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WITH THE EIGHTH ARMY IN THE FIELD*

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To journey through the Western Desert, into Tripolitania and Tunisia, across to Sicily, and up into Italy with the Eighth Army was a great privilege. No one could travel in that fine company without an ever-present pride in the British fighting-man. His feats of arms are well chronicled. To those travelling closely in his wake the wonder ever grew at the sight of the obstacles he overcame and the defences he stormed. Added to these he had the changing yet constant privations of the field and of the front line, heat and sandstorms, cold and mud, forced marches and tedious delays, pestilential flies, shortage of water, monotonous though ample rations, and other lesser trials. He deserved then, when he was wounded, the best that could be offered.

It is not easy to describe the efforts made to provide surgery worthy of the patient. The shifting backgrounds prove hard for the writer to depict and for the unacquainted reader to visualize and understand. Surgery in the field is influenced by many external circumstances. Some of these at first sight must appear almost ridiculous to the civilian surgeon. It thus becomes a specialty, not, by and large, a highly difficult technical specialty, but a specialty none the less. Any surgeon whose experience is purely civilian must approach it with a mind open to change. Otherwise there will be disappointments, and quite likely disasters.

Field surgery I would define as the care and treatment of the soldier from the time of wounding to his arrival at the base hospital area in which he will complete his treatment and be returned to duty or invalided. The term "forward surgery" I prefer to restrict to the original primary operative treatment. There is need for such distinction, especially in any description of these campaigns. For such base hospital areas were hundreds, often thousands, of miles from the fighting. It might be a matter of weeks before the wounded reached the base. Sometimes that was due to military difficulties and exigencies. Sometimes it was deliberate: many a man owes his life to being held and nursed in the field. There is thus more to be thought of than the primary operation. There is the treatment afforded over a period of time and often at a series of points in a varying and sometimes prolonged chain of evacuation which is still "in the field." Field surgery thus embraces forward surgery and maybe much more besides.

The aims of field surgery are to save life and limb, to give such treatment as will promote rapid healing where these are unlikely endangered, and to ensure that the patient passes in comfort to the base. It is a slight catalogue, but the thought and organization needed to achieve a high standard are immense, and affect the administrator as much as, or even more than, the surgeon. Ever-varying conditions call for flexible and adaptable minds. What was done in the last war in France did not necessarily suit the desert; what was done in the desert did not necessarily suit Italy.

THE CAMPAIGNS

The period dealt with covers the three campaigns in Africa, Sicily, and Italy. In the last it deals with events up to the

* Based upon experience as forward consulting surgeon, M.E.F. and A.F.H.Q., in October-November, 1942, and January, 1943, to February, 1944.

"winter line" of 1943-4. The first, to save confusion with the First Army, also in North Africa, will not unfittingly be termed here the Desert Campaign. A short description of the campaigns from a surgeon's point of view is an essential prelude to more specialized considerations.

The Desert Campaign

The Eighth Army advanced from el Alamein to Tunis, some 2,000 miles, in under seven months. To understand how surgery kept up with this it is necessary briefly to go back a little. The essence of desert warfare is mobility. In the earliest desert campaigns, with their swift and far-moving thrusts and counter-thrusts, the weakness of relatively immobile cumbersome casualty clearing stations had been shown up. New methods were needed. Surgery, like the fighting services and supplies, had also to be put on wheels. By the time of el Alamein there had gradually been developed by the previous consulting surgeon to the Middle East Forces, Major-Gen. D. C. Monro, a group of mobile units. This had been done by giving the light sections of some casualty clearing stations their own transport, and by the formation of small mobile field surgical teams. The latter consisted of surgeon, anaesthetist, a few trained orderlies, a staff car, and a lorry in which to carry gear, surgical and personal. While the mobile light sections were able to function autonomously the field surgical teams were independent in name only. They constituted a fluid mobile surgical potential, usable where most needed but dependent for many things on some host unit. This latter was either a casualty clearing station which needed surgical reinforcement, or the main dressing station of a field ambulance when the team was being used as a detached forward surgical centre. Their mobility was given them especially for the latter purpose. They could then keep up more closely with the fighting, and at field ambulance level afford surgery to casualties whose further journey back to the casualty clearing station would be lethal or hazardous. In practice later about half of these teams reinforced casualty clearing stations; half worked more forward at main dressing stations. The mobile light sections of casualty clearing stations could act similarly but more independently.

