

## EXPERIENCES OF WAR SURGERY AT A 600-BEDDED GENERAL HOSPITAL IN PALESTINE, NOVEMBER 1940 TO AUGUST 1941.<sup>1</sup>

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[Received November 24, 1944.]

The period during which this hospital was receiving casualties can be divided into two phases :—

(1) From November, 1940, to April, 1941, when we were receiving casualties from the first Western Desert Campaign—four months ; and

(2) The period June to July, 1941 (two months), when we were receiving wounded from Syria.

Some of the earlier casualties from the Western Desert had already passed through other hospitals, but in March and April, 1941, many of the wounded had only had treatment at C.C.S.s, and several had come direct from Tobruk to Haifa on hospital ship and thence to our hospital by train.

In the case of the Syrian war, casualties, passed through the C.C.S. at Nazareth or the Advanced Dressing Station at Damascus, travelled by Hedjaz railway to Amaan and from there by ambulance convoy to Jerusalem.

Most of the cases admitted to our hospital were " late " cases, i.e. a period of over twelve hours had elapsed between the infliction of the wounds and admission of the man to hospital, in many cases four to five days. Some of the cases had passed through a C.C.S. or advanced operating centre where the wounds had already been surgically treated, and in this connexion we met with the following faults in technique :—

(1) Primary suture : After excision of the wound, primary suture had been carried out and invariably the sutures had to be removed and drainage of the wound instituted on account of sepsis.

(2) Amputation stumps had been tightly sutured and on admission the sutures had to be removed, but often necrosis from tension on the skin had already occurred.

These two faults were most commonly encountered in the Free French wounded, whose surgeons seemed to amputate more frequently than we did.

(3) The third fault, one to which others have drawn attention, was the application of encircling plaster of Paris bandages, especially for G.S.W.s of leg with fracture and of the upper arm with fracture of humerus. It was our experience that where plasters had been applied and the patient immediately, or within twenty-four hours, sent on, these plasters had to be removed almost at once on account of the pain, swelling and pressure they were producing. In this connexion, if the wounded man cannot be kept for forty-eight hours before transport, I think a long postero-lateral plaster slab would be preferable for G.S.W. leg. With regard to the abduction plaster for G.S.W. humerus we found that not only was the comfort of the patient improved, but the position of the fragments also, when the plaster was removed and a " collar and cuff " with a long lateral plaster slab applied.

### TREATMENT OF THE WOUND IN HOSPITAL.

As most of the cases we dealt with were " late " cases, the complete excision technique, which ideally produces as nearly an aseptic wound as possible, could not be carried out on account of this time factor.

The procedure we evolved was one of *modified excision*, producing free drainage to the surface, and *immobilization in plaster of Paris*.

<sup>1</sup> Owing to pressure on space some cuts have been made in this article. The necessity to do this is regretted.—ED.

For a wound due to a high velocity missile with entrance and exit wounds it was found unnecessary to lay the whole track open widely. By enlarging the entrance and exit wounds by means of radiating incisions in skin and fascia, and light packing with sterilized vaseline gauze, drainage could be properly instituted. Powdered sulphonamide might be applied, if available, and the part immobilized in plaster of Paris—in the case of the limb, fixing the joints above and below the lesion.

For the treatment of low velocity missile wounds over twenty-four hours late—here again complete excision was not considered practicable and a modified excision was adopted, the principle being to leave the wound adequately drained to the surface.

The skin of the surrounding area was shaved and aseptic technique employed. The skin edges were excised and the wound laid open by radiating incisions, allowing a thorough exploration of the wound.

*The Fascia.*—Often there was found only a small hole in the fascia, but on incising it extensive laceration of the underlying muscle was discovered. Radiating incisions of the fascia were made.

No extensive excision of muscle was made unless it was obviously necrotic.

*Bone.*—Only completely loose fragments were removed.

*Nerves and vessels* were not repaired and only if a large vessel were torn and was bleeding was it tied.

