

## NEW HOPE FOR SPINAL CORD SUFFERERS\*

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BATTLE and air raid casualties involving injuries to the spinal cord and cauda equina with resulting paralysis excite our deepest sympathy and undoubtedly deserve the very best surgical and medical treatment available. The same applies to the civilian who has received such an injury from other causes.

Recollections from the past of the treatment of these tragic casualties have left depressing memories of hopelessness and helplessness. One remembers young men with sallow complexions, apathy and drowsiness: men emaciated from septic absorption, from smelling pressure sores and urinary infection.

Until recently, the medical profession still seemed to be possessed with the old idea that little could be done for these unfortunate sufferers. Experience during the present war has shown that these cases are by no means as hopeless and helpless as was previously thought and that the modern principles of rehabilitation can be successfully applied to these men to prevent their being cast on the human scrap heap.

Rehabilitation after spinal injuries seeks the fullest possible physical and psychological readjustment of the injured person to his permanent disability, with a view to restoring his will to live and working capacity. It is a very complex process and includes a long series of activities, which can be divided into three stages: (1) First aid and early treatment; (2) Physical and psychological readjustment; and (3) Permanent settlement on employment. In all three stages, which are closely linked, medical supervision is indispensable.

A short survey follows of those procedures which have been found useful for early treatment and the physical and psychological readjustment in 82 cases of spinal cord and cauda equina injuries. The patients were transferred to the Spinal Injury Centre, run by Britain's Ministry of Pensions, from first aid posts, base hospitals, and other medical institutions at varying intervals after injury and in varying conditions. In the majority of cases, their conditions were serious, due either to the initial spinal injury with gaping wounds discharging cerebrospinal fluid, or to associated injuries of other organs, such as lungs, intestines or extremities. A considerable number of cases, which were admitted at later dates after injury, showed signs of septic absorption, with anaemia and emaciation resulting from ascending urinary infection, pressure sores or injuries of other organs. As an example of this group, Figure 1 illustrates, apart from the large pressure sore, the profound emaciation of an officer of 27, who was admitted 6 months after gunshot injury to his right lung and spinal cord, causing a complete transverse syndrome at Th. 12. Figures 2 and 3 show the condition at later dates.

Experience gained from this and other cases makes obvious the answer to the question, 'When should a spinal casualty be transferred to a spinal centre or hospital equipped for the treatment of paraplegics?' There is no doubt that a spinal case ranks very high in priority of air transport; this has not so far been recognised. The time in which evacuation can be carried out must clearly vary; but if the

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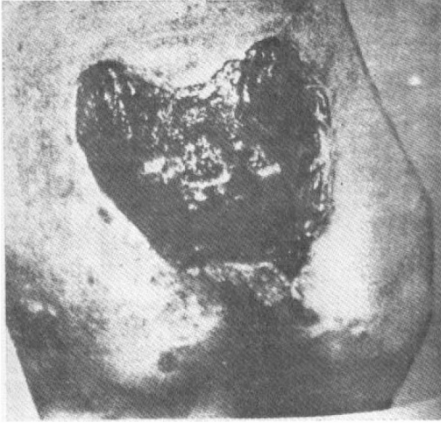


FIG. 1

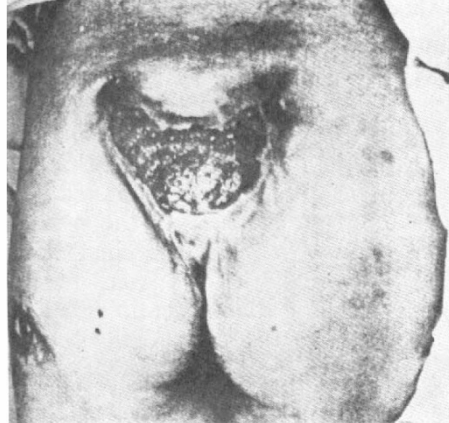


FIG. 2

FIG. 1.—Illustrates, apart from a large pressure sore, profound emaciation of an officer of 27 years, with complete transverse spinal syndrome at Th. 12 after gunshot injury. June 26, 1944.

FIG. 2.—The same case (as Fig. 1) two months later. October 29, 1944.

patient can reach a spinal centre within the first few days after injury, it gives him an enormous advantage, as the large staff and organisation there provide greater facilities for preventing the devastating complications of traumatic paraplegia. With rapid evacuation—*i.e.*, within 48 hours—there is seldom need at this stage to tamper with the paralysed bladder or to subject the skin to the hazards of spinal immobilisation in plaster.