Like the progress of science the desert advance was a succession of jumps. Static sometimes for a month or more, the army would suddenly leap to action and in a week or two move forward a few hundred miles. The dispositions of surgical units thus varied. The static periods represented preparation for stiff battles to be fought, such as, more particularly, el Alamein, Mareth, and the Wadi Akarit. Casualties in formidable numbers had then to be anticipated. In the intervals there were pursuits, with minor enemy rearguard actions and few casualties. Accordingly the same alternating disposition of units was repeated several times. At the set pieces there was a concentration of casualty clearing stations some 15 to 30 miles behind the line and in front of this, at suitable points, field surgical teams with some of the main dressing stations. When the break through occurred the latter moved forward with their field ambulances, and the casualty clearing stations moved one by one, in leap-frog fashion, until they were stretched out as

a chain of daily staging posts back to the base, the railhead, an embarkation point, or an advanced base. By the time the next set battle was to begin they were, in more or less degree, gathered into a similar concentration, linked backwards to some fresh disposal point. This was a campaign mainly on a narrow front with few lateral roads. Only occasionally did outlying units require to be sited far from the main coast road.

Thus surgery kept up with the fighting-man and watched him on his often-protracted journey to the base. The railway track was soon left behind. Benghazi harbour took some time to be clear for hospital ships. Tripoli to Benghazi is 700 miles of bleak desert road. Tripoli harbour also needed clearing. There was still a long stretch of desert road before Sfax and Sousse and the pleasant greenness of Tunisia.

The difficulty to both medical administrator and surgeon lay in the long road evacuation that was often necessary. To the former it meant the diversion of casualty clearing stations and field ambulances to act as staging posts; to the latter it meant that his patients would undergo an added strain on their strength and resistance, a strain which it was essential to ease for the seriously wounded. While the administrator has to keep the forward areas as clear as possible, the surgeon, knowing the value of rest, wishes to have little or no movement for his post-operative patient. A trite saying occasionally expressed, that the most efficient casualty clearing station is an empty one, pays little heed to sense and less to humanity. There must be give and take between administrator and clinician. In the Eighth Army a happy and harmonious balance was achieved.

The desert campaign was essentially a tented affair for casualty clearing stations and field ambulances. Rarely were there suitable buildings. Operating vehicles were gradually discarded as cramping and labour-making. The difficulties associated with tents were the limitations set by the necessary tent-poles, the absence of floors, the regulation of warmth, lighting and blackout, fly-proofing and sand-proofing, and dispersal. These would take much description, just as they took much labour to overcome. Most would agree to flies and sandstorms as the greatest trials. Dispersal of tents, to limit damage by possible bombing, was an irksome handicap. Too wide dispersal slowed the tempo, particularly of the operating theatre. To have pre-operative and post-operative tents at a distance, even 50 yards, from the theatre was tiresome and annoying, especially in a moonless period. It could be ridiculously easy to get lost in darkness "black as Egypt's night."

Gradually, as the Luftwaffe waned, pre-operative and post-operative tents, to cope with serious casualties, were brigaded to the theatre. The surgeon could then keep an eye on what was to come and what had gone, without passing across a blackness filled with the snares and gins of guy-ropes and slit-trenches, did he veer from the straight and narrow. The Luftwaffe's activity was restricted to night excursions, and there was gradually diminishing annoyance from this quarter. But it was early found advisable to pitch theatres well away from the main road, which naturally was a guide to a bomber, his machine-guns, and his cannon-guns.

It would have been ideal to be followed up at a close distance by general hospitals which could retain and nurse the patients. This was impossible to any great extent. If the enemy is retreating he must not be let rest. Fighting materials and stores must come first. Supply difficulties in this campaign were enormous. It was a German general who said that the desert was a tactician's paradise and a quartermaster's hell. A general hospital set up near Benghazi was in a few weeks 800 miles behind. The fall of Tripoli gave the much-prized opportunity of an advanced base for supplies and services. Till then everything, except limited urgent stores which were flown, had come up the 700-odd miles from Cyrenaica by road. Hospitals were set up in suitable buildings in Tripoli as soon as possible. Before they could all be established the hunt was well on. The earliest were soon full—sick have to be thought of as well as wounded—and all served until the end more as casualty clearing stations than as retaining hospitals. But they could deal with special casualties in a more satisfactory fashion, and they could retain those whose need was great, before evacuating them by ship. Later, when the battle had gone some 300 miles beyond Tripoli, hospital ships put into Sfax to obviate the need for the long road journey.

It would be a pity to leave this background of the desert campaign without trying to recapture the feeling of enthusiasm in the medical units. They vied with one another to put up the best show and to get the best seats at the drama. Full of zest for the chase, they were cock-a-hoop when moved to the front of the procession; left behind, they good-humouredly cursed their lot and settled down to what they derisively called "coffee-stalling." "Coffee-stalling" was important and necessary, and they knew it. But there was not the relish of being up with events and dealing with fresh casualties with the sound of the guns ahead. The medical units came from the United Kingdom, from New Zealand, from South Africa, from India, and, for a short time, from Australia. Of the great Dominions only Canada was not represented; she was soon to be.

