3, when he was invalided to England.

Case 5.—Private J. R., 1st Argyll and Sutherland Highlanders, was wounded at Magersfontein on December 11, 1899. The case was said to have been operated upon in a field hospital; a scalp flap had been made, but no trephine opening was visible in the vault. He was admitted to No. 2 General Hospital, Wynberg, a few days later. The bullet had struck the skull ¾ of an inch above and to the right of the occipital protuberance and glanced off, causing three small fissures. A disc of bone was removed, and the dura found lacerated. Twelve fragments of bone, mostly of the inner table, were removed from a depth of 1½ inches. The dura mater could not be brought together, a drain was inserted, and one end brought out at the lowest angle of the wound. The tube was removed in forty-eight hours. The wound was completely healed by the twelfth day. The patient made an excellent recovery, and was invalided home on January 31, 1900. He had no paralysis or aphasia at any time.
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Case 6.—Private F. O., 1st L.N. Lancaster Regiment, was wounded at Graspan on November 25, 1899, at a long range (over 1,000 yards). He was found on December 6, 1899, at No. 2 General Hospital, Wynberg, to have a glancing bullet wound 2 inches above the right eyebrow, 1½ inches in length. No bare bone or fracture could be detected; but the wound was septic. On December 12 he had headache, and his temperature was 100·2° F. On December 15 he had rigors and vomiting, and puffiness of the right eyelid was present. His temperature was 103·4° F.; but paralysis at any time was not observed.

On December 17 he was operated upon, the original wound being enlarged at both ends, and a third incision made in a T shape, including the periosteum. A small stellate fracture was found, and a disc of bone removed, which included the fracture. About one and a half drachms of pus were found between the dura mater and the vault, and were removed; the dura was inflamed, but not torn. The parts were cleaned and a drainage tube inserted, but the disc was not replaced; the scalp wound was closed, except at one end for the tube. His progress was good till December 25, when he became drowsy and his temperature went up. The wound was then opened again under an anaesthetic, and a probe passed between the vault and dura, all round the opening; no pus or blood was found. He died suddenly on the morning of December 28, 1899.

At the autopsy, an abscess cavity containing one and a half ounces of pus was found in the right frontal lobe, quite an inch beneath the anterior surface; it had a definite wall, and communicated through a cerebral laceration and a small track in the dura with the space between the dura and the cranial vault, just above the trephine opening.

Case 7.—Private L. G., 2nd Royal Highlanders, was wounded at Magersfontein on December 11, 1899, at a long range. He was admitted to No. 2 General Hospital, Wynberg, a few days later. The bullet apparently entered 1 inch from the middle line, over the coronal suture on the left side, and made its exit 1 inch from the middle line, over the lambdoid suture on the same side. The distance between the wounds was 4 inches and broken bone could be felt under the track of the bullet. On December 15, 1899, the patient was drowsy; both thick and slow in speech, and the pulse 60; his temperature was normal,
and he had complete loss of power in the right leg, arm and lower part of face, with loss of sensation over the same area. The left side was normal.

On December 16 a large semi-circular flap was reflected downwards, exposing a deep "gutter" fracture 4 inches long, which involved both tables, there was also much laceration of the dura and brain. One loose piece of bone, 1 inch square, was removed from near the entrance wound; also several smaller ones from the gutter. When all clots were removed the brain substance exuded. All sharp points of the edges of the gutter were chipped off with Hoffmann's gouge, and many small pieces of bone, found deeply embedded, were removed. The dura could not be brought together by sutures. There was little bleeding. A medium size drain was laid in the gutter and its end brought out at one extremity of the scalp incision, which was closed, except at this point; interrupted gut sutures were used. The tube was removed on December 18, and the wound looked well; sensation had then partly returned in both arm and leg. On December 24 he could move the arm and leg well, and sensation was nearly complete in them. On the same date the stitches were removed, and the wound found nearly healed. No suppuration had occurred. On January 1, 1900, a few twitches were noticed in the right arm, and speech had much improved. On January 30 the twitchings had gone, and he could walk about a little. He was greatly improved, but the grasp in the right hand was weak, and he dragged the right leg. On February 20 he was sent to Netley, the leg and face having almost recovered, but the arm was still weak. His speech was quite normal.