*Foreign Bodies.*—All cases having been X-rayed before operation, we applied the rule that F.B.s were removed only if readily accessible. The large fragments practically always carried some cloth with them, and often there was a collection of sero-pus around them and sometimes a collection of gas visible also in X-ray. Large splinters were removed, but smaller ones were left and, in a few cases, later, localized abscess formation round the F.B. required incision.

General anaesthesia was employed in all these cases as with local it would have been impossible to explore the wounds completely.

After the modified excision technique described above, the wound was treated with sulphonamide powder, light packing with sterilized vaseline gauze carried out and plaster of Paris applied.

It was our experience that with the proper institution of drainage and immobilization in plaster of Paris the patients were comfortable, their temperatures, which on admission were often elevated, fell, and in some cases the dressing could be left alone for six weeks, at the end of which time removal of the dressing showed an apparently healthy, granulating wound with advancing union of fractures (if these were present).

In other cases at the end of fourteen days the plaster was removed, a culture from the wound done, and secondary suture carried out.

Elevation of the temperature without pain and with no rise of pulse-rate does not call for the removal of the plaster. A white cell count is done and if a leucocytosis is present a course of sulphonamide is given and the condition settles down, so long as there is free drainage from the wound.

With the closed plaster treatment, if drainage is incomplete, then pain, elevation of pulse-rate and temperature occur and, on removing the plaster, examination of the wound usually reveals undrained collections of pus which are dealt with and the plaster re-applied.

It was our experience that it was very seldom necessary to remove a plaster case. We also found that changing of a plaster and dressing the wound was usually followed by a rise of temperature lasting three or four days.

The question of the smell which develops is one that has not been satisfactorily answered but we were trying, with perhaps as much success as any other measure, the effects of gauze bags filled with coffee grounds bandaged on to the stained part of the plaster.

There is no doubt that the closed plaster treatment, combined with the prophylactic use of sulphonamide, controls the local infection, provided adequate drainage to the surface has been allowed. Healthy looking granulation tissue is rapidly promoted but the growth of

epithelium appeared to be delayed and often, though the fracture had united, the skin lesion was still granulating and the epithelium surrounding it was thin, blue and unhealthy.

In some cases skin grafts were done, in others we were trying the effect of dressing the wounds with a 15 per cent solution of fresh chicken heart in Ringer's solution. This method was tried out in co-operation with the staff of the Hadassah Hospital, Jerusalem, and seemed to have a very definite effect in hastening epithelialization.

*Chemotherapy.*—A standard dosage of sulphonamide (and of M & B 693 in the case of chest wounds) was employed as routine. Whether the men had been on doses of sulphonamide prior to admission could be culled from their A.F. W. 3118, but all cases were given a post-operative course and no toxic effects were noted.

**WOUNDS OF BUTTOCK.**—There were 28 of these, 18 due to G.S.W. and 10 to splinters.

Of these, six men had through and through wounds of the buttock which received no other local treatment than a flavine dressing. They healed quite well and their average stay in hospital was nineteen days. One of these cases was transferred to an Australian General Hospital on the twelfth day, but the others were sent to the Convalescent Depot where they were under canvas and had to "do" for themselves.

In 8 cases the wounds had been excised and packed in a C.C.S. In 2 cases excision and primary suture had been done before admission. Needless to say these 2 cases were grossly infected on admission, and their stay in hospital was over sixty days apiece, F.B.s having to be removed later from both. In the 8 cases where excision and packing had been done prior to admission, F.B.s were removed in 4 and left alone in 2, and their average stay in hospital was fifty-three days.

In the 9 cases which we had to deal with primarily, a modified excision and treatment with M & B 693 powder locally, followed by drainage with sterile vaseline gauze and closed dressing, was the routine. Their average stay in hospital was thirty-seven days.

Of the 28 cases, 18 were sent to the Convalescent Depot after a stay in hospital of an average of forty-four days, 6 were transferred to an Australian or Indian General Hospital after an average stay of sixty days, 2 were sent to the Prisoner of War Camp, and 2 were boarded to the United Kingdom.

