

TAILPIECE

The Evolution of casualty evacuation in the British Army in the 20th Century (Part 2) –1918 to 1945

ABSTRACT

This is the second in a series of papers that examine the evolution of the military casualty evacuation chain during the 20th century. The Spanish Civil War demonstrated to the world the revolutionary tactic of 'Blitzkrieg' developed by the Germans. This and the experience of the British Expeditionary Force in 1940 emphasised the need for mobility in forward medical units. The campaign in the Western Desert led to the creation of a number of new units such as the Field Surgical Unit and the Field Transfusion Unit which were introduced across the British Army as a result of the findings of the Hartgill Committee. The aeroplane transformed the evacuation chain from CCSs to base hospitals and beyond.

Introduction

This is the second in a series of papers that examine the evolution of the military casualty evacuation chain during the 20th century. This paper reviews the period 1918-1945. The Spanish Civil War in the 1930s heralded major escalations in the level of violence consequent to warfare. It provided some insight into the effects of the global warfare that was to start at the end of the decade. The technology of the tank and the aeroplane radically altered military operations and the medical support required to care for injured soldiers.

Interwar Years

Aeromedical Evacuation

Although the conflict in Europe had ended in 1918, Great Britain retained extensive global interests. Military forces were involved in containing a number of local rebellions during the 1920s and 1930s. The extreme distances involved in conducting expeditionary military operations in the Middle East led to consideration of the use of aircraft for casualty evacuation. The first recorded instance of aircraft being used by British forces was for the evacuation of sick from the Kurdistan column in Iraq in April 1923. Some 200 cases of diarrhoea and dysentery were evacuated from an inaccessible mountain region back to Baghdad (1). This became a standard technique for casualty evacuation at the frontiers of the British Empire. As experience developed further, the Army and the Royal Air Force developed

working relationships for the command and control for the movement of casualties by air between land medical units (2).

EVACUATION: Army and RAF interoperability is a key element of casualty evacuation

The Spanish Civil-War

The civil war in Spain was seen by many as the pre-cursor to the European conflict of World War II. It was this experience that enabled the Germans to develop many of the detailed tactics needed to support the strategy of 'Blitzkrieg'. Volunteers from overseas extensively supported the medical services on both sides (3). Jolly (4) described the medical experience of this war in a book published in 1940. He highlighted the importance of time as the key determinant of outcome in the management of war wounds:

'in Spain it was shown that the reduction of the time-lag for the gravely wounded necessitates a reorganisation throughout the system of Forward Hospitals and Casualty Classification Centres. The interval cannot be reduced merely by increasing the number of surgical teams working in Casualty Clearing Stations'.

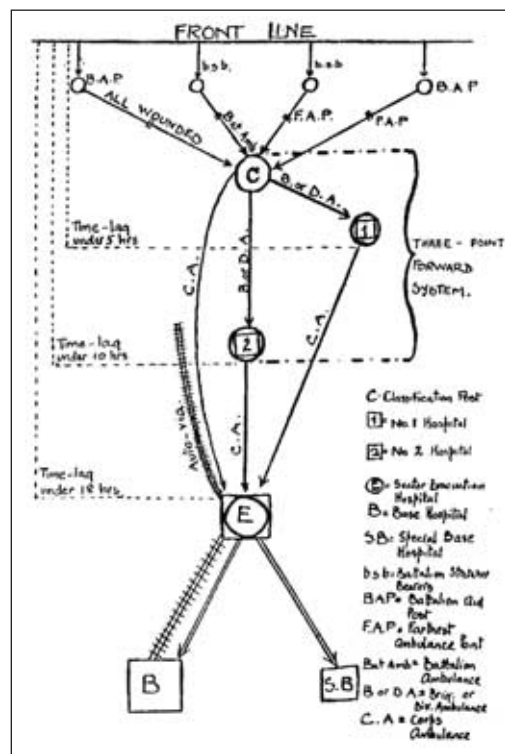


Fig 1. Diagram of Three-Point Forward System

Lt Col MCM Bricknell
DM MMedSci
MRCGP MFOM
MFPHM DMCC
DRCOG RAMC
Chief Instructor,
Defence Medical
Services Training
Centre, Keogh
Barracks, Ash Vale,
Aldershot, Hants,
GU12 5RQ.
Email:
mcm.bricknell@net.ntl.com

He proposed a concept for the organisation of military medical services called the 'Three Point Forward System'. This is shown diagrammatically in Figure 1.

This system divided the Casualty Clearing Station (CCS) into its component functions of an Evacuation Hospital (5) and established each as a separate unit. The Casualty Classification Centre, with trained classification (triage) teams, was placed in advance of the furthest forward hospital and acted as the pivot for the remainder of the system. The No1 Hospitals ('Hospitals of the First Urgency') were sited so that the time-lag from wounding to operation was reduced to under 5 hours. A dedicated shuttle of ambulances was established between the classification posts and the No1 hospitals.

