War Surgery of the Extremities

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TREATMENT OF WAR WOUNDS AND FRACTURES

BY

J. TRUETA, M.D.

The special features of modern warfare, and particularly the wide use of the aerial bomb, have introduced a great diversity in the type of war wounds, while the new strategy of air attack on the civil population has necessitated fresh arrangements for the reception and treatment of casualties. The organization of the surgical services must be adapted to the requirements of the varying conditions, but the actual treatment of any war wound—whatever the nature or scene of the battle in which it was received—should always be based on certain fundamental biological principles.

A Five-point Programme

The biological treatment of wounds (if we may so call it) rests on five basic principles. To ensure the greatest possible success in treating a recently inflicted wound, each and all of these five principles or "points," as we shall term them, should be applied. They are: (1) prompt surgical treatment; (2) cleansing of the wound; (3) excision of the wound; (4) provision of drainage; (5) immobilization in a plaster-of-Paris cast.

Point 1: Prompt Surgical Treatment.—The successful healing of a wound depends largely on the promptitude with which appropriate treatment is given. The risk of serious post-traumatic infection is directly proportional to the time interval between the receipt of the wound and the surgical operation. The work of the rescue parties, ambulance services, first-aid posts, and resuscitation teams must all be organized in such a way as to enable surgical treatment to be given with the minimum of delay. The shorter the period during which the casualty is left untended, and the shorter the time taken in transport to hospital, the earlier can resuscitation begin and the patient be ready for operation.

At this stage let me say that the choice of anaesthetic is important if the operation is not to cause undue risk. Spinal anaesthesia should never be used in shocked patients. Gas-and-oxygen should be given only by an experienced anaesthetist, and if the latter is not available ether should be used. It is important to remember that a patient suffering from shock requires much less anaesthesia than a fit subject. The amount of anaesthetic given should be the minimum required to enable the surgeon to carry out his task. In cases of severe shock a local anaesthetic should be employed.

Point 2: Cleansing of the Wound.—No antiseptic known to-day is equal to soap and water as a means of dealing with contamination in a wound. Even the best antiseptic is unable to remove "dirt" from the wound, and the majority in fact actually fix the dirt in the tissues. Others increase the risk of infection by further destruction of the cells. Both sodium coco-nut soap and sodium ricinoleate are more effective in getting rid of bacteria from a wound than are most of the non-caustic antiseptics. The staphylococcus is the only organism that has a certain degree of resistance against these soaps. For the skin a solution of iodine or a similar skin antiseptic should be used. At the end of the operation the wound may be dusted with sulphanilamide. I never used this in my country, where I treated over a thousand cases with this technique, and with only a very few exceptions had uniformly good results; but there now appears to be enough experimental evidence to justify the local application of one of the sulphonamide compounds as a prophylactic measure.

Point 3: Excision of the Wound.—This is the keystone of the whole technique and the factor which permits the final procedure—namely, the application of a closed plaster. *Without proper excision no recent wound should be enclosed in plaster.* This is a rule to which there can be no exception, and it is generally a lack of appreciation of the vital importance of proper excision that is responsible for the failures that may occur with this technique. To ensure proper excision the wound must first be enlarged (the *débridement* of the French). In wounds caused by high-explosives the extent of

damage in deeper tissues, particularly the muscles, is often enormously greater than that in the skin and superficial layers, and consequently, unless the traumatic opening in the skin is considerably enlarged by incision, excision of the deeper tissues is very difficult and must generally be incomplete. After the initial incision of the skin and fascia, and the excision of the dead portions of these tissues, the operation proceeds layer by layer into the deeper tissues in successive stages of incision and excision, until the bottom of the wound is reached. The periosteum, however, must never be incised. Only a narrow strip of skin should be excised; excision of the fascia should be radical, and that of the muscles still more radical, but in the case of the bone we must be as conservative as possible and limit resection to fragments which have lost their periosteal connexions or their muscular attachments.

Point 4: Provision of Drainage.—Dry gauze of a very fine mesh (similar to that employed in bandages of good quality) should be used to provide drainage for a recent wound. The gauze is inserted without pressure into the intramuscular spaces, and a flat layer is laid over the surface of the wound. Where a deep and narrow cavity remains at the bottom of the wound counter-drainage must be provided by the insertion of a piece of corrugated rubber through an opening into its most dependent part. The next and final stage of the technique, the immobilization in plaster, is also designed to provide drainage. Good plaster-of-Paris is highly absorbent, and the direct contact between the dry gauze and the plaster covering the wound facilitates the rapid absorption of the relatively small amount of discharge (mainly lymph and blood) which comes from a clean wound.

