The vertebrae can now be examined; if a depressed fractured lamina is discovered, the spines of the fractured vertebra above and below are cut off and the fracture examined. In some cases the fracture involves the laminae at each side, and these can be removed when the ligamenta subflava have been divided.

The lamina of one side may be fractured, and it may only be necessary to divide the uninjured side, or both laminae being fractured they can be removed without cutting any bone.

The most difficult step in the operation is the division of the first lamina. The lamina must be removed as far as the articular process, but it is not necessary to commence the section at this difficult spot; the lamina may be divided nearer to the spinous process and the remainder of the lamina removed with bone forceps. There are three well-known methods of dividing the laminae, of which the use of the cutting bone forceps is probably the easiest and most convenient. A saw may be used either of the guarded pattern, or a Hey's skull saw. The cut is made with an inward direction in order to avoid the articular process, and the section is completed with forceps. The drilling or trephining method is carried out by cutting a hole in the middle of the lamina with a drill or burr, and completing the section with De Vibiss or other suitable forceps. The entire division by forceps is rapid and sufficiently easy. Laminectomy forceps, Sargent's craniectomy forceps, or Jansen's bone forceps may be used. Whatever forceps are employed, the surgeon must be practised in the use of the instrument. With well-devised bone forceps the lamina may be bevelled until the edge is very thin and easily elevated. The spinal dura is separated from the lamina by tissue, and is not easily injured with ordinary care. The infiltration of the tissues with adrenalin solution, a long incision permitting easy retraction, and a good exposure of the laminae will greatly facilitate this difficult stage of the operation.

When the spinal canal is opened the condition of the fracture can be further investigated, detached fragments of bone or the missile may be discovered. The spinal canal will sometimes be found to be filled with effused blood, and a continuous stream of saline may be commenced at this stage. The dura is examined, and if uninjured and pulsating normally is not opened. If lacerations are present, depressed fragments of bone or missiles are sought for. The operation is completed by suturing the spinal muscles by one continuous catgut suture and suturing the skin without drainage. The wound is invariably painted with mastisol wound varnish.

Secondary infection and death from meningitis is very apt to follow drained laminectomy wounds when incontinence of urine or faeces is present.

At the conclusion of the operation, and for some days afterwards, the patient is placed flat on his back. The pressure upon the wound is advantageous.

In the dorsal area it is comparatively easy to explore the spinal canal anterior to the cord. One or two nerve roots may be divided with safety in this region and the theca gently retracted. The nerve roots are afterwards sutured with fine catgut. Operations for injury to the cauda equina have given the best results. Any division of the cauda which is discovered should be sutured. The probability of regeneration and recovery of function is considerable.

CONCLUSIONS.

1. The majority of cases of gunshot injury to the spine require excision of the wound and exploration at the earliest favourable opportunity.
2. The diagnosis is not so gloomy as past experience teaches.
3. Local anaesthesia is practically essential.
4. The administration of urotropine should be begun as soon after the injury as possible.
5. The presence of a missile together with severe pain are indications for immediate operation.
6. Accurate localization of foreign bodies is of the utmost moment. A lateral as well as an antero-posterior view is desirable.

REFERENCE.

1. A. J. Hull: *Surgery in War*, Chapter III.

THE TOXIC EFFECTS OF ETHYLHYDROCUPREIN ON THE EYE.

By GEORGE H. OLIVER, D.O. Oxon.,

HONORARY OPHTHALMIC SURGEON, ROYAL EYE AND EAR HOSPITAL, BRADFORD.

CONSIDERABLE interest has been aroused lately regarding the therapeutic value of the alkaloids and derivatives of cinchona, and attention has been drawn to this in recent numbers of the *BRITISH MEDICAL JOURNAL*.¹ In a paper by Morgenroth and Levy² on the chemo-therapy of pneumococcus infection, the process by which they arrived at the conclusion that the pneumococcus can be destroyed or rendered inert by quinine or its derivatives is described. They showed that in certain infections induced artificially by virulent strains of the pneumococcus the micro-organisms can be destroyed and the lives of the majority of the animals saved by the administration of ethylhydrocuprein. Fränkel³ used this drug, which is a quinine derivative, in a number of cases of pneumonia, which was then epidemic in Berlin. In describing his results, he said:

As with the serum therapy of pneumonia, which does not promise much, so with ethylhydrocuprein. This does not appear to be the thing we want, chiefly because it produces a very disagreeable complication, which, though it occurs in a small number of cases, yet is so evident that the drug cannot be recommended for use in practice. This complication is the occurrence of amblyopia, which we observed in 14.3 per cent. of our cases. The single dose prescribed was 0.5 gram, and from 1 to 2.5 grams were administered internally daily. After we became aware of this effect of the drug we did not give above 2 grams a day. The amblyopia disappeared rapidly (two days) on stopping the drug. I have no doubt that, had we continued this treatment, permanent visual defects would have followed. You know that in simple quinine intoxication complete amaurosis occurs. Ophthalmoscopic examination showed well-marked narrowing of the retinal vessels, chiefly the arteries, with reduced visual fields. When at the worst, the patients were able to make out fingers at 1 or 2 metres only.