**Case 8.—**Private W. P., 2nd Seaforth’s, was wounded at Magersfontein on December 11, 1899, at a long range, and admitted to No. 2 General Hospital at Wynberg in a few days. On December 17 he was found to have left facial paralysis, complete paralysis of tongue, paresis and partial anaesthesia of the right arm. The legs were normal. He had a "gutter" fracture running horizontally across the centre of the left parietal bone, 1½ inches long, and the scalp was divided over the injured bone. There was slight squint of the left eye inwards. His speech was very considerably affected, principally in the form of motor aphasia. Pulse 40 and temperature normal.

He was operated upon on December 18, and a disc of bone
removed from below the centre of the gutter. Many spiculae were removed, both large and loose, also some clot. The dura, which was not torn, was of a dark blue colour and did not pulsate. The dura was then divided, and a quantity of clot found and removed from the surface of the brain; the latter then pulsated slowly. The dura was not sutured and the disc was not replaced. The wound was then closed, except at one corner for a drainage tube. The symptoms persisted for four days and then rapidly disappeared. The tube was removed in forty-eight hours and all stitches on the seventh day. The wound healed soundly, and the patient regained full power of the tongue and speech, and the facial paralysis disappeared. He was invalided to England on January 31, 1900, with only some weakness of the right arm remaining.

**CASE 9.**—Private H. D., 2nd Royal Highlanders, was wounded at Springfontein on December 11, 1899, at a short range of about 250 yards. His condition at No. 2 General Hospital, Wynberg, on December 23, was as follows: Drowsy and aphasic, with paresis of the right arm; the right leg was normal; the right side, face and tongue were paralysed. He was then having Jacksonian epilepsy. The pulse was normal, and his temperature 99.9°F. A gutter fracture 4 inches long ran through the centre of the left Rolandic area. Operation was performed on December 23. The wound was then suppurating and a pulsating "hernia cerebri" present. The hernia cerebri and many loose pieces of bone were removed; tubes were placed in the ends of the wounds, and the scalp partly stitched up. On the next day the paralysis of the tongue had gone, the aphasia was better, and he had no fits. The temperature was normal. He improved for fourteen days, when the temperature went up, and the discharge became profuse.

A second operation was performed on January 18, 1900, when the wound was opened up and the granulations scraped; pus was seen oozing through a small rent in the dura. A director was passed into the brain for 2½ inches, and an abscess tapped containing one ounce of pus. The cavity was emptied and a tube inserted.

A third operation was performed on February 22, the track into the cavity was enlarged and a flexible silver tube inserted. Progress then was good. The wound healed soundly, and he was invalided on March 30, having recovered his speech, but his right arm was still very weak.
CASE 10.—Corporal W. O., 1st Gordon Highlanders, was wounded at Magersfontein on December 11, 1899, and admitted to No. 2 General Hospital in a few days. The bullet had entered the upper left frontal region close to the hairy scalp, and came out through the left orbit, disorganising the globe of the left eye. He had no paralysis, but his speech was considerably affected.

Operation on December 16.—Two discs of bone were removed from the vicinity of the entrance wound; much depression of the inner table existed, which was raised and removed. The dura was not much lacerated. The wound was closed without any drain. The stitches were removed on the fifth day, when the wound had almost healed. His speech gradually returned and a good recovery ensued. The left lobe was removed at another operation.

CASE 11.—Corporal C., 1st D.C.L.I., was wounded at Paardeburg on February 18, 1900, at a range of 450 yards, with a Mauser bullet. He was admitted to No. 2 General Hospital in a few days, in the following condition: A small entrance wound existed 1½ inches behind, and a little below, the external angular process of the frontal bone on the right side. The exit was ½-inch above and behind the left external angular process. The patient stated he had had much bleeding, and that he saw with his right eye for half an hour, and with the left for an hour after the injury; since then he has been totally blind. He had no paralysis, but had much headache. His progress was good. The wounds healed in a week, leaving proptosis, most marked on the right side, with conjunctivitis of both eyes and edema of the right lids, both pupils being dilated and not responding to light, but the ocular movements were fair. The headache yielded to pot. iod., but his vision did not improve. He was invalided at a later date.

