

BLOOD TRANSFUSION DURING THE BATTLE OF MARETH, WITH SPECIAL REFERENCE TO PROBLEMS OF SUPPLY.

THE following notes are extracted from a report by Captain H. K. Lucas, R.A.M.C., who, from the Battle of El Alamein onwards, was in charge of the Field Transfusion Unit (F.T.U.) responsible for the distribution of transfusion stores to forward units. The arrangements detailed are typical of those made throughout the campaign.

GENERAL LAY-OUT.

The general lay-out of medical units and of the Transfusion Units responsible for supply is shown schematically in Fig. 1.

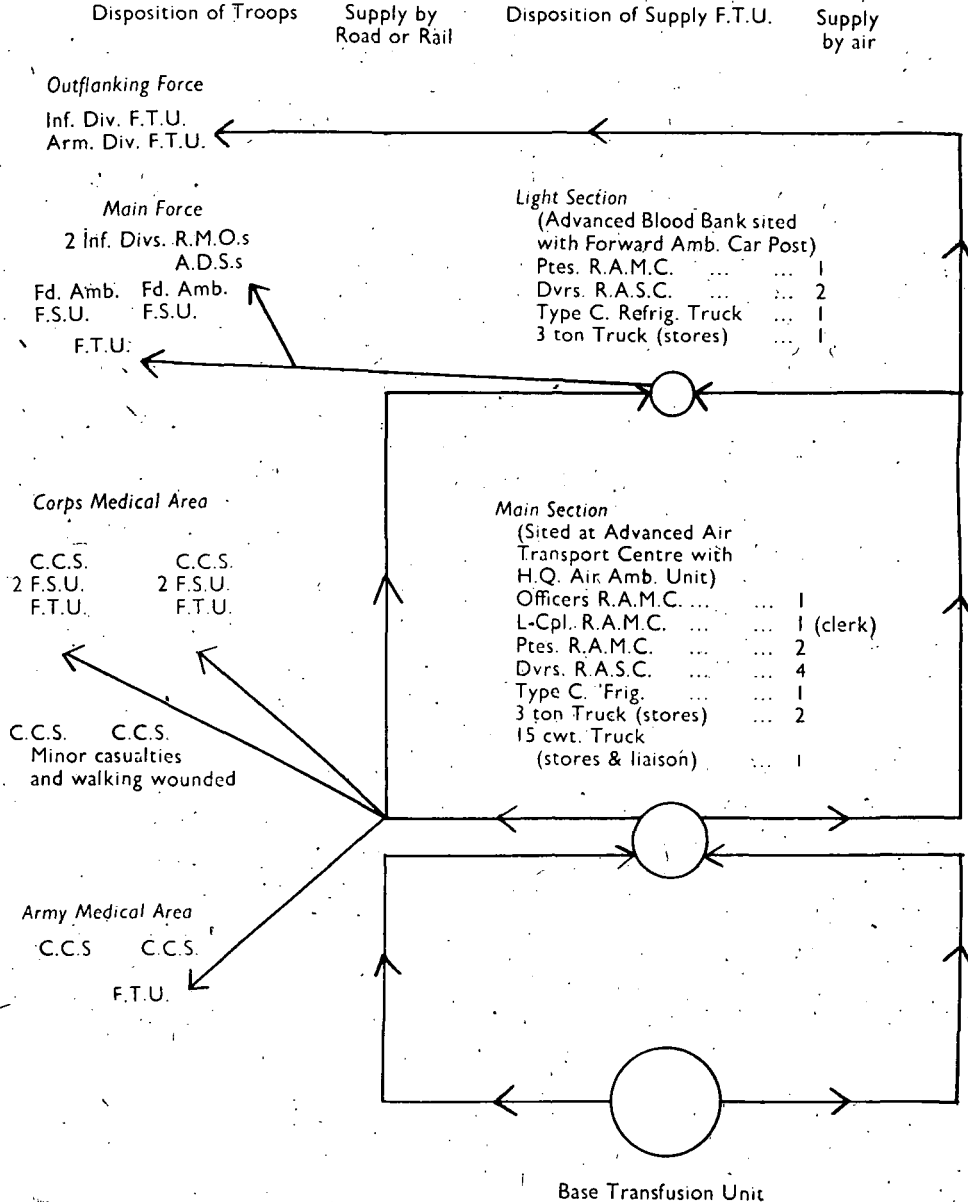


FIG. 1.

Distances vary according to circumstances. In this case the Advanced Blood Bank was about 5 miles behind the front line and the Main Supply Section a further 15 miles back.

OUTFLANKING FORCE.

As soon as serious resistance was encountered by the Mobile Column, one Field Ambulance (Fd. Amb.) opened out as Surgical Centre and a landing strip was prepared close to it for the evacuation of casualties by air. Transfusion stores were carried backwards and forwards from the Main Supply Section by ambulance plane.

CASUALTIES FROM THE MAIN FORCE.

