am convinced that no attempt should be made to remove the foreign body from the lung while the patient is in a base hospital in France.

RESULTS.

In my series of 450 cases there were 27 deaths, the causes of which when examined will show the hopelessness of certain cases and will also point to one problem in surgery which has not been solved—that is, cases in which the infected haemothorax is pocketed. In these 27 cases the causes of death were as follows:

1. Septicaemia, due to pocketing	Drained.
2. Septicaemia " " " " " " " " " "	Drained.
3. Septicaemia " " " " " " " " " "	Drained.
4. Abscess of lung " " " " " " " " " "	Drained.
5. Pneumonia and empyema (opposite side), haemothorax " " " " " " " " " "	Drained.
6. Gangrene of lung " " " " " " " " " "	Drained.
7. Septicaemia " " " " " " " " " "	Drained.
8. Septicaemia " " " " " " " " " "	Drained.
9. Moribund, time of operation " " " " " " " " " "	Drained.
10. Septicaemia, due to pocketing " " " " " " " " " "	Closed and reopened.
11. Septicaemia, due to pocketing " " " " " " " " " "	Closed and reopened.
12. Septicaemia, due to pocketing " " " " " " " " " "	Closed and reopened.
13. Pyaemic abscesses (both lungs) " " " " " " " " " "	Closed and reopened.
14. Pneumonia and empyema (opposite side), haemothorax " " " " " " " " " "	Closed and reopened.
15. Acute gas gangrene of chest wall " " " " " " " " " "	Closed and reopened.
16. Septicaemia " " " " " " " " " "	Closed and reopened.
17. Septicaemia " " " " " " " " " "	Closed and reopened.
18. Gas gangrene of chest wall " " " " " " " " " "	Closed and reopened.
19. Double pneumonia " " " " " " " " " "	No operation.
20. Bronchopneumonia and tuberculosis " " " " " " " " " "	No operation.
21. Septicaemia " " " " " " " " " "	No operation.
22. Gas gangrene (one side), pneumonia and empyema (opposite side) " " " " " " " " " "	No operation.
23. Streptococcus (arm), mediastinitis, abscess of lung " " " " " " " " " "	No operation.
24. Pneumonia (opposite side) " " " " " " " " " "	No operation.
25. Double bronchopneumonia " " " " " " " " " "	No operation.
26. Secondary pulmonary haemorrhage, infected haemothorax " " " " " " " " " "	Drained.
27. Died on table, before operation.	

CONCLUSIONS.

1. All cases of wounds of the chest should be treated in special wards or special hospitals.
2. Careful charts should be kept which record temperature, pulse, and respirations four times a day.
3. Early diagnosis of infection is important.
4. Every case in which there is more than two finger-breadths of dullness should be aspirated.
5. Cases of open pneumothorax should be closed as early as possible.
6. Cases in which there is a large amount of clot in the chest should be opened, blood and clot evacuated, and the chest closed. This should be done as early as possible.
7. Cases in which the haemothorax is found to be infected should be opened, washed out, and closed, some antiseptic being left in, preferably an emulsion of bipp in liquid paraffin.
8. Post-operative aspirations must be done in all closed cases the first forty-eight hours after operation.
9. No attempt should be made at the base in France to remove a foreign body from the lung.

THE MODERN TREATMENT OF EMPYEMA BY ANTISEPTICS.

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For all practical purposes cases of empyema may be divided into two classes—(a) those easily cured by simple surgical methods, and (b) those difficult or impossible to cure even by such extensive surgical operations as Estlander's or Schede's thoracoplasty or pulmonary decortication.

This difference is chiefly due to the fact that in the latter cases the condition has become chronic, either through neglect or inefficient surgical treatment in the early stages, with the result that the lung and diaphragm have become covered by granulation tissue, which by its further development into fibrous tissue renders the walls of the pus-producing cavity rigid so that they cannot collapse and so obliterate the cavity. Down to quite recently it has generally been believed that an empyema could be cured only when the cavity of the pleura was obliterated either by distension of the lung to meet the chest wall, or collapse of the chest wall to meet the

lung; the first process occurring in those cases that were easily cured, and the latter being brought about by Estlander's or Schede's operation in the cases which resisted ordinary treatment.

That this idea was wrong is, I think, proved by the histories of the following three cases treated in France last year:

CASE I.