The Sicilian Campaign

The now-well-established mobile field surgical units and light sections of casualty clearing stations, born out of necessity for desert warfare, fitted well into the diffuseness of the earliest days of the Sicilian invasion. They landed at different points with field ambulances and were immediately dealing with the most serious casualties. Scaled down to a reasonable minimum of equipment, some of the early units had to wade ashore carrying their panniers. Their transport followed quickly from the landing-craft. Lying off the invasion beaches were hospital ships and carriers. These were fed with casualties by craft plying between them and the shore, and their surgical staffs, reinforced by extra teams for the occasion, wasted no time in getting down to work which they continued to perform during the voyage to Africa or Malta.

The early rapid advance of the fighting troops allowed the getting ashore of the full strengths of the casualty clearing stations in the next few days. Certain of these followed the fighting upon the wide front, again with some field surgical units a little ahead; others, after bearing the brunt of the initial days, stayed and established a medical centre in Syracuse, to which the foremost transferred their patients for further transmission by ship. Within a fortnight general hospitals were beginning to arrive and to take up position in and around Syracuse.

The conditions in Sicily for the fighting troops were not enviable. The weather was oppressively hot, the close vegetation made it stifling, there was a high humidity, the flies were more numerous and vicious than anyone even from Egypt could have imagined, and the filth in the villages was widespread. Small wonder was it that everyone sighed, as they had thought they never would sigh, for the open spaces of the desert and the Mediterranean breeze which here seemed stilled. On and on, march and fight, fight and march, with little sleep the infantrymen pushed over rugged country. The enemy was to be given no respite. The strain our men endured in these pitiless days had its effect when they were wounded. Their resistance was much diminished. The surgical units had kept up with them, but the casualty often had more need of sleep than surgery. Many of those with abdominal wounds, whom from desert experience one would have expected to live, petered out listlessly on the second or third day after operation.

The relative lull in front of Catania, while progress from the west was being made, did not afford as much relief as it might have done. All roads, medically, led to Syracuse. They were poorish roads and wound wearily up and down hill. To the travelling wounded they were a trial, and the haven of rest seen ahead in Syracuse was for many to prove a mirage. For malaria had now become a problem. The general hospitals which had arrived were soon at full stretch. The next phase might require all the beds. Back and forth went the hospital ships and the planes. Only the wounded in immediate danger could be retained for that rest which they all needed and all richly deserved.

Etna dominates all eastern Sicily. With the fall of Catania the mobile units were soon on the move either on the roads flanking the mountain northwards or, the Canadian element, coming in from the west. Again there was rough country with congested difficult roads for the ambulances. Demolished bridges had been relatively few up to now; henceforth they were to be numerous. The rough diversions which had to be used until the engineers had built new crossings, and the delays caused, in the congestion of pursuit, by the new ones' being

one-way only, contributed additionally to the strain on the wounded. The field surgical units were again paying a handsome dividend in obviating such journeys for the bad cases, even though the distance was now only to Catania. Fortunately, the campaign was soon to be over.

For the Sicilian invasion several casualty clearing stations and field surgical units had dropped out of the Eighth Army temporarily and others had taken their place. The latter came either from the First Army, with which they had had experience in North Africa, or from non-fighting areas, either the United Kingdom or lines of communication abroad. There was thus a mingling of surgeons—veterans and novices in acquaintance with war and war wounds. Differences there were bound to be, both between those of the two armies, working on different lines on a different type of front, and between these and the new-comers. What the latter had most to realize, what is so often omitted in systems of war surgery or in training, were the strains and risks of post-operative transportation. The First Army surgeons had been working in a more static way, but in a countryside more cultivated than the desert and more akin to the Sicilian conditions. The little differences were interesting to observe. The new-comers in a few weeks had become hardy veterans.

Surgeons were now working usually, if not always, with a roof over their heads. Schools, monasteries, churches, and dwelling-houses were the commonest buildings used. Handier in most ways, they had their drawbacks. Cleanliness is not the most striking feature of Sicilian villages. (The most salient feature would have appealed more to the midwife than to the surgeon: Mussolini's bounty had worked wonders, if his Army had not.) The R.A.M.C. orderly who saw a pre-war recruiting poster which read "Join the Army and see the world" and retorted with "Join the R.A.M.C. and scrub it" had every justification in Sicily. But the scrubbing was done, and if asepsis could not always reach satisfactory heights it was not for want of effort. The vexations of taps which did not run, plugs which pulled but gave no issue, globes which did not illuminate, and flies which were ubiquitous did not add to the pleasures of patients, surgeons, and attendants.