The two Fd. Ambs. used as Main Dressing Stations were kept close together so that surgical facilities could be to a certain extent pooled. The F.T.U. was switched to whichever Fd. Amb. was receiving most casualties. Resuscitation was carried out in the other Fd. Amb. by the unit Transfusion Officer.

Seriously shocked casualties were resuscitated on admission to the Fd. Amb. and desperate cases operated on by the Field Surgical Unit. Cases when fit to travel were evacuated to the Corps Medical Area. In some forty cases a "travelling transfusion" was carried out during the journey (Lucas 1943). This proved of great value.

In the Corps Medical Area all major cases were dealt with in two C.C.S.s before further evacuation by road or air. Each C.C.S. had four operating theatres in action with one F.T.U. carrying out resuscitation for all. These two C.C.S.s were in close proximity and opened and shut alternately every eight hours. It was found that one F.T.U. could resuscitate patients for three surgical units operating simultaneously but, while the surgeons worked in shifts, no relief was available for the F.T.U. personnel. In prolonged battles (none after Alamein produced heavy casualties for more than three days) some relief for F.T.U. personnel is necessary. This cannot be guaranteed from the host unit whose officers are fully occupied.

Two other C.C.S.s in the Corps Medical Area dealt with minor cases and passed them to the Army Medical Area.

In the Army Medical Area two C.C.S.s were served by one F.T.U. Only six battle casualties required transfusion in this area.

TRANSFUSION SUPPLY ARRANGEMENTS.

Base Transfusion Unit.—The Base Transfusion Unit is responsible for all supplies of transfusion apparatus and fluids. In Middle East this unit also undertook the preparation and supply of sulphonamide preparations for intravenous and intraperitoneal use. During a battle the quantity of transfusion stores (exclusive of whole blood) required by a Corps Area was approximately $1\frac{1}{2}$ tons a day, for which fast and reliable transport is essential, e.g. M.T. supplied by either the Base Transfusion Unit or the Main Supply Section between which the stores are carried. For whole blood, air transport is essential. If F.T.U.s are fully stocked with blood at the beginning of a battle about 120 bottles of blood per Corps per day are required for replenishment but this amount obviously varies according to circumstances.

Forward Supply Unit.—Experience has shown that it is essential to have a unit whose sole function is to maintain the supply of transfusion materials in the forward areas. During a battle it is not possible for F.T.U.s to carry out their resuscitation duties and at the same time to fetch and carry supplies. In Middle East an augmented F.T.U. was relieved of other duties and used as Supply Unit. Details are shown in fig. 1.

The Main Supply Section of this unit was sited at the Advanced Air Transport Centre. This is imperative to ensure that consignments of blood arriving by air can be taken over and placed in a refrigerator without delay. The allotment and timing of air transport during a

battle is so uncertain that it is essential for all incoming planes to be met and this can only be done by a unit on the spot. From this section supplies were sent forward to the out-flanking force and, when it was far forward, to the Advanced Blood Bank by Air Ambulance. Supplies to nearby units including, in normal circumstances the Advanced Blood Bank, were made by a daily "delivery round" in the unit transport. This served a double purpose; all issues, except blood, were made on an exchange basis and the return of empties was therefore ensured—a very important point.

A further duty of the officer in charge of this unit was to maintain contact with administrative medical officers, to obtain information regarding anticipated casualties and to place demands accordingly on the Base Transfusion Unit. This control of supply had a considerable effect in decreasing wastage.

The Light Section (Advanced Blood Bank) was fed by the Main Section and distributed to forward units. It was sited with the Forward Ambulance Car Post of the forward M.A.C. through which all ambulances check out and in and therefore had up-to-date information of the location of medical units—a very important point in mobile warfare. The Light Section made a periodic delivery round to all the units it served.

It emerged as a general principle that, in the Corps Area and forward, it was not safe to rely on any form of communication other than personal contact and that the "daily round" was essential to ensure smooth supply.

SCALE OF TRANSFUSION EQUIPMENT.

The standard scale of transfusion equipment carried by medical units of 8th Army is shown in Table I.

TABLE I.—SCALE OF TRANSFUSION EQUIPMENT FOR MEDICAL UNITS IN EIGHTH ARMY.

	General Hospitals	C.C.S. Hvy. Sn.	C.C.S. Lt. Sn.	Field Amb.	Lt. Field Ambulance
Taking and giving sets complete	12	12	6	6	6
Extra giving sets without needles	12	12	6	6	16
Needles B.T.*	12	12	6	6	6
Cannulae*	6	6	3	3	3
Citrate bottles	24	24	—	—	—
Plasma or serum wet or dry, btl. with 1 giving set per 2 bottles	48	36	24	36†	36†
Grouping serum, dry	6	6	6	6	6
Glucose saline	48	48	12	12	12
Sulphanilamide saline	24	24	6	0	0
M.E. sets	6	—	—	—	—

*Needles and cannulae will not be exchanged, but will be retained, cleaned and sterilized by the unit; if necessary, needles can be sent to Det. No. 1 Base Transfusion Unit for resharpening.

†This item contains 6 small boxes, each containing 2 dried plasma, distilled water, and 1 giving set for distribution to R.M.O.s if required.