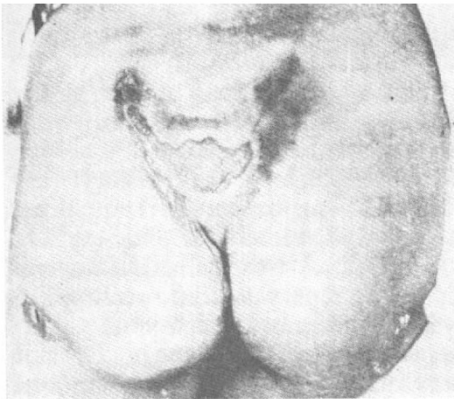


FIG. 3

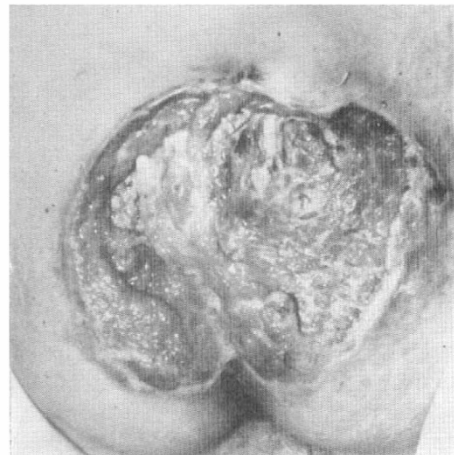


FIG. 4

FIG. 3.—The same case (as Fig. 1) about five months later. December 9, 1944.

FIG. 4.—Illustrates a huge pressure sore in a case of gunshot injury of the spinal cord, with complete transverse lesion at Th. 6. August 1, 1944.

The variety of clinical problems resulting from spinal injuries makes it obvious that the treatment is multifarious and has to be very active from the start. Two complications, which are the common cause of sepsis and death after spinal injuries, need special and permanent attention: pressure sores and urinary infection. Pressure sores develop over the bony parts of the body which normally have a poor circulation, and they are the result of ischaemia produced by local pressure. In the early stages of spinal injuries, this disastrous effect of local pressure on the peripheral circulation is promoted by the fall of blood pressure from the traumatic shock and the paralysis of the spinal centres and pathways subserving vasomotor control. In later stages, circulatory disturbances caused by intervening infections, such as pyrexial attacks from urinary infection and anoxaemia due to anaemia, produce the same ischaemic effect of local pressure and are responsible for the deterioration of healing sores and the development of new ones. Having regard to these factors, it is obvious that the preservation and improvement of a good general condition are of utmost importance in the prevention and treatment of pressure sores, and this fact has permanently to be considered in all therapeutic procedures. Repeated blood transfusions, special diets rich in protein, vitamins and glucose, scrupulous cleanliness of the patient, and meticulous care of the bowel are essential measures in improving the patient's general condition. Intervening infections are combated by courses of sulphonamides—especially sulphamezathine—and by penicillin.

The two cardinal methods of local treatment of pressure sores are frequent change of posture and redistribution of pressure. The patient is nursed on a special bed, which is rigid to prevent sagging and which is high to facilitate nursing, but not so high that nurses of average height cannot turn the patient without dragging. He lies on an air or sorbo mattress, but even more important than special mattresses are plenty of small pillows to support the paralysed limbs and trunk in the various positions adopted as a result of frequent turnings. The skin is kept scrupulously clean and the pressure points have gentle massage after each turning. Some patients were turned every  $\frac{1}{2}$  to 1 hour during the day and every 2 hours at night. This can only be carried out successfully if there is sufficient nursing staff available, and this is one of the reasons why a spinal ward needs a larger nursing staff than a general ward. If complete relief of pressure from a sore can be achieved, then this sore will heal, even in the presence of general infection. In our cases, this has always been possible in pressure sores on the heels, which are supposed to belong to the 'most difficult to heal' group, as any pressure on the heel can be avoided, whatever the position of the patient. Such sores, with deep necrosis, have healed within a period of 6 to 8 weeks.

Although pressure sores may be sterile at some stages of their history, they always get infected. Specific ways of destroying organisms depend on their nature, and for this reason swabs from the wounds are cultured at intervals. The excision of necrotic tissue and cleansing with peroxide and saline are mechanical ways of removing infecting organisms. Any antiseptics, except penicillin, are applied to the devitalised tissue with caution, as they have an inhibitory action on granulations, which play a vital part in the healing of deep sores, except in the later stage which is characterised by true regeneration of epithelium. The routine dressings after excision of sloughs are saline dressings twice a day, and in later stages, when epithelisation is in progress, alternating with pellidol ointment or allantoin powder.