The Italian Campaign

The Eighth Army initiated the invasion of Italy, on September 3, 1943, with its little-resisted landing in and around Reggio. Again the mobile units found their niche in the early diffuseness, and again, in the rapid race up the forefoot of Italy, they kept in touch. It is not to be imagined that they moved daily, leaving a trail of operated-upon casualties in their wake. They leap-frogged one another. And soon once again there was a chain of staging posts stretching back to the Straits of Messina over some 300 miles. As before, the swifter the pursuit the fewer were the casualties. The race, it will be remembered, was to aid the hard-pressed American Fifth Army at Salerno. Immediately the contact was established the Eighth Army swung to the east coast, and, with Bari and Taranto behind it, the early chain could largely be discontinued. But another was required as the army pushed northward.

The first real checks to progress did not occur till the weather broke, some two months after the Reggio landing. In this time the army had covered some 500 miles. From then on the picture changed. Cold, rain, snow, and mud altered the face

of a countryside previously blessed with the sun and with the fruits of the earth in profusion. The numerous wide dry riverbeds filled with the rain and the melting snow from the hills. The equally numerous one-way bridges, which replaced those demolished, again caused congestion and delays. Unmetalled roads crumbled. But the army was determined not to be static. The Trigno and Sangro were crossed. The difficulties encountered in getting casualties back across the swollen stream of the latter, before bridges were firmly established, were overcome by manhandling, by amphibious "ducks," and by the devotion of field ambulance orderlies. And so on to St. Vito and Ortona. Every advantage had to be taken to place mobile units well forward; a scorched-earth policy had left few buildings for casualty clearing stations, and it was bad country for tents. But the obvious and the unforeseeable delays on the roads proved the greatest indication for surgical units close up.

The West Italy Campaign

The landing at Salerno and the subsequent campaign on the west coast were not Eighth Army business. But the American Fifth Army, whose campaign it was, had a substantial British component, the medical units of which had all seen previous service with the Eighth and First Armies. Later there was to be a further mingling. Unofficially at first, officially later, I was able to observe the surgical aspect of this campaign, and it

would be a pity not to include briefly the contrasting picture. As will be remembered, the landing was a hotly contested affair. For some days the invasion force was restricted to an area in which medical units and their patients had to share whatever was hurtling around. Field surgical units came early with beach parties, and casualty clearing stations followed in the next few days. Digging down and sand-bagging were required to an extent not needed previously. While patients were received very promptly after

wounding there was the drawback of their post-operative care in tents. A canvas roof was not convincing protection from bomb, shell, or, more likely, large splinters from anti-aircraft fire, and the racket that went on from the latter alone was hardly rest-giving. The natural outcome was a rather more expeditious transfer to hospital ships than would have been considered advisable under less harassing conditions.

Soon, however, the advance progressed, and eventually Naples was taken. This allowed of general hospitals in buildings; but here again, as at Tripoli, they could at first be little more than final staging posts to the ships, though able to retain patients on the danger list. The specialties were soon installed—chest, facio-maxillary, and neurosurgical. With the forward casualty clearing stations only some three or four hours away, there was no need for the specialties to move from the hospitals.

There were few suitable buildings near the line, and most casualty clearing stations went under canvas as the line moved forward. This was pleasant until the weather broke. Then the scene changed, and duckboards and other squelchy reminders of Flanders in the last war reappeared. It was in keeping with the relatively static nature of the fighting. But there was slow but sure nibbling going on ahead, and surgery was keeping up by means of smaller advanced centres, one of which consisted of as much as the light section of a casualty clearing station with three additional field surgical units. Such could be accom-

modated in the only suitable building available at the time of the early Garigliano fighting. Elsewhere the field surgical units were working in pairs. The wounds at this time were very commonly multiple and severe from mortar fire.

The conditions on the two sides of Italy were now almost identical.

Some Other Features

Some other features of the campaigns may be given to fill in the picture.

The mine-fields of Alamein were largely meant to hinder tanks and vehicles. By the time Benghazi was reached, the anti-personnel mine, chiefly exemplified by what is known as the S mine, had made its appearance in numbers soon to become profuse. Roughly the size of a 2-lb. jam-jar and actuated by the tread of a foot, this infernal machine after a few seconds' delay springs five or six feet into the air and explodes, to scatter some 300-odd ball-bearing-like metal marbles with a high initial velocity. As the enemy retreated he planted more and more of these, not only in protective fields where he was making a stand but everywhere that his pursuer might walk—on the road verges and off the roads at points where transport might pull in for the night. The multiple wounds frequently caused by these mines were later to be excelled in severity by the multiple wounds of the several-barrelled mortars which were so fully exploited by the enemy. Such multiple wounds cause great anxiety to the surgeon. Not only is shock pronounced, but one or more of the wounds is often a serious one—a fractured femur or a penetrating abdominal injury. By the time the surgeon has dealt with this he has to face a dilemma of how much more the patient will withstand.