The complication here described has occurred in a case in which I am interested, but with disastrous results. In the early part of 1915 I was called in consultation to see a man, aged 40, who a month before was extremely ill with pneumonia. His medical man, with the consent of the consulting physician, prescribed ethylhydrocuprein in 5-grain doses, to be taken every three hours. The patient took in all 120 grains.

The day previous to the discontinuance of the drug the patient complained of roaring in the head, partial deafness, and a feeling as though a dark blind had been drawn over his eyes. He was so ill and difficult to understand that these symptoms were considered to be due to meningeal complications. The drug was stopped next day, when it was found that he was quite blind and could not distinguish light from dark.

I found that he had bare perception of light; the right pupil reacted very slightly to light, the left not at all. Pupils two-thirds dilated. Ophthalmoscopic examination showed that the vessels were reduced to fine threads, the arteries being made out with difficulty in the left eye; both discs were quite white. This was in February, 1915, one month after the commencement of the symptoms. I saw him again on March 11th, 1915. My notes are as follows:

Considerable improvement in vision; can find his way about inside and outside the house, and can distinguish such articles as a knife, fork, or spoon at three metres.

On April 3rd, 1915, there is much improvement; V. = R. $\frac{1}{5}$, L. $\frac{1}{4}$; reads J. 4 slowly & L. E. and & R. J. 14; both fields very much contracted; pupils react to accommodation and slightly to light. Colour vision obliterated. Right disc not quite so white, but vessels still attenuated, more so in left eye.

On June 5th, 1915, V. = R. $\frac{3}{8}$, L. $\frac{3}{8}$. Ophthalmoscopic examination: Right eye, faint blush on temporal side of disc. Left disc quite white and vessels reduced to fine threads. Pupils both oscillate in a remarkable manner, synchronously, in day and gas light.

August 25th, 1915. V. = R. $\frac{6}{10}$, L. $\frac{7}{10}$; near vision = J. 4 & R. and L. Complains of severe pains in the back, which have troubled him more or less since convalescence set in. Attacks last a few days, during which visual acuity is considerably lowered and fields much more contracted, with immediate restitution to former level when pain ceases. Small coloured objects 2 mm. to 3 mm. in diameter not spotted, but with larger objects, such as postage stamps, red and green colours are easily named.

It is impossible to map out the colour fields (Bardsley's scotometer); the patient is so uncertain of the boundary zone. Ophthalmoscopic examination: Discs as before; vessels, arteries, and veins have a well marked double outline, which is carried a considerable distance beyond the disc, and in one or two instances is more distinct than the blood column.

The most striking circumstance is the great improvement made up to June 5th, 1915, which one would have little expected, seeing that the vessels were so narrow and the discs so white, indicative of the destruction, from reduced blood supply, of a large number of ganglion cells in the retina, and the visual fields so much reduced, as shown in the accompanying charts.

I heard recently from the patient's family doctor that the improvement made was not maintained, and I asked the patient to come to my rooms, which he kindly did.

On February 5th, 1916, V. = R. $\frac{60}{60}$, L. $\frac{60}{60}$. Vision began to go down in November, 1915, and steadily declined until Christmas, when he could not see his food on the plate before him. In the second week of January, 1916, he began to improve, and has continued to do so up to date. Ophthalmoscope: Both discs now quite white with no trace of colour; details not discernible. Vessels seem to have increased in size a little, and a few very fine branches may be seen on the discs. Vessels in left eye are smaller than in right eye, and both arteries and veins have a double outline which extends far away from the disc.

Apart from these changes, the fundus is quite normal in

appearance. Pupils are dilated and contract very slightly to light and still oscillate. I am afraid there is little hope of this patient being able to earn his own living in the future.