The effects of treatment are judged by the culture of routine wound swabs and the appearance and size of the sore. The latter can be recorded by photographs

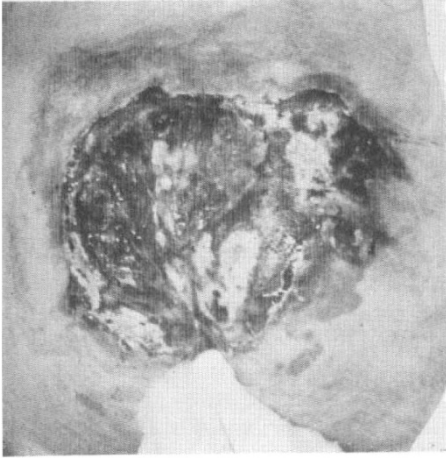


FIG. 5. August 9, 1944



FIG. 6. September 5, 1944

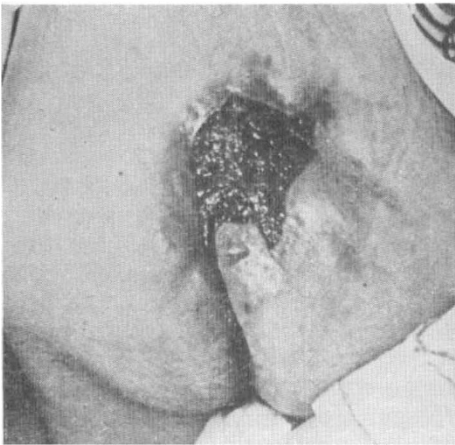


FIG. 7. October 9, 1944

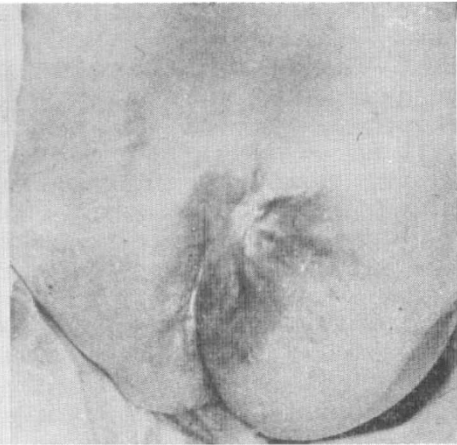


FIG. 8. December 28, 1944

FIGS. 5, 6, 7, and 8.—Illustrate the progress of healing of wound in Figure 4. Treated by excision of sloughs, systemic and local penicillin in the first few days, followed by saline dressings twice a day, finishing with pellidol ointment in the last stages of healing.

and by tracing the outline of the sore. This is done by means of a sterile decoated X-ray film, which is placed over the sore, a second film being placed on top. The outline of the sore is then traced on the top film, and thus a permanent record is obtained of its size and shape. This procedure is carried out periodically. After healing, the traced areas of the sore are measured by means of a planimeter—a method recommended in the last war by Carrel and his co-workers (1916)—making it possible to estimate the rate of healing of pressure sores under various conditions and by various forms of treatment, including plastic operations. Figures 4 to 8 illustrate the results obtained in a patient with gunshot injury of the spine, with complete transverse lesion at Th. 6, who was admitted with a huge pressure sore. This was treated for a few days with penicillin and afterwards by saline

