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WAR SURGERY IN THE MIDDLE EAST

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During the last nine months of 1942 3,279 battle casualties were brought to a military hospital on the lines of communication in the Middle East. All types of casualties were seen, under various and changing conditions, as a result of three different battles.

First, during April and May some 300 battle casualties, including a large proportion of severely ill patients, were received from Tobruk by sea. They had already had hospital treatment, and had been held at Tobruk until fit to travel. Suppurating wounds of all types were seen; battle wounds do not heal by first intention. Secondly, during the month of July alone, 2,287 battle casualties were received from the first battle of El Alamein. They arrived from 12 to 48 hours after being wounded, and the great majority had received no treatment other than the application of the first field dressing. The hospital, in fact, worked as a C.C.S., and continued to do so during the following two months. Thirdly, during the second battle of El Alamein, at the end of October, the conditions were again different, and in two weeks about 500 battle casualties were received, mostly from 36 to 48 hours after being wounded. The particular characteristic of this group was that they were selected cases, and for the most part comprised seriously wounded men who were not fit enough for a long journey and who had already received treatment.

These three periods have been particularly instructive, and an attempt is made below to summarize the main features of this diverse group of casualties occurring in men of different colour, different race, and different language. Before dealing with the casualties themselves, a few words about adapting a base hospital to function as a C.C.S. are not out of place.

Hospital Acting as a C.C.S.

As a result of the enemy's rapid advance to El Alamein and the battle that followed, convoys of 100 to 500 men began to arrive daily at the hospital, which now acted as a C.C.S. Convoys almost invariably arrived in the evenings; and an evacuation took place the following morning. The entrance and exit were made as easy as possible, and one-way traffic

was helpful. Stretcher-bearers became very tired with much carrying, and as many wheeled stretchers as possible were pressed into service.

At first sight one may imagine that a convoy from a battle consists exclusively of wounded men. This is not so. Out of 7,952 troops who arrived at the hospital during the heavy fighting of July, only 2,287 were battle casualties. Table I shows the parts of the body which were hit. The remaining 5,665 consisted of cases medically sick (especially enteritis and malaria), also an assortment of skin conditions, superficial suppurative lesions, piles, sore feet, cases of anxiety neurosis, and the counterpart in less-educated troops—viz., self-inflicted wounds. All these cases had to be rapidly sorted out. The surgical cases were divided into major and minor, which when stairs had to be surmounted often became synonymous with lying and walking. After admission a large reception ward was invaluable. A surgeon or an experienced medical officer with a sound knowledge of surgery acted as sorter, and decided what was necessary for each case. He was assisted by the transfusion officer, who treated shocked patients. A drink of tea was provided as soon as possible and antitetanic serum and morphine were given as required. Cases were written up by the sorting officer for theatre, x ray, or both. Coloured indicators placed at the end of the bed were a great help. These coloured tabs or bands were useful for theatre (blue), x ray (pink), special priority (blue with red cross), and operation completed (red). It is most important that surgery in a shocked patient should be done as soon as the shock has been adequately treated, otherwise his condition will deteriorate again.

A common source of delay in the theatre was waiting for patients. This can be avoided by having an adequate number of stretcher-bearers, and one intelligent orderly in charge of movement control. It is his job to see that there are always patients ready waiting in the anteroom to be taken into the theatre as soon as required. The operating surgeons often saw the patient for the first time in the anteroom, together with the wet x-ray film and report. The number of operations that can usefully be carried on at one time depends not only on the number of surgeons available but on anaesthetists, theatre staff, instruments, etc. Two surgeons working at two tables all night from 9 p.m. to 9 a.m. usually managed 50 cases between them, and during the month of July 1,004 cases went through the theatre. Much time is saved in minor cases by placing the patient and the stretcher on the operating table; this avoids much moving about. A table laid out with sterile instruments on the cafeteria system is also useful; each operating table can then be fed with the necessary tools as required.