The No2 hospitals took the remaining casualties prior to their onward move to evacuation hospitals. If the time-lag at both the No1 and No2 hospitals rose above the permissible limits and the evacuation road between these and the classification post was good then it was advised that the siting of the classification post and the means of evacuation to the classification post should be examined. If the time-lag between the classification post and one of the hospitals became extended then the hospitals should be moved.

Jolly noted that the conditions of the 'total war' experienced in Spain challenged many of the pre-existing assumptions. The extensive use of airpower had largely removed the imperative for the siting of surgical units at the limit of effective range of the enemy's artillery as all military units had now become vulnerable to enemy action.

In addition towns and cities had become targets, negating any protection that might have been afforded to civilians. Thus medical units had to adopt the same principles of dispersion, camouflage and protection employed by combatant units. Large aggregations of transport or wounded men at hospital sites had the potential to become targets for aerial bombardment.

The treatment function depended on two separate elements, the field hospital and the mobile surgical unit. The field hospital contained the core elements of a hospital, namely beds and nurses, administration and infrastructure. This unit could act as a No 1 or No 2 hospital and so movement of medical services could occur by means of a leap-frog system of a pair of these units. The surgical capability was delivered by means of self-sufficient mobile surgical units consisting of 14 personnel (surgeon, assistant surgeon, 2 anaesthetists, 2 theatre nurses, 2 orderlies, 3 driver sterilisers, one electrician and 2 ward nurses). Their equipment was moved in a specially designed Renault truck (the auto-chir). This included a portable steriliser, a special wheeled and counter-weighted theatre light, an electricity

generator and sufficient medical materiel to support two operating tables. Although not capable of working independently from another medical unit, the mobile surgical unit could either be deployed to a field hospital to give it surgical potential or act as a nucleus of a hospital unit. The hospital unit could be established by the addition of a truck loaded with 20 beds, 2 marquees, ward furnishings, kitchen materiel, an ambulance with a triage officer, a clerk, 2 ward nurses, 4 stretcher-bearers and a cook. This combination of units allowed the chief medical officer of an Army Corps to provide a flexible medical service to support military operations.

**TRIAGE: triage by destination.
SURGERY: creation of a specialist,
mobile Forward Surgical Hospital**

Second World War

Overview

The Second World War was a considerably expanded conflict compared to the First World War, with military forces engaged in every geographic region around the world. The 'Blitzkrieg' of the Spanish Civil War expanded the violence and destruction of military technology. Military planners had visions of columns of mechanised warriors moving rapidly around the battlefield where the terrain and military situation allowed. However, most battles included the set-piece artillery barrage, infantry operating on foot and the close-quarter fighting reminiscent of World War One. Casualty evacuation still started with the hand-carry of the seriously wounded by stretcher. The organisation and design of surgical hospitals was adapted to meet the demands and constraints of each environment. Fortunately gas was not used as a weapon, though the war ended under the shadow of nuclear weapons.

In the British Army Medical Services, the surgery of wounds went through three phases. Treatment by closed plaster was the rule at the beginning of the War. In the second phase of the development of wound management, wounds were excised and drained, the limb immobilised in a padded plaster and closure by secondary suture or skin graft was undertaken as soon as the surface was covered by granulation tissue.

By 1944, 'delayed primary suture' was the authorised treatment. In this the wound was excised by the forward surgeon and the defect closed in the base hospital between the fourth and sixth days (6). The understanding of wound shock expanded considerably leading to the design of complete systems for the movement of blood and plasma to medical units. The development of antibiotics, sulphonamides initially and then penicillin, augmented the armamentarium of the surgeon in the management of war wounds – but this did not replace the dictum

of wound excision learnt in the First World War.

SURGERY: establishment of debridement and delayed primary suture as the surgery of choice for war wounds.

European Front 1939-1940

The British Army entered the Second World War with a casualty evacuation system based on experience from the First World War (7). The scheme of evacuation published in the RAMC training manual continued to have the CCS as the point of convergence of all casualties (as shown in Figure 2 (8)). The CCS continued to be sited at the head of a railway line served by an Ambulance Train. It was a large unit, divided into a Heavy and Light section as organised at the end of World War 1 but without sufficient transport to move any element by itself.