CASE 12.—Private P. P., Imperial Yeomanry, was wounded near Edengburg on March 10, 1901, at a range under 100 yards, with a Mauser bullet. He was mounted when hit, and after falling was dragged along the ground for some distance. He was admitted to No. 12 General Hospital, Springfontein, on March 11, in the following condition: Scratches about the face; headache; pupils equal and re-acting; sensible, but no paralysis was observed. Entrance wound over back of neck, ¼-inch to the right of the median line, small, circular and clean. The exit wound was almost similar, ½-inch below the right malar prominence. He had full movement of
the lower jaw, and no fracture of it could be detected. The buccal cavity was not perforated by the bullet. There was slight ecchymosis behind the right ear and under the right conjunctiva. The wounds were cleaned and sealed with collodion. Progress was favourable till March 17, when his temperature went up to 101° F., with headache, referred principally to the vertex. Progress was bad subsequently; ecchymosis developed under both conjunctivae; pains were complained of in calves of both legs, and twitchings were noted in the right shoulder and leg. He was drowsy and refused food. The collodion was removed from the wounds, but both were found quite healthy. On March 19 he had retention of urine, was groaning and insensible; pupils medium and slow to act, and spasm of the muscles of left side of neck was present. The temperature rose to 107° F. at 4 p.m., when the right pupil was widely dilated and contracted. He died at 5.30 p.m. the same day.

At the autopsy pus found at the base of the brain and around the pons and medulla, spreading up the left side over the Rolandic area (patient lay on his left side during the illness). Both Rolandic areas were covered with semi-gelatinous lymph; there was a fracture of the great wing of the sphenoid and adjoining part of the petrous bone into the foramen lacerum medium; the piece being loose but attached. On laying open the track of the bullet, the neck of the condyle of the lower jaw was found fractured, and had evidently been forced upwards, causing the fracture of the base. No pus was found in the track of the bullet, which was aseptic, as also were both entrance and exit wounds. There was no evidence of suppuration in the external auditory meatus or tympanum. The membrane was intact, and no fracture of the posterior wall of the tympanum could be seen.

Case 13.—Private L. B., South African Light Horse, was admitted to No. 12 General Hospital on August 21, 1901, suffering from the effects of an old gunshot injury of the skull received at Colenso on December 15, 1899, at a range of 500 yards, with a Mauser bullet. He stated that after being wounded he had paralysis of the right leg, arm and side of face, was able to speak, but his bladder and rectum were not affected. He was sent to Netley, but remembers little about himself beyond that he was trephined on left side of his head. On recovery and discharge from Netley he returned to South Africa.

Present condition.—Has a semi-circular scar in the left tem-
poral region, and small sinus in its centre—evidently the old wound of entrance—where dead bone can be felt with a probe; also a scar, evidently the exit one, on a perpendicular to Reid’s base line, commencing \( \frac{3}{4} \) inch in front of external auditory meatus and continued up for 1\( \frac{1}{2} \) inches. The entrance scar was on the same line 4 inches above Reid’s base line as shown in fig. 3.

The sinus has been discharging at times for a year. He has full power in the right arm and leg, but the right side of the face is slightly drawn down. The lower jaw is displaced \( \frac{1}{2} \) inch to the right, the teeth not approximating. Uvula and soft palate are normal. The tongue when protruded describes a semicircle to the right. He cannot whistle properly. His speech is clear,
up his letters and omits many in a word. When he has written a word incorrectly he is quite conscious of it, endeavours to correct it, sometimes wrongly. Can write familiar words correctly, such as his own name. If he practises writing a word he writes it correctly after a time. Makes mistakes in calculations and in counting money, &c., and does the latter slowly. He can read print, slowly but correctly. The knee-jerks and plantar reflexes are normal; ankle clonus absent.

On September 3, 1901, a vertical incision was made over the trephine opening, under the entrance wound, and two pieces of dead bone removed, as shown in their natural size in fig. 4.

The wound healed by first intention. He was invalided on September 22, as unfit for further service; but with much marked improvement in cerebration, talk, memory and writing.

Fig. 4.

Case 14.—Private F., 1st Royal Irish Fusiliers, fell out of a train near Springfontein on October 30, 1901, and was admitted to No. 12 General Hospital the same day. He was found to have a depressed "pond" fracture in the right parietal region, near the middle line. No paralysis; was quite sensible (patient had also a compound comminuted fracture of the left leg, necessitating amputation, and a simple fracture of the right femur in the lower third). An operation being performed at once, the depression was found to confine itself to the outer table. A trephine disc was removed from the outer table and all the depressed pieces removed. The inner table was quite intact. Owing to the extensive laceration of the scalp, the wound healed by granulation. The bone was covered by February 3, 1902, and the wound soundly healed by March 28.

