

## Chapter VIII

### ADVANTAGES OF X-RAYS FOR MILITARY USE

Objections have been raised to the proposal to make the minor changes necessary to permit use of x-ray therapy in the front lines in order to eliminate the gas bacillus menace. For example, it has been stated that the mortality in gas bacillus infection is only a small fraction of the total deaths which occur from any cause. This statement regarding mortality is true, but it does not comprehend the many cases of crippling which result from débridement performed to avoid gas bacillus infection or the extensive surgical equipment and highly trained personnel necessary to perform this prophylactic type of surgery.

These casualties do not show in the mortality rate, nor are the time and energy expended in their care evident in the mortality records, but everyone knows the influence that gas bacillus infection has on the routine followed for first-aid care of the wounded. The entire first-aid procedure with regard to prevention of infection is organized to prevent tetanus and gas bacillus infection.

The mortality and morbidity in the present war should be only a fraction of what they have been in the past. Never again should a wounded soldier who is able to walk into an evacuation hospital die of a simple puncture wound of an extremity and subsequent gas gangrene.

For a country as large as ours, with its widely separated borders to defend, it seems that some of the x-ray therapy units and other medical personnel and equipment could be equipped for air transportation. This would make them more readily accessible to rapidly changing battle fronts which may be separated by thousands of miles. Noncombatant insignia should indicate the character of the planes and protect them from attack. They certainly would be as safe as motorized ground equipment, which is forced to travel the same roads as ammunition and troop trains.

One plane could carry four or more complete x-ray units. The entire personnel of the plane, officers, technicians and mechanics, could be permanently assigned to a plane. In time of

battle it could be placed with the evacuation forces in a position to treat wounded men within 12 to 24 hours after their injury. One plane with its personnel and x-ray equipment could thus expedite the flow of wounded to the rear by working in close cooperation with several surgical teams in the field or evacuation hospitals.

Much surgery must necessarily be performed, but it could be reconstructive from the first and not destructive, since an x-ray treatment for prophylaxis would eliminate the need for extensive débridement or early amputation and permit complete closure of a great many wounds which under other forms of treatment are left open.

For wounds which are infected when first treated with x-rays, subsequent treatments should be given at 12 hour intervals; prophylactic treatments should be given once every 24 hours. X-ray treatment should be continued for three to five days, occasionally longer, depending on the condition of the patient.

It is not necessary to disturb the bandages to give the x-ray treatment if only radiolucent dressings are used. No opaque dressings or ointments of mercury or zinc, extra-heavy casts or opaque metallic splints should be permitted.

With four or more tubes in operation, it would be possible for one crew to treat from 700 to 1,200 patients every day, depending on the number of hours of operation and allowing six minutes as the average time for each patient. With heavier tubes, it might be practical to decrease the time for each treatment, thereby making it possible to increase the number of treatments given each day. At any rate, one such unit could care for many wounded men and then could easily be flown to another point if the necessity should arise. Wounded men reaching a center where x-ray therapy is available 12 to 24 hours after their injury should not die of gas gangrene, and many infections due to other types of organisms could also be held to a minimum.

Control of hemorrhage, closure of wounds of the skull and viscera, immobilization of all broken bones, reduction of dislocations, suturing and repairing of all soft tissues with complete closure of practically every wound, administration of tetanus antitoxin and measures for relief of pain must be instituted as early as possible. *There is no longer any reason for the many*

*amputations or extensive removal of undamaged tissues in first-aid stations on the suspicion that gas gangrene may develop.* This was necessary in the past, but now that x-ray prophylaxis is available, no gas gangrene infection need develop. No anti-gas bacillus serum is necessary. *Always use tetanus antitoxin.*

Regardless of its possibilities for civil use, there can be no question of the necessity for a suitable apparatus for the military services for the prevention of infection during the second or third 12 hour period after injury.

Débridement is a serious operation, and in inexperienced hands it is especially serious, as Major Charlton<sup>10</sup> rightly stressed when he stated: "If the special training in this procedure must be secured at the expense of the early wounded in the next war, as in the last, it will be unfortunate, but, perhaps, unavoidable."

In the report presented to the Radiological Society of North America in 1931, it was stated that much apparently gangrenous tissue recovered, and no further surgical measures were necessary after x-ray therapy was started. In our report of 1938 it was suggested that only tissues cut off from normal circulation and easily accessible foreign bodies should be removed during the first-aid procedure.