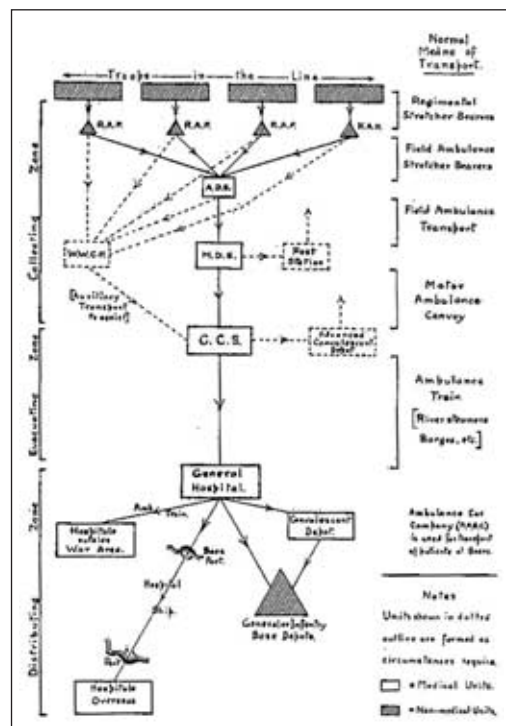


Fig 2. Casualty Evacuation Chain 1935.

The period of active operations started on May 10 1940 when German forces attacked Holland and Belgium. From May 17 until the completion of the evacuation of British forces from Dunkirk, Cherbourg and western French ports, the British Army was in retreat. This caused commensurate disruption to the casualty evacuation plan. It was apparent that the equipment for the CCS was too heavy and too bulky. When the CCS was required to move, this was the time when the demand for transport across the Corps area was at its peak. Practically every CCS in this campaign lost a greater or lesser part of its equipment on its first move (9).

Western Desert 1940-1943

The campaign in the Western Desert from 1940 until the battle of El Alamein in 1942 was a 'yo-yo' along the North African coastal strip. It was a battlefield of armoured manoeuvre warfare with extended lines of communication. By the end of 1941 it was evident that a unit had to be improvised that could carry out the duties of a CCS but without the logistic demands. The need for formally configured 'surgical teams' that could be moved to reinforce CCSs or exceptionally to divisional Main Dressing Stations (MDS) to form 'advanced surgical centres' was also identified. Whilst such an advanced unit could not replace the care provided by the CCS, there was no doubt that lives could be saved if the CCS was many miles further down the evacuation chain.

SURGERY: mobile field surgical teams to move between CCSs as reinforcements.

The medical plan for Operation Crusader in Libya in November 1941 gives an idea of the complexity of such an evacuation system. Mobile surgical teams were attached to the CCSs at the start of the operation ready to be pushed forward when needed. A mobile military hospital, modelled on the American hospital platoon, was allocated sufficient transport to be able to move independently. Each CCS was provided with a platoon of 34 lorries from the Royal Army Service Corps for as long as they were mobile units. The plan for XIII Corps was described as

'An advanced operating centre (HQ of an Indian field ambulance plus the light section from 2 Indian CCS) at Bir Mumin will serve Indian 4th Division. In the rear of New Zealand field ambulances will be a New Zealand mobile surgical team for emergency operative treatment in an advanced operating centre at Dar El Brug. Supporting this in the Bir Habata area will be an advanced operating centre consisting of the corps field ambulance, the light section of 14 CCS and 2 Field Transfusion Unit (10)'. This scheme of evacuation is shown at Figure 3.

The mobile, self-contained Field Surgical Teams were designed to be grouped and re-grouped in an ever-changing pattern and could function with either the field ambulance MDS or the CCS depending upon the tactical situation. The determining factor was to ensure that the interval between wounding and primary surgery did not exceed 8 hours (for wound management, not arrest of bleeding (9)).

SURGERY: 8 hour rule

Major-General Ogilvie, the surgical consultant to the Middle East Forces, listed

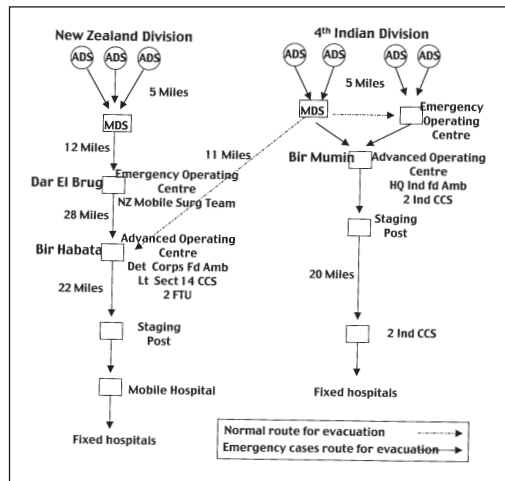


Fig. 3 Evacuation Chain. Operation Crusader.

the requirements for these forward surgical units (11):

1. It should be able to take 2 stretchers at a time and a third in an emergency.
2. The floor should be at or below ground level (for protection from shrapnel).
3. It should have room for traffic to pass without touching the operating team.
4. It should be kept as clear as possible, the sterilising and cleaning being relegated to an annex.
5. It should be well lit, yet lightproof, and have light traps at entry and exit.
6. It should be easily concealed from air observation.
7. It should be easily and quickly erected by members of the team without other help.
8. It should be packed up even more easily and quickly.

