

*Treatment of Ankle-joint Cases.*

*Early cases* are best treated on the general lines enunciated above and sutured early. Should the astragalus be widely damaged resection is best practised at once, but is a difficult procedure.

Fractures of the tibia and fibula secondarily involving the joint, if not too severe, do well if all loose and contused bone is carefully removed.

*Late cases.*—With a septic arthritis, when the astragalus is the fractured bone and is more than slightly damaged, it should be resected, arthrotomy being practically useless, save as a temporary measure to allow of some subsidence of the sepsis in the more severe infections. Where, however, either tibia or fibula is the bone involved and the bony damage is not too severe arthrotomy, with removal of all loose bone, often succeeds very well. When the lower end of the tibia is blown away and the joint involved the limb is best amputated at once; such a case is usually accompanied by extensive tendon damage.

*Tarsal Joint Cases.*

From what has been described above it is readily seen that the treatment of the gunshot wounds of the tarsal joints is inseparable from and dominated by that of the bones involved. For this reason their treatment will be described under the heading of the individual bones.

*Os calcis.*—Fractures of the os calcis into the neighbouring joints, even when severe, usually do well after removal of all loose and damaged bone. Any extensive resection is to be avoided as far as possible, otherwise the posterior arch of the foot is liable to be lost from collapse of the heel with, in consequence, considerable crippling of the usefulness of the limb.

*Cuboid.*—This bone, if severely fractured, yields good results after subperiosteal resection as the sepsis is localised to three small synovial cavities. During resection the tendon of the peroneus longus is liable to have its sheath opened and then slough. If this bone alone is removed regeneration is usually complete and the arch of the foot but little affected. Care must always be taken to prevent, as far as possible, any operation scar from extending on to the tread of the foot.

Fractures involving, either severally or collectively, the three cuneiform, scaphoid and bases of the second and third metatarsal bones are particularly important from the extent and ramifications of the synovial cavity that is opened up. They require to be treated with more respect than those of the remainder of the tarsus.

*Treatment of early cases.*—There is no doubt whatever in my own mind of the superiority of the use of B.I.P. paste in these cases over other methods of treatment, chiefly owing to the infrequency with which these cases need then be dressed.

*Late cases.*—B.I.P.P. here does very well, too, but I prefer to employ the Carrel-Dakin method—the cases appear to do better.

It is essential to success to have X ray plates taken at intervals during treatment so that any further bones requiring resection may be treated early. The plates are useful, too, as giving an idea of the progress of bone regeneration.

*Amputation.*—Should this be required Syme's operation or some modification of it is undoubtedly the best; should this not be practicable an amputation just below the middle of the leg must be practised. If a Syme's amputation is required for severe sepsis in the neighbourhood it is then infrequently of advantage merely to disarticulate and then leave the fibula and tibia untouched, with the flap fully open. Later on, when the sepsis has subsided, the operation is completed by sawing across the ends of the bones and suturing the flap in place.

## CONCLUSION.

Of the operative measures described above I have no hesitation in saying that, efficiently carried out, they yield the best results. Different roads may lead to one town—in just the same way different methods of wound treatment, when used in hands specially trained in their respective employment, may lead to almost equally satisfactory results. Those advocated in this paper are the outcome of an extensive experience in war cases spread over a period of three years' close observation, and built up out of series of successes and,

more especially in the earlier days of the campaign, out of not a few failures and disappointments. One thing, at any rate, is certain: no method of wound treatment can ever rectify defective surgical procedures or rectify mistakes arising from failure to follow out the fundamental surgical principles that should have been carried out. It is much more the efficiency of the primary operation than the use or not of antiseptics that is the chief factor in determining successful results.

Finally, I would like to thank Colonel C. H. S. Frankau, D.S.O., A.M.S., consulting surgeon, for the encouragement he has given me in the publication of this paper. In addition, I wish to acknowledge my indebtedness to Sister Miller, R.R.C., for the help she has most willingly given me; a number of the most successful results I have ever had are entirely due to her skilful help and scrupulous technique in the operating theatre.