Case 15.—Private S. was wounded at Modder River on November 28, 1899, at an unknown range. He was admitted to No. 2 General Hospital on December 2, 1899. His condition was very restless, and he refused examination. Apparently there was no paralysis. Temperature 103·4° F. Anæsthetised and
examined on December 2. Entrance wound ½-inch above, and to the left of the occipital protuberance, showing gutter fracture over the lateral sinus. Emphysematous crackling was present over the right side and back of neck. No wound could be seen or felt in the pharynx. Patient became very collapsed; the anaesthetic was discontinued and the wound dressed only. There was no exit wound. The progress of the case was bad; restlessness and acute delirium continued. He coughed up much fetid pus with some blood. The right lung became consolidated, and the temperature ranged between 102° and 104° F. He died on December 20, 1899.

At the autopsy a "Mauser bullet" was found embedded in the right quadratus lumborum, near the crest of the ilium. A gutter fracture involved 1½ inches of the occipital bone under the entrance wound, while much comminution was found. A large fragment of the inner table had been driven into the lower part of the occipital lobe on the left side, which was pulped. A spicule of bone projected into, but did not penetrate, the lateral sinus. The cerebellum was much bruised and somewhat lacerated. The bullet passed through the muscles of the back of the neck and entered the chest. The right lung was badly lacerated throughout in the vertical direction, and contained a piece of bone (rib?). The second and third dorsal vertebrae were deeply grooved on the right side of their bodies. The eighth and ninth ribs were grooved and the tenth and eleventh fractured close to their angles.

Remarks on the Preceding Cases.

Of the foregoing cases, thirteen were produced by small bore bullets, one by a 0.450 leaden revolver bullet (Case No. 1 in the August issue of this Journal), and one was the result of a fall from a train. These cases were treated in No. 2 and No. 12 General Hospitals, South African Field Force, the surgical divisions of which, at different times, were in my charge. Most of the cases were under my personal care during the whole of their illness, the remainder under various officers doing duty with me; these latter cases I was in constant touch with, assisting those in immediate charge at operations, consultations, and often at dressings also. It will be seen that the series embraces nearly every degree of severity of gunshot injury of the skull, from an apparent scalp
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wound with no bone damage, but with subdural haemorrhage, to complete perforation of the vault and base separately. Gutter fractures were the most common.

Case 3 is very interesting, a scalp wound apparently produced at close range, followed by insensibility, which disappeared, to come on again, accompanied by Jacksonian seizures, up to thirty-six in one day. At the operation one could find no trace of fracture, in spite of close examination; a subdural clot alone was found. The patient was young, 19 years, and the vault, evidently elastic, yielded to a force of the bullet sufficient to cause laceration of the vessels beneath the dura, but not enough to cause fracture at the point of impact. The amount of subdural clot was very considerable, viz., nearly two ounces. His Jacksonian fits diminished very much in number after the operation, but did not disappear till sleep had been procured by chloroform, on account of the patient's violence. After an eight hours' continuous sleep he awoke quite conscious and refreshed, and had no more fits. The drainage tube, which had been inserted on account of the size of the clot, may have had something to do with the continuance of the fits, but they entirely left him before the tube was removed on the fourth day after operation.

Case 4 shows temporary unconsciousness on receipt of injury, followed by recovery to find that he had paralysis of the opposite arm. The haemorrhage on to the arm centre in the Rolandic area must have occurred almost at once, certainly within ten minutes, of the receipt of injury. The amount of clot was small, about two drachms. The paralysis and anaesthesia had disappeared on the morning following operation. A drainage-tube was also put in, but removed forty-eight hours later. I am inclined to believe this to be a sound procedure.

Case 6 is exceedingly interesting, being apparently a glancing wound only of the scalp, and not laying bare the vault. The wound had become septic during the thirteen days which had elapsed prior to his admission to hospital, and the parts had to be cleaned and fomented for some days before operation. When the periosteum was reflected, a small stellate fracture was discovered, together with signs of extra-dural suppuration. The progress was promising for some days, but then the temperature went up, and the patient became drowsy. At the second operation a trochar should have been used to seek deeply for pus, after
division of the dura, but at the time septic meningitis was considered the more probable complication, then deep cerebral abscess, because the dura mater was intact.

