

Described by Brigadier General Rankin as "one of the finest dissertations on management of wounds which has been submitted through the Office of the Surgeon General of the U. S. Army," this paper by Colonel Churchill, arrived just as we were closing the first issue of the ANNALS OF SURGERY devoted to the transactions of the American Surgical Association. It was immediately accepted to appear in the Annals with the Transactions as a contribution by Col. Churchill, in absentia. The Editors join the Association in welcoming this fine report from an important battle area, and in congratulating Col. Churchill for his high accomplishment in the field and in reporting such excellent work.

THE SURGICAL MANAGEMENT OF THE WOUNDED IN THE MEDITERRANEAN THEATER AT THE TIME OF THE FALL OF ROME

COLONEL EDWARD D. CHURCHILL, M. C., A. U. S.

"I would remind you again how large and various was the experience of the battle-field, and how fertile the blood of warriors in rearing good surgeons."

T. CLIFFORD ALLBUTT.

FOREWORD

BY

BRIG. GEN'L FRED W. RANKIN, M.C.

DIRECTOR, SURGERY DIVISION, U. S. ARMY

The present-day health standards of our troops and survival rate among our wounded have been unequalled in the history of warfare. Perhaps one of the most important factors contributing to this highly gratifying record has been the role played by the professional consultants whose functions may be broadly described as administrative, correlative, advisory, educational and analytical. Consultants in the major fields of endeavor have been attached to every Service Command in the Zone of Interior and to all active Theaters of Operations. Selected on the basis of their special training and extensive background and on their eminent qualifications, they have been able to perform an incalculably valuable function in promoting higher standards of medical practice in this war.

As Surgical Consultant to the North African and Mediterranean Theater of Operations and representative of this group, Colonel Churchill has done more than improve the quality of surgery performed in this Theater. Uniquely equipped to perform his mission and imbued with the true scientific spirit, he early recognized the inadequacy of certain preformed concepts in the surgical management of the wounded. With this flexibility of mind and with an elastic organization, he has utilized an investigative approach and drawn

upon battlefield experience to evolve more rational and effective methods in the surgical care of the wounded. In this article, he has epitomized these observations and principles which constitute not only a contribution to war surgery but also to the advancement of medical science.

WOUND MANAGEMENT may be divided into three phases—initial, reparative and reconstructive. The first two are concerns of an overseas theater. The latter is the mission of the Zone of the Interior.

INITIAL SURGERY

The initial surgery of the forward area is primarily directed toward the preservation of life and limb. The immediate physiologic disturbances incident to blood loss and the wound itself are corrected by both resuscitative and surgical measures. Wound infection is prevented or controlled by surgery and chemotherapy.

Resuscitation from shock has two goals: first, to render the casualty transportable and preserve his life until a hospital can be reached; and second, to prepare the casualty to withstand life saving surgical procedures. Shock as observed in the forward area is caused by whole blood loss except in burns, crushing injuries or rapidly advancing infection. Plasma is used in the divisional area to prepare the wounded for transportation and keep them alive until they can reach a hospital. Whole blood would be preferable, but it is not practical to use transfusions within the divisional area.

Plasma alone is not adequate to prepare a seriously wounded casualty to withstand the surgical procedures that are essential, or to carry him through the critical postoperative period. After admission to hospital a limited amount is used to augment the effects of whole blood transfusion. Plasma is a substitute for whole blood only in the sense that it can be packaged and stored in adequate quantity in areas where blood cannot be obtained. Plasma is not a substitute for whole blood in the physiologic sense. For these reasons a Blood Transfusion Unit procures and processes whole blood in the base and distributes it to the Army installations.

Shipments of blood were made by L.S.T. to the Anzio beachhead in February. As the front advanced and forward landing strips were opened, blood has been shipped each day by plane. In approximately four months, over 16,000 pints of whole blood have been drawn and processed for delivery to the Fifth Army. The blood is drawn by vacuum into bottles that are used only once. Glucose is added to the citrate as a preservative. Each flask of blood is triply checked for type, examined by smear for malaria and Kahn-tested.

Although Type "O" blood is commonly referred to as "universal donor" blood, its use in large amounts in patients of other types is hazardous unless the agglutinin titer is low. Every bottle of blood is titered and only those with an agglutinin titer less than 1 to 64 are issued as "universal donor" blood. All banked blood carries an expiration date of seven days.

To augment the supply of blood forwarded from the base, evacuation hospitals maintain their own unit blood banks. Responsibility for the supply of type specific blood other than "O" rests upon the individual hospital.