While wounds from anti-personnel mines became for a time more numerous, those from anti-vehicle mines became fewer. The latter frequently took the form of severe compound injuries of the feet, from the underneath explosion. The harassed enemy, fortunately, had less time to plant so many of these later, and more efficient mine-detecting apparatus largely abolished a type of wound which led almost inevitably to amputation.

The army had moved off from el Alamein in shirts and shorts in October, 1942. It changed to battle dress for the winter in the desert, and was back in drill for the end of the African battle, the Sicilian adventure, and the early part of the Italian campaign. Retained clothing around missiles—a potent source of trouble—was never the feature in the dry desert, even with battle dress, that it became in the wet and mud of Italy.

While at el Alamein each forward casualty clearing station could only have one reinforcing team, by the time Italy was reached the number of field surgical units had been so increased as to allow of several at important points. The tenor of the working day was thus much evened, and efficiency rose. An experiment made in the intervening period, with the object of increasing the forward surgical potential during rush periods, is worthy of note. What were called reserve surgical teams were formed. They were drawn from base general hospitals, they consisted of personnel only, and they were meant to relieve, or spell with, a regular team, using the latter's equipment. The emergency over, they returned to their hospitals for the busier period at the base. A relief surgeon by himself is little use; a whole team is needed.

SURGICAL UNITS IN THE FIELD

The tactical disposition of units is the administrator's business. He sees the whole picture—the present one and the likely future; he is in touch with the other Services. In these campaigns, as may be imagined, he required breadth of mind and resource in changing situations. A rough idea of the principle behind the dispositions has been given above. How did surgery best fit into this?

The casualty clearing station is the key unit of field surgery. Reinforced by field surgical units, it can have several operating teams to take their spells of duty and remain fresh. It offers, because of the sisters on its establishment, a high standard of nursing. It has ample beds for serious casualties. It has good lighting, x rays, and suitable tents. It offers some refinements in the way of invalid food and hospital comforts. It can usually be sited clear of noise. Its position is generally assured for some weeks. Thus every wounded man who can with little

risk be passed back to a casualty clearing station, after first aid and resuscitation, will receive the best attention possible in the field.

For the desirable early treatment of wounds, therefore, the foremost casualty clearing stations were sited as far forward as possible, consistent with their retaining these attributes and with their conforming to the demands of the military situation, geographical and tactical. The latter, which might be handicapping to the ideal, had to be accepted. The lightly or moderately severely wounded could reach them without deleterious effect. But it was not always so with the serious casualty. The time factor and the strain factor came into play. These will be referred to when discussing evacuation of casualties.

The wounded who, after first aid from their regimental medical officer and supplementary attention with perhaps plasma transfusion at the advanced dressing stations of field ambulances, reached the main dressing stations of the latter were sorted into three groups. The first were those requiring resuscitation, the second those requiring operation as an urgent measure; the third group comprised all others. The first group naturally included many of the second. Resuscitation of course means more than transfusion of plasma or blood. It entails rest, warmth, and lying in reasonable comfort.

Surgery was taken to the second group by the field surgical units or by the light sections of casualty clearing stations. The needs of many of this group demanded it. Urgent need of operation, however, embraces two shades of meaning. It implies an imperativeness, and it may or may not imply very immediate performance. Some patients—for instance, with abdominal injuries—were little shocked and not bleeding, and could go on a further two or three hours to the casualty clearing station.

To the light sections of casualty clearing stations operative work at this level presented little difficulty. They had beds, suitable tents, and highly trained orderlies. They had often worked as unchanged teams. There were, however, not enough of these light sections, and separation from their main body impaired the effectiveness of the latter in no small way. Accordingly most of the surgery at this level fell to the lot of the mobile surgical teams. Their difficulties were greater, and it was interesting and gratifying to observe, as the months passed, how by the labour and ingenuity of both field ambulances and themselves the drawbacks were gradually overcome and a level close to casualty clearing station standard was attained. To the field ambulances the field surgical units owe much in their development. The former liked to have the latter attached. It meant that for the time they were more than a staging post, that they were provided with material of great clinical interest, and that their nursing orderlies received valuable education.

The early Middle East field surgical teams, the prototypes, did not carry beds. Nor do field ambulances. A stretcher is hardly the ideal resting-place for a post-operative abdominal or dyspnoeic chest patient. Many successful efforts were made in devising back-rests to fit these. Gradually, however, a few beds were "acquired" by most units and carried forwards. (The later field surgical units, instituted by the War Office, were to be given twenty beds and bedding, and another lorry for their conveyance.)

