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SURGICAL EXPERIENCES WITH THE B.E.F.

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The rapid movements and quick change in events in France and Flanders during May and June of this year imposed a strain on the medical organization comparable to that to which the combatant section and other services were submitted. A detailed consideration of the established medical arrangements and the means whereby these were adapted to the occasion is outside the scope of this communication. At the outset the disposition of medical units and personnel was essentially the same as that which was operative at the end of the last war. Additions were the provision of more mobile surgical teams for service in the casualty clearing area and the establishment of the Blood Transfusion Service.

The first phase of active operations was associated with such speed of movement that many wounded, with the necessary R.A.M.C. personnel and much material, had to be left behind. I would say, however, that in the second stage of operations all wounded who were evacuated to units south of the Somme were safely transported to England.

Bearing in mind this background to the active period of the war in France—the only time when battle casualties were handled in quantity—it can be understood that systematic work on new methods was seldom possible and records of results were imperfect or incomplete. As a result only personal impressions can be put forward in support of any views expressed here. The impressions received at the time have to some degree been confirmed or corrected by subsequent conversations on the subject with medical officers receiving casualties in this country. The outline which follows represents an attempt to piece together our aims and achievements in handling the wounded man, and defines those aspects of the subject which appear to call for further trial and study.

Wound Prophylaxis

In the treatment of any wound the aim of the surgeon is to repair mechanical damage so far as he can, but his most important task when dealing with missile injuries is to prevent or check progressive bacterial infection. The first step in this direction can be taken before the man is wounded, by immunizing him against the more dangerous infections. Under this heading comes protection against tetanus. Practically every man in the B.E.F. received two inoculations of toxoid given at the same time as he received T.A.B. Every wounded man received a single dose of 3,000 units of A.T.S. Whether due to these measures or not, the incidence of tetanus proved to be very low. The final figures are not yet available, but I know of only four cases occurring in

France, two of which were fatal. Anti-gas-gangrene serum (polyvalent) was available in quantity, but was not systematically employed as a prophylactic.

Chemical Agents.—The other prophylactic measure, of which great things were hoped, was the use of sulph-anilamide. This was given sometimes by the mouth shortly after the man had been wounded, and in other cases as a wound pack. The dosage when given by the mouth for prophylactic purposes was generally a primary dose of 2 grammes followed up with 1 gramme four-hourly, to the total amount of some 15 or 20 grammes. In the wound pack initiated by the work of Jenson *et al.* (1939) a total of from 5 to 20 grammes was put into the wound and kept in place by suture or a protective dressing. I do not think it is possible to give a final opinion of the results of this form of treatment. It had been hoped to check its value by controls, but events prevented this systematic study. The general impression is that both streptococcal and anaerobic infections were less in evidence in wounds than had been expected, and this fact has generally been attributed to the use of the sulphonamide group of drugs.

Surgical Treatment

The aim of the forward area organization was to bring the wounded man within the sphere of surgical aid within twelve hours of his being hit. It is generally accepted that from 20 to 40% of lying cases and about 5% of the walking wounded should be operated on within this period if the best results are to be obtained. In the event it was only in a few units and for limited periods that so short a time lag was operative. Before operation the importance of the treatment of primary and secondary wound shock was fully recognized, and resuscitation teams, generally organized by an officer of the Blood Transfusion Service, were established both in casualty clearing stations and in base hospitals. Warmth, rest, and morphine had their place, but undoubtedly the provision and transfusion of stored blood were of key value. The general principle of wound excision (*épluchage* of French surgeons) determined the scope of the primary operation apart from the repair of any special viscus. The procedure was carried out whenever possible if the patient was received within from twelve to twenty-four hours of injury. The excision should not involve the removal of much skin, but free incision is necessary to carry out the process effectively. Excision of devitalized fascia and muscle is of chief importance. In regard to primary suture after such operations, the general experience in France was against the practice. It is true that in a group of cases treated in the Metz area a measure of success was achieved; but in other instances

deep suppuration developed, adding greatly to the dangers and length of convalescence.

Under war conditions great importance attaches to the selection of the cases in which early wound excision is most urgent. In general all wounds of entry only, and therefore with a retained missile, come into this category: in the buttock, thigh, calf, or shoulder area these are particularly apt to develop serious anaerobic infection. In practice very small uncomplicated wounds of this type were not so treated, and in the case of multiple wounds only the larger ones were explored or excised. The complications of a fracture or joint injury are also indications for surgery. On the other hand, through-and-through wounds due to rifle or machine-gun bullets are recognized as relatively benign from the point of view of infection. It was noted in France that this was the case, and such wounds were seldom excised if uncomplicated by serious haemorrhage or the perforation of a hollow organ.