The initial wound operation is directed toward the prevention of infection by a complete excision of tissue devitalized by the missile. Procedures such as closure of a sucking wound of the chest or suture of a perforation of a hollow viscus restore physiologic equilibrium as well as arrest the dangers of infection. Recognition of all devitalized tissue is often times impossible, particularly in a massive wound or one complicated by skeletal injury. Disturbances of blood supply and subtle changes that indicate impending death of tissues may not be detectable. In a certain number of these cases mixed anaerobic infection of residual dead tissues is the inevitable sequela. Others will develop invasive infection spreading from the wound to involve normal tissues. To minimize the incidence and hazards of infection, primary closure by suture is strictly avoided. Exact maintenance of the reduction of fractures by precise methods is precluded by the necessity for evacuation to the rear, so temporary or transportation splinting, usually with plaster of paris, is employed.

Chemotherapy is initiated in the field by local and oral administration of sulfonamides. The value of this procedure is questioned by many surgeons of experience. Preoperative penicillin therapy is started on all but the lightly wounded casualties on admission to hospital in the forward area. At operation, topical application of penicillin is carried out only in wounds penetrating the meninges, serous cavities and joints. Parenteral administration is continued beyond the period of the likelihood of infection or until established infection has been controlled. No patient is held in the forward area solely for the purpose of continuing penicillin therapy.

Just as plasma is not a substitute for whole blood in resuscitation, neither are sulfonamides and penicillin substitutes for the surgical excision of devitalized tissue. Chemotherapeutic agents cannot sterilize dead, devitalized or avascular tissues nor do they prevent the septic decomposition of contaminated blood clot.

In this war there have been two quite different approaches to the application of chemotherapeutic agents to military surgery. The first would utilize these agents to permit delay in wound surgery, and minimize the completeness of the excision of dead tissue. The second employs chemotherapy to extend the scope of surgery and achieve a perfection in results previously considered impossible. The latter policy has guided the surgery of the Mediterranean Theater. To reiterate the axiom that penicillin is not a substitute for surgery is not enough. Every surgeon must learn that chemotherapy opens new and startling possibilities in wound management.

The magnitude of the surgical problems that confront the forward surgeons when supported by adequate resuscitation therapy is difficult to visualize by one not having a first-hand acquaintance with their work. Highest standards of precision must be maintained if the potentialities of surgery

are to be realized to full advantage. This precision must be attained in the use of the adjuncts to surgery as well as in operative technics. Initial surgery cannot be carried on as a hasty, slap-dash and bloody spectacle, with rapid evacuation of the patient to the rear if satisfactory results are to be achieved. The average operating times for certain types of cases recorded at an evacuation hospital were: one hour 49 minutes for penetrating wounds of the head; two hours for wounds of the abdomen; two hours and a half for wounds of the thorax. Many casualties have multiple wounds that require several major procedures in sequence or simultaneously. Postoperative care is as important as the operation and may demand holding the patient for ten days or longer.

Triage at the divisional clearing station based on the urgency of the wound and the condition of the casualty establishes a "three-point forward system," as described by Jolly in the Spanish Civil War. This provides a small surgical hospital for first priority casualties—in this theater a single platoon of a field hospital reorganized and equipped for this specific mission. Other casualties of less urgent types are transferred back to the chain of Evacuation Hospitals. An important modification of the system has placed the Field Hospital Platoon in physical conjunction with the clearing station triage point. This provides for the immediate transfer of wounded from the clearing station to the first priority surgical hospital by hand litter. No pause is required for resuscitation or interference with splinting or dressings. Expert surgical management that embraces resuscitation, operation and prolonged postoperative care, becomes immediately available. Cases with a continuing source of shock that cannot be made transportable without an operation are thus salvaged and the desperately wounded receive expert care as far forward as it can be provided.

Surgeons assigned the responsibility of caring for the wounded in a first priority surgical hospital must be highly trained and experienced, as their tasks are the most exacting of military surgery. The Auxiliary Surgical Group has been found ideal as a source for this personnel. The experience of the individual surgeon is augmented in the base during periods of an inactive front. Unity and uniformity in the control of this portion of forward surgical personnel has produced a high level of competence as well as economy in the deployment of specialized surgical skill and talent. If the achievements of surgery in this theater are ever judged noteworthy, they are attributable to the fact that expert rather than inexperienced surgeons are doing the work. All other measures are ancillary items.

