OPERATION SHOVELLER

THE SURGICAL COMMITMENT OF 2 FIELD HOSPITAL R.A.M.C.

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SUMMARY: The surgical commitment of 2 Field Hospital during its stay in Jordan is presented. The delay to treatment in many of the war injuries posed particularly difficult problems especially with regard to wound sepsis. The nature of the work undertaken by the hospital in this "disaster role" was akin to that seen in a Base Hospital rather than in a Field Medical Unit.

Introduction

The Field Surgical Team became operational within twenty-four hours of arrival in Jordan. It would have been possible to begin surgery earlier than this but the known state of casualties, the lack of sleep and the chaos that would ensue did not warrant a more premature start.

Ninety-four patients were admitted of whom ninety were surgical cases (Table I).

Table I
Admissions to 2 Field Hospital

Total admissions	...	...	...	...	...	...	...	...	...	...	...	...	94	
Number of children aged 14 and under	...	...	...	...	...	...	...	...	...	...	...	...	32	
Type of injury													Number of patients	
War wounds	{	Gunshot wounds											60*	
		Mine												
		Shrapnel												
Burns													10*	
Other injuries and disease													22	
Births													1	
Readmission													1	

*Of these 70 cases 29 had multiple injuries

Sixty of these had sustained war injuries which, in the majority of cases, had been inflicted five to ten days previously. The high number of children (32) admitted was at our own request and did not reflect the incidence of war injury in this group of the population. Three medical patients were admitted: these were respectively myocardial infarction, bilateral lower limb oedema due to inferior vena cava obstruction and an undiagnosed gross hepatomegaly in a child. One baby was born.

More than 50 per cent of the patients were admitted within the first five days, some as transfers from other national medical teams also operating under the auspices of the International Red Cross.

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Limb injuries and infection

There was a total of 65 limb injuries, 55 of which were due to war wounds, 46 were associated with fractures nearly all major in type. The problem with these injuries was to decide whether in view of the delay in treatment a wound toilet was necessary and, if so, how extensive this should be, bearing in mind that five to ten days after injury the repair processes of the body were well established, making identification of the important neurovascular bundles more difficult. Soon after beginning surgery it became apparent that complete and extensive wound toilet was necessary as many of the wounds had dead tissue in their depths together with retained foreign bodies. A complete toilet also permitted free drainage of pus.

Most of the wounds were grossly infected due to the delay in starting treatment. Bacteriological study was not immediately available and in any case the only antibiotic held by a Field Hospital in any quantity is benzyl-penicillin. All the patients received this in high dosage (1 mega unit every four to six hours) on its own until streptomycin was obtained from Cyprus. Resistance was suspected however and it was decided empirically to give ampicillin to all the traumatic cases after completion of a seven day course of streptomycin and penicillin. Later, culture of the infection and assessment of the antibiotic sensitivity of the organisms isolated was provided by the Pathology Laboratory of the Jordanian Army Base Hospital. This showed that the main organisms involved were *Escherichia coli*, *Bacillus proteus*, coagulase positive *Staphylococci* and *Pseudomonas pyocyaneus*, which proved to be virtually resistant to all the antibiotics. Later still pus swabs were sent to the Bacteriological Department of The Queen Alexandra Military Hospital, Millbank and these showed that although the organisms isolated were the same, the sensitivity pattern was not quite so unfavourable (Table II).

Table II
Sensitivity pattern of organisms isolated from the wound swabs
examined at The Queen Alexandra Military Hospital, Millbank

Organism isolated	Number of cases	Organism sensitive to
<i>Esch coli</i>	8	Gentamycin, Carbenicillin and Ampicillin
<i>Proteus Sp</i>	3	Carbenicillin only
<i>Ps pyocyaneus</i>	5	Gentamycin and Carbenicillin

It is suggested that the reason why drug resistance occurred in Jordan was that sophisticated antibiotics could be purchased over the counter without prescription. Further, in some of the patients, antibiotics had been administered for too short a period or in insufficient dosage prior to admission to our hospital. Infection in some of the limb injuries was only finally brought under control by repeated wound toilet and continuing antibiotics in the hope that the *in vivo* and *in vitro* sensitivity of the organisms was different.

It was frequently not possible to perform delayed primary suture and secondary suture had to be deferred until the third or fourth week after injury. At this time many of the soft tissues has become adherent and skin grafting was the only possible method of skin closure.

Upper limb injuries

There were thirty-two upper limb injuries, twenty-seven of which followed war trauma. These included seven fractures of the humerus and nine fractures of the radius and/or ulna, eleven of which were associated with a missile injury. Three cases from this group are illustrated.

