WAR WOUNDS AND AIR RAID CASUALTIES

The following is one of a series of lectures on the Treatment of War Wounds and Air Raid Casualties recently delivered at the British Postgraduate Medical School

WAR SURGERY IN SPAIN—I

BY

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"It has been more and more clearly demonstrated that the province of the surgeon is restricted to striving to eliminate or nullify the extraneous influences which tend to distort or interrupt the natural physiological process of repair."—SIR GEO. MAKINS.

It is my purpose here to give an outline of the practical lessons to be drawn from the most recent available experience in war surgery, both in the field and on the home front. It is of course impossible even to touch on all the developments that the well-organized Republican Medical Service in Spain has introduced into the practice of war surgery. I shall therefore limit myself to certain questions which have a general importance and in which I had an experience sufficient to enable me to give you a personal, not merely second-hand, opinion. I will touch on the present position in regard to three main topics: (1) the general problem of wound excision and primary suture, and the conditions favouring its success; (2) the treatment of septic wounds and of anaerobic infection; and (3) conservative surgery of limbs.

Wound Excision

Wound excision has completely replaced all attempts at local disinfection. This principle, which emerged from the great war, is now so generally accepted in war surgery that it would not need further mention except for the fact that in civil accident surgery it is by no means yet universally adopted. We may therefore unfortunately expect that the ancient practice of the casualty departments of many hospitals will be carried over into war surgery, in the first few weeks at least. We should of course insist on a proper standard of treatment of civil accidents in peace-time if we wish to secure the best treatment in war-time.

Success after primary wound excision consists in the avoidance of sepsis, and especially of gangrene. The chief factor in failure lies, I believe, not in a careless technique of asepsis, and certainly not in any possibility of anti-sepsis, but in the persistence in the wound of non-viable tissue or of gross foreign matter. It is in fact not merely the infecting organisms but their breeding ground that we must remove. For this reason a haematoma in a war wound is a potential danger, and must never be left unoperated. For this reason, too, injury to the femoral or popliteal artery is in my opinion a peremptory indication for immediate amputation if there is extensive laceration or a fracture.

Primary Suture

Once the excision is as complete as possible, and providing the case has come to operation within twelve hours, or in certain cases up to twenty-four hours, there is no contraindication to primary suture if certain conditions are fulfilled. The first of these is that the skin edges can be brought together without tension: sometimes a lateral incision, on one or both sides, will make this possible.

The second is that the case need not be further evacuated, but can be retained immobilized and under constant observation.

If the skin edges cannot be brought together without tension suture is useless and will always break down. If the case cannot be retained for the critical post-operative period suture is dangerous and should never be performed. I want especially to stress this point, because there seems to me to be a not very well considered readiness to advise primary suture after excision on the assumption that this will be the routine at casualty clearing stations, from which the majority of cases will immediately be further evacuated. If this is done I feel perfectly certain that our Spanish experience will repeat itself and that surgeons in base hospitals will be removing sutures almost as a routine as the cases arrive with severe sepsis or gangrene, while the surgeons in the casualty clearing stations will continue happily unaware of the lack of success of their operative efforts. The result might well be an undue reaction against primary suture as such, though it is of course the very best method available if the proper precautions can be taken. Further, there are certain cases which demand primary suture as the only method of saving life or limb. These are:

1. Open pneumothorax, a class by itself requiring immediate operative intervention, if possible at a first-aid post.
2. Penetrating head wounds. The results when the ventricles have not been penetrated are so excellent with early operation and primary suture without drainage that no case should ever be left unoperated over the twenty-four hours. The wound should always be sutured and the patient be given a period of ten days at least, twenty days if possible, of undisturbed post-operative rest. Without such treatment the mortality from such wounds, when the dura has been penetrated, approaches 100 per cent.
3. Penetrating wounds of joints form the third class of case that require excision and primary suture. The results after such treatment are again so excellent, and the consequences of any other treatment are so serious, that these cases should be brought into the class of urgencies for both operation and subsequent retention in the hospital of operation.