For the usual type of wound only the minimum of instruments is necessary, since so much of the treatment depends on proper cleaning up and proper immobilization, and not on heroic cutting. Much of the value of good work is lost if concise notes are not written on the field medical card at the end of the operation. A convoy will be going out in the morning, and most patients should be written up for evacuation as soon as the operation is completed. Under these circum-

TABLE I.—Showing Region of Body hit in 2,287* Casualties from the First Battle of El Alamein in July, 1942

	Cases	Lesions		Cases	Lesions
Scalp and head ..	168	176	Genitals	4	6
Neck	36	37	Burns	91	130
Face and jaw (not M.-F.U.) ..	44	45	Blast	23	23
Chest	105	110	Mult. abrasions ..	30	30
Eyes	20	22	Fractures:		
Ears	11	11	Humerus	21	21
Spine	8	8	Forearm	7	7
Abdomen	32	32	Pelvis	8	8
Trunk	221	231	Femur	19	19
Limbs:			Tibia	22	26
Miscellaneous ..	735	780	Carpus and hand ..	17	18
Elbow	27	29	Tarsus and foot ..	12	12
Knee	89	90	Others	3	3
Ankle and foot ..	123	128	Multiple S.W. ..	72	72
Hand	236	240	Clavicle	6	6
Buttocks	97	104	Total	2,287	2,394

* Excluding 57 casualties admitted to the facio-maxillary unit.

stances it is easy to see why no plasters should be skin-tight unless they are also split. A skin-tight plaster is only permissible if the surgeon who has applied it can keep it under his personal observation for a few days, and in busy periods this is out of the question. With a quick turnover all sorts of points need attention. For instance, at the end of the first night's operating we were left with a bowl full of false teeth: fortunately the owners were found before the convoy was dispatched. Incidentally, don't put dentures in dettol; they are out of sight and may get lost.

The Wounds in General

It is a point of cardinal importance that all wounds dealt with have been a result of fighting in dry sandy desert. The problem is quite different from that presented in the last war, in Flanders, where surgeons had to contend with highly manured wet mud. Secondly, the amount of clothing worn was very small, and only rarely was clothing found in a wound. Thirdly, sulphanilamide was used either by mouth or locally in the wound, or both, and this apparently greatly prolongs the time which may be allowed to elapse between wounding and surgical intervention. Prophylactic sulphanilamide technique in the Middle East has now been standardized as follows: Locally, 10 g. into the wound and another 10 g. after operation; by mouth, 5 tablets (2.5 g.) :t 6 a.m. and 6 p.m. daily for 4 days. The dosage is printed on a ration card label, and is ticked off as given. The method is simple and works well. The greatest number of wounds were caused by fragments of H.E. shell, mine, grenade, or bomb.

Flesh Wounds

By far the largest number of wounds were minor flesh wounds. Patients arrived in July with the first field dressing applied, and a very good dressing it is. Treatment consists primarily in minimizing the infection, and to this end thorough cleansing of the surrounding skin is important, and if facilities permit it is well worth while to spend some time in cleaning the skin with soap and water and shaving off the hairs. Shaving in itself is a very good mechanical way of cleaning. Wide excision has not been found necessary, and a trim is adequate, usually combined with incision of the skin and deep fascia at each end of the wound to assist drainage. A Spencer Wells forceps or a finger is inserted along the track before this has closed up, and in a large number of cases the missile is easily located and removed. A preliminary radiograph shows whether removal of the foreign body is indicated or not. No prolonged search is justifiable. To allow adequate drainage the size of the external wound should bear a definite relation to the depth of the wound. Dead or damaged tissue should be removed even up to 48 hours after wounding. Treatment by trimming merges into establishing adequate drainage.

Sometimes a large wound at the front of the thigh, with a missile lodged in the posterior compartment, is well treated by making a counter-incision posteriorly to allow drainage and prevent the formation of a haematoma. I saw one case of profound toxæmia from gas infection which had developed in a large haematoma of the thigh and had spread to the surrounding muscles. A counter-drain posteriorly and removal of the large fragment would have prevented it. Adequate drainage combined with the usual general treatment cured the patient. Extensive operations for flesh wounds have been unnecessary and meddlesome. Sulphanilamide powder, and plenty of it, is placed in or blown into the wound, and rubbed into a paste with the finger. Enough dressing of gauze and wool should be applied to absorb all discharge. One hopes that the next dressing will not be done too soon, for repeated dressings are not only useless but harmful. One of the values of a plaster cast is that the wound will not be disturbed after proper treatment. Careful immobilization with plaster slabs or casts is of the very greatest value.