In the event of a man not coming under surgical care for two or three days after being wounded, formal wound excision is out of place. It is in these circumstances that serious anaerobic infection, either local or progressive, was most often seen, to a degree recognized as gas gangrene. The number of more serious infections of this character observed was small, certainly less than was seen under corresponding conditions of evacuation in the last war. The treatment employed was to lay the wound freely open, remove the missile if possible, and excise necrotic muscle. Amputation was resorted to only in the more serious cases of gas infection.

The after-treatment both of wounds excised early and of wounds laid open on account of infection was to pack them with gauze sometimes soaked in vaseline. When sulphanilamide was put into the wound the gauze pack was not employed. A course of sulphanilamide was also sometimes given by the mouth to both groups of cases. The general practice was to avoid the redressing of wounds for four or five days unless the clinical signs suggested some progressive infection or the presence of secondary haemorrhage or gangrene. The closed plaster cast was not systematically used for wounds uncomplicated by fracture.

Fractures

Femur.—Transportation of fractures from the field to the C.C.S. was carried out on the accepted lines; from the C.C.S. to the base fractures of the femur were put in Thomas splints, the traction often being applied through a transfixion pin in the heel. Under stress a certain number were sent down with a hitch over the ankle; this method almost always produced a pressure sore if the boot and sock had been removed, and should not be employed. Adhesive traction was little used, although there is a good deal to be said for it under the conditions in question.

In the base hospitals fractures of the femur were still kept in Thomas splints and the fragments aligned with the aid of skeletal traction. Before the war of movement had begun the Braun-Böhler frame was often employed for this injury, and in some cases traction without any splint. When rapid evacuation was necessary the shortcomings of these latter methods for active service conditions were noted, because for transportation it was desirable to transfer all such cases to Thomas splints or plaster if the fracture was to be immobilized properly for the journey.

Tibia and Fibula.—In the forward area rough immobilization was secured by the Thomas splint or by Cramer wire. From the C.C.S. onwards fractures involving the knee and those of the leg were in general fixed

in whole plaster cases. This proved comfortable and efficient. The positional results were often so good that no change of plaster was necessary at the base, at any rate for two or three weeks. Some instances of the development of serious pressure under the case were observed; this complication was avoided if the cast was cut through in its whole length when it was likely that the patient would be moved within twenty-four hours of its application.

In a good many instances transfixion wires or pins were incorporated with the plaster. Though there is a risk in the use of this method in the presence of an open fracture I cannot say I saw more than one serious example. Some surgeons used the Thomas splint for the transport stage in fractures of the leg. I am satisfied that plaster gives much better immobilization and greater ease to the patient.

Upper Extremity.—Fractures in the upper third of the humerus were moved in the forward area, the arm, with an axillary pad, being bound to the side. Fractures in the lower section of the bone and fractures of the elbow-joint and forearm were roughly immobilized with Cramer wire splinting. From the C.C.S. to the base the fractures in the upper third were often treated as above, and the fractures of the lower part of the humerus and of the forearm were immobilized in a plaster case or in plaster slats. If the patient is to be moved soon after application of the case provision for expansion is just as important in this area as in the lower extremity.

It will be observed that the Trueta or Winnett Orr method of using the closed plaster case was generally applied in the treatment of many fractures of both extremities with satisfactory results. Its use for simple flesh wounds was exceptional, although the value of the principle of infrequent wound dressing, inherent in the method, was recognized and conformed with.

Fractures of the spine due to missiles were moved from the forward zone in the dorsal position on stretchers, and of the few cases seen at the base most arrived without any special splint being applied.

Abdominal, Head, and Chest Wounds

Little opportunity occurred in France in May and June for the practice of the more deliberate type of surgery applied to abdominal, head, and chest wounds. Certainly no advance was made on the experiences of the last war. The following notes give a view of the policy which was adopted.

Abdomen.—It was recognized that early operation was the only means of saving life when hollow viscera had been damaged, and that it was often necessary for intra-abdominal haemorrhage apart from intestinal perforation. Operations of this character take time and call for reasonable conveniences. In consequence the number of cases operated on in France was small. It was not possible to estimate the recovery rate.

Head.—Very little operating on cranial injuries was done in the forward area. The only operations performed were those for tangential injuries with little damage to the brain substance or where depressed fractures appeared to be present. The procedure adopted was limited to wound excision and the removal of loose or depressed fragments. So far as was practicable the scalp was closed without drainage.

Chest.—In open warfare gunshot wounds of the chest account for a large number of the fatalities, and the percentage of this kind of injury reaching the base hospitals was not high. Systematic early operation was not carried out. Cases of open pneumothorax were regarded

as urgent, and were sutured or stopped up, so far as possible. A few operations were done for primary haemorrhage either from the parietes of the chest or from the lung. In the cases arriving at the base aspiration was adopted for haemothorax, and closed drainage was carried out only when infection became clearly established. A few instances of pressure pneumothorax were treated by needling.