Arab, aged 17, found during the inspection of an outlying hospital, with an empyema of the right side which had burst through the chest wall in two places—in the fourth space in the nipple line and in the sixth space in the anterior axillary line. He had an evening temperature of 102° to 104°, and was in a very weak and emaciated condition. On May 19th a piece of the eighth rib was removed in the scapular line, and the pleura opened. One pint and a half of odourless pus was evacuated, and the pleural cavity was freely douched with Dakin's solution and hot water, and a large double drainage tube inserted. He was dressed daily and syringed with Dakin's solution and hot water. The discharge, which was at first very copious, rapidly diminished, and at the end of four weeks there was only a little serous discharge on the dressings, though there was still a large intrapleural cavity, shown by the fact that from 6 to 8 oz. of lotion could be injected without pressure or discomfort. The drainage tube was left out and the wound closed without rise of temperature; on two or three occasions during the following week a probe was inserted, but, as only a little clean serum escaped and there was no further rise of temperature, the wound was allowed to cicatrize, and the patient was discharged in the beginning of July. The physical signs showed that the lung was still contracted and that there was a considerable pneumothorax.

CASE II.

An Arab, aged 18. This case was very similar; he had an empyema of the left side which had burst through the chest wall and formed a large subcutaneous abscess over the sixth space in the nipple line. On June 1st a piece of the eighth rib was removed in the scapular line, and when the pleura was opened nearly four litres of thin, foul-smelling pus escaped. The pleural cavity was douched with Dakin's solution and hot water and a large double drainage tube inserted. The further history and treatment was the same as the previous case. In three weeks the discharge had lessened so much that the drainage tube was left out and the wound closed. Here again a probe was passed on a couple of occasions and only a little serum escaped. He was discharged healed, early in July.

CASE III.

A French soldier, aged 30, said that he had been partially buried by an explosion nine months previously. An operation was performed and a tube put into his left side, from which there was daily discharge up to the time he was seen by me, last June, when he had a sinus in the posterior axillary line, about the level of the eighth rib, through which a probe could be passed for six to eight inches. The discharge was copious, and there was a slight evening rise of temperature. The sinus was enlarged, a drainage tube inserted, and the cavity washed out daily with Dakin's solution and hot water. The discharge lessened rapidly and the temperature became normal; the tube was left out at the end of three weeks, and the discharge being only serous the wound was allowed to close and the patient was discharged from hospital at the end of five weeks, healed and apparently well, though he still had a considerable pneumothorax.

The first two cases were neglected acute empyemas which had been allowed to burst externally, in fact the "empyema of necessity" of the early writers; and the third case was probably a haemothorax, which had been drained and allowed to become septic. In all three cases the result of treatment came as a great surprise, as it had been thought that an extensive operation would have been necessary; the drainage and douching was only done as a preliminary measure to get the cases as clean as possible before undertaking an Estlander's operation.

Since treating the above cases and returning to Dublin, I have read of Tuffier's treatment of empyema by the Carrel-Dakin method. He claims the same results—that is, that the discharge gradually lessens and finally is only serous, and as soon as this occurs, or it is proved that the discharge is sterile or almost so, by bacteriological examination, he removes the tubes and allows the wound to close. He draws attention to the fact that the patient is cured and the thoracotomy wound closed, while there is still a free space in the pleural cavity, and this is the real crux of the whole subject; for up to this all our efforts have been directed to obliterating this space, as it was considered impossible to obtain a cure of a case of empyema until this space had ceased to exist. In future our efforts must be directed to sterilizing the walls of this space, which has been proved to be possible, perhaps not in every one of these cases, but certainly in a large number of them. Whether we attempt to do this, as outlined in the above cases, by frequent washing with some reliable antiseptic by

means of a syringe, or by more frequent washings, as in the Carrel-Dakin treatment, will depend on various factors, such as personal predisposition, nursing facilities and idiosyncrasies of the patient. It would seem natural to suppose that quicker and surer results could be obtained by the two-hourly flushings of Carrel-Dakin than the daily or twice daily flushings by syringe when dressing the case.

Conclusions.

1. Most if not all cases of empyema can be cured without resort to such mutilating and dangerous operations as thoracoplasty and pulmonary decortication, because it is not necessary to obliterate the pleural space, but merely to render its walls sterile, and this is possible by frequent washings with hypochlorite solutions.

2. Flushing of the pleural cavity with hypochlorite solution is not dangerous provided there is a free exit for the fluid, as by the use of a double drainage tube.

3. The earlier this treatment is instituted the sooner and more surely will a cure be obtained, as there will be less formation of granulation and scar tissue, and the organisms will not have had time to entrench themselves deeply in the tissues, and will therefore be more exposed to the action of the antiseptic.

4. The drainage should be free, and the opening should not be valvular; if a Carrel tube is used it should be introduced as far as possible into the pleural cavity through a large drainage tube, so that the fluid, starting at the most remote part of the septic space, passes down over its walls and escapes freely between the Carrel tube and the drainage tube.

5. The opening is most suitably made by removing one inch of the eighth rib in the scapular line, as this is the most dependent spot for practically all positions, and there is no fear of its closure by the rising diaphragm.

PARALYSIS FOLLOWING ARTERIAL INJURIES.

BY

CAPTAIN HAROLD BURROWS, R.A.M.C.(T.F.).