A well-run first priority surgical hospital exerts a remarkably favorable effect on the morale of combat troops and their officers. The divisional medical service receives a stimulus to maintain its arduous task by first hand evidence that the lives of the most desperately wounded may be saved by skillful first-aid measures and rapid evacuation. Splinting is improved, the use of plasma in Aid Stations is increased and the temptation for clearing

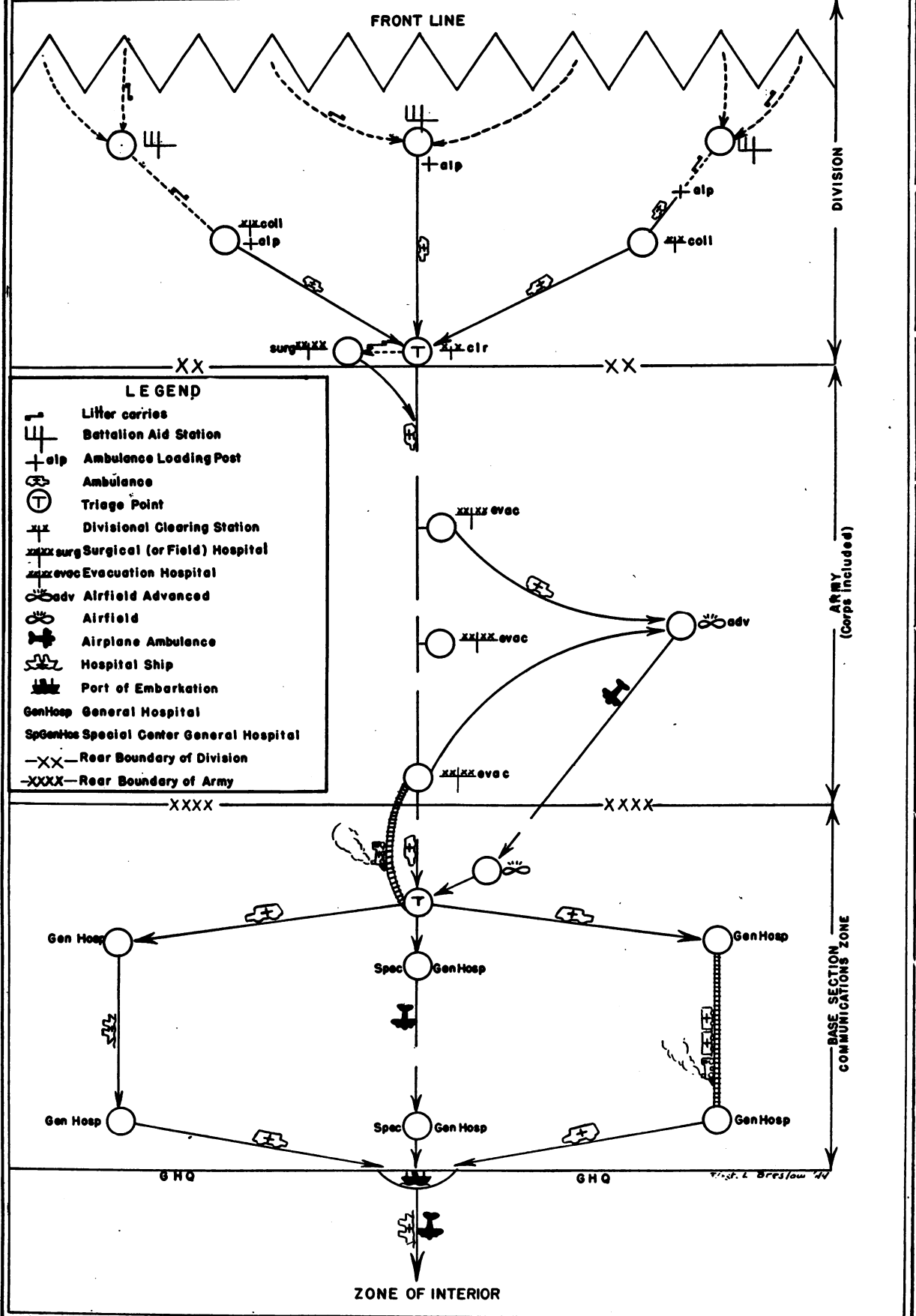


FIG. 1.—Diagrammatic representation of an Overseas Theater.

or collecting companies to indulge in heroic surgical procedures for which they were never designed or equipped is removed.

Evacuation hospitals handle the great bulk of the wounded in the forward area, as the small group of first priority cases diverted to the Field Hospital Platoon constitutes approximately one-thirteenth of the total number. These institutions, with trained and experienced professional staffs, have attained a high degree of proficiency in the procedures of initial wound management and remain the backbone of the Army medical service.

REPARATIVE SURGERY

A highly significant and far-reaching advance in military surgery has taken place in the base hospitals with the development of what may be called *reparative surgery*. Wounds left unsutured at the initial operation are routinely closed by suture, usually at the time of the first dressing. With the use of penicillin as a safeguard against infection, the management of wounds complicated by fracture or joint involvement has been revolutionized. Surgical procedures in special fields of surgery—thoracic, craniocerebral, abdominal—have also been radically altered by the application of similar principles. The significance of this development and its effect on returning an increased number of wounded soldiers to duty and in preventing deformity, disability and death in the seriously wounded can hardly be overestimated.

Reparative surgery is not to be confused with the reconstructive surgery of the Zone of the Interior. Reparative surgery is designed to prevent or cut short wound infection either before it is established or at the period of its inception. Once established, wound infection is destructive of tissue and at times of life. In many instances it permanently precludes the restoration of function by the most skillful reconstructive efforts.