REPORT ON AN  
OUTBREAK OF SCURVY IN THE SOUTH  
AFRICAN NATIVE LABOUR CORPS.

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THE following report upon an outbreak of scurvy which occurred during the spring of the present year among the South African Native Labour Corps is presented, along with observations as to its causation and suggestions for the future prevention of scurvy in Native Labour Corps.

1. *The S.A.N.L.C.: Conditions of Life and Rations in France.*

The South African Native Labour Corps was brought to France for work on the lines of communication. The natives were recruited from all parts of South Africa, and included Basuto, Bavenda, Xosas, Zulus, and other tribes. They were formed into companies of about 450 men, each with its own interior economy. The conditions of living were, as far as possible, modelled on the system obtaining in the compounds of the South African mines. They were well clothed, well huddled, and the diet speaks for itself—an ample, substantial, and varied diet.

*Kaffir Personnel.—Field Ration.*

Frozen meat ... ..	1 lb.	Fresh vegetables ... ..	8 oz.
or Preserved meat ... ..	9 oz.	Margarine ... ..	1 oz.
*Mealie meal ... ..	1 lb.	English tobacco or cigar-	
Bread ... ..	1 lb.	ettes (per week) ... ..	2 oz.
Coffee ... ..	1 oz.	or Kaffir cigarettes (per	
Sugar ... ..	2 oz.	week) ... ..	3 oz.
Salt ... ..	½ oz.	Matches (once a week)...	1 box.

\* If the full ration is not obtainable, an equal quantity of rice may be issued in lieu.

The conditions of work were excellent, though in some instances, due to exigencies of the services, the hours were long; but as labourers they proved themselves equal to, if not superior to, any labour of its kind in France.

The health of the contingent has, on the whole, been very good. In 1917 I was for six months in medical charge of four companies of the S.A.N.L.C. on one of the country depôts; they were compounded, but given considerable liberty to go out for walks under supervision, and were thus able to obtain a certain amount of fresh fruit from neighbouring apple orchards. There was not a single case of scurvy in those companies during that period. At the end of 1917 I took over medical charge of four other companies of S.A.N.L.C. who had just arrived in France. These men were given work on the docks in one of the port towns. In order to be near the docks they were accommodated in a single large camp, but owing to the congested conditions of the area it was relatively smaller than the camp of the previous four companies, and being in the midst of surrounding docks and suburbs, the liberty of the natives was very much restricted; but as regards coting, hutting, and diet the conditions were the same as in the previous four companies referred to.

Each company in the camp had its own separate cooking arrangements.

2. *The Outbreak of Scurvy.*

Towards the middle of March, 1918, two natives in "X" Camp (No. 1 Native Labour Camp), of which I had

medical charge, were admitted to the Camp Detention Hospital with symptoms suggestive of scurvy. A systematic inspection was therefore made of the gums of all the natives in the camp; it was found that 40 per cent. showed a tendency to scurvy, the distribution being equally divided in all four companies. Antiscorbutic measures (detailed below) were therefore instituted; these did not interfere in any way with the work of the companies. During the period from March 15th to April 15th 19 cases of definite scurvy were admitted to detention hospital, all four companies being more or less equally affected.

By April 15th, however, gum inspections showed the tendency reduced from 40 per cent. to 10 per cent. Since that date until August only two cases presented themselves, and the periodic gum inspections indicated a tendency to the condition in less than 5 per cent.

In another ("Y") camp (Nos. 4 and 7 Labour Companies) in this area, having the same number as "X" Camp and living under similar conditions, the outbreak was more serious. The diagnosis of scurvy was first made on May 3rd, though I am given to understand that previous to that date a certain number of cases, undiagnosed, had been evacuated to a base hospital. From that date until July 16th 142 cases occurred.<sup>1</sup> With the exception of two, the cases were derived from three of the four companies of the corps. The only difference ascertained in the conditions of the four companies was that the 33rd Company, in which only two cases occurred, was from time to time given prunes and fruit bought by the company commander from company funds. The reason for this large number of cases in "Y" Camp was that the condition had not been recognised when the first cases occurred, and therefore some time elapsed before antiscorbutic measures were instituted. Towards the middle of May these measures were rigidly enforced and by the middle of July the outbreak had practically ceased.