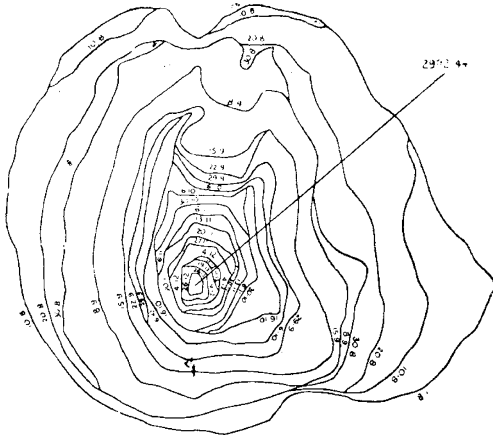


FIG. 9

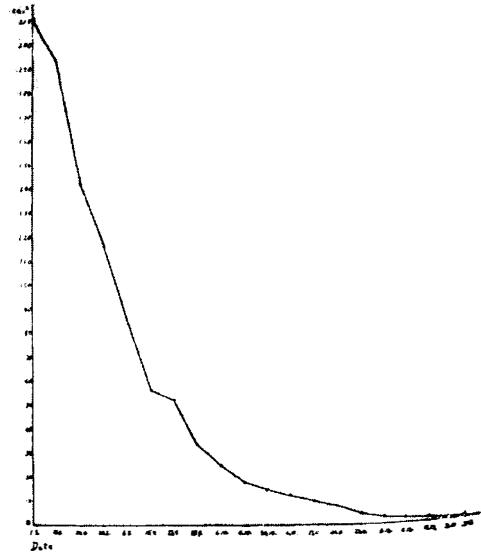


FIG. 10

FIG. 9.—Outlines of sore illustrated in Figures 4–8, as obtained by the ‘two-film’ method.

FIG. 10.—Progress chart of the same case (Figures 4–8) as measured by planimeter.

dressings twice a day, alternating with pellidol ointment in the last stages of healing. Figure 9 demonstrates the outlines of the sore from the beginning to the end obtained by the two-film method at various intervals. Figure 10 is a progress chart, recording the traced areas as measured by the planimeter.

Urinary infection following paralysis of the bladder is still a serious problem in paraplegics. So far, the paralysed bladder has been treated by various methods. Evaluating these procedures from the writer’s personal observations, it appears that neither urethral catheterisation nor suprapubic cystotomy has yet proved a safeguard against ascending urinary infection. In the present war, suprapubic cystotomy has been adopted by most of the surgeons as a routine emergency method in the early treatment of the paralysed bladder on the battlefield. Judging by the presence of urinary infection which has always existed in patients admitted to the Centre after suprapubic cystotomy (in a considerable number of cases of severe ascending type even), and by the presence of contracted bladders which have developed after this procedure, there is no real reason to consider this method as *the* method of choice in the treatment of every case of paralysed bladder. Tidal drainage (Laver, 1917; Munro, 1943; Lawrie & Nathan, 1939; Stewart, 1942; Riches, 1943) has proved a valuable auxiliary method after suprapubic cystotomy. This method, however, is of use only if it is understood by everybody concerned and is constantly supervised. The apparatus used in this Centre is that designed by Riches (1943). The fluids used for irrigation are  $\frac{1}{2}$  per cent acetic acid, 4 per cent boric acid or nuflave 1 : 1000 or 1 : 2000 and, in cases with stone formation, solution G (Suby, Suby & Albright, 1942).

Whenever practicable, suprapubic drainage is discontinued to encourage better voluntary action of the bladder. In these cases it is necessary, especially

during the first period after discontinuation, to continue bladder washouts intermittently by urethral catheterisation. In cases in which urethritis develops, this has to be combined with washouts of the urethra itself. In this Centre, intermittent urethral catheterisation and continuous catheterisation—the latter is combined with tidal drainage—have proved satisfactory. But these methods are also discontinued in spinal cord lesions as soon as an automatic bladder is well established. The automatic action of the bladder can be greatly improved by exercising the 'mass reflex' as recommended in the last war by Riddoch (1918).

Pyrexial attacks due to urinary infection are counteracted by courses of sulphonamides, and in cases in which staphylococci and haemolytic streptococci are present, and with systemic courses of penicillin. Two of the main factors in counteracting ascending urinary infection, especially stone formation, are the shortening of the duration of the recumbent position and restoring the best possible physical fitness of the man. The former is more feasible in cases of gunshot injury, as the support of the spine has not been interfered with in the majority of cases. Recumbent position in plaster beds and the application of plaster casts are condemned in this Centre.

The sudden conversion of a vigorous man into a helpless cripple naturally tends to severe psychological shock and reactive depression. From the beginning, the patient's mental condition needs careful attention and treatment to prevent anxiety or resentment, which lead to apathy and inactivity.

In dealing with these mental disorders, the creation of a cheerful atmosphere and high morale in the ward is of vital importance. The whole unit must be impregnated with enthusiasm, and this inspires the patient to cooperate to the full. On arrival at the Centre, he sees men similarly affected but bright and cheerful, doing exercises or work. This positive proof of recuperation is invaluable in convincing the man that hope is not lost. Indifference, anxiety and resentment, as well as the over-cheerfulness and self-deception which some of the cases show, also need attention in later stages, as all these psychological reactions may impede successful training or impair the patient's working efficiency.