Point 5: Immobilization in Plaster-of-Paris Cast.—With the provision of drainage the last stage in the surgical procedure is accomplished and the wound is now ready for protection. The only single method that will prevent initial absorption of toxic products from the wound, protect the granulation tissue and newly formed epithelium from damage, and provide an effective barrier to secondary infection is the use of the plaster-of-Paris cast. This should be applied direct to the skin, except over bony prominences. The plaster should be well moulded to the limb, particularly over the wound, in order to establish good contact with the drainage gauze and to maintain a gentle pressure on the surface of the wound, a factor which assists the progress of epithelization.

Importance of Proper Wound Excision

Here, then, we have a "five-point technique." In treating a recent wound the surgeon's aim should be to fulfil to the utmost each and all of these five points. It is important, however, to remember that the keystone of the whole technique, on which success ultimately depends, lies in Point 3. Without proper excision, however faithfully the other points are fulfilled, the technique is worthless or even dangerous. Now, in that Point 3 is closely linked to, and indeed largely dependent on, Point 1, the latter is also an extremely important factor. Early operation is essential for proper excision. If the operation is carried out more than six or eight hours after infliction of the injury the contaminated area may by this time be so extensive that the amount of enlargement and excision required makes the procedure a very serious one. Point 5 in its turn depends on Point 3, for unless excision is complete the treatment of a recent wound in a closed plaster, far from being beneficial, is fraught with serious danger.

In the case of Points 2, 4, and 5 it might be possible, in certain injuries that are more frequent in peacetime than in wartime, to substitute alternative methods without seriously affecting the success of the treatment, as follows:

Point 2.—If and when an ideal antiseptic is found this may come to be used in place of the soap and water which are the best means known to-day of cleaning a wound.

Point 4.—In peacetime injuries drainage is not always necessary and the wound can often be closed by primary suture, although in war wounds primary suture is permissible only in exceptional cases.

Point 5.—Relatively good immobilization can be obtained by other methods—e.g., continuous traction, the Thomas or Braun splint, etc. Nevertheless the closed plaster, inasmuch as it provides many other beneficial effects that are absent in alternative methods, is in my opinion superior to all others for the treatment of recent wounds, always provided that Point 3 (excision) has been properly carried out, a factor which, as we have already seen, largely depends on the fulfilment of Point 1.

"Closed-plaster Technique"

In this article I have purposely avoided the term "closed-plaster technique"—which has generally been employed to describe the method I use for the treatment of recent wounds

—because it lays stress on only one part of the technique, and that, while undoubtedly of very great importance, not the most essential part. This misconception has given rise to some discussion as to the paternity of the technique which I have been advocating in this country during the past two years. Some surgeons believe that the only difference between my technique and that of Winnett Orr is that I use dry gauze and he vaselined gauze. I decided to take no part in a discussion which I thought would contribute nothing to the progress of our science and which would only seem to set me up as a rival to Winnett Orr, for whom I have a great admiration and respect. I now realize, however, that I made a big mistake in not doing so, for I find that many surgeons to-day are under the impression that my technique is simply the Orr technique applied to recent wounds—an impression which is so contrary to fact that it is apt to lead to disastrous results in treatment. The Orr technique, which Winnett Orr himself said was based on the provision of drainage and immobilization in plaster, is certainly the best method of treating wounds at a stage when the patient has survived the great dangers of the initial period. The indications for this later technique, if not universally accepted, are at least well known, and the sceptical attitude adopted by surgeons in Spain, France, and finally in England (I have reason to believe in the U.S.A. also), when I first reported the results I had obtained in treating recent wounds in Barcelona, was, I think, due to their belief that my method was nothing more than the Orr technique applied as soon as possible after the infliction of the wound. Moreover, experience seemed to justify the doubts of these surgeons, for complications occurred following the use of a technique based on drainage and plaster immobilization. Winnett Orr himself has recently stressed the fact that his technique is based on the two principles of drainage and rest, saying that excision is a secondary factor which should only be carried out by surgeons of wide experience. To this I would reply that my technique is based on five principles, the "points" that I have described, of which excision is the most essential of all, and that no surgeon who is incapable of performing an elaborate excision should attempt to employ it.

As I pointed out in the small book I published two years ago, my original idea when I first began using the technique in 1929 was to combine the principles of Friedrich and those of Winnett Orr. In presenting it to British surgeons after ten years of personal trial, in which the initial difficulties that accompany any new technique had been largely surmounted, I hoped that my technique would provide a starting-point from which surgeons in this country could develop further improvements, and that they should not have to solve for themselves the problems that confronted me twelve years ago.

