after-history of an arterio-venous aneurysm in this situation is available—and the successful result we have attained appear to us to justify our decision.

We had to choose between, on the one hand, attempting to place a ligature on the artery on either side of the sac and, on the other, excising the whole sac and the involved portion of the artery. We chose the latter alternative because of the difficulty in isolating and ligaturing the artery sufficiently near to the sac (especially on the distal side, on account of the enormously dilated veins) to ensure against collateral channels re-establishing circulation into the sac.

If we ever have to perform the operation again we shall not replace the resected clavicle, for we think that if we had not done this the suppuration which determined the subsequent haemorrhages from the ligatured end of the artery might not have occurred. It would have been better not to have used silk for the main arterial ligatures. In military surgery, where asepsis of the wound can rarely with certainty be attained, catgut of an absorption rate of not more than twenty days should be used for large arteries, so as to minimize the duration of a ligature sinus if such occur, and which, so long as it exists, is a menace of haemorrhage.

NOTES ON A CASE OF PENETRATING WOUND OF THE HEART.

BY

R. GARSIDE DIXON, M.B., Ch.B., CAPT. R.A.M.C.(T.F.),
SURGICAL SPECIALIST, CASUALTY CLEARING STATION (T.F.), ON
ACTIVE SERVICE; HONORARY SURGEON, BINGLEY
COTTAGE HOSPITAL;

AND

P. McEWAN, M.A., M.B., Ch.B., F.R.C.S. EDIN.,
CAPT. R.A.M.C.(T.F.),

CASUALTY CLEARING STATION (T.F.), ON ACTIVE SERVICE; HONORARY
ASSISTANT SURGEON, BRADFORD ROYAL INFIRMARY.

The following case is the only example of a wound of the heart in a series of 123 wounds of the thorax and its walls which have passed through this casualty clearing station during the last ten months. The great majority of penetrating wounds of the lungs have progressed sufficiently well to be sent to the base, and it is a recognized fact that most of these cases ultimately recover. Probably nearly all cardiac wounds produce death from haemorrhage too quickly to allow of the patients being removed alive even to a short distance from the battle-field.

In the case recorded here the patient was wounded, whilst in the upright position, by a rifle grenade, at 12.15 a.m., on March 23rd, 1916. He was admitted to this hospital the same day at about 7 p.m., with a diagnosis of "gunshot wound of chest and right arm, compound fracture left elbow." His tally showed that he had had hypodermic injections of antitetanic serum (500 units) and of morphine ($\frac{1}{2}$ grain) at the field ambulance.

On admission, he was cold, suffering very severely from shock, short of breath, and cyanosed, but his lips were pale. Temperature 101° F., pulse 112, respiration 28. He was too ill for his wounds to be dressed then, but with brandy, salines, and hot-water bottles he improved sufficiently to have this done the following morning. His left arm, which was fractured, was transferred from a straight splint to a Thomas's, and the wound of his right arm, which was slight, was dressed. There was a small wound $\frac{1}{2}$ in. to the inner side and $\frac{1}{4}$ in. above the left nipple. A catheter was passed, and about a pint of normal urine drawn off. The patient was still very short of breath, and the dressing of his wounds was as much as his condition

In regard to ligature of the first part of the right subclavian artery, it is much easier, with an aneurysmal condition of the third part, to gain access to it inside the jugular vein and just outside its point of origin from the innominate, as was done at the second operation, than to secure it outside the jugular vein, as was done at the first operation.

At the bottom of the neck on the right side the jugular vein diverges outward from the carotid, leaving a small triangular space, crossing the base of which the subclavian artery will be found.

The upper end of the innominate artery and the root of the subclavian artery often lie well below the level of the manubrium sterni (they did in our case), but access to the latter can be attained by strong traction on the carotid and to the former by additional traction on the subclavian after this is found and isolated.

So resistant to trauma are large arteries that even strong traction on a considerable length of vessel stripped of its sheath and entirely isolated does not result in any harm.

REFERENCES.

¹ *Surgical Experiences in South Africa*, p. 142. ² *British Journal of Surgery*, vol. iii, No. 10.

would permit of. At 2 p.m. the pallor increased, he became more cyanosed, and his breathing more difficult. His temperature rose to 102° F., pulse 130, respiration 45. At 6 p.m. morphine $\frac{1}{2}$ gr. was given hypodermically to relieve the distress caused by the shortness of breath. He was semi-conscious all the time he was in this hospital. He knew his name, regiment, and home address; but kept on trying to get out of bed, and was often delirious. He never complained of any pain either in the chest or arm, but suffered considerably from thirst. The heart sounds were normal. There were signs of fluid in both pleural cavities, more on the right than on the left side. There was neither cough nor expectoration. The cyanosis deepened, the pallor and dyspnoea increased, and he died at 11.45 a.m. on March 25th, having lived 59½ hours after receiving the injury, and having during that time been conveyed from the regiment to the field ambulance, and from that unit to this clearing station.