If the initial wound operation has been a complete one, wounds of the soft parts may be closed by suture on or after the fourth day. The dressing applied in the evacuation hospital is removed under aseptic precautions in an operating room of a general hospital at the base. Following closure, the part is immobilized preferably by a light plaster encasement, or if this is impractical, by bed rest.

Decision to close a wound by suture is based solely on an appraisal of the gross appearance at the time of removal of the dressing. Preliminary qualitative or quantitative bacteriologic analysis of the flora of the wound by smear or culture does not provide information pertinent to this decision or allow the prediction of the result. "Clean" wounds that heal by first intention after delayed closure may show a profuse and varied flora, both anaerobic and aerobic. Identification of species and tests for pathogenicity would require weeks of arduous laboratory procedure.

It is estimated that during the Italian Campaign alone, at least 25,000 soft-part wounds have been closed on the basis of gross appearance only. Healing has resulted in approximately 95 per cent, and no loss of life or limb or serious complications have been reported. Residual dead tissue in a

deep recess of the wound is the most common cause of the failure in the 5 per cent that may be classed as unsuccessful closures. If the suture is not successful because of infection, appropriate studies and corrective therapy is instituted before resuture is attempted.

The presence of residual dead tissue or established invasive infection at the time of the first dressing is evidenced by discharge of pus and redness

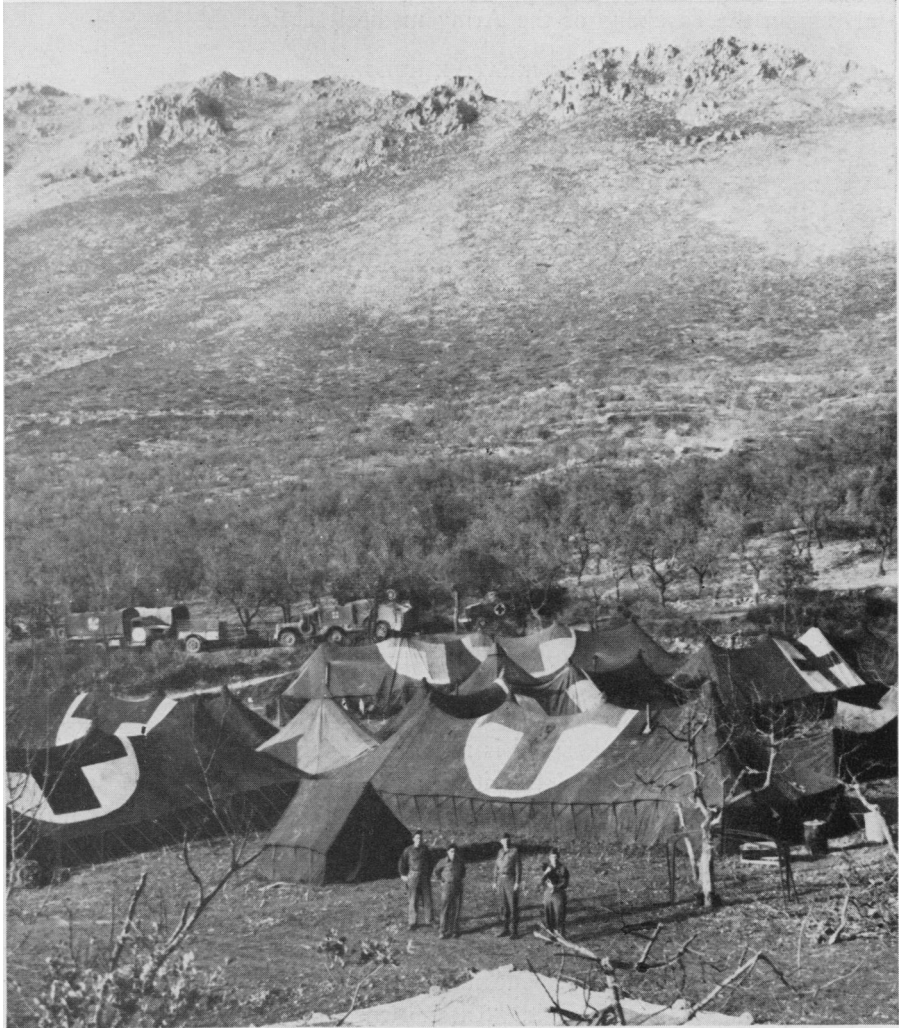


FIG. 2.—Platoon of a Field Hospital acting as a forward surgical hospital with Fifth Army in Italy.

and edema of the wound margins. When these are present but minimal, the wound is allowed to "clean up" with moist dressings. Surgical excision of devitalized fragments or removal of retained foreign bodies may speed this process. Secondary closure may then be performed after a few days. If established infection is severe, or if the patient is toxic or anemic, a course of