#### COMPLICATIONS OF BUTTOCK WOUNDS.

(1) (i) *Infection* occurred in 12 cases and could, I think, have been avoided by better drainage on excision. This figure includes the 2 cases primarily sutured at a C.C.S. Two cases had exit wounds so close to the anus that infection was hardly avoidable.

(ii) *Bone Injury.*—Only 2 cases of buttock wounds were complicated by bone injury—(a) a comminuted fracture of ilium with entrance wound in buttock and exit in right iliac fossa, (b) a comminuted fracture of ischium.

(iii) *Nerve Injury.*—One case had a complete sciatic nerve paralysis. He had a huge grossly infected wound and was transferred to the orthopaedic centre after a period of 110 days.

In another case the sciatic nerve was exposed in the wound but not damaged. He had a temporary paralysis which cleared up and he was discharged to the Convalescent Depot on the seventy-fourth day.

Two cases had temporary paresis of the leg with drop foot and accompanied by severe hyperaesthesia along the distribution of the common peroneal nerve. Both recovered completely.

(iv) *Vessel Injury.*—One case had a severe secondary haemorrhage from the gluteal vessels which required transfusion and packing.

(2) **WOUNDS OF THIGH** totalled 69—27 due to splinters and 42 to G.S.W.

Of these, 8 had through-and-through wounds with varying degrees of muscular destruction; in 2 cases no surgical treatment had been carried out prior to admission to the General Hospital. In both these cases, which were admitted 16 days and 7 days respectively after the infliction of the wounds, gradually increasing swelling of the thigh made its appearance, and in both a large haematoma surrounding a wound in the femoral artery was discovered; ligation had to

be carried out. The other through-and-through wounds had been treated at a C.C.S. by excision and were treated on arrival at hospital by modified excision and free drainage instituted.

Foreign bodies were removed at the time of primary operation in 9 cases, at a later date in 8 cases, and not removed in 11 cases.

The majority of the other thigh wounds were large, gaping wounds with involvement of large amount of muscle and nearly all infected.

*Bone Injury.*—There were 6 cases of fracture of femur, comminuted, and 1 fractured patella.

*Nerve Injury.*—1 division of sciatic nerve ; 1 complete drop foot ; 1 partial drop foot which recovered.

*Vessel Injury.*—3 cases of injury to femoral artery with puncture of wall—two already described.

*Amputations.*—There were 4 amputations of thigh—3 primary before admission to the G.H. and 1 for sepsis following ligation of wounded femoral artery.

*Average stay in hospital.*—

36 discharged to convalescent depot after average stay of 51 days.

22 transferred to Australian General Hospital, Free French Hospital or Indian General Hospital after average stay of 42 days.

4 boarded to U.K. after average stay of 114 days.

3 transferred to P.O.W. camp after average stay of 11 days.

4 to duty R.T.U. after average stay of 54 days.

*Infection of the thigh* wounds was the most common complication and in several cases there was evidence of anaerobic cellulitis clinically, and in one case of gas-gangrene infection of the biceps femoris muscle, which was excised, and the wound treated with M & B 693 powder supplemented by oral sulphapyridine. This case developed no further symptoms.

The only method of preventing and dealing with infection is free and meticulous excision, local and general treatment with sulphonamide and infrequent or closed dressings of the adequately drained wound.

(3) WOUNDS OF LEG totalled 94, of which 51 were due to *G.S.W.* and 43 to splinter wounds.

*Foreign bodies* were removed in 8 cases and were left alone in 16.

Four of the *G.S.W.s* were *through-and-through* wounds.

There were 4 amputations in this series, all done prior to admission to our hospital.

The wounds were associated with *fractures* in 28 cases, i.e. a little over 28 per cent of wounds of leg were associated with fractures.

The tibia and fibula were fractured in 6 cases ; the tibia alone in 19 cases ; the fibula alone in 3 cases.

*Nerve injuries* complicated the wounds in 8 cases—the posterior tibial nerve in 1 case, the anterior tibial nerve in 1 case, and the common peroneal nerve in 6 cases.