AMONG the accidents of war injury of a main blood vessel is common, yet little inquiry appears to have been made into the effects upon the structures which lie within the area of distribution of the wounded vessel. Injury of a main artery—for example, the common femoral, the popliteal, or the brachial—may produce immediate and remarkable consequences in the affected limb. As the ensuing symptoms are paralytic they have been apt to be regarded either as “functional” or as arising from concomitant nerve lesions, for, owing to the close association and common anatomical relations between the vessels and the nerves, simultaneous injuries of the structures are of frequent occurrence.

As the following cases will show, extensive paralytic phenomena may follow a vascular lesion independently of any direct traumatism of the main peripheral nerves. That these sequences are not infrequent is shown by our experience at the — General Hospital, and also by knowledge gained at the other military hospitals in the neighbourhood.

FIG. 1.—Shaded area shows extent of loss of sensation to light touch, the upper limit of which is marked by 1; 2 defines the upper limit of loss of sensation to pin-pricks.

The patient complained of pain in the hand and fingers and a “tingling, horrible sensation” in the same area. He said his

“funny bone” was tender, and that pain shooting down to the fingers could be caused by pressure applied to the ulnar nerve at the elbow.

There was anaesthesia to light touch and pressure, as shown in Fig. 1, and it is notable that the loss of pressure sense was slightly greater than the loss to light touch. There was also complete loss of sense of position in the wrist and all joints below the wrist. There was absolute paralysis of all muscles below the elbow. The right hand was warmer than the left. The radial pulse could be felt, but the pressure within it was too low for accurate estimation with Riva-Rocci apparatus. A pressure of less than 20 mm. of mercury was sufficient to obliterate the pulse. The maximum systolic blood pressure in the left arm was 118.

There can be no question that the clinical symptoms in this case cannot be accounted for by peripheral nerve injury, for the musculo-spiral escaped damage, and yet the forearm muscles were completely paralysed.

CASE II.

Q.M. Sergt. W. G. D. Wounded on June 23rd, 1917, was admitted on June 25th, under the care of Captain E. T. Tatlow, R.A.M.C.(T.F.). The note from the casualty clearing station was: “Through wound of left arm and forearm, passing through bend of elbow and wounding brachial artery. Wound explored through separate incision at bend of elbow. Artery tied. Bipp dressing. Packing for serious oozing. Scalp wound cleaned.”

There was a small entry wound on the inner posterior surface of the left arm, with a small exit wound on the radial side of the anterior surface of the forearm. Both wounds had been excised, bipped, and firmly plugged with gauze. There was an oblique operation wound in front at the bend of the elbow, and this also had been sutured. The limb was fixed on an internal rectangular splint. There was no injury to the bones or to the elbow-joint, the projectile having passed anteriorly to these structures. The left hand and forearm were much swollen and colder than the right hand and forearm, and there was considerable bruising in the neighbourhood of the elbow. No radial pulse could be felt. He complained of “pins and needles” in the left hand, from the wrist to the tips of the fingers. He felt this especially if he coughed, sighed, or took a deep breath.

There was “glove” anaesthesia of the left hand (Fig. 2), including the loss of appreciation of light touch, pin-pricks, pressure, tuning-fork vibrations, and sense of position; further, there was complete paralysis of all the muscles below the elbow, except the supinator longus and extensor carpi radialis longior, which were not paralysed. In this connexion it may be noted that the blood supply of these two muscles is derived from the superior profunda artery. The paralysed muscles felt hard and inelastic. On July 9th it was noted that there had been no material alteration in the loss of power or sensation since the patient's admission. The oedema had become less, but it had not disappeared, although the limb had been elevated; the hand was now warm.

FIG. 2.—Shaded area shows loss to light touch; 2 shows upper limit of loss to pin-pricks; and 3, the upper limit of loss to deep pressure. The area of loss to light touch alone has been defined on the palmar surface owing to discomfort caused to the patient during examination of this region. The arrows show the direction of the wound.

In this case it is clear that the ulnar and median nerves may have been injured, but it is equally clear that the musculo-spiral escaped. Consequently, some factor additional to peripheral nerve injury is required to explain the symptoms.

CASE III.

Pte. S. U. F., wounded August 23rd, 1917, was admitted on August 25th under the care of Captain J. H. C. Fegan. He presented three wounds: (1) Gunshot wound of left leg, with compound fracture of left tibia and fibula; (2) a large vertical wound in the left deltoid region, tightly plugged with gauze, over which the skin was sutured; (3) a long vertical wound on the inner side of the left arm, also plugged tightly with gauze and sutured. The notes accompanying the patient from the casualty clearing station did not mention any arterial injury.

The patient had pins and needles in the left hand for the first twenty-four hours, but this symptom disappeared. He complained of a “feeling of pressure” in the hand. The radial pulse could not be felt. There was moderate oedema of the forearm and hand, and the muscles felt hard, inelastic, and tender. The fingers and thumb were flexed at all the joints.