### 3. Symptomatology of Cases.

There was nothing new noted in the clinical aspect of the outbreak. To one who had not seen scurvy before the diagnosis of the early cases might have been missed owing to the absence of gingivitis.

(a) The first symptoms with which the natives generally reported ick, and which could easily be ignored, were indefinite *myalgic pains* in the chest, neck, back, and legs, associated with a certain amount of cramp (subjective) in the calf and hamstring muscles. On inquiry they generally admitted to being easily fatigued and breathless on exertion.

(b) *Gingivitis*.—This classical sign, though present in most of the cases to a greater or less degree, was in some cases entirely absent. It varied from a slight swelling of the gums and inter-dental processes, with a slight blueness of the gum border, to great hypertrophy of the gum tissue. In a few of the bad cases the gums protruded 1/3 to 1/2 inch. The gums were then very red, ulcerated, and septic, and bled freely on the slightest pressure. Bacteriological examinations of the gums were made by Lieutenant-Colonel C. J. Martin, assistant adviser in pathology, who found the material from the ulcerated edges teeming with spirochaetes and *Bacillus fusiformis*. These, which are common denizens of the mouth, had, in Lieutenant-Colonel Martin's opinion, taken advantage of the lowered local resistance to invade the gums. At the weekly gum inspections of the companies one had to rely on the condition of the gums for a measure of the scorbutic taint in the individuals—every native showing slight gingivitis, with bleeding on pressure was considered a potential scorbutic.

(c) *Hæmorrhages into muscles*.—This was the most important and prominent feature in almost all the cases admitted to hospital, principally because it lamed the man and incapacitated him for work. In some of the cases it was the only sign present. These hæmorrhages occurred in certain definite muscles or groups of muscles—as a rule the muscles of the calf were affected; next in order of frequency were those of the thigh forming the inner border of the popliteal space. The part affected was swollen to a greater or less degree; pitting on pressure was frequently obtained over an adjoining bone. The swelling was hard and brawny and very tender; it caused the patient considerable pain on movement of the limb. As a rule, only one leg was affected, infrequently both legs, and then the second leg would only be slightly swollen. These swellings occurred at times with great rapidity, which one would expect from a hæmorrhage. A man would sometimes be at work one day, feeling pretty fit; the following morning he would hobble painfully to sick parade with assistance, and one would find the affected calf 2 to 3 inches bigger in circumference than the other. There was no further increase in swelling once the patient was put to bed, and it gradually subsided in five to ten days, but for two or three weeks there remained a certain amount of tender induration.

(d) Small *petechial hæmorrhages* into the hair follicles of the leg were almost constant in the cases.

(e) Another very constant feature was the roughness of the skin—coarse goose skin—over the upper end of the tibia, and on the legs between knee and ankle.

(f) *Anæmia* was present in over half the patients.

(g) Cardiac weakness with dilatation was not severe in any of the cases, though in some tachycardia occurred on exertion and a distinct

mitral murmur at the apex was present. These disappeared as the patient improved.

(h) Subperiosteal and synovial swelling were each seen in one instance.

(i) *Fever*. This occurred only in cases where there was much gingivitis, but subsided very rapidly (3 or 4 days) once the oral sepsis was controlled.

The general condition of the patients when admitted to hospital varied; most of them looked ill and drawn, but very rapidly threw this off. In none of the cases did intestinal hæmorrhage occur.

### 4. Treatment of the Cases and General Measures Taken.

The treatment of those already affected consisted of:—

(i.) Full diet with an extra supply of fresh vegetables lightly boiled. When the gums did not allow mastication, solid food was passed through a mincing machine.