Necropsy.

The body, which was examined four hours after death, before the onset of rigor mortis, was that of a well-built man of medium height and good muscular development. The skin was pale, but cyanosed, and there were no wounds other than the three already mentioned. The wounds of the left elbow and right arm were of no pathological interest, and could not have been factors of any importance in causing death. A small external wound, situated just above and internal to the left nipple, was traced transversely inwards for about two inches through the subcutaneous tissue and chest muscle; its subsequent course was through the sternum, leaving the internal mammary artery intact; then through the edge of the left lung, the pericardium, the right ventricle, and the pericardium; finally the missile was found imbedded in the right lung. It was

A. Probe through wound in left lung. B. Probe through two wounds in pericardium. C. Probe through entrance wound in right ventricle. D. Probe through exit wound in right ventricle. E. Piece of metal in right lung. F. Wad of cotton-wool to evert margin of right lung to show piece of rifle grenade.

not removed for examination, but its small size could be judged from an x-ray photograph.

The left pleural cavity contained a considerable quantity of blood, but the lung was of nearly the normal size; the right pleural cavity was almost full of blood, and the lung was found to be collapsed. The blood was fluid except for a single clot on the right side. The left lung had a slit like wound of entrance, detected with difficulty, half an inch from the margin, at the inner and lower part of the anterior surface of the upper lobe, and a larger wound of exit through the margin of the inferior surface; about half an inch of the lung tissue had been passed through. There was a patch of recent fibrinous pleurisy between the upper and lower lobes, extending for about 2 in. on to the anterior surface of the lower lobe. On the under surface of the middle lobe of the right lung, about half an inch from the inner margin, a small piece of metal could be seen lying in the lung substance. There was no recent pleurisy, but the upper and middle lobes were almost completely fused by dense old adhesions.

Description of Cardiac Wounds.

The pericardium showed an entrance and an exit wound over the right ventricle. On opening the sac a small piece of khaki cloth was found, together with a small quantity of clotted and fluid blood. The pericardium presented the appearance of early pericarditis. The left ventricle was distended, but the right was partially collapsed, and near the centre of its anterior surface was a small circular wound of entrance which passed obliquely through the muscle to a wound of exit very near to the right border of the heart; an interval of an inch separated the two wounds, and round each was a small circular area of bruised tissue. The right ventricle was opened posteriorly and found to contain some very bright red blood clot. No wound was visible from the interior, and on passing a probe it was found that the wound passed through one of the lacunae between the pillars of cardiac muscle, having just penetrated the ventricular cavity.

The cause of death was severe haemorrhage, complicated with pulmonary collapse and interference with the heart's action. The enormous amount of blood in the pleural sacs came from the heart; the lung wounds were not capable of causing much haemorrhage. With each systole some blood would be forced through the small openings in the right ventricle into the pericardial sac, and from there blood would ooze through the pericardial openings into the pleurae. There was no attempt at closure of the openings by clot. Their small size accounts for the length of time the patient survived.

The occurrence of pericarditis and pleurisy (the latter being curiously localized) showed the beginning of an infective process.

The wounds of the left lung were no doubt closed by blood clot, while that of the right was kept open by the shrapnel on the surface causing collapse.

An x-ray photograph of the specimen was taken by Captain F. H. Gibson, R.A.M.C., and no foreign body other than the one described was found.

The specimen has been sent to the War Museum of the Royal College of Surgeons, London.

WHITE GANGRENE.

BY

MAJOR A. J. HULL, F.R.C.S., R.A.M.C.

In addition to gas gangrene and gangrene due to direct interference with the blood supply, septic gunshot wounds may be attacked by a very acute infective process which is a form of gangrene. The condition appears to be an acute streptococcal infection, and is, in appearance, not unlike phlegmasia alba dolens, but is attended by the local circumstances associated with gangrene and the general effects of an acute toxæmia.

This form of gangrene has only been seen in the lower extremity.

The skin is glazed and white, moist, cold, and pits on firm pressure. A very firm oedema is present, and the distal pulse in the limb cannot be felt. The glazed white appearance of the distended skin, instead of the usual redness, seems particularly characteristic. Early in the condition the patient is extremely ill, with clammy, sweating face, and running pulse. The condition is extremely fatal, and death occurs in about twelve hours. The infection is so rapidly fatal that little change in the colour of the limb has been noticed. In those cases which have survived somewhat longer, it has been found that, during the last few hours, the limb has become mottled black and the discharge exceedingly foul. No gas has been noticed in the discharge, and no crackling has been detected in the tissues. The appearance is somewhat suggestive of deep-seated pus, owing to the tension of the skin, but, on making an incision into the limb, the wound merely oozes serum.