Fascia comes into its own in wartime; it determines the spread of infection. Sometimes a tense swollen thigh, due to a haematoma, requires decompression by longitudinal incision of the fascia lata and evacuation of the clot. The same thing occurs in the forearm: for example, an Indian soldier had a clean through-and-through bullet wound of the forearm; the track passed right through between the two

bones; the forearm was tense and swollen, the radial pulse obliterated, and the fingers cold. A long incision was made through the tight constricting fascia. The space was thus decompressed and the circulation re-established.

In war wounds no sutures should be used, and no packing unless it is necessary to control haemorrhage. Drainage-tubes are quite unnecessary, and in one case at least caused severe secondary haemorrhage from pressure on the popliteal artery. The best initial drainage is obtained by a good honest hole through skin and fascia. A transverse cut across the fascia lata is often useful in addition to the usual longitudinal incision. Either the wound can be left widely open or a piece of rubber glove or a strip of vaselined gauze may be laid in the wound to keep it open. It is essential to see that the drain does not act as a cork and so prevent instead of assisting drainage.

Fractures

In forward areas another part of the body is often the only splint available: e.g., one leg is tied to the other, an arm is bandaged to the side; morphine gr. 1/4 to 1/2 completes the splinting. For fractures of the femur and wounds in and around the knee-joint the "Tobruk" plaster is excellent. Strapping extension is applied to the skin below the knee. Elastoplast extension strapping is much better than the ordinary strapping. It is kept in place by a bandage from above downwards. A posterior plaster slab is applied from mid-thigh to beyond the toes. A pad behind the heel prevents pressure sores, and a pad behind the knee gives comfort. A Thomas splint is applied and strapping extension (2 cords) is tied over the end. The splints supplied always have rings which are too big for the average limb, in order that they may be used for all sizes of patients; it is therefore necessary to push a large pad of wool, or the patient's underclothing, between the ring and the great trochanter to make the ring fit snugly. The pad is kept in place by a bandage; this is most important because pads have a tendency to shift during transportation. Finally a pad is placed in front of the knee and one or two plaster bandages are applied over the whole leg and splint to keep the apparatus firm. The site of the wound and fracture is drawn on the plaster with a copying-pencil; the surgeon initials it and records the date. If the plaster is a temporary one for transport only, and the wound has not received attention, this fact should be indicated in large letters on the plaster.

For wounds of the leg with fracture of the tibia and fibula an ordinary plaster is applied, mid-thigh to beyond the toes, with a pad behind the heel. It must be either split or padded anteriorly. If the plaster is to be split it is a great convenience to place a long piece of 1/2-in. rubber tubing smeared with vaseline on the antero-external (fleshy) part of the leg before applying the circumferential plaster bandages. It is pulled out after the plaster has set, leaving a gutter along which the cast can be easily cut with shears. Alternatively a strip of linoleum can be used, and a sharp knife to cut down on it, but the tubing is simpler. In cases complicated by nerve lesions special care is needed to avoid pressure sores.

For wounds of the arm with fracture of the humerus a Böhler "U" with padding over the shoulder and over the internal epicondyle is excellent. A collar-and-cuff bandage is applied and the upper arm fixed to the side with one or two flannelette or preferably plaster bandages round the chest wall. Fractures of the forearm are conveniently treated with anterior and posterior plaster slabs, from mid-humerus to knuckles, and kept in place by ordinary cotton bandage. A sling is necessary.