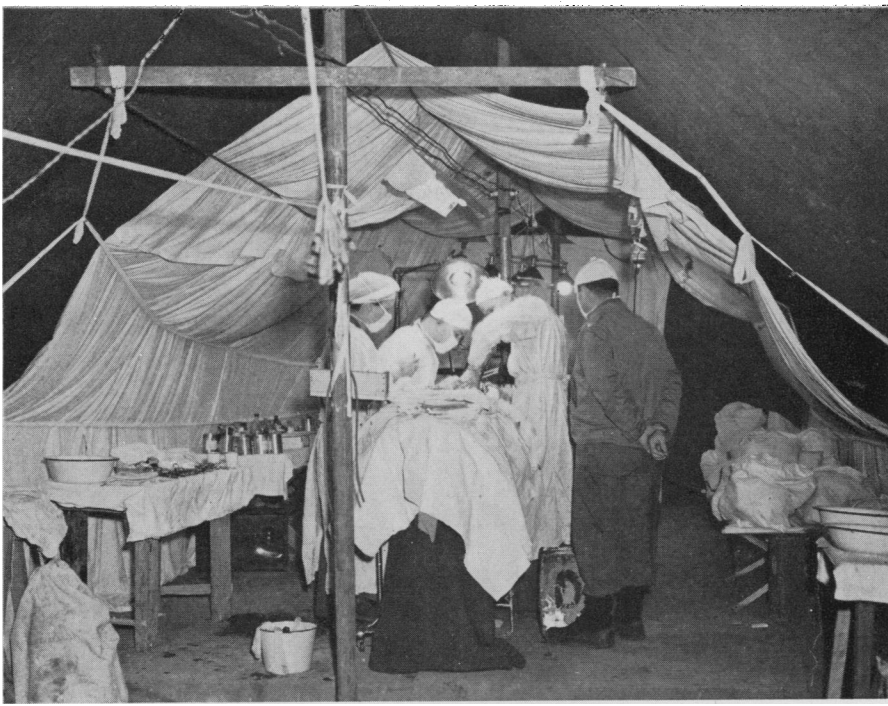


FIG. 3.—Initial wound surgery for first priority cases at the rear boundary of the divisional area. Surgical team operating in a Field Hospital Platoon.



FIG. 4.—Expert postoperative care under difficulties of wind, rain and mud. Continuous transfusion of blood and plasma. Gastric siphon drainage.



FIG. 5.—Evacuation Hospital with Fifth Army in Italy—December, 1943.

FIG. 6A

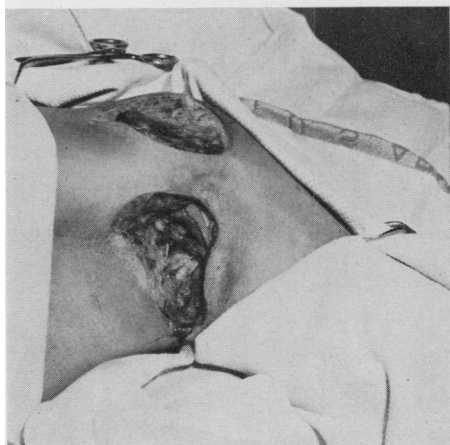


FIG. 6B

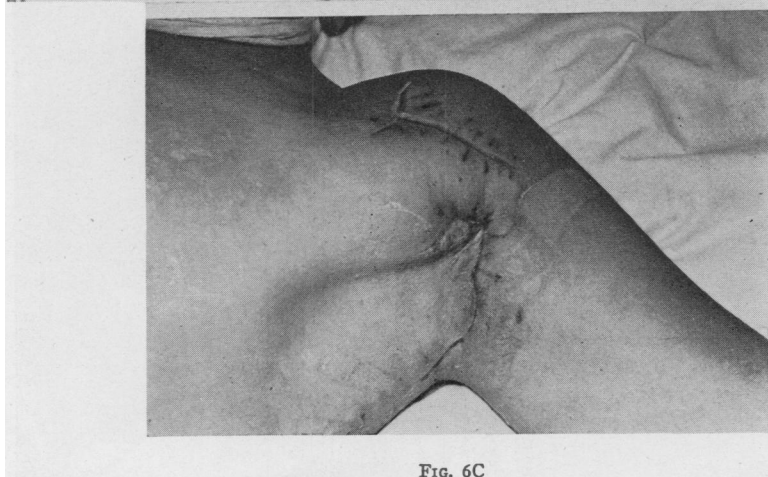


FIG. 6C

FIG. 6.—Reparative surgery of soft-part wound of axilla:
 (A) First dressing at base hospital four days following initial débridement in forward evacuation hospital.