In the more severe and extensive forms the infection is so severe and the patient's condition so serious that no treatment appears practicable.

Amputation gives the only chance of recovery, and is successful when the infection is more localized, as happened in Case I.

White Gangrene of the Leg.

CASE I.—Pte. S., wounded March 9th with rifle grenade, dressed at field ambulance and transferred to base. Shell wound of left leg with comminuted fracture of upper third of tibia and fibula, and flesh wounds in the region of knee. Leg swollen and white, extending well up to thigh, and looking like

phlegmasia alba dolens. Foot cold, and no pulsation to be felt in distal vessels of ankle; wound foul with sanious discharge; temperature 102°, pulse 124. Bacteriological examination showed streptococcus. Amputation through lower third of thigh; recovery (Lieutenant S.'s case).

CASE II.—Pte. L. was shot through the calf on September 24th and admitted to a base hospital on September 25th. There was a small wound of entrance and a wound of exit the size of half a crown, through which muscle bulged; the leg was white, the skin tense and cold. Incisions, 3 in. long, were made on each side through the bullet track, capillary bandages were inserted, and continuous saline irrigation applied. The next day the skin was much more swollen, it pitted on firm pressure, and had the appearance of a limb containing deep-seated pus but was white in colour. Very little pus came from the wounds; a thin, foul-smelling discharge exuded. The patient's temperature was 103°; he was restless, and his general condition was very much worse. Numerous incisions were made into the subcutaneous tissue. The patient's condition did not improve, the pulse became rapid, shock was very pronounced. The limb turned blotchy black and was extremely foul. The usual remedies were employed, including rectal saline injection. The patient died eight hours after the second operation.

CASE III.—Cpl. W., admitted to hospital suffering from a shell wound of thigh. There was a compound fracture of femur and severe destruction of the knee-joint. The wounds had been cleaned and dressed with cyanide gauze at a clearing station. About fifty-six hours after the injury the patient had a rigor. His temperature rose to 104° F.; vomiting and collapse occurred. The limb became cold and no pulse could be detected. The skin was white in colour, and a firm oedema rapidly occurred in the whole limb. No crackling was present, indicative of gas. The patient's condition did not admit of surgical interference, and he died twelve hours after the appearance of the gangrene. Bacteriological examination discovered streptococci in the blood and in the discharge from the wound.

SIMPLE AND INEXPENSIVE METHODS FOR FERMENTATION TESTS AND FOR OBTAINING CULTURES OF ANAEROBES.

By J. M. BEATTIE, M.A., M.D.,

PROFESSOR OF BACTERIOLOGY, UNIVERSITY OF LIVERPOOL.

In most bacteriological laboratories the work during the war has been very much increased, and with the increased cost of apparatus and media various devices have had to be employed to reduce expenditure. It may, therefore, be of interest to record two methods which I am using, and which are simple, inexpensive, and, at the same time, efficient.

1. For Fermentation Tests.

For these I use small test tubes, which can be made in the laboratory from ordinary glass tubing of $\frac{1}{4}$ in. or $\frac{3}{8}$ in. diameter. Introduce into these tubes about $\frac{1}{2}$ c.cm. of any of the sugar media. These tubes, plugged and sterilized in the ordinary way, are inoculated with the organism whose reaction is to be tested, and then some sterilized vaseline, which has a melting point of about 55° C., poured into the tube. The vaseline solidifies and forms a plug, lying in contact with the fluid media. The tubes are then incubated in the ordinary way, and where gas is formed the vaseline plug is pushed up in the tube, and, if the media is cold when inoculated, there is sufficient absorbed oxygen to allow the free growth of the organism and to allow the reddening (the acid reaction) to show. In twenty-four hours, with the ordinary acid and gas-producing members of the typhoid-coli group, the reactions are very definite. Later, reduction takes place and the media becomes colourless, but if a hole is bored through the vaseline plug to allow ingress of air the red reaction reappears in a few minutes, starting at the upper part of the media and gradually spreading downwards. This method is simple and inexpensive, and it has the added advantage over the ordinary method that small quantities of gas, which may not be indicated by the ordinary Durham tube method, are always detected, the gas showing as small bubbles at the lower part of the vaseline plug. The method may be used for accurate estimation of the amount of gas produced by any given organism.

2. For Anaerobic Cultures.

Ordinary test tubes containing peptone broth or glucose peptone broth are used, and for the common anaerobes I find the peptone broth quite satisfactory. Melted sterilized vaseline is poured into the tube till it forms a