The accommodation provided by the field ambulances was mainly in the form of collapsible shelters suspended and carried out from the sides and backs of lorries on to goal-post-like steel frames. Weatherproof as these were, they were rather a cheerless, gloomy environment for those too ill to be passed on. Gradually again from the desert, in some mysterious fashion, the field ambulances acquired the trim white windowed tents known as E.P.I.Ps.

Beds and tents, so far so good. Nursing was another problem. There were no sisters at this level. The field ambulance orderly had not had the opportunities of his casualty clearing station colleague. The latter got much continuous practice. Only on occasion would a field ambulance have a surgical unit attached. The surgeon of the latter guided and helped the orderlies, but he would often be long periods in the theatre, and there were gastric suction and transfusion drip apparatus to be watched, deterioration in patients to be observed, bleeding to be detected, let alone the other multi-

furious calls of nursing. The sisters and doctors of the R.A.M.C. get much praise; the rank and file get less than their due. These orderlies were keen and industrious, and many reached high levels of intelligence and proficiency. But it stood to reason that with only occasional experience they would not achieve the standard of nursing of a casualty clearing station.

It was thus becoming evident before the end of the desert campaign that to overcome these drawbacks any advanced operating centre forward of a casualty clearing station would be best constituted by two surgical units and a transfusion unit, attached to a main dressing station. (The new system of field dressing stations was not yet here in operation.) The transfusion unit took much of the worry off the surgeons, not only by saving their time but by its officer supervising the pre-operative ward, and, in conference with the surgeon, deciding priorities. The presence of a second surgical unit meant a more regular spell of duty for each surgeon and the opportunity of more careful post-operative supervision. A further development which took place later in Italy was the institution of a pool of experienced nursing orderlies at the Corps field ambulance. These had all been a year or more with casualty clearing stations and could now be called upon by these forward detached surgical centres. The arrival of fresh field ambulances had made this desirable, since their orderlies were as yet little experienced in this type of nursing. On occasions, when suitable accommodation was available, sisters went forward to this level.

None the less, it can be imagined that the casualty clearing station was still the better place if the wounded men could be got there safely.

Another disadvantage of the solitary forward team needs mention. The field ambulance and its team sometimes had to be up and doing before the patients it harboured were fit to be moved. Occasionally another unit such as a casualty clearing station took over the site and the patients. Otherwise a party had to be left behind to nurse them. The surgeon could not always look back. Complications might arise and no theatre was available. The ordinary arrangements, however much care was taken, were relatively primitive and cheerless. The casualty clearing stations, on the other hand, were relatively static, and by the time they had been leap-frogged several times their patients were fit to move.

The detached field surgical units did work which caught the imagination. To the other Services, laymen in these matters, the idea of a mobile surgeon who could operate upon a casualty almost at once was in military slang "just the job." The operation itself hypnotizes the layman to the exclusion of other necessary but publicized considerations. There developed almost inevitably a tendency to try to exploit these mobile units beyond what was wise. In their laudable anxiety to help the fighting troops to the utmost, even medical minds, though not of those in the highest positions, became a little imbued with the same tendency. It is not a good thing to move these teams over-frequently, for the reasons given above. Again, it is not wise to have advanced operating centres too far forward, within ordinary range of the enemy's guns or in close proximity to the noise and tremor of our own. A mile or two can make much odds. For it is the most serious cases which are to be treated, and they have not only to be operated upon but to be held several days. It is a terrifying thing for bed-bound patients in a tent to be shelled or bombed. Weak though they may be, not all will remain bed-bound, and indwelling drip and suction tubes soon become outdwelling as the casualty takes to earth. Apart from this, the surgeon must have reasonable quiet and rest if he is to do good work. There occurred necessary and advantageous exceptions to the rule. In the early stages of invasions work had to be done within range of fire. Again, if an odd shell kept dropping into a town or village where a suitable building for a unit was available, not too much was thought of that.

The Specialized Units

The development of forward specialized work is one of the most interesting items in the surgical history of the campaigns. The need for mobile ophthalmic units in forward areas had long been recognized and met, and the tale of eyesight saved by this wise provision will no doubt in time be told. The other

surgical specialized units of the army are devoted to chest, maxillo-facial, neurosurgical, and orthopaedic work. Since orthopaedics in the field is essentially concerned with compound fractures, all forward surgeons must be orthopaedists up to a point. The place for the special orthopaedic teams is at a site where patients can be held for a period up to two or three months so that skeletal-traction appliances and the like need not be disturbed by premature evacuation. Their place, then, is at the base hospitals—better still, at an advanced base when such holding is possible. It usually needs time before an advanced base hospital is in a position to hold other than danger-list and some other special types of case not requiring more than four or six weeks' retention at this stage.