(ii.) Lime-juice, ½ oz., was given three times a day. In the last case under my charge I omitted the lime-juice and gave three fresh lemons per diem. The rapidity with which the patient improved was remarkable, notwithstanding the fact that he was well over 40 years of age and had very definite gingivitis and swellings of the legs; none of the previous cases that had been given lime-juice made such rapid progress as this one when the lemons were substituted.

(iii.) Iron in the form of mist. mag. co. c. ferro was exhibited to counteract anæmia and the tendency to constipation.

(iv.) Massage to the affected limb, first very gently but gradually more vigorously when the patient could bear the pressure; ordinary liniment, terebinth, was used as a lubricant.

(v.) The gums were treated three times a day with a mouth-wash of hydrogen peroxide, followed by gentle swabbing with pledgets of cotton-wool soaked in 1 to 60 carbolic solution. As a rule the condition had so much improved in five to seven days that the patients could masticate their food and use a soft tooth-brush.

As soon as the patient was able to hobble about the ward with the aid of a stick he was allowed "up" daily for an increasing number of hours, but he was not discharged until all the induration and tenderness of the affected limb had disappeared, nor until the heart had regained its normal action, tested by exertion. Most of the cases were discharged within five weeks of the onset. After discharge the patient was given light duty for a week, but continued to get his lime-juice and iron mixture. Men of under 40 years made a much more rapid and complete recovery than those over that age. To obviate further trouble the following measures were adopted and enforced, and they proved efficacious:—

1. Acting on instructions, particular attention was paid to cooking of fresh meat and vegetables (see paragraphs dealing with the cause of outbreak below). The time of cooking was not allowed to exceed 45 minutes; the food to be cooked was introduced into water already on the boil, and at the end of from 30 to 40 minutes the fires were drawn, but the food allowed to remain in the boiler until it was required for a meal. When necessary it was heated up again for a few minutes before use.

2. The vegetable ration was supplemented by the purchase of extra fresh vegetables, cabbages, carrots, &c., bought with company funds. The carrots were issued raw, and with a little persuasion the natives ate them willingly.

3. A ration of lime-juice, ½ oz., was issued daily to all natives who showed any tendency to scurvy.

Of these measures, the one that seems to have given the best effect was the reduction in the time of cooking fresh food. This statement is supported by the fact that in Company of "Y" Camp, in which the disease was most prevalent, and lasted longest, it was discovered that notwithstanding instructions (though extra vegetable and lime-juice were being issued), the boiling of meat, &c., was being carried on for two hours at least, thus keeping up the disease, which soon improved after the cooking was reduced to 40 minutes.

### 5. Cause of the Outbreak.

#### (a) Summary of knowledge of etiology of scurvy.

Scurvy is usually associated in one's mind with sailors on long voyages in sailing ships, living on salt meat; prisoners undergoing long sentences; expeditions of discovery to Arctic regions; and troops besieged for a long period. Recently it has been a problem with which the medical officer has been confronted in connexion with the employment of coloured labourers, removed from their normal home and surroundings. Scurvy is clearly due to lack of some constituent in a diet which is supplied more particularly by fresh vegetables, and is present in fresh meat to some extent. Scientific research in recent years by Holst, and his colleagues, Frohlich and Furst, of Christiania University, and by the Misses Chick and Hume, of the Lister Institute, have proven that an efficient diet must contain certain active principles which they term "antiscorbutic vitamins," and the lack of which in man and certain animals will produce scurvy. The experiments of Holst, Frohlich, Furst, Chick, and Hume have shown that all fresh fruits, vegetables, and roots contain this principle in varying amount, but that it is sensitive to prolonged drying and heat, so that in desiccated and tinned vegetables, and canned fruits, it is to all intents and purposes absent. The cooking of cabbage for 30 minutes was found by Chick and Hume to reduce its antiscorbutic value to less than half, and prolonged boiling to annul it. Seeds of cereals, pulses, &c., are devoid of antiscorbutic value, but attain it on germination, a discovery the practical importance of which will emerge below.

(b) Interpretation of the present outbreak in the light of the above facts.