Two types of forward surgical units were used in the Middle East, canvas 'lean-to's attached to standard 3 ton lorries and specially designed operating lorries. Whilst the operating lorry seemed to offer a bespoke solution, in fact it met very few of the criteria above. Any mechanical fault in the lorry meant the loss of all the fitted equipment. However large they were, they were always too small. The operating theatre was about 4 feet above the ground, necessitating a lift of this height for every patient (10). If the unit is the target of air or artillery attack, all members of the team felt very vulnerable so high off the ground (6).

SURGERY: specially designed operating theatres vulnerable to mechanical failure.

The experience in the Middle East informed the development of Army field medical units for subsequent campaigns. The need for a variety of medical units, organised by function, that could be grouped together to meet the requirements of a particular operation were self-evident. The attachment of a field surgical unit to a light field ambulance dressing station provided the

simplest operating unit. This grouping was inefficient as the lone surgeon was likely to be overwhelmed and the whole organisation was not designed to hold or nurse the serious cases that were the *raison d'être* of such an organisation. Furthermore, two additional services, resuscitation and radiography were required for all but the most exceptional circumstances. It was also established that the output of a single field surgical team was much less than half of two grouped together. The combination could rotate turns of duty and have a proper rest, and nursing, done by orderlies, could be better observed (6).

SURGERY: surgical teams should work in pairs.

Whilst the conditions in the desert allowed post-operative casualties to be nursed in austere conditions on stretchers under a tarpaulin suspended over goal-post-like frames from the back of a lorry, this was a rather dismal setting for the seriously ill. It was clear that field surgical teams should be supported by a small number of beds for post-operative nursing with suitable shelter. Overall, the most effective organisation for such a unit was formed from the Dressing Station of the Corps field ambulance, the light section of a CCS, additional surgical teams and mobile specialist units such as a transfusion unit, X-ray unit and bacteriological laboratory (9). An example of the internal design of a Field Surgical Team in the Middle East was contained in the Field Surgical Pocket Book published in 1944 (11) and is shown in Figure 4.

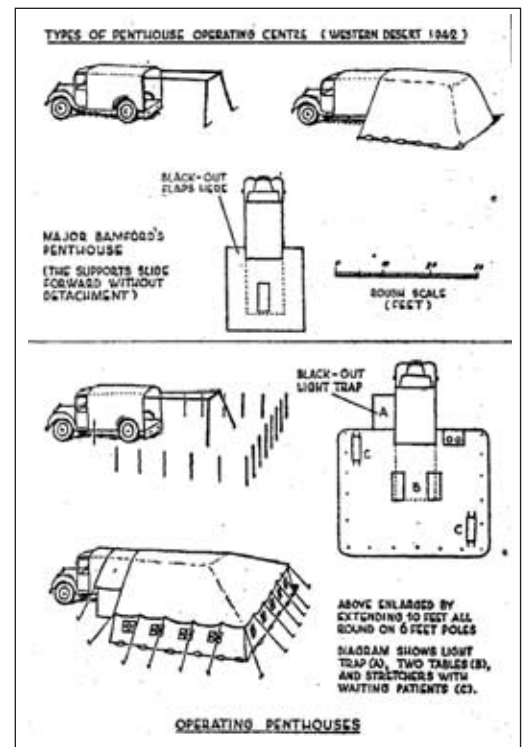


Fig 4. Internal plan of a Field Surgical Unit in the Middle East.

SURGERY: surgical capability requires resuscitation, radiography and post-operative holding.

The 8th Army put these principles into practice for the Third Libyan Campaign, starting at El Alamein in October 1942. The field surgical team and the field dressing station recommended by the Hartgill Committee (vide infra) were formally introduced. Some CCSs were made completely mobile by reducing the equipment scales but retaining the clinical capability. In the series of set battles that preceded retreats by the Germans, CCSs were sited well forward to receive the bulk of casualties until the breakthrough was achieved. The field surgical units and field dressing stations were kept packed and moved forward close behind the advancing troops, ready to set up and receive casualties if pockets of resistance were encountered.

EVACUATION: Field Dressing Station created to care for non-surgical cases to reduce evacuation from Corps area.

Reorganisation Of Medical Services In The Field

The experience of operations in France and the Middle East had demonstrated that the design for medical services in the field was unsuited to the new style of land warfare. The Director General Army Medical Services appointed a committee to examine the organisation of medical services in the field. This was known as the Hartgill Committee after its chairman (12). The committee considered that there were four defects of the current organisation: field medical units were cumbersome, insufficiently mobile and not adaptable to the tactical situation; field ambulances did not possess adequate means of communication internally or with their parent formations; casualties were not distributed directly to appropriate units but passed through a channel of evacuation which caused congestion in the forward areas while insufficient transport led to delay in the distribution of casualties to selected centres; finally, surgeons, their assistants and equipment were located too far to the rear of divisions and corps.