(B) Closure of wound by secondary suture with advancement of skin flap into axilla.

(C) First-intention healing 12 days after suture; 16 days after wounding.



FIG. 7A

FIG. 7.—Reparative surgery of wounds compounding fractures of both bones of the forearm and fracture-dislocation of the humerus.

(A) First dressing at base hospital on fifth day. Secondary anemia corrected by 1600 cc. of whole blood. Penicillin therapy.

(B) Screw fixation of comminuted head of the humerus following open reduction of dislocation.

(C) Reduction of fracture of both bones of the forearm with wiring at fracture site of the radius. Application of skeletal traction.

(D) Wound closure.

(E) Postoperative skeletal traction.



FIG. 7B



FIG. 7C



FIG. 7D

penicillin therapy and blood transfusions is instituted and followed by radical wound revision with staged closure.

The topical use of sulfonamides appears to contribute nothing to the favorable results of reparative wound surgery. Parallel series of closures show as satisfactory or better results without the topical application of sulfonamides at the time of suture, as with it. Penicillin therapy is entirely unnecessary as an adjunct to the usual reparative surgery of soft-part wounds. It is used parentally for cases of established infection and in the reparative surgery of complicated wounds.

The reparative surgery of complicated wounds, including those with extensive muscle damage as well as those with skeletal or joint injury and penetration of the viscera, is a more major undertaking. It is in this group that both the incidence and hazards of infection may be expected to be greater. It is this group of cases that is kept on penicillin therapy during the interval between initial and reparative surgery and so main-

tained until the likelihood of infection is past. Immediate correction of secondary anemia on arrival at the base is an essential part of the program as the days are few during which the anemia from the initial blood loss may be projected into the anemia of chronic infection and indolent wound healing. The procedures of reparative surgery are frequently of great magnitude and the patients must be adequately supported by whole blood transfusions before, during and subsequent to operation.

Compound fractures are removed from transportation splints, the wound is revisioned for further removal of devitalized tissue, reduction of the fracture is secured and maintained by skeletal traction, internal fixation or other means as indicated. The original débridement incisions directly compounding the fracture site are closed by suture. Dependent stab wound drainage to the fracture site is usually established for a limited period of time.

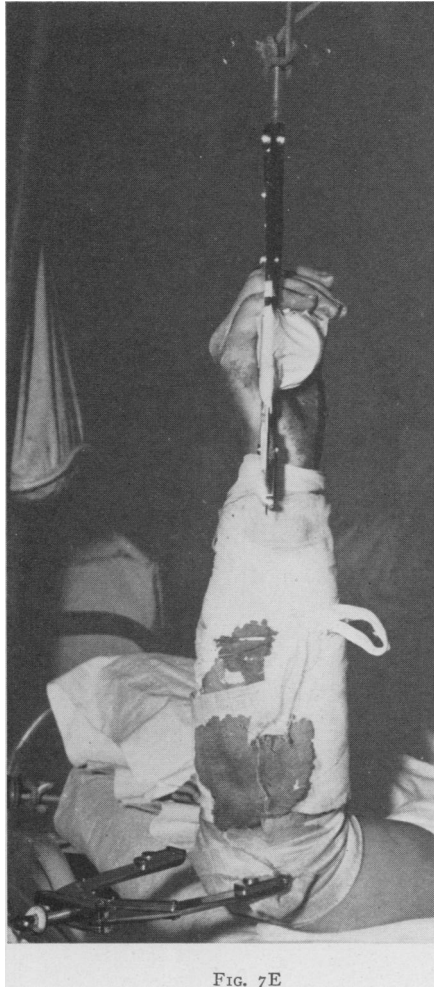
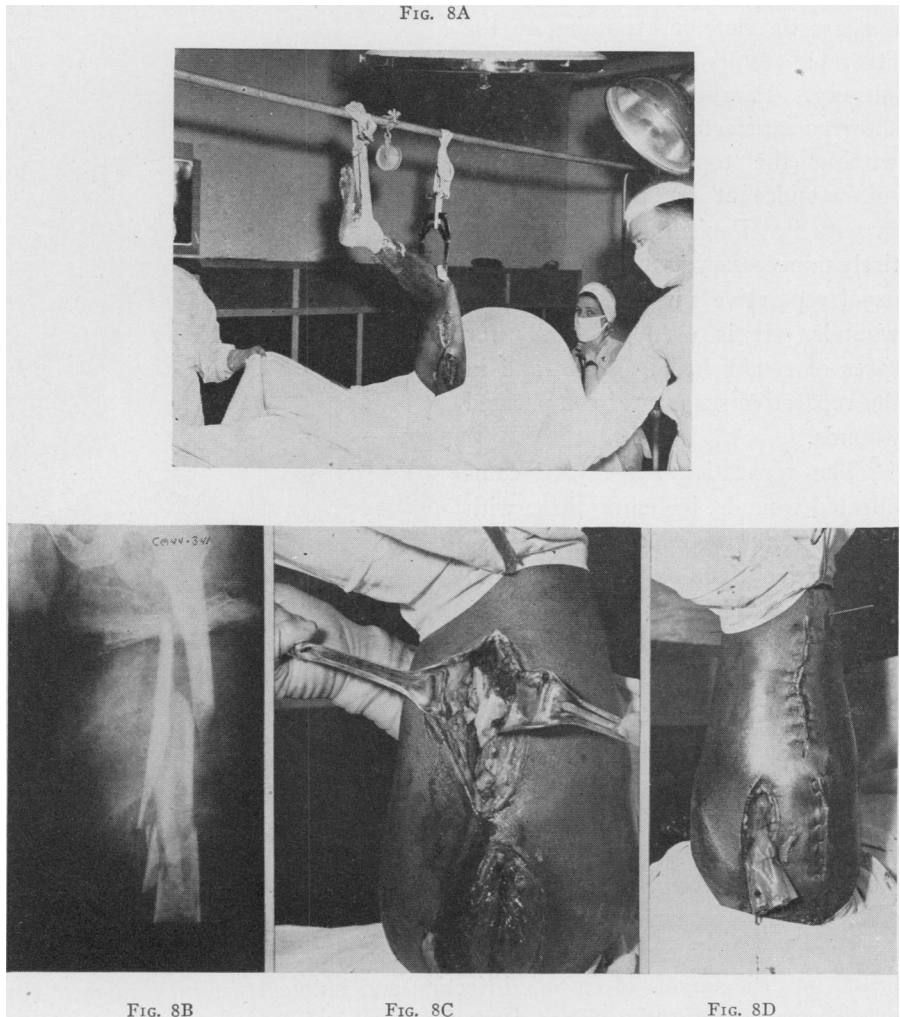