Head Wounds

A common injury is a small penetrating wound of the head just under the side of the helmet. The patient may feel and look well, the wound may appear small and be readily missed, yet a fragment of shell may be lodged in the brain. A radiograph shows the hole in the skull, usually less than 1/2 in. in diameter, with comet-like fragments of bone passing inwards. Treatment is essentially that of trying to get the wound to heal by first intention and so prevent escape of C.S.F. and the onset of meningitis. After thorough shaving, the wound is narrowly excised and enlarged at either end in a linear manner. The mastoid self-retaining retractor is most useful to get a view of the hole. Loose fragments of bone are

removed. It is often impossible to close the dura. On but four occasions (out of about 25 penetrating wounds) was the foreign body removed, and then only when it was easily accessible near the surface. The wound is powdered with sulph-anilamide and the scalp is closed in two layers, preferably with fine silk sutures; a small glove drain is inserted through the stab wound, or through the extremity of the incision, to drain the subaponeurotic space. When transport was available patients were evacuated to the head centre. The good blood supply and consequent good healing properties of the scalp must have saved many lives, and several of these patients have now returned to duty.

Neck Wounds

It was remarkable how important structures in the neck apparently escaped injury. One patient sustained a wound of the oesophagus. Gastrostomy saved his life. Another had a wound perforating the carotid artery and jugular vein. He developed a traumatic false aneurysm (pulsating haematoma) which gradually enlarged and displaced the trachea to the opposite side. It was left as long as possible before any surgery was attempted, to allow the collateral circulation to establish itself. Finally surgery became imperative owing to pressure on the trachea. Under intratracheal anaesthesia, and with a pre-operative blood drip transfusion, the haematoma was opened, the proximal and distal ends of the common carotid artery compressed, and the rent in the artery and vein were easily seen. Both were ligatured. Unfortunately the patient developed severe pneumonia and had to be propped up in bed. Complete hemiplegia (probably due to thrombosis) developed 48 hours after operation; however, the hemiplegia cleared up and the patient recovered completely.

In one case of perforating wound of the neck the cervical sympathetic cord was involved, as shown by a typical Horner's syndrome; the patient was otherwise quite well.

Chest Wounds

Among the 500 battle casualties from the second battle of El Alamein, 65 suffered from wounds penetrating the pleural cavity. Contrary to what one would expect, these patients travelled very well. Remarkably little surgery was required after arrival at hospital, certainly in the early stages. Two cases were taken to the theatre for the arrest of haemorrhage, and one for closing a sucking wound. Most of the small sucking wounds were well treated by a vaselined gauze pad to close the wound, and a piece of elastoplast or a few silkworm-gut sutures to keep it in place. The treatment required was almost entirely medical, and was carried out by the medical specialist. Patients were propped up, and in many cases the haemothorax required aspirating on one or more occasions. A few developed empyemata, which were drained by closed under-water intercostal drainage. When fit to travel they were transferred to the chest centre, under the care of Major Logan, R.A.M.C., who tells me that all the patients did well except one who died of poliomyelitis. Further surgery was required in several cases, either for draining pus or for removal of foreign bodies when the sepsis had settled down.

Abdominal Cases

Of the 300 cases received from Tobruk 3 had injuries perforating the bowel (one died). Of 2,287 casualties from the first battle of El Alamein 8 received perforating wounds of the gut (3 died).

Among the 500 casualties from the second battle of El Alamein there were 30 perforating thoraco-abdominal or abdominal wounds, including one extensive wound of the sacrum, in which perforation of the rectum had been suspected and colostomy performed. Although in fact the rectum had not been perforated, the colostomy proved valuable in that it saved the large sacral wound from faecal contamination. Twenty-three patients were operated on in forward areas, and 3 in the hospital (see Table II). They can be divided into four groups:

(1) Thoraco-abdominal wounds, of which there were 11, with a mortality of 10. These figures bear out the very serious nature of this type of wound.

(2) Penetrating abdominal wounds with perforation of the bowel, of which there were 11, with a mortality of 2.