Conclusion

It must be admitted that any general experience of active surgery during the Battle of France was so limited by events that no definite conclusion in advance of our existing knowledge can be drawn from it. I would say that wound excision as a general principle still stands as the surgeon's sheet anchor. In sulphonamide and its derivatives we undoubtedly have allies of considerable power; we are not yet clear how far they should be regarded as adjuncts to surgical treatment or to what degree they may replace it. It is clearly desirable that controlled experiments should be planned in order to determine the value and the optimum dosage of the sulphonamide group of drugs, both in prophylaxis and in the treatment of missile injuries.

REFERENCE

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HAEMOLYTIC STREPTOCOCCI IN THE CARDIAC LESIONS OF ACUTE RHEUMATISM

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The aetiology of acute rheumatism has not yet been exactly defined, and the ravages of this crippling disease justify an even greater amount of investigation into the problem than has been given.

The haemolytic streptococcus has been regarded as the causal agent because of the obvious relation of acute rheumatism to a preceding acute tonsillitis occurring usually about two weeks before the onset of the rheumatic syndrome. This antecedent tonsillitis is known to be caused by the haemolytic streptococcus, and most patients in the early stages of their attack of rheumatism still harbour large numbers of haemolytic streptococci in their throats even though they have recovered clinically from the throat infection (Coburn, 1931; Collis, 1931; Schlesinger, 1930; Green, 1938; McCulloch and Irvine-Jones, 1929). Haemolytic streptococci are, of course, found in large numbers in the throat for a few weeks after clinical cure of any uncomplicated attack of tonsillitis. Moreover, outbreaks of rheumatic fever amounting to minor epidemics have occurred in semi-closed communities where streptococcal tonsillitis has been epidemic (Bradley, 1932; Glover, 1930; Schlesinger, 1930; Grenet, 1920; Glover and Griffith, 1931).

Such findings, although only indirect evidence, cannot be overlooked in spite of the large number of failures to recover any specific organism from the heart lesions or from the joint fluids. For this reason a search has been made for a filterable virus, and claims that such a virus

exists have been made by Schlesinger *et al.* (1935) and by Eagles *et al.* (1937).

Recently a more determined attempt has been made to recover a haemolytic streptococcus from the cardiac lesions of acute rheumatism even although the pathological appearances in the heart are not similar to streptococcal lesions in other tissues. A difficulty in such bacteriological investigations is that very few patients die in the acute stage. Green (1939) reported results in 9 such cases, and he was successful in all but one in cultivating haemolytic streptococci from those valves which showed vegetations, while no haemolytic streptococci were isolated from undamaged valves. Moreover, the streptococci isolated from different areas in any given case, including the throat strain, were of the same type (Griffith). The blood (post mortem) from such cases yielded no streptococci. Control cases never yielded haemolytic streptococci. Collis (1939) recovered haemolytic streptococci from 22 damaged valves collected from 17 cases of rheumatic fever.

Such evidence suggests an actual infection of the heart valves with haemolytic streptococci. We have continued this work, and the results of a series of 10 necropsies are reported.

Methods

The necropsies were performed as soon as possible after death, but in some cases twenty-four hours had elapsed and contaminants (nearly always coliform bacilli) were common in the material examined. After the thorax was opened the outer layer of pericardium was seared with a hot iron, and blood was removed from the cardiac chambers with a capillary pipette passed through the seared surface. The pericardium was opened through the seared area and some fluid removed for culture. Cultures were made also of any free pleural and peritoneal fluid. If there was a sero-fibrinous pericarditis pieces of fibrin were excised for culture. The surfaces of the liver and spleen were likewise seared and small pieces taken for culture.

The heart was then removed and opened as aseptically as possible after searing the surface. Cusps from the valves and a piece of myocardium were excised. In some of the cases these specimens were washed in alcohol before cultures were made. A throat swab was taken (post mortem), and on occasions the tonsils were removed for dissection and culture. In one case, in which the patient had died of chorea, the surface of the temporal lobe of the brain was seared and a little brain pulp aspirated with a pipette.

The culture medium used was the rich broth (from trypsin digest of horse muscle) described by O'Meara (1934), and subcultures were made after six hours, eighteen hours, and daily thereafter. Haemolytic streptococci grow most profusely in this medium in a few hours, and much of the success of the results was dependent on the fact that a subculture was made six hours after incubation. Frequently haemolytic streptococci were obtained in abundant growth by subculture or blood agar from the six-hour broth culture. Later subcultures from the original culture yielded only a few streptococci, which were difficult to isolate from contaminating bacteria. Case I, which is described to illustrate this, is a typical example of this observation, noted also by Green, who used the same technique (personal communication).

In 5 of the cases special methods were tried in an attempt to inhibit the growth of coliform bacilli. Heart valves and other tissues were cultured in broth containing sodium azide, and crystal-violet blood plates were used for subculture, but these methods did not yield as good results as that described above. Similar methods were adopted in 10 control cases.