FAILURES OF MEDICAL SYSTEM:
insufficient mobility,
inadequate communications,
too many intermediate units
between wounding and definitive
treatment, surgery located too far
from point of wounding.

The committee revised the system of evacuation with the aim of reducing the number of staging posts through which a casualty should pass. The main feature of this new system was the classification of the casualty as far forward as possible and evacuation from that point direct to the medical unit in the rear which would most adequately deal with his particular case (13). This led to a re-organisation of existing units (particularly field ambulances) and created new units (Field Surgical Units, Field Dressing Stations). The overall scheme is shown in Figure 5 (6).

EVACUATION: limit number of medical units between triage and definitive treatment.

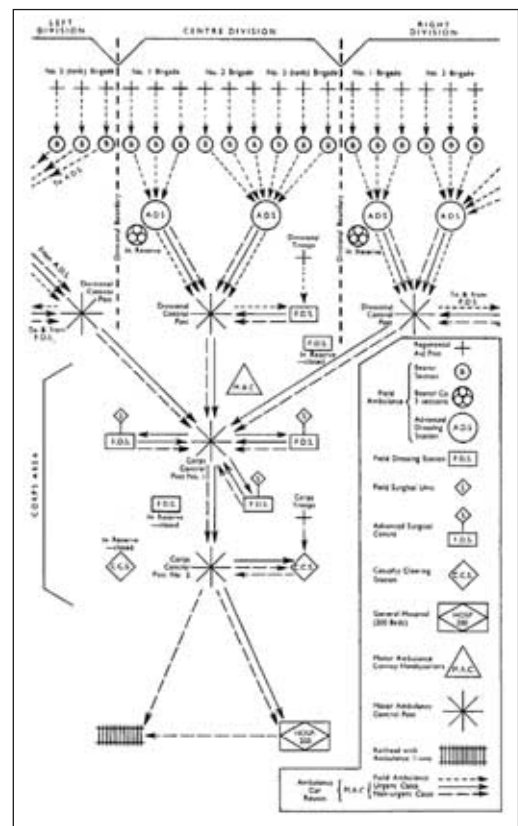


Fig 5. Revised Scheme of Evacuation (Hartgill Scheme).

The duties of the Regimental Organisation in the collection and initial treatment of casualties remained unchanged. The Advanced Dressing Station (ADS), whilst much closer to the front line, replaced many of the functions of the MDS. Substantially greater emphasis was given to the sorting of casualties according to the nature of the wound, their general condition and the kind of treatment indicated. This extended to ensuring that casualties were evacuated and distributed according to the sorting process.

Casualties were divided into Groups. Group 1 cases were those exhibiting severe shock and urgently in need of resuscitation. These were to be despatched immediately to the divisional Field Dressing Station (FDS) which had specific facilities for resuscitation,

usually based on an attached Field Transfusion Unit. The Field Transfusion Unit was designed to provide a mobile blood transfusion unit expert in resuscitation. This consisted of one medical officer and 3 other ranks. Group 2 cases were those requiring immediate surgical attention (wounds of the chest, abdomen and cases of severe or complicated fracture). These cases were to be sent to the Advanced Surgical Centre (formed from the Corps FDS with a Field Surgical Unit (FSU) and FTU attached). Finally Group 3, the remainder and the majority were to be despatched to the CCS. The prime consideration of the ADS was that of mobility and therefore it was decreed that this unit should not be engaged in active treatment of cases.

**TRIAGE: Groups 1, 2 and 3
RESUSCITATION: establishment of
Field Transfusion Units.**

The Field Surgical Unit (FSU) evolved from the innovations in place in the Western Desert. The location of this unit was subject to much debate. Whilst it was possible to attach them to the field ambulance, little or no post-operative holding and care was possible as the unit was committed to maintaining contact with its parent division in conventional ground operations. Thus it was considered unwise to locate FSUs at this level in the evacuation chain. However, there were circumstances where evacuation rearwards was either not possible or involved a substantial journey. The formation of parachute and glider forces required a plan for the surgical treatment and holding of casualties prior to the link up with ground

forces and so specific surgical teams were developed for this role (14). The plan for Field Surgical Units was further elaborated in the Field Surgery Pocket (12) book and included designs for their internal layout. These are shown at Figure 6.

**SURGERY: airborne forces require
integral surgical support.**

All available evidence had demonstrated the need for the CCS to have sufficient integral mobility to enable the medical services to organise the re-deployment of the unit rather than relying on the transport organisation. The allocation of additional transport did not meet with the approval of the War Office. The CCS was reduced in size to accommodate 120 casualties (50 in beds and 70 on stretchers) but retained the historical three tasks: surgical treatment of battle casualties, accommodation of casualties until evacuation and retention of mild sick or injured.