<sup>1</sup> The number of cases in "Y" Camp are those that have come directly under my observation, and will no doubt vary from those eventually notified at headquarters.

As pointed out at the commencement of this report, these men were upon a liberal scale of rations, according to European Army Scale. Half a pound of fresh vegetables is not, however, any too much for a diet which is partaken of over long periods, and is sailing "near the wind" if no opportunity occurs for supplementing, as takes place in the natural circumstances of the natives. This ration of fresh vegetable probably allowed of no margin for reduction in antiscorbutic value by prolonged heating. On investigation it was found that all food was being cooked by boiling for at least three hours, and except in the case of the 33rd Company no fresh fruit was being obtained by the natives, so that their food was, not unlikely, seriously deficient in antiscorbutic vitamins, due to the destruction of these in the fresh potatoes, onions, &c., by prolonged exposure to boiling.

I attribute the outbreak to a combination of these two causes: (1) Inability in the case of certain companies to supplement the diet occasionally with extra fresh fruit and vegetables; and (2) reduction of the antiscorbutic value of the fresh vegetables supplied by excessive cooking. The marked improvement occurring directly in those companies in which measures were taken to supplement diet and enforce a reasonable period of cooking justifies this opinion.

#### 6. Suggestions for Prophylaxis in the Future.

Before considering how to obviate scurvy in future it is well to consider further why natives not infrequently suffer from this disease when confined in camps or mines, &c., whereas there is very little scurvy among them living in their kraals in South Africa. Occasionally in spring one comes across a native who may show a slight tendency to the disease, generally in years when the previous kaffir corn (millet) crop has been a failure, but during the eight years I have been in practice in Basutoland I have never seen a single case of well-defined scurvy occurring among the Basutos living at home. During the summer the native has an abundant supply of fresh vegetables, roots, and fruits, but in his kraal, from April to November (the winter and spring months), the average native obtains no vegetables or fruit. He has meat once or twice a month, but his staple article of diet is a thick porridge made with maize or millet meal, and washed down with large draughts of kaffir beer.

One has frequently wondered why he did not develop scurvy by the end of those winter months. An explanation is, however, to hand in the discovery of Furst, verified and amplified by Chick and Hume, that during the germination of seeds the antiscorbutic substance is developed in large amount, for kaffir beer, of which natives partake largely, up to three gallons a day, is a thin fermented gruel made with a *germinated* millet. Thus in the gratification of his appetite for acid, alcoholic beverages, the native appears, unknowingly, to have protected himself from scurvy during the winter season.

Kaffir beer ("Leting" or "Joala") is made by germinating a small quantity of kaffir corn (millet) by steeping it in water for 48 hours; it is then dried in the sun for a day. The same day or the next it is ground coarsely between two stones. This meal is then placed in a large pot, and to it is added boiling water to make a very thin porridge, to which is added a small quantity of yeast (the residue of a previous brew). Fermentation is thus set up and allowed to continue for 36 to 48 hours, after which the whole is strained through a coarse straw strainer; the resulting opaque brownish fluid constitutes kaffir beer, which makes a very pleasant and satisfying drink. The points to be noted in the making of the drink are that only sufficient grain is germinated and ground for the one brew; never is it done with a view to provision for a future occasion. Again, boiling water is added to the meal, but there is no further boiling. Kaffir beer has been largely used in South Africa to arrest scurvy in prisons and mines. It has also been the practice on the Rand to give natives another acid, fermented beverage, "Mahew," and the natives have been supplied with this since landing in France. This is made from the meal of *ordinary ground maize or millet without previous germination*. The meal is stirred into boiling water and the process of boiling continued for an hour or so until a thin porridge is made; this is then evacuated into vats, and some wheat meal is added to cause fermentation. The porridge, after being diluted with a sufficient amount of hot water, is allowed to stand for 36 hours and is then ready for use. It is much more easily manufactured on a large scale than kaffir beer, and for this reason has been used as a substitute for the latter; but it is now clear why this substitute has been without influence to prevent scurvy.