*Vessel Injury.*—There were 3 cases of blood-vessel injury accompanying wounds of leg—one of the anterior tibial artery, one of the posterior tibial artery, and one of the popliteal artery.

The average stay in hospital for wounds of the legs was as follows :—

44 were discharged to 1 B.C. depot after an average stay of 42 days.

41 were transferred to other hospitals after a stay averaging 30 days.

7 were returned to their units after an average stay of 36 days.

2 were boarded to United Kingdom after an average stay of 79 days.

(4) WOUNDS OF THE FOOT accounted for a total of 38 cases, and of these 31 (or 81 per cent of the cases) had *fractures*.

(1) Os calcis was fractured in 11 cases (4 bilateral).

(2) Talus alone was fractured in 2 instances.

- (3) Talus and navicular in 2 instances.
- (4) Navicular alone was fractured in 1 instance.
- (5) Cuboid and metatarsals in 1 instance.
- (6) Multiple fractures of tarsus in 1 instance.
- (7) Metatarsals and phalanges in 12 instances.
- (8) Os calcis, cuboid and talus in 1 instance.

Foreign bodies were removed in 4 cases and left in 5 cases.

The causes of the fractures were:—

- (i) Due to G.S.W. in 24 cases.
- (ii) Due to splinters in 7 cases.
- (iii) Due to land mines in 7 cases.

#### *Disposal.*

18 were discharged to convalescent depot after 42 days.

13 were transferred to other hospitals after 23 days.

3 were discharged to unit after 48 days.

4 were discharged to United Kingdom after 148 days.

There were 2 cases of mid-tarsal amputation and 2 cases of amputation of toes performed.

In one case amputation was for gangrene of 2nd and 3rd toes and was performed in our hospital; the others were done prior to admission.

(5) WOUNDS IN THE REGION OF THE KNEE-JOINT accounted for 23 cases: of these, 8 were penetrating wounds of the joint, 15 of the wounds were due to G.S.W. and 8 to splinter wounds.

In 6 cases foreign bodies were removed from the region of the joint, and in 4 cases the foreign bodies were left.

Nine wounds in this region were complicated by fracture:—

- (i) The patella in 2 cases.
- (ii) The patella and femur in 1 case.
- (iii) The femoral condyle (med.) in 1 case.
- (iv) The tibial condyle in 3 cases.
- (v) The fibular head in 2 cases.

There were 2 cases of wounds of the popliteal artery requiring ligature and the common peroneal nerve was involved in 2 cases.

The disposal and length of stay in hospital were as follows:—

- (1) 12 cases to con. depot after average stay of 42 days.
- (2) 5 cases to other hospitals after average stay of 17 days.
- (3) 2 cases to their units after average stay of 5 days.
- (4) 2 cases to duty after average stay of 67 days.
- (5) 2 cases to U.K., boarded, after average stay of 49 days.

#### *Result on leaving hospital—stiffness.*

Of the 16 cases discharged to their units, duty and convalescent depot, 10 had good movement of the knee-joint despite the fact that foreign bodies were left in 2 cases, 6 had limitation of flexion, and all of these were through-and-through wounds, and of these 4 had fractures and 1 had locking? and 2 effusion.

(6) WOUNDS IN REGION OF HIP-JOINT.—These numbered 7, and 4 of these cases were wounded by explosion of land mines and had fractures of the pelvis.

(7) WOUNDS OF UPPER EXTREMITY.—These totalled 122, i.e. 25 per cent of the total were wounds of upper extremity. Of these 53 or 43 per cent were complicated by fracture and 24 or 19 per cent had wounds of other parts of the body.

*Foreign bodies* were removed either at the time of primary operation or later in 14 cases, and in 15 cases the foreign bodies were left in. 70 of the wounds were due to G.S.W. and 52 were caused by splinters.

*Fractures* were present in 53 of the cases:—

- Humerus fractured in 9 cases.
- Radius and ulna fractured in 7 cases.
- Radius alone fractured in 6 cases.
- Ulna alone fractured in 6 cases.
- Carpal bones fractured in 5 cases.
- Metacarpals fractured in 12 cases.
- Metacarpals and phalanges fractured in 4 cases.
- Phalanges fractured in 4 cases.