**MOBILITY: CCS reduced in size to
facilitate mobility.**

The role of the General Hospital was also revised. This was now fixed at 200 beds (in contrast to the 600 and 1200 bed units previously established). These hospitals were to be situated at the railhead or airhead and to assume in the evacuating function previously undertaken by the CCS.

The Hartgill Committee reported in 1942 and re-organisation started. This was constrained by the difficulties of re-organising units committed to operations in the Middle East. In the event, the only organisation that conformed to the new scheme was 21 Army Group landing in Normandy in 1944.

Tunisia And The Mediterranean Front 1943-1945

The First Army landed in Northern Tunisia in November 1942. CCSs were organised on 'light scales' for the assault landing. The speed of the advance put considerable pressure on the transport system and this in turn precluded the expansion of CCSs into the 'heavier' scales. These same principles were applied to the organisation of the general hospitals. Each was designed to be moved and set up in tactical blocks. This enabled the hospitals to be self-contained and to function immediately on opening. The First Army and the Eighth Army met up in 1943. The Mediterranean Front then extended to an invasion of Sicily and finally a slow, tortuous slog Northwards through Italy. The field medical services remained essentially unchanged from that which had evolved in the desert. However, the strategic emphasis shifted towards Northern Europe

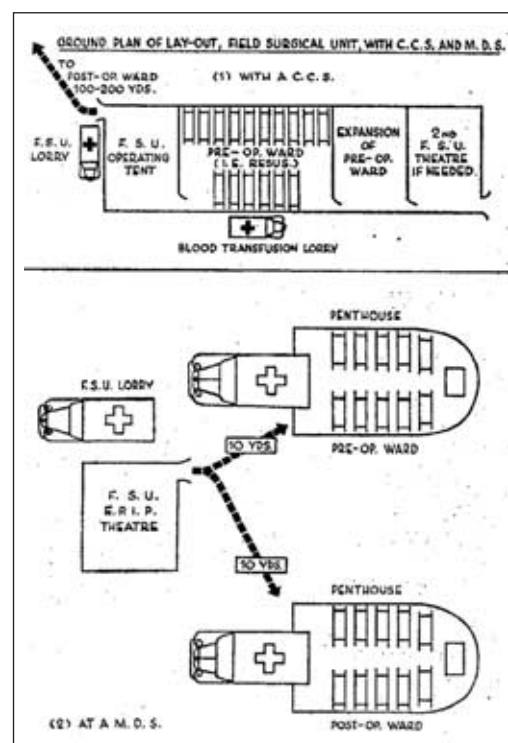


Fig 6. Designs for Field Surgical Units.

and so many units were redeployed to UK in preparation for D-Day.

Northern European Front 1944-1945

The first steps in raising the medical component of the expeditionary force for the invasion of Northern Europe (15) started in January 1943. The findings of the Hartgill Committee defined the overall medical organisation from the outset of the medical plan. However, the management of casualties arising from the landing was the first challenge for the medical planners. The organisation tasked with the control of supporting military operations after the first 'foothold' had been achieved was the 'Beach Group'. It was decided that within the Beach Group there should be a medical unit capable of affording first-aid treatment, including life-saving surgery, to ensure the immediate evacuation of the majority of casualties by sea to the UK with a reasonable degree of assurance that they would need no further intervention (Figure 7). Furthermore, these units should be capable of retaining casualties unfit for further evacuation in the short term. It was decided that the FDS and FSU combination was the best organisation for the task. They would then evacuate casualties 'over the beach' to designated ships that had completed the process of off-loading their military equipment and stores. This scheme was backed up with a comprehensive plan for the reception and distribution of casualties to hospitals within the UK. This was to be augmented by the evacuation of serious casualties by air as soon as forward airstrips had been established. In the event, the assault was less costly than had been envisaged and the medical services met the task without serious mishap. Evacuation by air began on June 13, a week earlier than planned, which shortened the period that serious casualties were retained in field hospitals.

EVACUATION: specific medical systems may be designed for specific military operations, though the principles remain valid.

The casualty evacuation chain laid down by the Hartgill Committee provided the flexibility for the medical commanders to design a plan to support the campaign in Northern Europe until the end of the war in May 1945. The reduced size of the CCS was adequate for the task and could be reinforced by one or more Field Surgical Units if required. This ensured that the CCS remained sufficiently small to be moved by a single platoon of three-ton lorries (17). During the autumn and winter CCSs were accommodated in buildings and paradoxically took longer to establish (4-12 hours) than when set up in fields (2-6 hours).