TABLE II

Case	Wound	Other Wounds	Hours before Operation	Abdominal Injuries	Operation	Result
1	Abdomino-thoracic	—	48	Spleen; stomach	Splenectomy; stomach sutured	Died 3rd day
2	"	—	72	Spleen; kidney; colon perforated	Splenectomy; nephrectomy	Died 4th day
3	"	+	56	Upper gut, retroperitoneal; pancreas	Drainage	Died 17th day
4	"	—	—	Liver	Nil	Died 3rd day
5	"	++	18	Stomach	Sutured	Died 17th day
6	"	—	35	Liver	Laparotomy	Died 6th day
7	"	—	5½	Stomach; spleen	Sutured	Died 7th day
8	"	—	—	Liver	Subdiaphragmatic abscess; drained 13th day	Died 14th day
9	"	+	—	Diaphragmatic hernia; stomach in left pleural cavity	Nil	Died 9th day
10	"	—	—	No abdominal symptoms or signs; severe chest wound	Nil. P.M. showed perforated diaphragm. No gut injury	Died 21st day
11	"	+	10	Stomach and small intestine	Sutured	Recovered
12	Penetrating abdominal	—	7	Small intestine; right kidney	Gut sutured	Died 13th day; sepsis
13	"	—	7	3 small intestine; 2 sigmoid perforated	S.I. sutured; sigmoid exteriorized	Died 10th day; chest and jaundice
14	"	—	17	Stomach; transverse colon (mult.)	Stomach sutured; colon exteriorized	Recovered
15	"	—	9½	Upper small intestine (9 perforated)	Sutured	"
16	"	—	?	Ileum (6 perforated)	"	"
17	"	+	9	Jejunum and ileum (7 perforated)	"	"
18	"	+	8½	Mult. perforations jejunum; 3 perforations ileum	Jejunum resected 9 in.; ileum sutured	"
19	"	—	4½	4 perforations lower ileum; 2 caecum	Ileum sutured; caecostomy	"
20	"	—	40	1 small intestine; 1 sigmoid	S.I. sutured; sigmoid exteriorized	"
21	"	+	5	Ascending colon destroyed	Resection ascending colon; ileocolostomy	"
22	"	+	Under 10	Perforated pelvic colon	Exteriorized	"
23	"	(+)	9	Contusion of small intestine	Laparotomy	"
24	"	—	12	Haemoperitoneum	"	"
25	"	—	36	"	"	"
26	"	—	24	Retroperitoneal haemorrhage in pelvis	"	"
27	"	(+)	7½	Gross protrusion of small intestine	Laparotomy; gut replaced; faecal fistula later	"
28	"	—	?	Buttock and sacral wound	Colostomy for suspected bowel injury; actually bowel intact	"
29	"	(+)	—	T. and T. bullet wound; R.I.F. to left loin; clinically bowel perforation	Nil	"
30	Wound back	—	48	Wound back; foreign body anterior to L.1	Laparotomy; retroperitoneal haematoma and foreign body removed	Died 3rd day

(3) Other penetrating abdominal wounds without gut perforation: 7 cases, mortality 1.

(4) A single case of through-and-through bullet wound of the abdomen from right iliac fossa to left loin. Clinically, perforation of the gut must have occurred. No operation: recovery.

The most instructive cases are the 11 wounds with bowel perforation. The 9 who recovered owe their lives to 9 different surgeons who were working in forward areas. Operation had been performed as early as possible and the patients had been held in forward areas for from 5 to 16 days. Post-operative intravenous saline drip, continuous gastric suction, and sulphadiazine had been used as a routine. The sulphadiazine had usually been given intraperitoneally by catheter inserted through the wound—10 g. suspended in 50 c.cm. saline at the end of the operation, and repeated if necessary. Small-intestine perforations had been sutured (resection in one). Large-intestine perforations had been exteriorized (resection in one). The cardinal points seemed to be early operation, late evacuation, intravenous saline drip, continuous gastric suction, and sulphadiazine. All this is very difficult with mobile warfare, but was possible when the line of battle was static.

During convalescence two laparotomy wounds burst open and had to be resutured, and one patient developed secondary intestinal obstruction due to a band of adhesions which had to be divided.

Wounds of Buttock, Genito-urinary Organs, Spine

The chief point to remember about buttock wounds is that the missile may have penetrated into the pelvis, so injuring the bowel or bladder. Suppuration in the buttock is very troublesome (especially if it tracks up from a fracture of the upper end of the femur). A few huge open buttock wounds were seen. They responded well to sodium sulphate dressings (12%) and subsequently needed secondary suture or skin grafting. A wound of the buttock in association with a fractured femur is very difficult to treat, because the ring of the Thomas splint comes up against the wound. One case of this type was put in a hip spica plaster cast. This appears to be the best treatment, but the plaster soon gets sodden unless a window can be cut.