The different "gutter fractures" varied considerably according to locality, thickness of bone at point of impact, and depth of vault involved, viz., from a superficial groove of the outer table to a complete destruction of both tables and diploe, for varying lengths. In many of these there was much laceration of the dura and pulping of the brain substance, mixed with clot and bone débris. As to the amount of brain laceration found in these gutter fractures, our experience goes to show that it also varies considerably, and will depend principally upon the length of the gutter. This latter again depends upon the rotundity of the vault at the part hit. The laceration would be more when the track of the bullet formed a small arc of a large circle than when it formed a large arc of a small circle; consequently it will be greater in antero-posterior wounds than in transverse ones.

It is remarkable to note how many of these and other head injuries are found at or near the Rolandic area on the left side. This can be understood when one remembers that the parietal eminence is a very prominent part of the cranial vault, and that when a soldier is advancing, during an action, the left side of the head is held in advance of the right.

Involvement of the frontal sinuses and the danger of septic infection from admission of air, is a very serious complication, as shown in the first case.* A case bearing on this point came under notice at Pietersburg, Transvaal, where a native received a blow from a stick, and the inner table was fractured and depressed. Air bubbled up through the infundibulum during expiration. Although all depressions were removed by operation, death ensued from septic meningitis. The loss of much cerebro-spinal fluid is also a bad sign, emaciation of the patient and lowering of vitality ensuing so rapidly, in addition to the constant danger of septic infection through the moistened dressings. I am unaware of any means of dealing successfully with these two complications. In dealing with gutter fractures, as well as others, very thorough search should be made for depression of the inner table and for spiculae driven into the brain. They should all be removed. If

* See this Journal, No. 2, p. 104.
any are left behind they are likely to give rise to subsequent trouble (vide Case 13).

Among these personal cases there were none of penetration of the vault with retention of the bullet, although a few were seen in other hospitals. Perforations of the vault were common. A typical case, and one full of interest, is Case 2. Here the range was 1,500 yards, showing the amount of force still retained by the bullet. The patient remembered little of what happened for forty-eight hours. The entrance opening in the skull had no fissures radiating from it on the external surface, although a large piece of the inner table was fractured off and depressed. The opening in the dura was small. Many pieces of both tables were driven nearly two inches into the brain substance, these varied in size, being mostly small and easy to escape detection at the operation. That the superior longitudinal sinus escaped injury was fortunate. One could feel—at time of the operation—with the finger the opening made by the bullet in the falx cerebri, it was small but distinct. The conditions at the exit wound were quite different. It was larger and more irregular, and with a tendency to eversion of its edges, but apparently no bone had been driven out through it. The same clean-cut perforation of bone did not exist as at the entrance, fracturing of the margins existed with loosening and displacements of fragments, some of these latter over-riding the adjacent but sound vault. There was no fine communication, but there was more laceration of the dura than at the entrance. Apparently a bullet can pass through both hemispheres in an oblique direction without doing much serious damage. I am inclined to think that most of the bone débris found in the track of a perforating wound comes from the inner table, so that the vault would be bevelled at the expense of the inner table around the entrance perforation. Bone débris cannot be expected to be found in or around an exit perforation beneath the level of the vault, unless the entrance and exit perforation are very near one another, in which case the injury to the vault would probably take the form of a "gutter," unless the convexity was very considerable at the spot hit. Bone débris I have seen once in an entrance wound of the scalp, overlying a perforation, and this fact has been satisfactorily accounted for by Mr. Makins in his book.

With regard to "hernia cerebri," I believe they are in great
measure due to sepsis and the retention of bone débris, clot, and disintegrated or pulped brain substance, beneath the vault. The fungating mass grows outwards through the rent in the dura mater and vault perforation, in the line of least resistance, from increased intracranial pressure. The increase in size is, I think, due to combined irritation from bone spicules and sepsis. Hernæ are seldom met with in aseptic conditions, but flourish under the reverse. I think they can be cautiously removed from any wound without much risk, and further exploration then carried out. If sources of irritation are removed, they are unlikely to recur.

Exploration of every gunshot wound of the head with bone injury is necessary, and in many where no such injury is apparent, but suspected. Trephining is not necessary in gutter fractures where a large opening exists already in the vault. Hoffmann’s gouge will often suffice to raise fragments. I have never replaced a trephine disc in any of these cases and cannot regret the course pursued. Where a trephine disc has been removed, further enlargement of the opening is nearly always necessary, thus leaving an irregular opening which the disc will not completely fill. The periosteum and dura are often removed or damaged to some extent by injury or operation, and necrosis of the disc is liable to ensue, if it be replaced under these conditions. The re-formation of bone in trephine openings is, in my opinion, very rare—this may to some extent be accounted for by the damage to the dura mater and periosteum from the original injury, or to a want of proper re-adjustment of the periosteum over the trephine opening at the end of the operation. The usual result found is a depressed scar which pulsates. A metal shield may subsequently be required to protect the parts.