*Involvement of Joints.*—The shoulder-joint was involved in 1 case only, the elbow-joint in 4 cases, in 2 of which the olecranon was shattered, and in 1 of which the radial head was shattered.

The radio-carpal joint was involved in 2 cases and the carpal joint in 1 case where there was associated fractures of lower end of radius, hamate, triquetrum, scaphoid and base of 5th metacarpal.

*Nerve Injuries.*—Injury to nerves occurred in 13 cases as follows:—

Incomplete lesion of radial nerve in upper third of arm in 1 case.  
Complete lesion of median in forearm wound in 1 case, and complete lesion of median and ulnar nerves in wound of upper arm in 1 case.

In the other 10 cases the ulnar nerve was involved:—

- Complete lesion in shoulder wound in 1 case.
- Incomplete lesion in upper arm wound in 1 case.
- Complete lesion at elbow in 2 cases.
- Incomplete lesion at elbow in 1 case.
- Complete lesion in forearm in 1 case.
- Incomplete lesion in forearm in 3 cases.
- Incomplete lesion in hand in 1 case.

Six of these 10 ulnar nerve lesions were showing signs of clearing up, or had recovered, on the patients leaving hospital.

*Blood-vessel Injuries.*—There were 2 cases of wounds of the radial artery in lower third of forearm. In both cases injury had been overlooked at the primary operation and severe hæmorrhage from a traumatic aneurysm occurred, requiring ligation and transfusion in both cases.

*Through-and-through* wounds occurred in 16 cases in which no other treatment than dressing the wounds had been adopted. The hand was involved five times, the forearm five times, the shoulder region twice and the elbow, upper arm, axilla and deltoid regions once each. In these 16 cases the average stay in hospital was 21 days.

Several wounds had been excised and sutured at forward stations, and in all these cases infection was definitely encouraged by the sutures, which were removed on admission.

*Amputations* in upper extremity wounds totalled 13.

- (1) Guillotine upper arm performed prior to admission.
- (2) Lower third forearm performed prior to admission.
- (3) Mid third forearm performed prior to admission.
- (4) At wrist-joint performed prior to admission.
- (5) Thumb blown off at M.C.P. joint prior to admission.
- (6) Fifth finger blown off at M.C.P. joint prior to admission.
- (7) Amputation thumb at M.C.P. joint.
- (8) 1st, 2nd, 3rd and 4th fingers amputated at M.C.P. joints.
- (9) Thumb, 1st and mid fingers amputated at M.C.P. joints.
- (10) Index finger amputated at M.C.P. joint.
- (11) 1st, 2nd and 3rd fingers amputated at M.C.P. joints.
- (12) 4th and 5th fingers amputated at M.C.P. joints.
- (13) 5th finger amputated at M.C.P. joint.

The *disposal* of cases and average stay in hospital for upper extremity wounds was as follows:—

53 cases to the convalescent depot after average stay of 45 days.

41 cases to other hospitals after average stay of 25 days.

20 cases to duty after average stay of 29 days.

1 case boarded to U.K. after stay of 12 days.

7 cases to P.O.W. camp after average stay of 17 days.

In 3 cases there was marked limitation of movement of the elbow-joint and in 6 cases stiffness of fingers was marked—extension of fingers and flexion of the elbow were the movements restricted.

(8) HEAD AND NECK WOUNDS accounted for 48 patients or 9 per cent of the total. 17 of these were complicated by fracture, and 9 had wounds in other parts of the body. Of these wounds 27 were due to G.S.W.; 9 were due to splinters; and 12 were due to bomb wounds.

*Fractures.*—Of the 48 cases, 6 had fractures of skull, 7 had fractures of mandible, and 4 had fractures of maxilla.

*Foreign bodies* were removed in 7 instances and left alone in 4, viz. (1) in cerebellum, (2) body of sphenoid, (3) parietal lobe, and (4) in the neck behind the œsophagus.