Case 39, Fig. 1, shows the exit wound of a high velocity missile injury to the right shoulder joint. This had occurred three weeks before admission and had had no previous treatment, gross infection was present and the head of the humerus was dead. At wound

Fig. 1

Fig. 2

Fig. 3

1 mg.

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toilet all the dead bone was removed including the humeral head. Due to persisting sepsis the wound was left open and irrigated daily with saline, being left to close by secondary intention. Fig. 2 was taken after wound toilet and Fig. 3 shows the wound healing satisfactorily four weeks later.

Case 23, Fig. 4, shows the exit wound of a missile injury, which had shattered the right humerus, taken at the time of delayed primary suture a skin flap being cut to cover the defect. Fig. 5 shows the arm after three weeks. In this case there was an associated radial nerve injury.

Fig. 4

Fig. 5

There were eight hand injuries and typical was that of a boy aged eight who had shattered the right index finger in a mine explosion (Fig. 6) Primary skin closure was obtained, after removing this finger through the shaft of the metacarpal, leaving a hand with good function and the added advantage of acceptable cosmetic result (Fig. 7).

Lower limb injuries

There were thirty-three lower limb injuries, twenty-eight of which followed war trauma. Eight fractures of the femur were seen, five of which were shattered following a high velocity missile injury. After wound toilet the fractures were immobilized using fixed or sliding skeletal traction, the hospital carpenter from the Royal Engineers making the necessary frames.

One of these cases was Case 38, a shattered femur in a boy aged six and Fig. 8 shows the skin grafted exit wound with a drain still in situ. Skin closure by this method

Fig. 6

Fig. 7

Fig. 8

was adopted in spite of the presence of infection because the serous discharge from the large granulating surface was depleting the boy of protein.

Six compound fractures of the tibia were admitted, five of which followed missile injuries.

Trunk wounds

Eighteen wounds of the trunk were admitted all following war injury. Six of these were penetrating abdominal wounds, and two presented particularly interesting problems.

The first (Case 27), a boy aged thirteen was transferred from another hospital two days after receiving multiple fragment wounds to his abdomen and legs following a mine explosion. He had already undergone laparotomy at which a small segment of jejunum was resected. Examination revealed a very ill looking boy with multiple small puncture wounds of the lower abdominal wall, which was oedematous, a large swollen scrotum and multiple injuries to his lower limbs. There was dependent oedema of the left side of the thorax and axilla. He had not passed urine for forty-eight hours. It was not possible clinically to determine the exact state of his urethra or bladder in view of the swollen abdomen and scrotum (Fig. 9). A cystogram using the portable X-ray machine, demon-

Fig. 9

strated an obvious lesion at the base of the bladder with extra-vesicle escape of urine. At operation two holes in the bladder wall were repaired and the bladder was drained both supra-pubically and per urethra. The retro-vesical space was also drained. Two days later he developed a small intestinal obstruction which did not settle on routine treatment and at laparotomy an abdominal wall dehiscence was found. After a stormy post operative course he made a satisfactory recovery. It must be remembered that facilities for the estimation of serum electrolytes are not available in a field hospital.

The second (Case 74), was of a young woman aged twenty who had sustained a gun shot wound to the tenth thoracic vertebra damaging her spinal cord beyond repair. The bullet then traversed her right loin damaging the kidney. Laminectomy and exploration of the loin wound had been performed in another hospital and she was transferred one week after injury. As an added complication she was thirty-nine weeks pregnant. Both spine and loin wounds were septic and there was haemorrhage from the latter. Wound toilet was performed and the spinal wound closed. Blood and urine continued to escape from the loin wound and an intravenous pyelogram was performed to assess the state of the left kidney should nephrectomy on the right become necessary.

This demonstrated adequate function on the left though hydronephrosis was present due to the pregnancy, dye was also seen to be passing down the right ureter. Two days later she was delivered of a normal female infant after a labour lasting twenty minutes.

After this she developed marked peripheral oedema as a result of hypo-proteinaemia secondary to protein loss. Her poor nutritional state and electrolyte disturbance aggravated this condition though she never became azotaemic. Replacement therapy with intravenous albumin and electrolytes was quite successful but she went on to develop a left, followed a day or so later by a right, spontaneous pneumothorax necessitating chest tube drainage and tracheostomy. She was transferred to the Jordanian Army Base Hospital at the end of our stay. They were able to remove both chest drainage and the tracheostomy tubes but she died one week later from pneumonia.