A wound of the genitals is likely to involve also the cave of Retzius, the urethra, and perhaps the bladder. The uncomplicated bladder wound does well with suprapubic drainage. One patient had received a wound of his penis, and a piece of his shorts had been driven into the wound near the base of the organ. It had been passed naturally along the urethra and was emerging, rolled up, from the external urinary meatus, from which it was easily picked out. In one instance the membranous urethra had been completely shot away, and a perineal urethra had to be established. He had control of his urine, because the internal sphincter was still functioning, though the external sphincter had been destroyed. Two cases of ureteric fistula were seen, due to wounds in the loin; and I recollect two cases in which the kidney had been removed in forward areas. A wound of the kidney alone is certainly not common.

Wounds of the spine are usually associated with complete paraplegia, and are apt to arrive during rush periods when there is little time to deal with them. In the few cases in which operation was performed it was usually found that pressure on the spinal cord was produced by bone fragments and not by the missile itself. Suprapubic cystotomy is often necessary in these cases.

Vascular Lesions; Amputation

Ligature of a main vessel with extensive damage to the limb distal to it is fraught with grave danger and usually ends with amputation. The subclavian artery was divided in one case and thrombosed in another. Amputation had to be performed through the middle of the upper arm. In the only two cases in which the popliteal artery was ligatured amputation was subsequently required in each. One case of ligature of the femoral artery in Hunter's canal subsequently required amputation, though in a few others the result was quite satisfactory. The result seems to depend to a considerable extent on the damage to the limb itself and the attendant infection; but, apart from this, the conclusion to be drawn is that ligature of the femoral artery is to be preferred

to ligature of the popliteal. Ligature of the tibial vessels has been entirely satisfactory. The accompanying veins have been tied as well as the artery.

In the last group of 500 wounded there were 3 cases of traumatic (false) aneurysm—the right common carotid, the brachial, and the superficial femoral. In order to allow the collateral circulation to develop they were left alone as long as possible (3 to 5 weeks) before operation was performed. Pressure symptoms or rapid increase in size made further delay unjustifiable. At operation much clot was found in each case, and this tended to mask the pulsatile nature of the swelling, which may readily be mistaken for an abscess. In each case a direct attack was made on the aneurysm itself; the haematoma was opened and the vessels tied in the wound, with satisfactory results.

Thirty-two amputations of arm or leg have been performed in the hospital—upper arm 7, forearm 3, thigh 10, below knee 12: five (2 arm, 3 leg) were for gangrene due to arterial lesions; 4 (1 arm and 3 leg) for secondary haemorrhage; 23 for gross trauma and sepsis, one of which (forearm) was for gas gangrene. The chief points concerning amputation are as follows. The limb should not be removed at the site of election, for infection is almost sure to follow. The maximum length of limb should be preserved, because secondary amputation is often necessary. Some form of flap should be fashioned, as guillotine amputation is so painful. The flaps should not be sutured. The best dressing is probably a vaselined gauze pack; sometimes one or two sutures can be inserted to hold the flap in place over the pack. In badly infected cases the flaps are sutured back to the limb itself, thus leaving the stump widely open; secondary suture can be undertaken later. A liberal quantity of sulphanilamide powder is rubbed into a paste on the stump.

Nerve Lesions and Blast Injuries

Lesions of the ulnar and musculospiral nerves are common; the median is less often involved. Musculospiral lesions were not always due to the wound itself, but sometimes due to pressure—e.g., if the limb was allowed to hang over the operating table. External popliteal lesions were also frequent, and occasionally the whole sciatic nerve was paralysed. Special care must be taken to see that plaster casts do not cause pressure sores in these cases, when the skin is insensitive. It is important to look for nerve lesions before the operation is begun.

