A SERIES OF OVER 100 AMPUTATIONS OF THE THIGH FOR TROPICAL ULCER.

BY

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Royal Army Medical Corps.

Haec olim meminisse juvabit.

VIRGIL.

[The Consulting Surgeon to the Army writes: This deserves publication as a permanent record of the indescribable hardships and suffering from multiple disease and inhuman conditions endured by Britons in slavery in Thailand. The Surgery described is drastic and heroic—tragic, in that under different conditions little might have been necessary; surprising in the recovery rate; and inspiring as a record of R.A.M.C. labourers of all ranks achieving the impossible.]

Tropical ulcer is a well-recognised cause of disability among troops on service in Malaya, India and elsewhere, but the frequency with which it was encountered among prisoners of war in Thailand was appalling. In addition, the severity of the lesion was often much greater than that usually portrayed, being in many cases an acute phagadænic process, at its worst resembling rapidly spreading infectious gangrene. These ulcers are known to result from trauma in jungle countries. They begin commonly as a minute pemphigus-like vesicle which soon becomes seabby and is surrounded by a wide zone of inflammatory œdema. It may localise, forming a minute ulcer, or may spread more or less widely before extensive lesion of continuity occurs; more usually ulceration and spread occur at the same time. Once ulceration occurs surrounding œdema tends to ameliorate and the condition usually becomes localised. Invariably it is chronic. Commonly an ulcer the size of a shilling takes three months to heal in a person who is otherwise in fair health. In a large minority of cases localisation alternates with spread both laterally and into the underlying tissues, in extreme cases involving and destroying fascial sheaths, tendons, periosteum and bone. Although blood vessels are often involved secondary hemorrhage is uncommon probably because the advancing margin of the ulcer is preceded by a gangrenous change which includes vascular thrombosis.

In this series we present the first 100 patients who came to amputation. The decision to remove the limb was, in the first case, a desperate attempt to save a dying man and, in many instances, was made too late. Our early reluctance to amputate was due to the fear that with our primitive conditions the mortality would be alarming and that more lives would be saved by expectant treatment. However, by the application of simple Listerian principles we found that the mortality from the operation per se was negligible. Although conditions in the wards approximated to those described by Florence Nightingale in the Crimean War, it was possible to perform even a bilateral amputation of the thigh safely with smooth recovery.
Before describing more minutely this series of cases, we might explain why so desperate an expedient as amputation was so often necessary. This jungle camp hospital at Chungkai receives most of its patients from railway construction parties in central Thailand. It was their duty to complete a railway by a certain date. In many instances, this entailed inadequate rations (perhaps only rice) and entire absence of quarters. Patients quickly developed dysentery, malaria, beri-beri, pellagra and tropical ulcer, in such numbers that the Japanese had no option but to work the sick. Often the Japanese guards worked side by side with the men. The fact that hundreds, possibly thousands, died may have been regretted by the Japanese but it was certainly regarded as a military necessity. The following letter read out to all the troops by the Japanese explains itself. It is a good example of English as she is Japped by a second-rate interpreter:

INSTRUCTIONS GIVEN TO P.O.W. ON MY ASSUMING THE COMMAND.

I have the pleasure to lead you on the charge of last stretch of Railway Construction Wardom with the appointment of present post.

In examination of various reports, as well as to the result of my partial Camp inspection of the present conditions, am pleased to find that you are, in general, keeping discipline and working diligently. At the same time, regret to find seriousness in health matter.

It is evident that there are various causes inevitable for this end, but to my opinion, due mainly to the fact for absence of firm belief us Japanese "Health follows will" and "Ceases only when enemy is completely annihilated."

Those who fail to reach objective in charge, by lack of health or spirit, is considered in Japanese Army as most shameful deed: "Devotion till death" is good, yet still we have the spirit, "Devotion to Imperial cause even to the 7th turn of life in incarnation," the spirit which, cannot become void by death.

You are in the act of charge in colleague with Imperial Japanese Army. You are expected to charge to the last stage of this work with good spirit by taking good care of your own health.

Besides, you are to remember that your welfare is guaranteed only by obedience to the order of the Imperial Japanese Army.

Imperial Japanese Army, will not be unfair to those who are honest and obey them, but protect them. You are to understand this fundamental Japanese spirit, and carry out the task given you, with perfect ease of mind, under protection of I.J.A.

Given in Kanchanburi, June 26 '43.
Col. Siju Nakamura.
Commander of P.O.W. Camp in Thailand.