That ethylhydrocuprein is a dangerous drug I have no doubt, and its internal administration is to be carefully avoided. It may happily be discovered that much smaller doses than those given heretofore will suffice to destroy the pneumococcus; indeed, it has been shown by Henry

F. Moore⁴ in his experimental studies with this drug that "it inhibits the growth of and kills pneumococci *in vitro* in very considerable dilution," and that "the serum of rabbits which have been previously treated with a single dose of ethylhydrocuprein exerts a bactericidal action on, and later inhibits

the growth of pneumococci in the test tube." Known also by the name of optoquin, this substance has been used by ophthalmic surgeons in the treatment of serpiginous ulcer of the cornea. Some say it will cure a virulent ulcer in ten days, and others, including myself, have seen no special advantage in its use, while cases have been reported in which the instillation of a 1 per cent. solution of the drug has caused rapid destruction of the cornea.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, 1915, ii, pp. 542 and 827. ² *Berl. Klin. Woch.*, 1911, p. 1560. ³ *Ibid.*, 1912, p. 664. ⁴ Quoted in Epitome of Current Medical Literature, BRITISH MEDICAL JOURNAL, December 18th, 1915, p. 52.

SOME NOTES FROM THE BATTLE FRONT IN NORTHERN FRANCE.

By A. LAPHORN SMITH, M.D., M.R.C.S.ENG.,

LATE SURGEON-IN-CHIEF OF LADY EVA WEMYSS HOSPITAL; LATE TEMPORARY MAJOR R.A.M.C.; FORMERLY SURGEON-IN-CHIEF, SAMARITAN HOSPITAL, MONTREAL, AND PROFESSOR OF ABDOMINAL SURGERY, BISHOP'S UNIVERSITY.

My experience has been gained in the military hospital established and maintained under ideal conditions by Lady Eva Wemyss near Soissons, and by frequent visits to the great receiving hospitals at Compiègne under Ligusard, Carrel, and Mencièrè. These hospitals were only a few miles behind the firing line.

In such a hospital as that of Lady Wemyss the conditions for the rapid healing of wounds were unusually favourable. The three most important elements of success in treating wounds we had there in abundance—sunlight, fresh air, and pure water—and we made use of them all to the fullest extent. Every bed in the hospital was carried out of doors at 10 a.m., and the patients remained out until sundown. The heavy dressings were removed, and only a light layer of gauze put over the wounds to keep out dust but to let the light in. Even the operating was practically out of doors, to the great advantage not only of the patients, but also of the surgeons and nurses. The bathhouse was outside of the hospital, so that the wounded entered the wards clean in body and clothing. They were induced to drink water by every possible means, generally in the form of Imperial Drink, made with a teaspoonful of cream of tartar and the juice of one lemon to the quart of boiling water, and sweetened with sugar or saccharine to taste. Many were suffering from rheumatism, arthritis, neuritis, and cystitis, and these were all given fifteen grains of potassium bicarbonate in a tumbler of lemonade; this makes a pleasant effervescent drink, containing citrate of potash. Sometimes they took their water at every meal, flavoured with

red wine, and at other times they had an abundance of beef-tea. When they had lost a great deal of blood and were unable to drink enough to replace it quickly, they were given large quantities of beef-tea by the rectum by slow continuous absorption, the reservoir being a douche bag lying at the foot of the bed, raised on blocks, so that the supply was only a few inches higher than the rectum. When thus introduced without pressure the rectum does not so easily rebel, but will, on the contrary, drink up enormous quantities of liquid. As every patient had received antitetanus injections, we did not have a single case nor did we have one of typhoid. There were no deaths and no amputations of limbs. We had several very high temperatures, which caused me a great deal of anxiety until, at Sir Joseph Godfrey's suggestion, I gave 10-grain doses of quinine. One case turned out to be tertian and another quartan ague.

In the morning we were awakened by the roaring of the guns, and soon after the wounded men began to arrive at the base hospital, already having had their wounds swabbed with 2 per cent. iodine at the field dressing station. Those who had fractures were put up in temporary splints, and then some thirty ambulances arrived from the subsidiary hospitals, so that by noon there was hardly a surgical case left. Carrel took many of the badly infected cases, or rather those in whom there was every probability of suppuration occurring. Mencièrè, the orthopaedic surgeon of Rheims, and chief of the Compassion Hospital, was allotted the bad cases of joint injury by shrapnel and bullet, requiring great operative skill or his "embalming" treatment. To the Lady Wemyss Hospital were allotted the compound comminuted fractures and many of the wounds and burns caused by shrapnel bursting at close quarters. By two o'clock the patients had been bathed, x-rayed, and in the operating-room. The x-ray machine was run by storage batteries charged by a small gasoline engine. The x-ray plates were held up before the operator, and each piece easily seen and removed. In many cases the fragment of shell was nearly a foot