It is obvious that, in the process of physical and psychological readjustment, the physiotherapist and occupational therapist must play a very important part. The idea is to mobilise all compensatory mechanisms in the paraplegic, in order to shift his psychomotor capabilities from the lower to the upper part of his body. From the first, physiotherapy is started with passive movements of the paralysed limbs to prevent stiffness of the joints. There have been patients—especially those who were admitted in plaster beds—whose recovery from paralysis was impaired by superimposed stiffness of all joints of the lower limbs and the spine. In the spastic stage of paralysis following spinal cord injury, passive movements carried out regularly and from the onset have a beneficial effect in preventing flexor spasms and contractures. As soon as possible, especially when some voluntary function has returned, movements of joints by suspension methods in slings (as recommended by Guthrie-Smith, 1943) are added and have proved very effective.

Active exercises play a cardinal part in the rehabilitation of spinal injured, and these should be started early. As soon as possible in some cases of complete transverse lesions—5 to 8 weeks after injury—the patient is promoted to a wheelchair. This in itself adds greatly to his range of activity.

Special attention is paid, particularly in the early stages, to those muscles which

have a synergic action on the paralysed muscles and can compensate their loss. This is of vital importance for rehabilitation after lesions of the lower thoracic cord, conus and cauda equina, with complete paraplegia, and everything should then be done to strengthen the abdominal muscles, erector spinae, latissimus dorsi, and quadratus lumborum. This is imperative for the following reasons: (1) The combined operation of these muscle groups will greatly improve balance and mobility of the trunk. (2) Strong action of these muscles makes activity of the upper limbs more effective owing to the increased fixation of the trunk. (3) The stronger the power of the abdominal muscles in conus-cauda equina lesions, the better and sooner the return of voluntary micturition and the sooner can the suprapubic drainage be abandoned. (4) The combined operation of these muscle groups will even restore the walking capability of the paraplegic in parallel bars or on crutches by pelvic tilting. The psychological effect of this achievement on the man is naturally enormous. It is necessary for keeping the balance in these cases to fix the knees by light bivalved plaster and to keep the feet in the right angle by simple toe springs. Figures 11 and 12 illustrate a patient during exercise on parallel bars and elbow crutches. This man sustained a gunshot injury through his right lung and spine with complete transverse lesion at Th. 12 on 1 July 1944.

Most of the exercises are done in the wards, which are equipped with Balkan beams and parallel bars. When a man has recovered to such a degree that he can start walking exercises in the parallel bars, his example is an encouragement to others who are not so far advanced.



FIG. 11



FIG. 12

FIG. 11.—Walking exercise with training splints by a man with transverse spinal lesion at Th. 12, with complete paraplegia of both lower limbs. Walking is accomplished by compensatory function of abdominal and trunk muscles.

FIG. 12.—Walking exercise with training splints by a man with transverse spinal lesion at Th. 12, with complete paraplegia of both lower limbs. Walking is accomplished by compensatory function of abdominal and trunk muscles.

Electrotherapy is only applied in lower motor neuron lesions such as conus-cauda equina lesions and has proved useful in dealing with atrophy of the denervated muscles and in accelerating functional recovery once voluntary function has commenced. This treatment is used as a substitute for active exercise and is consequently applied by vigorous contractions, the number of which are gradually increased—in various cases up to 600. It is also started at the earliest possible date after injury (see Guttman & Guttman, 1943).

Games play an important part in the physical and psychological readjustment of paraplegics. In a country in which the play instinct is so highly developed, games are always appreciated by the patient as a good method of rehabilitation. A number of games can easily be adapted to the limited abilities of paraplegics. Darts and snooker are two examples of games which are employed in our work (Figs 13 and 14). The writer has introduced a special game, which is called 'wheel-chair polo'. The idea of this game is to distract the patient's attention from his disability, to keep the man's intelligence and concentration lively, to promote a good blood circulation, to keep his healthy limbs supple, and to invigorate the body. The game can be played by any number of men—generally three or four on each side. With a wheel-chair for a pony, with polo sticks adapted to the height of the wheel-chair, they play under supervision in the gymnasium with a wooden disc for a ball, or out in the open air with a weighted ball (Figs 15, 16 and 17). This game is not played roughly, and each man endeavours to avoid crashing into another player's chair, as this is considered a foul.

It is also planned to form a musical band with these men, with wind instruments. Besides proving a form of entertainment and increasing the men's independence, it will also help to strengthen their abdominal muscles.