This scale was augmented as required—i.e. Fd. Amb. likely to be heavily involved were given two extra boxes of serum while those which acted as hosts to Field Surgical Units carried additional glucose saline and sulphonamide preparations.

During periods of calm, F.T.U.s maintained their refrigerators about half full of blood. For about seven days before the battle opened 100 bottles of blood a day was flown up until they were fully stocked (over all total about 800 pints). In addition, stocks of plasma, serum, saline and sulphonamide preparations were augmented.

SUPPLIES AVAILABLE FROM THE TRANSFUSION SERVICE.

- (1) Whole blood.
- (2) Dry plasma and distilled water.

- (3) Wet serum or plasma.
- (4) Glucose (5 per cent) and saline (0.3 per cent).
- (5) Sulphonamide drugs.
 - (a) Sulphanilamide 0.5 per cent in normal saline (for intravenous administration).
 - (b) Sulphanilamide 4 per cent, dextrose 20 per cent, sod. bicarb. 4 per cent, in 100 c.c. bottles for addition to glucose saline.
 - (c) Sulphanilamide 5 per cent in glycerine, in 100 c.c. bottles (for direct application to wounds, particularly synovial membranes).
 - (d) Sulphathiazole pulv. 10 grammes, sterile, in test-tubes.
 - (e) Sodium sulphathiazole solution 30 per cent, in 10 c.c. ampoules.
 - (f) Sulphathiazole 3 per cent in glycerine, in 100 c.c. bottles (for intraperitoneal application).
 - (g) Sulphadiazine suspension, 10 grammes, in 100 c.c. bottles (for intraperitoneal application).
 - (h) Sod. sulphadiazine solution 30 per cent, in 100 c.c. bottles.
- (6) Sod. citrate 4 per cent, sod. bicarb. 4 per cent, in 100 c.c. bottles for intensive alkali administration.

TRANSFUSION WORK CARRIED OUT IN ONE CORPS OVER A PERIOD OF TEN DAYS.

This analysis comprises the transfusions carried out over a period of ten days (March 16 to 25) in 8 Fd. Ambs., 3 F.T.U.s, and 2 C.C.S.s.

Casualties were not on a heavy scale and therefore received adequate attention early. The units concerned were experienced in transfusion and were aware of the necessity for conserving supplies. At no time was there any shortage of blood.

TABLE II.

Location	Battle Casualties Admitted	Number of Transfusions Performed	Percentage Admissions Transfused	Bottles	
				Blood	Plasma
Seven A.D.S.s	1,393	32	2.38	0	63
Eight M.D.S.s	1,359	100	7.36	314	128
Two C.C.S.s	985	102	10.35	228	61
TOTALS	3,737	234 (a)	(b)	542	252

(a) This is not the number of patients transfused as casualties transfused in A.D.S.s and M.D.S.s in a number of cases receive blood later in C.C.S. The accurate number of casualties treated by transfusion is not known but is probably 180 to 200.

(b) A total is not shown in this column: in consequence of (a) as this would be misleading. The figure is estimated at 13 to 15 per cent.

PENETRATING ABDOMINAL INJURIES.

The transfusions carried out on penetrating abdominal injuries are shown in Table III.

TABLE III.

Penetrating Abdominal Injuries, March 16—25.

FIELD AMBULANCES.

(a) Total admitted to M.D.S. of which record could be found (2.65 per cent of admissions) ..	37
(b) Died after admission (pre-operation)	3
(c) Died shortly after operation	4
(d) Died before further evacuation (within two days)	4
(e) Evacuated before operation (11 of these were sent back with travelling transfusions in progress)	22
(f) Held in Field Ambulance during post-operative period (includes (d) above)	8

Fluid used on these cases.

(a) On 37 cases admitted :	Blood 67	Serum 17	G-saline 110
(b) On 8 cases immediately surviving operation :	Blood 45	Serum 8	G-saline 110
Per case.:	Blood 5.6	Serum 1.0	G-saline 13.75

CASUALTY CLEARING STATIONS.

Cases operated	22
Deaths within twenty-four hours	3
<i>Fluids used :</i>	
<i>Fluids used per case :</i>	Blood 40 Serum 3 G-saline 365
Average over whole area, 37 cases :	Blood 1.8 Serum 0.14 G-saline 16.6
Per case :	Blood 127 Serum 20 G-saline 475
	Blood 3.5 Serum 0.54 G-saline 12.8

It is regretted that details of these cases are not as complete as might appear desirable but figures were asked for with a view to discovering the volume of fluids used. It is not the object of this report to deal with the surgical aspect of these cases.

TABLE II. (contd.).

Used	Average per transfusion			Average per 100 Casualties.			
	Total	Blood	Plasma	Total	Blood	Plasma	Total
63	0	1.97	1.97	0	4.54	4.54	4.54
442	3.14	1.28	4.42	23.10	9.45	32.52	32.52
289	2.23	0.60	2.83	23.15	6.17	29.32	29.32
794	2.32	1.10	3.42	46.25	20.13	66.38	66.38