To provide early skilled treatment a few mobile neurosurgical units had been formed at home early in the war. At the time of el Alamein there was one of these in the Middle East. To provide the widest service it was located in Cairo. Patients could be sent there fairly quickly from the army's jumping-off point, and, with the aid of air transport, for some time in the early advance. About two months later, when the army had advanced some 800 miles, a second unit arrived and was sent forward, to be attached at first to a casualty clearing station on the lines of communication. Later, when the battle had swept well beyond Tripoli, it arrived during the formation of that advanced base. Delays of evacuation were proving a problem, so the unit was split. The advance party went to the foremost casualty clearing station which drained the line; the rear section stayed at a hospital in Tripoli. There they received the operated-upon patients, most of whom travel well, and retained the serious cases in optimum circumstances, the others going on to the Delta by air or sea. This arrangement of the split team held admirably right up into Italy, although administrative troubles supplied a hitch or two. Its success in the desert has been related. Even greater scope was forthcoming from the heavy fighting on the Trigno and Sangro in Italy in the closing weeks of 1943.

A maxillo-facial team was dispatched to Tripoli at the time the advanced base was set up, and remained there till the end of the Tunisian campaign. When Sicily was invaded, it was decided to split this team also so that severe cases there should have prompt attention and yet there would remain a section at a general hospital. The advanced section was eventually pushed forward experimentally to the same level as the ophthalmic and neurosurgical. The three, "the unholy trinity" as they were known, thereafter were kept together. They were located always at the most forward casualty clearing station which drained the whole line. This, because of the more usual narrow front, was often the foremost. The vast majority of the special casualties thus passed through the sections of these teams at an early period after wounding. By such siting the general surgeons were relieved of much worry, and the argument of how much they should or should not do was largely dispensed with. They were quite willing, indeed eager, to pass on these patients to more-trained teams so long as the latter were at hand. Previous advice, to clean up such wounds and send the patients back to an advanced base for special treatment, was unsatisfactory. Once a general surgeon, untrained in a specialty, embarks on such a cleansing he tends to do too little or too much.

The exigencies and variations of war, however, are unlikely always to allow such ready facilities, particularly if special teams are few. As circumstances permit it would seem wise to train general surgeons in the elementary technical procedures admittedly necessary. Otherwise it is unjust of specialists to deride the general surgeon's results, as is so frequently done. This is as unfair as the proposition, equally often asserted, that the specialist can do all the general surgeon's work competently.

The chief justification for an advanced maxillo-facial team was for the fractured-jaw patient to have uniform early and adequate fixation—the dental surgeon's business. Splitting of the team as it was done sent forward also a surgeon with plastic training. This was still more experimental and of doubtful value. But the surgeon concerned, admittedly at first somewhat sceptical, was in a few months able to report that he had found plenty to do. His work included submandibular

drainages, removal of foreign bodies, closure of deep layers of cheek wounds, the accurate suture of lips, the immediate replacement of displaced fractured nasal bones, zygomatic bones, and orbital margins, and the repair of torn eyelids. In many instances the patients with these injuries could not have reached an advanced base hospital till three days later.

It needs little imagination to appreciate the value of the trinity at this level, not only singly but in conjunction on the same patient.

As field ambulances had fostered field surgical units, so likewise casualty clearing stations fostered the trinity. There were sometimes difficulties of accommodation in one casualty clearing station for the extra theatres and personnel. The drawbacks were always overcome and the trinity remained undivided. It is doubtful, however, if the specialties could have worked so closely together had their teams not been split. The trinity would then have been too cumbersome for any of the foremost casualty clearing stations to accommodate in addition to the general teams.

The chest specialty was not made so advanced, although, had there been a sufficiency of chest teams, the experiment of placing a team at the same level as the trinity might have been tried. The policy with only one team "in the field," as distinct from the base, was to place the field unit with a suitable advanced general hospital. Theoretically it was at a site where it could hold patients for six weeks. In practice it could not hold them all because of the other heavy demands upon such a hospital. But it could hold the serious ones. Haemothorax and its possible infection constitute the most important complications of chest wounds. Removal of foreign bodies and the treatment of complications are better performed, if possible, with the greater facilities of a general hospital in the matters of x rays, theatres, laboratories, and nursing. What the field surgeon contributed to the chest specialty was the closing of sucking wounds, débridement of others, and aspiration of haemothoraces after 48 hours. Only occasionally was anything more indicated.

(To be concluded)

SENSITIVITY TO LIVER EXTRACT

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The purpose of this communication is to stress the not uncommon occurrence of allergic reactions to intramuscular liver therapy, their alarming nature on occasion, and the practicability of desensitization.