*The eye* was irreparably damaged and enucleated in 5 cases.

*Disposal.*—The maxillary and mandibular fracture cases were sent to the Facio-Maxillary Unit and numbered four. One case was transferred to the Neuro-Surgical Unit.

8 cases returned to unit after an average stay in hospital of 27 days.

16 cases were sent to the convalescent depot after an average stay of 30 days.

17 cases were transferred to other hospitals after an average stay of 61 days.

4 cases sent to P. of War camp after an average stay of 18 days.

3 cases died in hospital after average stay of 15 days.

Deaths were due to (1) rupture of cerebral abscess into ventricle twenty-four hours after admission; (2) F.B. in cerebellum and meningitis; (3) G.S.W. jaw died under anæsthetic.

(9) CHEST WOUNDS numbered 35—7 per cent of the total.

27 were due to G.S.W. and 8 to shell or bomb wounds. 13 of these cases had wounds in other parts of the body. 9 were non-penetrating wounds.

*Foreign bodies* were present in 7 of the cases in the following situations:—Left lung, 4 cases; right lung, 2 cases; diaphragm, 1 case.

*Fractures* of ribs or shoulder girdle were present in 5 of the 35 cases. There were 21 cases of intra-thoracic complications: Hæmo-pneumothorax was present in 2 cases; hæmothorax was present in 15 cases; hæmothorax with collapsed lung in 3 cases; broncho-pleural fistula in 1 case.

*Hæmoptysis* was present in only 3 of these cases.

In *Hæmothorax* cases treatment was:—(1) 10 cases treated by rest alone—average stay in hospital 30 days. (2) 3 cases treated by aspiration—average stay in hospital 88 days. (3) 2 cases treated by rib resection and closed drainage on account of infection—average stay in hospital 96 days.

*Disposal:*

5 returned to duty after average stay of 18 days.

14 sent to convalescent depot after average stay of 36 days.

14 transferred to other hospitals after average stay of 50 days.

2 transferred to P.O.W. camp after average stay of 16 days.

(10) WOUNDS OF TRUNK AND SPINE.—These totalled 12—4 being wounds due to G.S.W. and the remaining 8 to shell or bomb fragments.

*Bone injury* was present in 4 cases and in 3 of them foreign bodies were embedded in the vertebral bodies, and in 1 case in the spinal canal. None of these foreign bodies were sought for, and altogether foreign bodies were removed in 3 out of the 12 cases.

There were 2 cases where the spinal wound was complicated by *hæmothorax*. In 1 case there was complete paraplegia at level of 4th and 5th dorsal vertebræ, and in another involvement of body of 2nd lumbar vertebra with affection of the femoral nerve.

The others were mostly shell-splinter wounds and their disposal was as follows :—

- 5 returned to their unit after an average stay of 11 days.
- 3 transferred to convalescent depot after an average stay of 27 days.
- 3 transferred to other hospitals after an average stay of 19 days.
- 1 died after 12 days in hospital.

(11) GENITO URINARY WOUNDS.—There were 6 cases of this type, 2 due to G.S.W. and the rest to splinters.

The two G.S.W.s were interesting :—

- (1) Pte. B., wounded on 30.6.41—sustained :—
  - (i) Superficial entrance and exit wounds anterior aspect right thigh.
  - (ii) Bullet passed through corpora cavernosa causing hæmaturia but no obvious injury to urethra—small entry and exit wounds of penis.
  - (iii) Superficial entry and exit wounds anterior aspect left thigh, and
  - (iv) lacerated wound outer aspect of left thigh where the bullet had ricocheted after hitting a coin in left trouser pocket and lodged there.

The wounds were excised and treated with M & B 693 powder on 3.7.41, and he made a good recovery.

(2) Fus. W., G.S.W. perineum, entrance at side of anus. Laparotomy performed at C.C.S.; projectile had gone through the right side of bladder, exit near right kidney. Perforated small gut sutured and cystostomy. Recovery.