Along with the physical training goes rehabilitation of paraplegics by work. From the early stages and while the men are still in bed occupation is found, and they are taught simple handicrafts, not only from a diversional point of view, but in the first place to promote and increase dexterity of their hands. This work is continued in the O.T. department when the man is up in his chair. The work is graded and correlated to the physical improvement of the man and to his previous personality, and a number of skilled crafts are made easy for him to learn.

But, in time, patients tire of making toys and crave for some serious employment. Arrangements are now being made by the authorities concerned to introduce

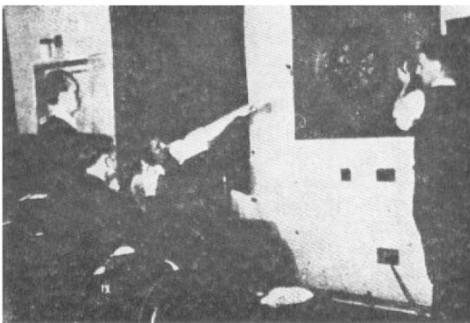


FIG. 13



FIG. 14

FIG. 13.—Paraplegics playing darts.

FIG. 14.—Paraplegics playing snooker.





FIG. 15

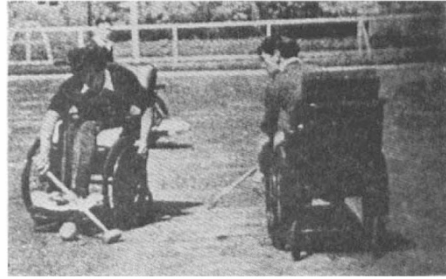


FIG. 16

FIGS. 15 and 16.—The first wheel-chair polo team, together with their P.T. instructor.

vocational training in the spinal wards by adding special instructors to the occupational therapy staff, and it is hoped that, in future, vocational training of the spinal injured can be started at an early date, while the man is still in bed. Some of the men have taken up carpentry, the working bench having, of course, to be adjusted to the disability of the men. (Figure 18 shows a paraplegic, whose previous occupation was carpentry, who has taken up his old trade and will become an instructor for others.) Some of the men have taken up clerical work and are being trained in shorthand and typewriting. One man has already become an instructor for the blind. At the instigation of the Medical Superintendent of this hospital, Major-General H. H. Blake, a neighbouring firm agreed to assist in the work, and a small number of patients are employed on part-time work and are conveyed to and from the factory. Other patients have taken correspondence courses, and one officer (who can be seen demonstrating in Figures 11 and 12) has already passed his first law examination, 10 months after a severe gunshot injury through his right lung and spine.

At a not too distant date, it is hoped to make provision for hostels during training and one can visualise settlements for paraplegics, with accommodation in bungalows suitable for the married and unmarried and special facilities for employment.



FIG. 17



FIG. 18

FIG. 17.—The first wheel-chair polo team in action, together with their P.T. instructor.

FIG. 18.—Paraplegic doing carpentry work, the bench being adjusted to his disability.

We are still in the pioneer days with rehabilitation of spinal injured persons, and there is much more to be done for these tragic war casualties, especially for adjustment of employment to their permanent disability. It is already shown that the early mortality of spinal injured (*i.e.*, within the 1st year after injury), even if associated with lesions of other organs, is much lower than one would expect from the statistics of the last war (over 50 per cent). In our cases, the early mortality has been 7.3 per cent.

The results so far achieved in rehabilitation are encouraging. They show the direction in which to move and a spirit which is worth while strengthening: namely, that every effort should be made to further the health and happiness of these men, who so richly deserve it.

The modern principles of rehabilitation can be successfully applied to almost every form of injury to the spinal cord and cauda equina.

A report is given on methods of early treatment and physical and psychological readjustment practised in a spinal centre on 82 cases of spinal injuries.

The importance of early admission of spinal casualties to a spinal centre or similar institution for the better prevention of complications, such as pressure sores and ascending urinary infection, is emphasised. Details of treatment of pressure sores and bladder paralysis are discussed.

The aim of physiotherapy and occupational therapy in paraplegics is to mobilise all compensatory mechanisms in the injured person, in order to shift his psychomotor capabilities from the lower part of the body to the upper. Games play an essential part in the rehabilitation of traumatic paraplegics. Wheel-chair polo has proved especially successful.

Early vocational training is the best form of occupational therapy in paraplegics. The importance of special facilities for employment in the physical and psychological readjustment of paraplegics is emphasised.

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