To sum up, the danger of scurvy amongst South African native troops can be avoided by: (1) Seeing that the value of the limited supply of fresh vegetables is not dissipated by unnecessarily prolonged cooking; (2) supplementing this supply by the purchase of fresh fruit or vegetables from corps funds; (3) provision of mildly alcoholic native beer prepared from *germinated* grain of some sort.

In conclusion, I wish to express my gratitude to Lieutenant-Colonel C. J. Martin, F.R.S., A.A.M.C., for the bacteriology of the gingivitis and for the encouragement and advice he has given me in drawing up this paper.

## A CASE OF ABSENCE OF ALL SENSATION.

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THE remarkable case described below is that of a Breton sailor, aged 37, who emigrated to Canada eight years ago and enlisted in the Canadian Army in 1916. In June, 1918, he was admitted to the Military Isolation Hospital, Aldershot, for an attack of mumps, and it was then that the following observations were made.

The patient was a well-developed, powerful-looking man, of a very cheerful, even temperament, highly good-natured, and far removed from the neurotic or hysterical type as popularly conceived. Mentally he was perfectly sound, rather above than below the average level of intelligence. Questioned as to his family history, he would appear to be alone in presenting the peculiar characteristics here described. As a child he appears to have possessed a slight degree of cutaneous sensibility, and he dates its complete absence from the time when he had an attack of yellow fever in Senegal at the age of 17. This was his only previous malady, and he has always enjoyed robust health.

It will be convenient to describe the condition found under the heads of the different sensations.

*Sense of touch.*—There is complete absence of both superficial and deep tactile sense over the whole skin surface, and also over mucous membrane where attainable. There is no consciousness of deep vibration. A tuning fork not being available, a poker, the end of which was allowed to fall from the height of about a foot on to the tibia, the ribs, or the skull, produced no sensation of any kind—the patient, with eyes closed, not even knowing that he was touched. He does not feel the ground with his feet, and experiences difficulty when walking at night. He states that his inability to bring his heels together at the command "Attention" without controlling the movement with his eyes has frequently led him into trouble with his drill-sergeant. There is complete inability to recognise objects placed in the hand when the eyes are shut.

*Sense of pain.*—This is completely absent. In October, 1916, at the Hôpital de St. Louis at Quebec he underwent the radical cure of double inguinal hernia without anæsthetic of any kind, the patient being totally unconscious of any sensation either of pain or touch. His body is plentifully strewn with the scars of wounds and burns which he has inflicted on himself either for bets or to astonish the onlookers. I have myself seen him on more than one occasion hold a burning match against the skin of his arm for the space of 10 or 15 seconds, and then unconcernedly pick off the charred epidermis. He never suffers from headache, toothache, abdominal or other visceral pain of any description. The cornea, it may be noted, shares in the general anæsthesia.

*Thermal sensation.*—This is also absent. On placing the fingers in water so hot as to raise a blister, but well below boiling point (the eyes being closed), there was a slight convulsive movement of the hand, and he stated he was conscious of what he described as an electric shock, saying that he remembered feeling such a sensation when a boy. The feeling, he affirmed, was not a painful one. The placing of the hand in cold water evoked no sensation. There is no perception of temperature in food or drink. There is insensibility to atmospheric changes of temperature. The extremes of heat and cold encountered during sea voyages produced no corresponding changes of sensation. He states, however, that the great cold experienced on one occasion while rounding Cape Horn gave rise to vaguely unpleasant sensations. During the attack of yellow fever mentioned above he remembers the fact of his violent shivering followed by profuse sweating, but was unconscious of the feeling of cold or heat.

*Muscular sense and sense of position.*—The muscular sense appears to be completely absent. With the eyes closed, if asked to make any movement with his arms—the choice of movement being left to him—he is incapable of doing so, saying he cannot tell if his arms are moving or not, and all he can accomplish is a slight convulsive twitching of the hands and arms. On the other hand, if when standing upright with closed eyes he is told to walk