We are certain that tissues which appear to be severely damaged by gas bacillus infection often recover their vitality and normal function after irradiation. Any débridement required can be done after the acute toxic and invasive phase of the disease has passed—the fifth to seventh day or even later. In other words, the necessity for débridement is not the same today as it was 20 years ago; x-ray therapy has changed the indications for this procedure so completely that at times débridement is entirely unnecessary. It is not indicated for gas gangrene until after the line of demarcation has formed and one has determined which tissue is vital and which is nonvital. Operating at this stage is much less serious than during the period of initial shock from the injury and of active invasion of the infection. The advanced first-aid stations are not the proper place for débridement for gas bacillus infection of any tissue which has any prospect of recovery.

There is no time to waste on the battlefield for the care of an early wound, and prolonged treatment of any kind is out of the question. Emergency treatment must be immediate, simple and

quickly completed. X-ray tubes must be manufactured to deliver sufficient r units to each port required in not more than two or three minutes. This is not much time to spend on a wounded area of tissue every 12 or 24 hours, especially since it provides adequate treatment or prophylaxis.

More wounded men could be handled in a given time with x-ray than with any extensive surgical measure, such as continuous irrigation; furthermore, there would be greater economy for the soldier concerned because he would not have the permanent deformity and disability which often follows extensive débridement.

Controlling all hemorrhage by complete closure of all wounds, thus insuring primary repair in a large percentage of cases, is a feature which cannot be overlooked and can best be provided by the use of x-rays for prophylaxis and therapy. Without x-ray therapy, not only are the wounds left open, they are enlarged by numerous incisions. The dangers of serious hemorrhage in such circumstances are obvious.

We believe the wounded man can be prepared more quickly and more efficiently for a safer and shorter convalescence with x-ray therapy than without it.

#### FIRST AID WITHOUT X-RAY THERAPY

The following comment by Eloesser<sup>8</sup> relates the difficulties encountered with the older methods of surgical management and the inefficiency of the chemicals.

It was evident to surgeons who took part in the late civil war in Spain that modern warfare was to differ greatly from previous wars and that the difference would be due to advances in the mechanics of transportation and especially to extensive use of aviation. It was apparent that surgeons had much to learn and to unlearn in matters of organization, *in evacuation of wounded* and also *in the treatment of war injuries. Especially noticeable was distrust in chemical anti-sepsis. Irrigation, Dakin's tubes and the complicated ritual of anti-sepsis that ornamented military hospitals in 1918 were unused or forgotten. Their place was taken by extensive incisions and plaster of paris splints.* Rapid military movements, and the need, after the bombing of thickly populated centers, of attending great masses of wounded *called more than ever for surgical methods that were rapid and safe and that permitted of prompt evacuation with a minimum of postoperative attention.* Trueta has written of these methods in his monograph of the Treatment of War Wounds and Fractures. The

interest his manual has aroused is evidence of our concern for military preparedness.

It appears, therefore, that two methods are available for the handling of wounded men. One consists of the plan previously used, which makes no attempt at tissue reconstruction. It advocates cleansing the wound, using chemicals locally and multiple incisions and then allowing the wounds to remain open. The other plan includes cleansing the wound as thoroughly as possible, suturing the remaining structures to permit the start of primary repair and administering x-ray therapy for the prevention of infection. Chemicals may also be used locally.

The principal difference in the two plans lies in the fact that when x-ray therapy is used for prevention of wound infection it is apparently safe to suture the damaged tissues instead of removing them, as is recommended when x-ray therapy is omitted. The former plan starts with destructive surgical procedures, whereas the latter emphasizes reconstructive measures from the beginning of surgical care. This can be accomplished in five to 10 minutes of every 24 hours without removing any dressing or in any way disturbing the patient. We believe our wounded soldiers are entitled to the latter plan.

There have been so many inquiries on this subject that the foregoing discussion relative to the military application of x-ray therapy for the wounded seems warranted at this time. It should be clear, however, that despite the fact that x-ray prophylaxis and treatment of wound infection is essential, the details of the procedure are yet to be worked out. The foregoing remarks are based on the data now on hand, but experience, after all, is the best teacher and with experience will come the plan that will be finally adopted.

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