The only common blast injury was bilateral rupture of the tympanic membrane. The ears must on no account be syringed, for this invites infection. Patients are often badly shaken after blast, but recover in a few days. Only one case of crush syndrome was seen, and this proved fatal.

Burns

The worst cases of burns came from fighting in tanks. In peacetime, tanning the burn is highly satisfactory; but this is not so in war, because the facilities for preliminary cleansing of the burns are unobtainable, and tanning a dirty burn is as harmful as suturing a dirty wound. Moreover, a tanned burn needs skilled and careful nursing, which is impossible on lines of communication. Almost all the burns seen during the period under review had been cleaned up more or less, then powdered with sulphanilamide and dressed with vaselined gauze. Patients travelled best with plenty of padding, and in the case of the limbs a light well-padded plaster-of-Paris cast was definitely beneficial. In the early stages plenty of intravenous plasma or serum is essential. After the first week or ten days the haemoconcentration disappears and secondary anaemia develops. Blood transfusions at this stage help considerably.

Cases of severe burns travel very badly even up to two weeks after burning. After a long journey they arrive toxic and ill; the tongue is dry, and this is a good indication for pushing fluids. The tongue and the pulse are the most helpful guides to the general condition. The colour is often difficult to determine because the face is involved. Where all four limbs are burnt a transfusion may be given into the sternum.

It is easy to put too much sulphanilamide powder on the burns, especially in severe cases, as sulphanilamide is readily

and quickly absorbed from burnt areas and gives rise to profound toxæmia. I have seen one patient with a blood sulphanilamide of 20 mg. per 100 c.cm., and another (fatal) case of 40 mg. entirely due to local absorption (optimum concentration 5 mg. per 100 c.cm.). These patients were very cyanosed, and showed marked dyspnoea, tachycardia, and restlessness, and later unconsciousness. There were no physical signs in the chest. Lieut.-Col. W. C. Wilson pointed out that sulphanilamide was responsible. Sulphanilamide is now kept in the theatre in little gauze bags containing 10 g. each—that is the ration per patient. When, after a long journey, a burnt patient arrives toxic and ill the worst thing to do is to dress the burn the same evening. Plenty of fluids, and morphine gr. 1/4, should be given, and the patient must be left alone to recover from the journey. The burns should be dressed before and not after evacuation, and frequent dressings are harmful. Burns of the back are difficult to treat and to move.

Nursing and General Treatment

After heavy fighting the casualties arrive dead tired, and desire nothing but sleep, and lots of it. If they are not overcome with tiredness they want plenty of tea, a good meal, a good wash, and a good sleep. Next morning the bowels need attention. Constipation is very common, perhaps owing to the lack of water in the desert; many patients had not had their bowels open for four days or a week. A No. 9 pill, followed by mag. sulph. in the morning, is the answer. Ill patients are less disturbed if an enema can be given. Many complained of sore backs, from being jolted in an ambulance. Some huge bedsores were seen in patients who were too ill for evacuation and had to be nursed in the forward areas for some days on stretchers without ring pillows. Morphine gr. 1/4 or mist. 315s (pot. brom. gr. 15, chloral hydrate gr. 15, tinct. opii gr. 15) is most useful, and certain cases of battle euphoria respond very well to luminal gr. 1/2 t.d.s. for two days. Patients did not bother much about their wounds or the loss of a limb; this is in marked contrast to the mental distress caused by an amputation due to an accident. A grenade exploding in the hand causes the most ghastly wounds; several cases have been seen. One or both hands are blown off or mutilated; the face is spattered and the sight of one or both eyes is destroyed. Life continues and the patient recovers, but without hands or sight. For multiple superficial grenade wounds of the limbs a hot soapy bath is excellent treatment if sufficiently sterile conditions are obtainable.

Transfusions.—In all, 328 pints of blood (mostly stored) and 96 pints of plasma or serum were used in the hospital during the last six months of 1942, apart from a considerable quantity of 5% glucose in N/5 saline. Transfusions were used for shock, for burns, and during convalescence when the haemoglobin fell below 60%. For shock two to four pints of blood or plasma were required; the first pint was run in quickly. Patients have been received from forward areas who have had as much as 13 pints of protein-containing fluid during the first day or two. When blood is transfused to anaemic patients with suppurating wounds stored blood has to be given slowly and used with caution, because reactions are common and in the presence of undrained pus the benefit of transfusion is quickly lost.