FIG. 7E

Open arthrotomy is carried out for impending or early joint infection. Devitalized cartilage and retained foreign bodies are removed and the joint space closed. In a few cases when serious trauma or early established infection has irreparably ruined the joint architecture, resection of the joint



- FIG. 8.**—Reparative surgery of compound fracture of the femur.
- (A) Suspension for operative access at the first dressing on the sixth day following initial débridement in a forward hospital. Anemia corrected by transfusion, penicillin therapy.
- (B) Comminuted fracture as received at the base following evacuation to the rear in a hip spica encasement.
- (C) Revision of the fracture site, with removal of residual devitalized bone fragments.
- (D) Closure of débridement incisions; establishment of posterior dependent drainage; wire inserted for skeletal traction.

has been performed and satisfactory healing in a position of maximum usefulness achieved.

Radical management of massive organizing hemothorax by thoracotomy,

evacuation of the clot and decortication of the lung has proved its effectiveness in returning soldiers to duty and appears to have diminished the incidence of empyema. The same procedure applied to established posttraumatic empyema with penicillin therapy as an adjunct, is followed by immediate healing with a fully expanded lung. It is no longer acceptable to hold that a patient with a penetrating chest wound is making satisfactory progress as long as empyema has not made itself manifest. The focus has been changed from

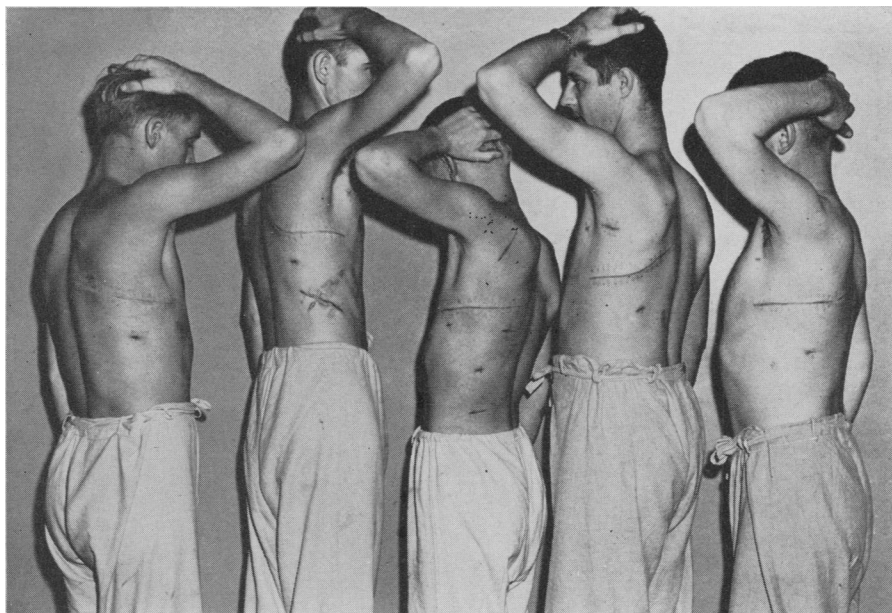


FIG. 9.—Reparative surgery of thoracic wounds.