The other 4 cases were all splinter wounds of the scrotum, 2 of them superficial and 2 accompanied by hæmatocele of tunica vaginalis, one of which became infected and required incision and drainage.

(12) ABDOMINAL WOUNDS numbered 6—4 due to G.S.W. and 2 to splinters. All had signs of visceral damage and were operated on either at C.C.S. or hospital within twelve hours of wounding.

LATE COMPLICATIONS of war wounds were largely due to sepsis and included :—

(1) *Abscess formation* round retained foreign bodies.

(2) *Thrombosis*, usually femoral, from sepsis in the thigh and notoriously staphylococcal in origin.

(3) *Sequestrum formation*, requiring sequestrectomy, was a frequent complication, and it was our practice to rely largely on the result of the X-ray examination in deciding when to remove sequestrum. In the upper extremity it was usually four to six weeks before the sequestrum was removed, and in the lower extremity eight to twelve weeks before the sequestrum was separated.

(4) *Causalgia* was a complication encountered in G.S.W. of buttock and thigh. Characterized by burning pain of great intensity, vasomotor disturbances and marked hyperæsthesia. The suggestion that the condition is caused by irritation of the peri-arterial sympathetic fibres is upheld, as there was no spinal nerve lesion associated.

(5) *Hæmorrhage from Traumatic Aneurysm*.—This complication, alarming in its onset and trying in its treatment, occurred in four cases :—

- (i) In radial artery in upper third forearm.
- (ii) In anterior tibial artery in upper third leg.
- (iii) In femoral artery in lower third thigh, and
- (iv) In popliteal artery.

All four cases had sustained through-and-through G.S.W.s and the wounds had primarily been treated at C.C.S.s. In none was there any evidence of interference with the circulation



of the limb below the lesion. All started bleeding copiously from their wounds which in two of the cases were enclosed in plaster of Paris.

In all, after transfusion of citrated blood, the wounds had to be opened up and in all, except one, after clearing away a mass of organizing blood clot, a small gaping wound was discovered in the wall of the artery involved. In all four cases, proximal and distal ligation of the affected vessel was carried out, and the collateral circulation already developed, even in the case of the popliteal, was sufficient to preserve the limb. In one case amputation had to be carried out at a later date for sepsis.

(6) *Staphylococcal Septicæmia*.—There were two cases of this, both originating in G.S.W. thigh, and one of these had, ultimately, to have his thigh amputated.

*Results*.—Of the 488 cases treated, there was only one case of clinical gas gangrene and none of tetanus. There were four deaths in the series.

#### SUMMARY AND CONCLUSIONS.

(1) The closed plaster treatment combined with controlled chemotherapy is the ideal treatment of war wounds. The comfort and painless healing is in marked contrast to the painful and shockful methods which were in vogue in the last war. Just as the Winnett-Orr treatment of osteomyelitis converted the post-operative treatment of that condition from months of acute physical and mental suffering to a comparatively painless convalescence free from the agony of frequent dressings, so has the closed plaster treatment operated in war wounds. Where plaster of Paris treatment is impossible, the aim should be infrequent wound dressings—using acriflavin or euglamide.

(2) Primary suture has no place in war wounds.

(3) The importance of *Transfusion* of large amounts of blood in cases of hæmorrhage and of repeated small (250—500 c.c.) transfusions of *freshly* citrated blood in septicæmia cannot be over-rated.

(4) While the closed plaster treatment hastens the process of granulation in large wounds it appears to delay the epithelialization of such wounds, which process is stimulated by air and by light—U.V.R.

(5) *Disposal of Cases from Hospital*.—The statistics given for the average duration of stay in hospital in this paper are vitiated by reason of the transfer of cases to other hospitals before treatment was complete. This rapid emptying of General Hospitals to make room for fresh cases is one of the great drawbacks and interferes with the continuity of treatment which one is accustomed to in civilian practice.

I am indebted to my first Commanding Officer, Colonel E. V. Whitby, who was A.D.M.S. of the area during the time these casualties were admitted.