Gas Gangrene and Tetanus.—Gas gangrene in the true sense has been very rare, and gas infection uncommon. It developed in a badly lacerated forearm with vascular block, in a large undrained haematoma of thigh, and as a terminal event in severe infection of an amputated leg and arm. No case of tetanus has been seen.

Anaesthesia.—Pentothal has been the anaesthetic of choice, especially for short operations. It was used for induction, followed by ether when longer anaesthesia or abdominal relaxation was required. If a drip saline was being given, pentothal was injected into the rubber tubing. Ethyl chloride was also used for induction, especially when the supply of pentothal was running short. Only a very light anaesthesia is required for most cases, and the tired wounded man is easily and quickly anaesthetized.

X Rays.—When the hospital was acting as a C.C.S., a wet x-ray film and report were made available by the radiologist in most cases, and were seen in the anteroom adjoining the

theatre. A radiograph was valuable for showing the presence or absence of fractures and foreign bodies. If the surgeon knows the approximate size and location of a shell fragment he can decide whether to go for it or not. No precise location by x rays was found necessary. The size of the external wound often gave a misleading idea of the size of the missile: a long thin fragment can make a large or small entrance wound, depending on its angle of entry. It was especially helpful to know of the presence of foreign bodies in the knee-joint, skull, spine, and chest. In wounds of the buttock or thorax, where abdominal injury was suspected clinically, a radiograph sometimes settled the matter for or against laparotomy. On one occasion the presence of gas under the diaphragm was a deciding factor.

Deaths

Table III indicates the main causes of death. Probably the figure of 1.3% is approximately accurate for most C.C.S. work. If a patient is fit enough to reach a C.C.S. his chance of

TABLE III.—Mortality in Hospital

	Head	Head and Face	Face	Neck	Spine	Chest	Thoraco-abdominal	Abdominal	Bladder and Scrotum	Trunk	Lower limbs	Multiple	Burns	Total	Percentage	Died within 1 week of wound	Lived over 1 week
300 casualties from Tobruk, including many serious cases	1	2				1		2			1		1	8	3		
2,679 casualties from 1st battle of El Alamein and subsequently when acting as a C.C.S.	5	1	2	2	1	1	3			2	6	9	5	37	1.3	33	4
500 casualties from 2nd battle of El Alamein; many seriously ill	8	4	1		3	3	10	3	1		2	12	5	52	10	35	17
Total	14	4	4	2	5	5	11	8	1	2	9	21	11	97			

recovery is excellent. The high mortality rate of 3% for the casualties from Tobruk and 10% from the second battle of El Alamein is due to the fact that seriously ill patients were sent to the hospital; this figure is far in excess of the mortality figures in most hospitals.

"Don'ts"

In conclusion, a few "don'ts" may be added:

- Don't suture wounds.
- Don't suture amputation stumps.
- Don't amputate at the site of election; go below it.
- Don't use packing except to stop haemorrhage.
- Don't use drainage tubing.
- Don't use unpadded plasters.
- Don't let a plaster dry with the heel resting on the stretcher.
- Don't forget to give morphine before a long bumpy journey.
- Don't forget to sling a Thomas splint on the stretcher bar.
- Don't forget to give plenty of fluids by mouth.
- Don't forget that the ligature of a main vessel should be prominently recorded on the field medical card and underlined. Gangrene is so dangerous.

Conclusions

The salient features of war surgery in the Middle East have been the value of organized resuscitation and local and general sulphanilamide; the importance of thorough immobilization; the adequacy of conservative surgery and wound trimming (even up to 48 hours after wounding), instead of wound excision; the dangers attendant on tension around wounds and the necessity for a good blood supply in damaged limbs; the satisfactory way in which the wounded man travels (except the abdominal cases and those with severe burns); and, finally, the need to adapt and improvise articles to fulfil functions for which they were never intended. War surgery is not difficult, but careful attention to important details is well repaid by results.

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