Case 1 is of singular interest. I have before me very extensive notes of this man’s case, which in this article must necessarily be curtailed. The range at which he received his injury was very short, and would no doubt account for the so-called explosive effects observed in the bony vault at the exit wound. The calibre of the bullet was also large (0.450) and the bullet was entirely leaden. I do not believe a similar, or such an extensive bony injury, would have resulted from a 0.303 or Mauser bullet, at the same close range with an equal amount of driving power behind it. The patient was wounded on August 16, 1901, and had to be carried in a waggon with his column till September 9, when he
was transferred to a stationary field hospital. He constantly lost quantities of cerebro-spinal fluid during this time, and the difficulties in dressing him and keeping the wound clean must have been great. After operation he seemed to improve for a time, although the fluid drained into the dressings in enormous quantity. We were quite unable to check it. He lived for nine days after the operation; during this period he became extremely emaciated. At the autopsy one was quite surprised to find that pus flowed from the interior of the skull when the body was turned face downwards (patient always lay on his back during the illness). In reality proper drainage had not been established. The pus was not of a highly septic nature, had no offensive smell, and had evidently formed from the disintegrated and necrosed parts of the anterior extremity of the frontal lobes, which must have been pulped originally by the bullet. There was no trace of septic meningitis present, although the frontal sinuses were freely opened into by the original injury.

Case 12 indicates the danger of admission of air and septic germs into the cranial cavity. The autopsy showed that the neck of the lower jaw had been fractured by the bullet and the condyle had been driven upwards into the glenoid fossa, thus causing an indirect fracture of the base. The wounds and track never suppurated; they healed without trouble, consequently sepsis was not admitted by this channel. I am of opinion (although one failed to discover it at the post mortem) that the tympanic cavity was opened by the fracture and that air entered through the Eustachian tube, and thus caused septic meningitis.

Case 15 is the only one of gutter fracture of the base which I had. The range must have been long, as the bullet was retained. Owing to the patient's condition when put upon the table, operative measures could not have been carried out. I doubt whether much could have been done for him surgically. The fact that he lived for twenty-four days with such a grave injury to the cerebellum is remarkable. During this time he was never conscious, but swallowed liquids when they were placed in his pharynx.

Case 13 is of interest in showing the late after-effects of a wound involving Broca's convolution. From the sketch of the two pieces of bone which were removed from the sinus in site of the original entrance scar and trephine opening, it will be seen that neither of them showed any evidence, from size or shape, of their having...
been pieces removed by the trephine and subsequently replaced. I should say that they were pieces originally fractured and driven into the brain substance by the bullet, and that they escaped detection and removal at the original operation.

Case 2 is of further interest, in that it has been traced subsequently, almost up to the present date. As to his subsequent fits, they have neither been numerous nor severe, and may have been due—as the patient himself admits—to dietetic or other errors in living. Moreover, he has some hemianopsia from the occipital lesion, the extent of which we do not know. It is to be regretted that I originally overlooked it.

If one had a similar case again, I should adopt the American method of placing a thin layer of gutta percha between the brain and the scalp, so as to avoid the formation of adhesions between these structures. These adhesions probably induce the fits, by dragging and irritation. I have quite recently seen a case in the West London Hospital where gutta percha was inserted, and the results are likely to be promising.

Cerebral abscesses are very undesirable complications to gunshot wounds and often very difficult to recognise. When such a condition is suspected, the wound should be opened up, a trephine disc removed, if not already done, and the dura mater freely opened. Extensive and deep exploration with a trochar should then be made in many directions, and if pus is found, it should be evacuated and the cavity drained, but not irrigated. If the cavity be deeply situated and not immediately beneath the trephine opening, a flexible silver wire drainage-tube with flanges should be inserted. As the cavity fills up subsequently, more layers of gauze may be placed between the scalp and flanges of this tube, so as to shorten its depth of insertion, until it is no longer required. When these abscesses are properly drained they should heal up without trouble. If they are left alone death is almost certain to ensue.

On the whole, one may say that head injuries are very satisfactory to deal with, and the astonishing results which follow successful operations are distinctly encouraging alike to the patient and the surgeon.