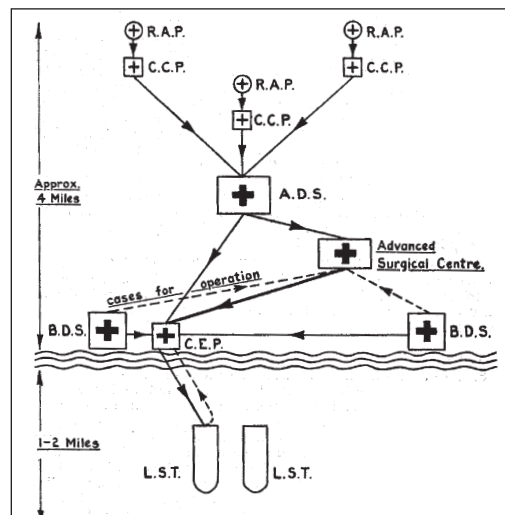


Fig 7. Medical Layout for a Beach Landing (17).

There was general agreement that surgery should not be undertaken too far forward, certainly not within the noise of friendly artillery or within the range of that of the enemy (18). When this limitation was not possible, on a beach or a drop zone, only those casualties of the highest priority were likely to benefit from such surgery. The exact design depended on the size of the units, the proximity of the enemy and risk of air attack.

SURGERY: should be done in a stable, secure environment ie. CCS not field ambulance.

Where risks were high, units were dispersed so that the consequences of a direct hit would be limited to single elements. This militated against internal efficiency and exposed the casualties to the external weather when moving between departments.

SECURITY: dispersal of unit as means of protection.

Whatever the size of the facility, the basic organisation followed a similar pattern. The casualty was received into the reception station. It was vital that this area had adequate space. The evacuation department was usually located close by to reduce the distance the numerous, less serious cases had to be carried. The pre-operative ward (also called resuscitation) was run under the direction of the transfusion officer. This person was entrusted with the responsibility for pre-operative diagnosis and treatment and the administration of blood or other fluid for the treatment of shock. The collation of the serious cases into one area also assisted the surgeon in the assessment of priorities for surgery. The X-ray set was also located in this area. The layout of the operating theatres was dependant on the size of the parent organisation and the number of operating teams.

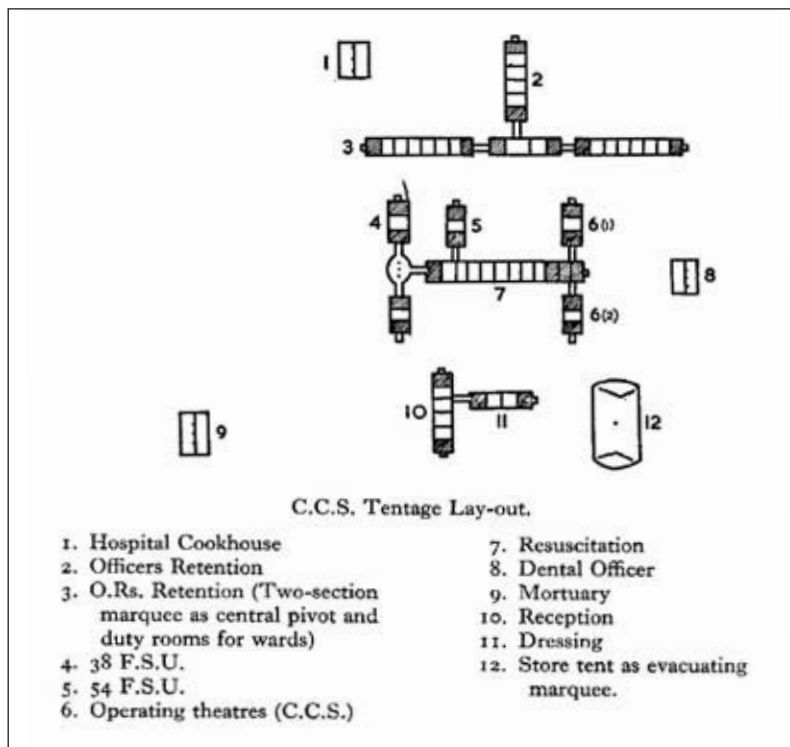


Fig 8. CCS Tentage Layout.