Since Schlesinger (1930) first drew attention to the occurrence of reactions to liver therapy we have been able to find in the literature records of less than a hundred cases of allergic reactions to oral, intravenous, and intramuscular liver therapy. When the widespread use of liver extracts throughout the world is considered, such a small number of reported cases would appear to indicate that allergic reactions to liver extracts are rare. Delikat (1943) had 14 cases of sensitivity to liver therapy among 200 cases of pernicious anaemia, and records in detail three severe cases. Of 60 consecutive cases of pernicious anaemia admitted to our wards during the past five years, four (6.6%) have subsequently developed reactions after one to three years of maintenance therapy. Barfred (1942) reports 19 cases showing allergic reactions among a total of 49 treated with intramuscular liver extracts—an incidence of approximately 40%. It should be pointed out, however, that Barfred was using experimental extracts which were often neither purified nor concentrated, and hence were given in large amounts (5 to 10 c.cm.).

We have been able to find only two papers in the British literature devoted to the subject of allergic reactions to liver therapy. Andrews (1941) records one case and Delikat (1943) three cases in detail. The most significant British reference is contained in a letter to the *British Medical Journal* by Morgans (1943)—a few weeks after Delikat's article—record-

ing the only fatality ever published from a reaction to an intramuscular injection of liver extract. In 1936 Ungley, Davidson, and Wayne, in an investigation of the clinical efficacy of the original Dakin and West preparation (anahaemin), mentioned that reactions to intravenous therapy occurred in two cases.

Reactions to liver extract may be classified as primary—i.e., those occurring after the first liver injection; and secondary—i.e., those which appear for the first time after weeks, months, or years of parenteral therapy.

Primary reactions are not due to acquired sensitivity, but are an immediate response of the body to the parenteral injection of foreign material. Such reactions were much more common when liver extracts were given by the intravenous route (Castle and Taylor, 1931; Murphy, 1932). The use of the intramuscular route and the purification and concentration of liver extracts have resulted almost in their complete disappearance. Disagreeable effects reported include pyrexia, collapse, shivering, vertigo, flushing, headache, and dyspnoea (Strauss and Castle, 1932; Schlumm, 1932; Strandell and Hammar, 1932).

Secondary reactions to oral, intravenous, and intramuscular liver therapy have been described. They are undoubtedly of an allergic nature. In support of this contention are the eosinophilia, the latent period between the primary injection and the onset of symptoms, the clinical features, including bronchospasm and the characteristic skin reactions, and the response to adrenaline. Sensitivity can be passively transferred to a normal individual from the sensitive individual by the Praetorius-Küstner technique (Grün, 1934; Lasch, 1936; Criepe, 1938; Pache, 1939; Jones, 1939; and ourselves in 2 cases). The sensitivity has been shown to be specific to the organ from which the extract has been prepared rather than for the species of animal concerned (Criepe, 1938; Pache, 1939; Jones, 1939; Scarlett and Macnab, 1942).

During the past ten years one of us has had referred to him approximately 40 patients with reactions to parenteral liver therapy, 21 of whom have been investigated during the last two years. Of these cases 15 were so severe that they were admitted to hospital for investigation and desensitization.

A study of the literature shows that sensitivity has occurred to all the leading brands of liver extract. On the continent of Europe, campolon in Germany and pernaemon in the Netherlands appear to be often incriminated, while in America reticulogen and Lederle extracts are those chiefly mentioned. In our experience anahaemin and campolon are the commonest offending extracts, but we have also had cases sensitive to other British extracts and to Continental and American products. The frequency with which reactions are reported to such highly purified extracts as reticulogen and anahaemin indicates clearly that the causation of the reactions does not correspond to the degree of purification and concentration, but rather to the chances of sensitivity occurring from extracts which enjoy the greatest popularity in the various countries.

When such sensitivity is established to a particular liver extract, injections of a different extract may be given in some cases without any reactions. Thus on occasion we have had patients sensitive to anahaemin or campolon who tolerated reticulogen well. Such patients, however, tended to become sensitive to reticulogen in a period of weeks or months. In general, however, our experience suggests that if a patient shows marked reactions to one liver extract, sensitivity will extend to all liver extracts.

The reaction generally occurs within 5 to 30 minutes after injection. In many reported cases, and 9 out of 19 of our cases investigated during the past two years, there have been periods of interruption of therapy lasting in some instances for several months, with the reactions appearing shortly after the resumption of treatment but not after the first injection of the new course of treatment. Another important feature is that once the reactions have appeared they usually increase in severity after successive injections.

Types of Reaction

A study of the literature reveals that almost every type of allergic reaction has been observed in cases sensitive to liver therapy. The commonest reactions, in our experience, are