A few words on the technique of suture. I am strongly of the opinion that no internal suturing should be performed under any circumstances—neither of nerves nor of tendons nor of fascial layers. At most it is sometimes necessary to tie off an artery. I never sutured the capsule of any joint, and the results were uniformly good. With this technique the skin only is sutured, and it is sutured very carefully to secure exact apposition. This is the technique recommended by Böhler. His experience is overwhelmingly greater than that of any British surgeon can be, owing to our almost complete lack of organization of traumatology as an independent branch of surgery. The question cannot of course be regarded as settled. But it seems to me that surgeons who recommend internal suture of contaminated wounds should give us the practical experience on which they base their view.

If the incidence of infection after skin suture only is even appreciably lower than after suture by layers, or of nerves and tendons, then such internal suture should be avoided, since once the wound has healed by first intention a secondary aseptic suture of nerves and tendons

is easy and without risk, whereas, if infection supervenes, not only is the primary suture of nerves and tendons lost, but there will be both sloughing and the subsequent development of much scar tissue.

With regard to the sometimes recommended partial suture with a few "situation sutures" only, I can see nothing to recommend it. Either we hope to obtain healing by first intention, in which case we should suture completely and carefully, or, if we think we are not likely to obtain healing by first intention, we shall do better to leave the whole wound fully open without any suturing at all.

The Question of Drainage

It is now agreed that in certain situations drainage after primary suture should be avoided; these are the peritoneum, the skull and brain, the joints, and compound fractures where primary suture is attempted. It must be stressed emphatically that Spanish experience fully confirms the inadvisability of draining in such cases. But this leads us to question the advisability of draining at all where no sepsis is established, as after a primary suture. Drainage by strips of gauze, unfortunately still very popular in Spain, has to be mentioned only to be condemned. Such "drainage" acts merely as a plug, and if left for more than forty-eight hours makes sepsis a certainty. Dependent drainage is usually advised if it is thought that haemostasis is imperfect. Personally I would advise firm bandaging maintained for about six hours, which is sufficient to still any oozing.

So far, therefore, the wound is excised as completely as possible and the skin carefully sutured without drainage, but only if the conditions enumerated above are fulfilled. Firm bandaging has been applied to stop oozing; but this is in most cases only the first half of the operation, although the tradition that the surgeon's essential task is over once he has finished stitching is so deeply rooted in most that the second half of the operation—the task of providing rest for the wound—is usually relegated in textbooks to a simple statement such as "the limb should be placed on a skeletal splint."

Conditions Essential for Success in Wound Treatment

The surgeon who desires success in accident work—and war surgery is, after all, only a special and horrible form of accident surgery—must learn early the fundamental lesson of the great orthopaedists, of Robert Jones and of Böhler, that operative intervention is but an item in the treatment. Success in wound treatment depends on providing the optimal conditions for the injured tissues to undergo the spontaneous process of repair. The first part of the treatment consists in the apposition of live tissue to live tissue, after the removal of all foreign, dead, and dying matter. The second part is the provision of rest for the processes of repair and to overcome the infection which is almost inevitably still present. The conditions necessary are: immobility of the injured parts in relation to one another; a good blood supply; and the avoidance of all that hinders rapid tissue metabolism. This requires exact methods of immobilization in all severe limb injuries, even when a fracture is not present. The technique of immobilization is no more to be learned from lectures or textbooks than is the technique of operation. It needs practical experience. For this reason alone, since limbs are concerned in 70 per cent. of all war injuries, it is essential that the war-time general surgeon shall have had personal experience in the modern treatment of injuries in peace-time.

The second condition required by the freshly operated wound is a good blood supply and the reduction or avoidance of oedema. Elevation is therefore essential. Oedema is always present at first, the onset being fairly rapid and inevitable after the injury. But it is quite certain that the disappearance of this initial oedema is the best possible sign of success in treatment and that its persistence is invariably a sign of at least relative failure.