In addition to the greatly depleted state of the patients who arrived in our hospital from up country, other factors played a part in preventing the healing of these ulcers. The Oriental standard of living compared with the European is a low one. Our troops lacked even this humble level of subsistence and were in fact the slaves of coolies, from a material point of view. There was therefore an almost total absence of dressings and appurtenances without which a hospital resembles a lazarus house. Had these patients been treated in British military hospitals few would have come to amputation. At the time of writing for example there is no toilet paper and those patients with high morale use the leaves of trees; the others terminate defaecation in the quadripedal manner.
If the R.A.M.C. personnel had not worked like heroes a state of affairs resembling what occurred in Mesopotamia in 1916 during the last war would have happened. At the time of writing, it appears that our hospital performs amputations for tropical ulcer far more often than others, and this anomaly disturbed us. Before operation was done the medical officer talked the matter over with the patient who gave his consent to amputation if it should be necessary. The surgical officer was then consulted and, in the face of indications outlined below, advised amputation. The Commanding Officer of the hospital, or his deputy, then interviewed the patient and examined him. As it happened, he always concurred in the necessity. In only one instance was unanimity not complete. This involved the case of a soldier both of whose limbs had to be amputated in the opinion of the surgical officer and the C.O.; in the opinion of the medical officer of the ward, one limb was beyond redemption and he felt the other could be given a little longer time in the hope of saving it. Since the patient also had amebic dysentery and a bed sore over the sacrum 4" in diameter and was greatly emaciated, we considered this most improbable. At the time of writing (33 days after operation) the stumps are healed, his dysentery is confined to three stools a day and his bed sore is granulating satisfactorily. We hope to cover it with pinch grafts shortly. [Addendum: He was well at the time the war ended.]
A Series of Over 100 Amputations of the Thigh for Tropical Ulcer

In the face of the unanimous opinion of all the medical officers in this camp it remains to explain why we had so many cases requiring amputation. Over 75 p.c. of these cases came from two groups of camps which underwent particularly severe privation and overwork. This hospital acted as a base hospital to these areas and we are certain that we have the majority of the bad ulcers in Thailand. [Lt.-Col. A. E. Coates, A.A.M.C., had an identical set of cases in Burma at the same time.] Tropical ulcers in our camp at this moment (Nov. 19, 1943) number more than 2,000 cases of which about 500 are bed-ridden. There is not the same likelihood of amputation being required in these; in fact, about 150 have already been booked for skin grafting when the surface of the ulcer appears receptive.

Etiology.

The ages of patients varied between 21 (four cases) and 40 (three cases), the average age being 28. Approximately 40 p.c. were under 30. This however is of no great significance as it was impossible to ascertain the relative numbers in each group of the force at risk.

The duration of the ulcer from its inception until amputation varied from one month (three cases) to eight months (one case), the duration not having been ascertained in 12 cases. The average duration was 3.5 months.

As will be seen from table 1 trauma is the outstanding etiological agent. Our clinical experience confirms the work of others in assigning a specific infectious basis to the condition. The author often developed tropical ulcers super-imposed upon blisters of the feet.

Table 1. Original Cause of Ulcer.

<table>
<thead>
<tr>
<th>Original Cause</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo scratch</td>
<td>32</td>
</tr>
<tr>
<td>Rock splinter or stone</td>
<td>6</td>
</tr>
<tr>
<td>Septic blister</td>
<td>5</td>
</tr>
<tr>
<td>Hammer blow (accidental)</td>
<td>2</td>
</tr>
<tr>
<td>Railway spike (accidental)</td>
<td>2</td>
</tr>
<tr>
<td>Axe blow (accidental)</td>
<td>1</td>
</tr>
<tr>
<td>&quot;Knock&quot;</td>
<td>2</td>
</tr>
<tr>
<td>Punitive blow by guard</td>
<td>4</td>
</tr>
<tr>
<td>Cause not ascertained or unknown</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
The incidence of intercurrent disease is shown in tables 2 & 3. It will be seen that approximately 75 p.c. of the series had one or more serious intercurrent disease. Often the downward progress of an ulcer dated from an attack of malaria. The next commonest cause for a relapse of an ulcer was nutritional deficiency, either beri-beri or pellagra, or a combination of both. Next in importance was amœbic dysentery.