Five patients, all with severe mixed infection empyema of residual hemothorax following débridement of wounds of the chest in the forward area. Varying degrees of pulmonary collapse and fibropurulent loculation of pleural space. Without preliminary drainage, thoracotomy with decortication of the lung performed on 9th, 16th, 21st, 21st and 21st days after wounding. Penicillin therapy, parental and topical. Complete primary healing, with fully expanded lungs—ready for rehabilitation to duty status.

the management of posttraumatic pleural infection to the preservation of lung function. In the history of military surgery this will stand as one of the significant advances of World War II.

Early closure of small intestinal fistulae is a life-saving measure. Repair of exteriorized segments of large bowel returns a certain number of soldiers to limited duty and simplifies the nursing problems of the evacuation of others to the Zone of the Interior. Loop-sigmoid colostomy as an adjunct to the management of wounds of the perineum and anal regions has permitted early secondary suture followed by closure of the colostomy and return to full duty.

Skin loss in wounds comes from the missile, the over enthusiastic surgeon or infection. Skin defects attributable to tangential hits or the tearing action of the missile at the wound of exit are repaired by skin grafts as early as the

fourth day following injury. In facial injuries, splinting of the bony parts and primary suture of soft parts with provision for drainage at the time of initial surgery is followed by meticulous wound management on arrival at the base. It is believed that there is a material reduction in the incidence of disfiguring mutilations. Extensive loss of skin and soft parts attributable to the missile is not commonly observed, and it seems likely that many of the facial mutilations of warfare are attributable to loss of tissue by sepsis and contracture—both preventable.



FIG. 10.—Tangential wound of calf producing skin and soft-part defect measuring four by five inches. Secondary débridement at base hospital on twelfth day following initial débridement. Immediate split-thickness skin graft. First dressing shown five days later (17 days after wounding). No chemotherapy for reparative surgery.

Revision of craniocerebral wounds when there is evidence of residual devitalized tissue or impending infection is followed by closure when feasible even if established infection is disclosed. Observations are being made relative to the earlier repair of peripheral nerve injuries. This is a procedure that may better be considered as early reparative surgery rather than late reconstructive surgery. The projected method of management includes revision and appraisal of the nerve injury at the time of secondary wound closure and in suitable cases repair as soon as satisfactory healing is established (two and one-half to three weeks).

To realize fully the potentialities of reparative surgery requires the introduction of a new concept in the organization of military surgery. The time-lag between wounding and initial surgery referred to as "the golden period"

has been greatly reduced by the organization of medical service in the forward area to this end. The time-lag between initial surgery and reparative surgery has now assumed an equal degree of importance. Just as every hour added to the time-lag between injury and initial surgery increases the loss of life and limb, so does every day added to the time-lag between initial and reparative surgery. Four to ten days is the "golden period" to close wounds, reduce and fix fractures, remove retained missiles and carry out other procedures to prevent or abort infection. To fail to take cognizance of the potentialities of early reparative surgery at the base in the future plans and operations will be as unthinkable as a failure to plan for the removal of the wounded from the field of battle.

Air evacuation between Army and Base, early establishment of general hospitals in close support of an advancing Army, sorting of casualties on arrival at Base so they may have the benefit of expert and specialized surgical management, are matters of administrative import. Education of surgeons to undertake new and unfamiliar procedures; the correction of anemia by whole blood transfusion so that essential surgery may be undertaken at an early date and increased attention to rehabilitation procedures are some of the major problems faced by professional personnel.

Particularly important is the concept that the surgical management of a wounded soldier from the field of battle to his ultimate hospital disposition within the theater demands continuity of policy and effort. A wounded man is not like a box of ammunition or a crate of rations that can be deposited at the boundary of an echelon and responsibility dismissed. Only by co-ordination of policy and methods between echelons can military surgery attain its full stature.

It is a satisfaction to note the contrast between the present concept of wound management and the doctrines in vogue scarcely a year ago. The closed-plaster management of wounds and fractures was designed to conserve life but exacted a high price in skeletal and soft-part deformity. Its use is now limited to certain cases with established infection of bone or with massive defects of soft parts compounding a fracture site. Recommendations that minimized the necessity for a complete initial wound operation or sought to delay it (wound trimming, "salting down with sulfa drugs," *etc.*) accepted suppuration as inevitable in a considerable proportion of cases and relied on chemotherapy to hold sepsis within bounds. Resuscitation measures that relied on plasma alone to compensate for loss of whole blood prolonged life but tied the hands of the surgeon in the performance of life-saving surgery. These and other earlier concepts were but faltering steps toward what will emerge as the ultimate scope of surgery as developed in the present war.