Two penetrating wounds of the chest were admitted. One a male aged eighteen (Case 28) sustained a through and through gun shot wound of the right upper chest. He was seen four hours after injury in a shocked state, dyspnoeic and with a flapping segment of the chest due to the explosive nature of the exit wound. One intercostal drain was inserted but three to four hours later he developed severe surgical emphysema. A second chest drain was inserted and a tracheostomy performed. He was transferred to another hospital ten days later for convalescence.

The second case was a boy aged fourteen (Case II) who had a missile entry wound in the left supra clavicular fossa. Clinically he had a left brachial plexus nerve lesion and an absent radial pulse. X-ray demonstrated a missile lodged in the posterior mediastinum (Fig. 10) and what we thought to be an aneurysm of the left subclavian artery.

Fig. 10

After two or three days the left arm became hyperaesthetic but there was no evidence of an increase in the size of the subclavian aneurysm radiologically. The hyperaesthesia was associated with peripheral nerve recovery as he was able to move his forearm and fingers after three weeks. The radial pulse never returned.

There were four spinal injuries, all associated with paraplegia or quadraplegia one of which has already been described. (Case 74). Another was seen in a young boy whose

history on admission recorded that "He fell down in the street and would not get up again". A radiograph revealed a bullet lodged in the liver having traversed the lower thoracic spine before coming to rest. Laminectomy showed that the spinal cord was damaged beyond repair. Laparotomy was not required as there was no evidence of haemoperitoneum.

Head injuries

Three major head injuries were admitted, none however as a result of war trauma. One little boy aged nine (Case 67) was admitted half an hour after having sustained severe de-scalping injuries, a severe compound fracture of the right parietal bone, closed fractures of the right humerus, radius and ulna, and an open fracture of the left radius and ulna. He was unconscious. After elevating the depressed parietal fracture, the dura was inspected and was found to be torn (Fig. 11). There was also bleeding from the

Fig. 11

middle meningeal vein, difficult to control without diathermy, an essential piece of equipment not on the scale of a Field Surgical Team. Haemostasis was achieved using Sterispon. It took five or six days for him to return to any sort of conscious level. He was restless and had difficulty in identifying his environment. He was still in this state when the unit left Jordan.

Burns

Ten burn cases were admitted some being very severely burned having a significant percentage of full thickness skin loss. The cause of the burns varied from hot water to phosphorus or petrol. Some of them were injured five to ten days before and as a result were very infected when first seen. Many had large caked-up eschars, especially those damaged by phosphorus. One (Case 31) illustrates such a burn and this was a girl aged eleven. She had superficial and deep burns affecting her face, anterior chest, and both upper limbs (Fig. 12). Split skin grafts had to be applied to her upper eyelids early in treatment to prevent contracture. Skin cover was eventually obtained after wound toilet using further split skin grafts to cover her face, chest and limbs (Fig. 13).

Once again the main problem with these cases was the control of infection. Infection beneath the thick eschars was eventually overcome by a combination of hourly soaks each day in a bath of one per cent Hibitane, the water of which was continually agitated (to assist removal of the eschar) followed by the application of Sulphamylon cream to the whole area. The new drug Ketamine placed these patients in a trance like state as a

Fig. 12

Fig. 13

Fig. 14

result of which both the medical and nursing staff were able to perform a thorough burns. toilet. One so treated was a child aged seven (Case 54) who had sustained full thickness burns to the lower abdomen, perineum and most of the lower limbs (Fig. 14). This group of cases made heavy demands on the time and skill of the operating theatre and nursing staff.

Conclusions

Only some of the more interesting cases have been presented. A wide range of trauma was dealt with by the Field Surgical Team. The role of the unit was of necessity that of a base hospital with greater emphasis on repair and reconstructive surgery not usually within the province of a field hospital. This commitment was foreseen before leaving Cyprus and additional surgical instruments were taken. Many lessons were learnt regarding methods of treatment in this situation and the equipment required by a medical unit being used in what might be called a "Disaster" role.

The work load was extremely heavy during the first four or five days, especially as there were several evening and night emergencies. After this operating sessions lasted approximately seven to eight hours each day. All were agreed that in future it would be desirable to have a second Field Surgical Team on such an operation.

There were nine deaths among the in-patients, four were over seventy years of age, no child died.

The hospital was very sorry to leave Jordan. Twenty-two casualties remained as in-patients in the very capable hands of a Finnish Surgical Team.

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We should like to thank all the members of the unit without whose tireless help the patients would not have benefited as much as they did.