**Table 2. Other Diseases during Course of Ulcer.**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Malaria and amoebic dysentery</th>
<th>Malaria and amoebic dysentery and avitaminosis</th>
<th>Malaria and diarrhoea</th>
<th>Malaria and beri-beri</th>
<th>Amoebic dysentery</th>
<th>Amoebic dysentery and beri-beri</th>
<th>Amoebic dysentery and avitaminosis</th>
<th>Diarrhoea and beri-beri</th>
<th>Diarrhoea and pyrexia undiagnosed</th>
<th>Pyrexia undiagnosed and avitaminosis</th>
<th>Avitaminosis</th>
<th>Beri-beri</th>
<th>Pellegra</th>
<th>Diphtheria</th>
<th>No other illness</th>
<th>Not ascertained</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria.</td>
<td>28</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>18</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

Commonly, relapses of ulcers could be ascribed to evacuation of a patient from one camp to another, the conditions of transit in open trucks or barges for many hours permitting no facilities for a change of dressing or treatment. In some cases two or more days would be spent on these journeys, and patients were compelled to walk varying distances from one means of transport to another. Feeding arrangements were often poor and shelter frequently inadequate.
Table 3. Incidence of Individual Diseases during Course of Ulcer.

<table>
<thead>
<tr>
<th>Malaria</th>
<th>Dysentery</th>
<th>Diarrhoea</th>
<th>Pyrexia undiagnosed</th>
<th>Polyvitaminosis</th>
<th>Beri-beri</th>
<th>Pellagra</th>
</tr>
</thead>
<tbody>
<tr>
<td>46&quot;</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

" includes at least 20 cases with more than one attack (up to 10), two with repeated attacks.

It has been mentioned elsewhere that bad food, slave conditions of housing and working, and absence of medical facilities had much to do with the origin and rapid deterioration of tropical ulcers. In many cases men have been forced out to work for varying periods who should have been confined to bed, with the inevitable result that their condition became rapidly worse.

**Indications for Amputation.**

In brief the indication was to save life.

1. A large sloughing ulcer not necessarily involving bone, with infectious gangrene extending under the skin up the musculo-fascial planes. When the patient's condition permitted it, débridement was performed under anaesthesia (in 34 cases that came to amputation). In hundreds of other cases, when this was combined with a blood transfusion to build up the patient, healing occurred, resulting in a large granulating surface. Many of these cases are now awaiting skin graft.

2. An ulcer which involves underlying bone with such evidence of spreading osteomyelitis as extreme tenderness up and down the tibia, high fever and rapid deterioration of the patient. All of us felt that the wisest course here was prompt amputation above the knee if 6" of tibia could not be spared. We would emphasise that the involvement of bone in an ulcerative process was by itself no indication for amputation. Many such discharged a sequestrum or had it removed, and healed over completely; many await skin grafting.
(3) Similarly, the involvement of metatarsal, tarsal, or ankle joints with adjoining infection of bone generally called for amputation at the nearest site of election. This was an unusual indication. For example, we have recently seen an ulcer covering the whole dorsum of the foot which quite successfully took all 32 pinch grafts of skin.

**TREATMENT OF TROPICAL ULCER.**

Before describing the operative technique and a more detailed analysis of some of these cases, we might say a few words about the treatment of tropical ulcer in this hospital. The nature of this treatment was entirely conditioned by the supplies of drugs and dressings. Most of us were agreed that the ideal treatment was to clean the ulcer once or twice a day with an antiseptic lotion, for example mercury biniodide or perchloride, then sprinkle it liberally with iodoform powder, over which a sterile dressing was applied. We found iodoform the most uniformly successful dressing, which often acted magically (cf. the use of BIPP in the last war in infected wounds). However, what small quantities of iodoform reached us were quickly used up. Almost the same remarks might be made about sulphonamide or sulphapyridine dusted over the ulcer. Failing these drugs, we used lotions of potassium permanganate, mercury biniodide,
lysol, eusol, eusol emulsion in coconut oil, a one in twenty powder of calomel in zinc oxide, boric acid powder, salol, salicylic acid and aspirin. As quickly as we ran out of one antiseptic we used another. There was never any shortage of lysol and chloride of lime. A solution of the latter containing 0·5 p.c. of chlorine was euphemistically referred to in this area as eusol. These applications were made under the grave disadvantages of insufficiency of bowls, dressings, bandages, dressing forceps, fresh water and indeed of orderlies. Transfusion was resorted to more frequently than would be the case in Europe for it was our only method of building up resistance. More than 80 p.c. of the ulcers that came to amputation had been transfused.

Among our supplies we found a few ampoules of 2 p.c. Trypaflavine (Bayer) which, according to the circular, could be used intravenously for ulcers. A series of six patients was given twice weekly injections of 5 c.c.s. of 2 p.c. Trypaflavine, on the whole with striking improvement. The fact was unexpected although it was known from the work of Menkin that antiseptic dyes are removed from the blood stream by localised inflammatory processes. We were fortunate to get a supply of Flavine (May & Baker) which is isomeric with the Bayer substance. We made this material up in saline and treated a series of 22 patients with it, again with gratifying results.