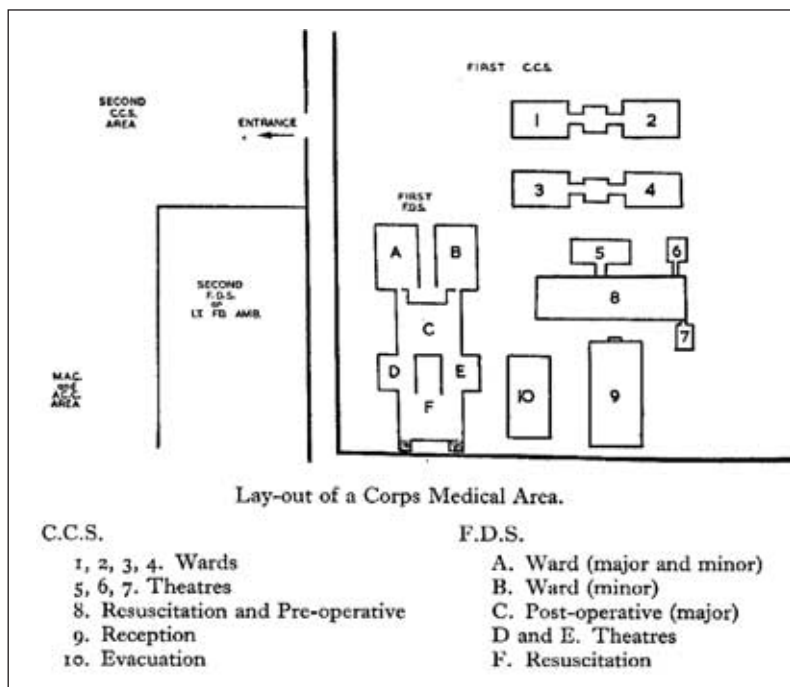


Fig 9. Layout of a Corps Medical Area.

If possible the theatres and the wards should have been separated to remove the distraction of extraneous noise. Instruments were laid out on a 'cafeteria' basis with only those needed for a particular operation taken so as to reduce the volume of materiel for sterilisation. The post-operation ward was intended to be reserved for the most seriously wounded patients needing special care and attention. If every injury was sent there after an operation the unit would soon become overcrowded and the nursing staff would be unable to devote proper time to the serious cases. An example of the layout of a CCS is shown at Figure 8 (16).

**LAYOUT OF MEDICAL UNIT:
reception, evacuation, resuscitation,
X-ray, surgery, post-operative ward,
general ward.**

Whenever possible the policy of grouping CCSs that had been developed in World War 1 was followed, thereby creating a 'Corps Medical centre'. This arrangement simplified the evacuation procedure as all casualties were sent to one place and their subsequent disposition was decided by a single reception process. This was all the more important where onward movement was by air as a single airfield might serve a number of medical units and casualties could not be allowed to build up awaiting movement on the airfield itself (19). In many cases the FDS was used as a filter to take light cases and sick, and to co-ordinate the evacuation of casualties who did not need admission to a CCS prior to onward evacuation. When 2 or more CCSs were grouped, admissions could be controlled either on a time basis or by the number of casualties admitted depending on the workload. An example of the layout of a Corps Medical Area is shown in Figure 9 (16).

EVACUATION: grouping of CCSs

Burma 1942-1945

The environment over which the campaign in Burma was fought had as many extremes as anywhere in Europe and the Mediterranean. The mountain warfare of Eastern Assam, the open warfare of the Central Burmese Plain, the amphibious operations along the coast of Burma and the long-range penetration operations of the Chindit expeditions each presented their own challenges. Above all else it was a campaign characterised by greater distances than the Middle East where movement overland was a major feat of endurance. However, the availability of evacuation by air transformed the management of battle casualties (20).

Jungle operations caused similar challenges to other campaigns whereby very small units might be operating some considerable time (duration of travel not distance) from the base. Infiltration of the enemy onto the lines of communication was frequent and so casualty evacuation by land involved the commitment of forces for the protection of the ambulance convoy. Thus Jungle Surgical Units were developed that were configured for man-portable movement. These could be attached to the ADS of a field ambulance (21,22) or even further forward with the bearer companies.

A unit of about 25 holding beds was found to be most practical (6). Movement, casualty evacuation and re-supply of medical materiel

was frequently by air and so all equipment had to be man-portable and as interchangeable as possible. The theatre and the holding area could be as primitive as stretchers supported on forked sticks with slit trenches for the casualties if the medical site came under fire. In spite of these limitations, many lives were saved when the alternative was a five day hand carry to a Base hospital or an uncertain wait for evacuation by air.

SURGERY: specialist units may be required for specific environments.

Summary

The wide variety of environments during World War 2 in which military forces were committed led to the creation of a range of medical units that could be tailored to provide medical support to the fighting forces. The timeless challenge of providing surgical treatment as soon as possible after wounding associated with the relative complexity of hospital services and the immobility of serious post-operative cases remained.

The Hartgill committee broke from the single casualty 'pipeline' of the First World War by establishing the ADS as the focus for distribution of casualties to the different medical units on the basis of the clinical need of the casualty. This followed the concept described by Jolly.

Small, mobile surgical teams (FSUs) were developed to reinforce forward medical units to provide treatment for small numbers of casualties. Mobile resuscitation teams (FTU) were created to administer blood and intravenous fluids to the sickest casualties.

If larger numbers of casualties were expected, then larger medical units were required (CCSs). The CCS continued to be dependant on the transport services for movement. The FDS was created as a holding and nursing unit with the dual function of either hosting one or more FSUs or FTUs to create an advanced surgical centre, or to act as a holding centre for the minor sick or injured so as to limit the extent of their evacuation.

Finally, the aeroplane transformed the speed and efficiency of casualty evacuation from forward surgical units to rear hospitals in a similar manner to the transformation achieved by the motor ambulance in the First World War.

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