There is a third main principle in the post-operative treatment of wounds—non-interference. In this the Spanish War marks a definite advance. Not, of course, that the idea is at all new. The Winnett-Orr operation, the Dickson Wright treatment of varicose ulcer, and the occlusive treatment of septic burns are but a few examples of a general tendency to realize that the surgeon's task is to assist tissue repair that is trying to develop quite independently of any efforts on his part. Observing this principle of non-interference, there are two alternative methods available. One is that of open wound treatment with no dressing whatever. This method is applicable whether the wound has been sutured or not. The Catalan school of surgeons, strongly under the influence of Böhler, applied this method on a very wide scale. The results are so excellent that I feel quite certain that it is merely a matter of time until this becomes a generally recognized standard treatment in casualty work.

There is, however, another method which also gave such excellent results in Barcelona that it is a serious rival to open wound treatment. That method is the closed plaster cast applied to a fresh wound, with or without petroleum jelly. This is not so simple as open-wound treatment and needs discussion. In the first place, it is evident that if primary suture has been performed there is little advantage in a closed cast, but considerable danger. In these cases it is clear that a large window should always be cut immediately, with open treatment of the sutured wound. But there remains a number of cases when suture cannot be performed, and for these the closed plaster is the ideal form of treatment. The conditions for its application are, first, that a complete wound excision must have been performed; and, secondly, that the conditions are the same as for wound suture: the wound must be fresh—in general under twelve hours—and show no signs of infection already developed. This method may, however, be permissible for cases requiring further evacuation, if proper precautions are taken for observation of pulse and temperature, together with elevation of the limb during transport.

Organization of Surgery in War-time

I will now mention two principles that touch the organization of surgery, especially of the first operative intervention, in war-time. The principle governing field surgery is, of course, that the wounded must be got away from the front as far and as fast as possible, that absolutely nothing must be allowed to interrupt the flow of casualties to the rear, even if this means some loss of lives that might have been saved under peace-time working conditions. For this reason the casualty clearing station was developed, near enough to the front to enable the first operative intervention to reduce enormously the incidence of severe sepsis and gangrene, yet inevitably also too near to the front to permit the majority of cases to remain there. On the home front, however, conditions will be different. It will remain absolutely essential to evacuate casualties very rapidly, and not to retain any save almost desperate cases (about 2 per cent.) in

the central area. London, however, possesses numerous electrified railways, and it would be a simple matter to arrange the immediate evacuation of the remaining 98 per cent., even the very light cases, well out into the Home Counties, where they could not only be operated on but also be retained. This would ensure the observance of two principles: (1) that the more severe cases do much better if they can be given complete rest for the critical post-operative period; (2) that Robert Jones's principle of continuity of treatment and of surgical responsibility shall be achieved from the very start. I think the importance of this second factor cannot be overestimated. I cannot forbear to mention one matter of the highest importance in effective evacuation—the standardized stretcher and stretcher fitting, so that the wounded person never leaves the stretcher he or she is first laid on until the operating table is reached. The stretcher may often with advantage even be laid on the operating table.

After this excursion into the organizational field we will return to surgical matters, and consider the present position of the treatment of sepsis.

(Part II, bringing the lecture to its conclusion, will be given in next week's issue.)

FOOTWEAR AND FITNESS

THE SHOEMAKER AND THE DOCTOR

At the request of the Medical Committee of the National Fitness Council a demonstration showing the importance of footwear in relation to fitness and health was given at the London School of Hygiene and Tropical Medicine on May 19. Viscount Dawson of Penn, who presided, briefly described the functions of the committee, of which he is chairman, its task being, he said, to take such action as might be found desirable in order to enlist the co-operation of the medical profession in promoting the council's policy, and to consider and report on the medical aspect of the council's work. Footwear seemed to be a subject which called for inquiry in view of the number of people whose posture and gait left much to be desired, the defect being due probably to inappropriate footwear.