It has been suggested that a good treatment for these ulcers would be to put them up in plaster of paris after the method of Winnett-Orr. This technique has every a priori consideration against it. The patients had suffered from over-neglect and to sophisticate the procedure by immobilising the limb in plaster of paris seemed to us a mockery. On the contrary when a few experimental ulcers were treated by frequent application of warm antiseptic solutions and sterile dressings they quickly improved.

**Operative Technique.**

Patients who came to operation were generally in poor shape. Most were emaciated, many had an obviously pellagrous skin, many had a watery diarrhoea, passing about 10 stools in 24 hours, which from the appearances of their tongue and the absence of inflammatory exudate in the faeces we designated as pellagrous. A few had amœbic dysentery. It became necessary therefore to use a technique which would combine rapid surgery with reasonable prospects of having a useful stump. The wretched conditions in the wards made a two stage operation out of the question. As a rule when a good 6" of tibia could not be saved amputation was done at the lower thigh. In a few instances we succumbed to the importunings of the patient and left a short stump of tibia. In two cases this turned out to be so unwise as to necessitate re-amputation at the usual site, the wound having totally broken down probably as a result of an extension of the infection along the muscle planes. Both of these, two months after operation, are alive and well, getting about on crutches. After we had done about 20 amputations our supply of chloroform and ether ran out. Fortunately we acquired 10 grams of percaïne (Ciba) and a small supply of dental novocain in ampoules. We improvised a spinal needle
from a Labat 8 cm. local anaesthetic needle. From this point on our worries about a stock of anaesthetics were over. We were in a position also to discover that the usual dental ampoule of 2 p.c. novocain is a perfect spinal anaesthetic in a dose of 6 c.cs., and this in spite of the fact that it contains adrenaline. We even had the impression that the presence of adrenaline minimised the usual after-headache. About 60 amputations were done under percuraine intraspinally, 2 c.cs. of 0·8 p.c. being mixed with 8 c.cs. of spinal fluid. This large quantity was found necessary as we worked with no pre-operative sedation. Even so, the patient would wince when the sciatic nerve was sectioned unless we gave him a few whiffs of precious chloroform. About 20 patients were done using 120 milligrams novocain intraspinally. This anaesthetic permitted sectioning the sciatic nerve without pain.

The instruments included a dozen well-worn Spencer Wells forceps, a muscle retractor—improvised from a mess tin—and an abundance of cotton thread. We were reduced to using thread when our small supply of catgut was exhausted and it turned out to be preferable. The only two cases of secondary hemorrhage that we encountered were in patients where we used chromic catgut. The linen consisted of an assortment of towels which were sterilised by boiling in a weak solution of lysol. Gloves were not used, the surgeon's hands being scrubbed in hot water containing lysol. During the operation the wound and the surgeon's hands were frequently douché with 1/1000 mercury biniode solution.

The operative site was carefully prepared; the stinking ulcer was wrapped with newspapers and the whole made water tight, if possible, with sheets of cellophane. The operative site was disinfected by merurochrome in spirit or any other disinfectant except tincture of iodine, which the skin would not tolerate. The thigh was half flexed and the leg half extended, the heel resting on a box so that the surgeon could reach the popliteal area. Just before commencing the operation the leg was elevated and a Samway's anchor tourniquet was quickly applied round the thigh. When expeditiously performed there was only a minimum of venous congestion and practically no blood was lost when the vessels were severed. Because it saved time, and because the poor condition of the patient would imperil the vitality of a long flap, we adopted a circular cutaneous incision just above the upper border of the patella. Where there was a reasonable supply of subcutaneous fat the deep fascia was dissected from the skin; otherwise not, and a cuff was folded back of skin and fascia for about 3" anteriorly and for about 1" behind. This gave a flap with a transverse scar behind the stump of the femur. Using a clean knife the bone was denuded of its muscles in four sweeps one inch above the cutaneous incision. The point of the knife was first insinuated into the extensor pouch of the knee joint and the quadriceps was sectioned. Similarly we sectioned the hamstrings medially and the biceps and tensor fascia lata laterally. The point of the knife was then insinuated between the periosteum and the structures in the popliteal fossa which were severed by two or three bold sweeps. The muscle retractor was now encircled about the denuded femur. It required several sweeps of the knife to sever the lower attachments
of the adductor magnus, and the femur was transected at the junction of the lower and middle thirds. At first we used an ordinary carpenter's tenon saw quite successfully, sterilising it in strong lysol solution. Later we acquired a hacksaw which could be boiled. Bonedust was sponged away with biniodide lotion and the retractor removed. Artery forceps were now applied to all transected blood vessels that could be seen, and after some experience we had no difficulty in spotting about a dozen of these, the lumen standing out quite clearly in the middle of a muscle belly or in the intermuscular septa. Generally the popliteal artery and vein were tied together. The internal and external popliteal nerves were sought for and a further inch was removed from each. By this time the tourniquet could be safely removed. Three or four more bleeding points were picked up and it now remained to close the stump. The muscles fell naturally over the end of the bone and a continuous suture of linen from side to side was laid including the fascia lata, muscular fascia and the tendinous insertions of muscles. The wound was again doused with biniodide and the skin was closed with interrupted linen sutures. At first we used a rubber drain. Towards the end of the series we closed the wound without drainage with better results. The duration of the operation was 20 minutes without haste. When the occasion called for haste we could complete the operation properly in 12 minutes.