In a base hospital, where surgeons have to deal only with patients who have survived the most critical period, the Orr technique is undoubtedly the best, and it was the cases which he saw in these conditions during the last war that suggested to Orr the technique which he later developed. But I am convinced that in dealing with recent wounds of any kind the only way to obviate the risk of gas gangrene or fulminating sepsis is to use a technique based on the five points which I have described. Further improvements should and will follow, but unless the treatment is built up on all five of the basic principles that I have so constantly described the technique is not my technique, and I disclaim all responsibility for the results which may follow its use.

Application of "Five-point Technique" to Front-line Casualties

It may be objected that in the case of wounds received in the front line application of the five-point technique is often impossible owing to the impracticability of fulfilling Point 1—namely, prompt surgical treatment. On the face of it such an objection would appear to have some justification. Although to-day a soldier wounded on the battlefield can be treated much more quickly than formerly, owing to the great mobility of modern warfare—for the speed of an advancing army, either his own or the enemy's, will quickly leave him in the rear—nevertheless a considerable period must still often elapse before he arrives in hospital. In this interval shock increases and his condition becomes more serious, and consequently, when even-

tually he reaches the surgeon, it may be found necessary to postpone operation until he is fit for it. Meanwhile the risk of gas gangrene developing is steadily increasing, and all too often by the time the patient has sufficiently recovered from shock to stand the operation this infection is already well established.

It is, however, still possible to apply the five-point technique to such cases if certain preliminary surgical measures are taken at the advanced casualty clearing station. The adoption of these measures will avoid, or at any rate lessen, the risk of gas gangrene and at the same time will allow the patient time for the resuscitation which he requires before the operation.

An injection of 0.005 g. of morphine in the case of patients whose sensitivity is already reduced by shock, or 0.2 to 0.5 g. of evipan in others, is a sufficient analgesic for the simple operative procedure required. The patient is laid on the table, undressed, and the wound examined, and as soon as the instruments are ready the injection is given. During the short operation a quick blood transfusion may be introduced by a rapid method such as the one of Duran (i.e., from closed bottles with an air pressure of 25 lb.). The skin surrounding the wound is quickly washed with soap and water and swabbed over with a solution of iodine. With a knife and a pair of scissors the wound is enlarged by incisions made above and below it, parallel to the long axis of the limb; the superficial and, when necessary, the deep fascia should be divided without hesitation. The wound is then dusted with sulphanilamide, a piece of dry gauze is inserted to keep it open, and the limb is immobilized by means of either a Thomas splint or a plaster cast. If the latter is used, a note must be written on the surface indicating that radical operation has not yet been performed.

The whole procedure will take a skilful surgeon less than ten minutes, and can be carried out while the first resuscitation treatment is taking place. The patient is then ready for evacuation to a base hospital, and can with relative safety wait for ten hours or so for his proper operation.

This preliminary treatment is equally applicable to air-raided casualties who have a serious penetrating wound and are severely shocked.

A FIRST-AID POST IN ACTION

BY

ARTHUR SHEARD, M.D.

The first-aid post with which I am associated is one of twenty-one similar first-aid posts in a northern city. It is in a large converted council school, and serves a well-populated working-class area of about 35,000 people. Organization and training of the staff are undertaken by my colleague, Dr. Arthur Barratt, and myself on alternate weeks. Every day the post is visited by the medical officer on duty, who also attends on three evenings each week to give instruction and supervise practice exercises, which are held very frequently.

The original staff of over 50 full-time workers has been cut down to 15, of whom 3 are men on 12-hour shifts of duty and 12 are women on 8-hour shifts. We depend very largely upon our part-time volunteer staff, numbering over 60, who take turns in sleeping at the post. A red warning brings a large number of volunteers for duty within a few minutes. Should the warning occur at night, between 7 p.m. and 7 a.m., four ambulances are sent to the post with ten cars for first-aid parties and sitting casualties. The officer in charge of the post is a full-time member of the staff, a nurse, who is responsible for the general administration in the absence of the medical officers. Her duties include supervision and training of the staff in first aid, home nursing, and gas decontamination. During a raid the medical officer is too busy doing surgical work to exercise command over the post, so the officer-in-charge supervises the organization, including various departments of control room with telephonists, clerks, and messengers, male and female reception rooms, first-aid rooms, rest rooms, store rooms, and canteen.

During the months of training we instituted a scheme for action stations, and by constant practice had reduced the time of preparation to less than five minutes. We found ourselves well prepared to render adequate treatment to the casualties