Mr. C. Lambrinudi of Guy's Hospital gave a brief exposition of the structure and function of the muscles of the lower extremity. It was not sufficiently understood that the foot had a dual function. It was divided longitudinally into two parts: an outer part which was a balancing structure and an inner part designed for propulsion. It was sometimes said that the little toe was an atavistic member, but the smallness of a structure was no indication of its uselessness, and those who had studied the foot would deprecate the view that any of the toes were useless. Mr. Lambrinudi's remarks were illustrated by a diagrammatic film produced at Guy's Hospital showing the normal and abnormal action of the foot muscles and the rationale of treatment of claw toes and pes cavus.

Mr. H. Bradley, director of research of the British Boot and Shoe Association, described the methods now followed by progressive shoemakers for measuring the foot in such a manner as to take cognizance of its shape. The old craftsman made certain measurements which enabled him to carry in his eye the shape of the foot for which he was making the shoe, but in mass production, with 120 million pairs of shoes being produced in this country every year, the taking of mere lengths was not enough. Mr. Bradley showed the complicated devices used by his association for grading shoes so as to fit an almost infinite diversity of feet. One result of research showed that in women, for each one-third inch in length, an increase of breadth at the broadest part of three-twentieths of an inch had to be allowed. His association had also studied the habits of gait, even by equipping soles with

electric studs whereby the walker on a conducting surface produced an electrical record of the manner in which the feet and their parts successively touched the ground. The idea of occupational footwear was now being developed. It had long been felt that the footwear used by, say, a waitress who spent long hours on her feet should be different in design from that used by the sedentary worker, and a special shoe—not an orthopaedic contrivance, but a comfortable and not inelegant pattern—had been devised. The experiments were still in progress and were very promising. One difference discovered was that the shop-girl's reaction to heel height was to hold herself back, while the waitress's reaction to heel height was to bend forward.

Sir Adolphe Abrahams remarked on the shoe worn by the athletic runner. The runner's shoe was built on the principle of the dancing pump. It had no heel and was skin-tight, permitting no movement of the small muscles of the foot. Although he could not suppose that this had any bearing on footwear in general, because footwear worn for maximum speed for a few minutes must differ greatly from ordinary footwear, it was a curious anomaly, when one considered the actual structure of the foot, and particularly the use of the small muscles, that in order to get maximum speed an instrument of torture which violated all the principles of foot hygiene should be devised.

One question from a member of the audience, which was mainly composed of physical educationists, related to the footwear of very young children. The hygiene of the foot, said this speaker, began in very early life, and yet young children's shoes often seemed to have no relation to the developing foot. Mr. Bradley pointed out that here the difficulty was commercial. Parents would not pay enough for footwear, knowing that the young child so quickly grew out of it.

PURITY OF WATER SUPPLIES

The eleventh annual report of the Water Pollution Research Board, issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, 1s.), again emphasizes the need for constant vigilance on the part of those responsible for the supply of water to the public. The serious outbreak of typhoid fever at Croydon, due to the infection of part of the public water supply of the district, focused public attention on the importance of taking all practicable steps to protect sources of water from pollution, of systematic treatment of all supplies in any way liable to pollution, and of frequent examination of samples to ensure that the treatment is adequate. The Board says that any neglect of the lessons to be learnt from the Croydon outbreak would be deplorable. The research undertaken under the supervision of the Board includes investigations on the treatment of water for public supply and for industrial purposes, the treatment and disposal of domestic sewage and industrial effluents, and on problems of pollution of rivers.

Treatment of Water by Synthetic Resins

The discovery that acids, bases, and salts can be removed from solution in water by means of certain synthetic resins has aroused widespread interest, and much progress has been made in the development of the resins for industrial purposes. The main applications of the resins up to the present have included the treatment of water to remove all or part of the dissolved salts. This had previously been possible only by more expensive methods, such as distillation. Utilization of the resins for removal of objectionable substances in very low concentration in water is also being developed rapidly. Recent work under the Board has shown that under certain conditions fluorides which are sometimes present in water in small concentrations may be removed by resins of one type; the fluorine is not readily removed, however, when other salts usually found in natural waters are present. Removal of fluorine from water is of importance since evidence from various localities has indicated that the dental defect known as "mottled enamel" may be caused by drinking water containing fluorine to the extent of one part per million.