Amputation below the knee differed in one important detail from the above procedure: no attempt was made to cover the exposed bones with a pad of muscle and fascia. This omission was purely for technical reasons, since it was difficult to free the anterior and posterior tibial musculature and the triceps of the calf sufficiently from the underlying attachments without causing more mangling of these structures than was justifiable. We obeyed the accepted

| Table 4. Analysis of Amputation Sites with Deaths. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                | Double.          | Lower third thigh. | Legs.            |
|--------------------------------|-----------------|-----------------|-----------------|-----------------|
| Both legs.                     | 4               | 1               | 6               | 40              | 40             | 80              | 11              | 3              | 14              | 100 Cases.      |
| Mixed.                         | 2               | 1               | 4               | 14              | 9              | 23              | 3               | 2              | 5               | 32 Died.        |
| Total.                         | 2               | —               | 2               | 26              | 31             | 57              | 8               | 1              | 9               | 68 Remained.    |
convention of cutting the fibula at a higher level than the tibia. The skin was sutured to provide drainage in an anterior-posterior direction.

In general, considering the debilitated state of the patients, their frequently septic skins, the crowded slave conditions of the wards, most of the wounds healed well by delayed primary union. Experience taught us to leave the skin stitches in for three weeks or even longer. Patients who were suffering from dysentery or pellagra showed delayed or absent healing of the wound with, in many instances, suppuration and the breaking down of the suture line, with the result that the case had to be treated as a guillotine amputation. Four of these cases have recently come up for secondary suture and, of these, two have again broken down.

At the moment of writing 32 patients have died out of a total of 100 operated on. As judged by clinical evidence, only one died from surgical causes. This was the case of a patient who was getting about on crutches one month after the operation, the stump being entirely healed. He knocked his stump against a corner of the bamboo slats as he was getting out of bed and broke the wound slightly open. The injured thigh swelled by about a litre above its normal volume and a thin trickle of blood oozed from it. Infection set in and, after repeated haemorrhages the patient died within four days. At this time the hospital camp was flooded as a result of heavy monsoon rains and we were in no position to deal with the matter adequately. The other cases that died all stood their operations well with practically no operative shock and without untoward results at the operative site. The majority of deaths could be attributed to malnutrition, which showed itself in weakness and refusal to eat, with possibly terminal broncho-pneumonia. Such patients had obvious symptoms of avitaminosis. A significant proportion of the remainder died of amoebic dysentery (there were practically no amoebicidal drugs). Quite commonly a patient would entirely recover from his operation and two months later would develop a new ailment which carried him off.

For example Pte. T. had both legs amputated above the knee two months before his death. With the aid of two transfusions he healed his incision by delayed primary union. One month after operation the camp shoemaker made a special pair of boots for him to hobble about in as soon as his stumps were in condition. He had a large sacral bed-sore which he had acquired long before amputation and which predicament is practically unavoidable in such cases in the circumstances under which patients are housed. About six weeks after his operation when his bed-sore was almost healed and when he had been out for a number of days in a wheelcart he developed a remittent high fever with fleeting evidence of endocarditis. Although the blood smears were negative he was given a course of quinine. His fever went about a week after its commencement leaving him unwilling and unable to eat more than a few eggs a day. He died very emaciated.

The fact that many of our amputation cases died of other ailments (tables 5 and 6) is not remarkable in the nature of things: a patient’s resistance must be very low when he is unable to hold in check a small infectious cutaneous lesion, and he has a correspondingly poor prospect of shaking off any other serious ailment.
A series of over 100 cases of tropical ulcer that came to amputation is described with a brief discussion of the value of simple Listerian antisepsis under conditions that even Lord Lister did not have to contend with. Several treatments of tropical ulcers are discussed.
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