THE DIAGNOSIS AND TREATMENT OF YAWS AMONG WEST AFRICAN TROOPS.

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This paper is an analysis of seventy-two cases of yaws referred to the Yaws Clinic at a West African military hospital over a period of four months and includes a short note on the pathology of yaws ulceration. The patients were native soldiers from the Gambia, Sierra Leone, the Gold Coast, Nigeria and the Cameroons; the average being 22 years.

The following table shows the cases classified according to their main lesions:

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary yaws</td>
<td>2 cases</td>
</tr>
<tr>
<td>Secondary yaws</td>
<td>nil</td>
</tr>
<tr>
<td>Tertiary yaws</td>
<td>70 cases</td>
</tr>
<tr>
<td>(a) Foot-yaws</td>
<td>43</td>
</tr>
<tr>
<td>(b) Pustular rash</td>
<td>7</td>
</tr>
<tr>
<td>(c) Framboesiform rash</td>
<td>1</td>
</tr>
<tr>
<td>(d) Solitary sessile plaque</td>
<td>2</td>
</tr>
<tr>
<td>(e) Ganglion</td>
<td>5</td>
</tr>
<tr>
<td>(f) Juxta-articular nodules</td>
<td>4</td>
</tr>
<tr>
<td>(g) Bone-yaws</td>
<td>4</td>
</tr>
<tr>
<td>(h) Ulcers of the lower limb</td>
<td>4</td>
</tr>
</tbody>
</table>

Of the above cases five had yaws of the hand as well as yaws lesions elsewhere, and a further eleven cases had foot-yaws in addition to other lesions. It was found that the presence of these concomitant lesions was a valuable aid to diagnosis when the nature of the main lesion was in doubt.

A full history was taken from every case and a definite history of yaws in childhood was obtained in seventeen cases and a doubtful history in a further eleven. In ten of the cases, with no history of infection in childhood, a history of yaws in one or both parents was obtained.
The two cases of primary yaws both gave a history of recent association with infected persons. In neither was there a previous family history of yaws. In one case the typical frambesium was found on the buttock and, in the other, on the eyebrow. The Kahn test was positive in both cases.

No cases of secondary rash were seen and a history of lesions suggestive of secondary yaws was elicited from only thirty-four cases.

The majority of the patients (97.2 per cent.) presented tertiary lesions, most of which were in the form of foot-yaws.

These cases of foot-yaws presented three distinct types of lesion: A hyperkeratotic type, a punctate type and the classical subdermal yaws.

The Hyperkeratotic Type—This commenced as a thickening of the epithelium along the edge of the sole forming a thick pad which, while usually confined to the posterior and lateral borders of the heel, spread forwards and covered the entire posterior half of the sole in the more severe cases. Later, the thickened epithelium began to crack, deep fissures appeared, and fragments of epithelium would come away leaving ragged holes. In some cases there was complete exfoliation of the epithelial pad so that only a thickened irregular border was left with apparently normal skin in the centre.

Punctate Type (keratosis punctata).—In these cases the sole was found to be studded with small pits 2 to 5 mm. in diameter which did not extend down to the dermal layers. They looked rather as though pieces of epithelium had been dug out with the point of a penknife. In many cases only a few were present but, in others, the entire sole was involved.

In most of the cases of foot-yaws both hyperkeratotic and punctate lesions were present. The classical subdermal yaw occurred in only two cases and presented no unusual features. All three types of lesion were tender on pressure and often occasioned considerable disability.

In thirty-three of the forty-three cases of foot-yaws a history of intermittent disability with exacerbations during the rainy season was obtained.

The diagnosis was based on the presence of "pitting," the hypertrophic epithelium, the history of exacerbation during the rains and the positive Kahn test. Many natives were found to have cracks round the heels which were, however, of a finer character than the coarse fissures of yaws and were not usually tender on pressure. Soldiers also complained of tender feet on being moved from a very damp climate to a dry one, particularly if there was much marching, and in these cases the soles frequently showed fine cracks. The history and the absence of hypertrophic epithelium made it easy to distinguish this condition from yaws.

A similar condition to foot-yaws was observed on the hands. In five cases a generalized thickening of the epithelium was found over the palms and palmar surface of the fingers associated with patches of desquamation and contracture of the little finger in some degree. In two cases the ring finger was also affected. In only one case, in which "pitting" was also present, were the lesions causing any discomfort.

The digital contracture is described as a typical sign of late yaws (Pronk, 1941).
but, in West Africa, appears to be of little diagnostic value by itself as, in a control investigation of 100 cases with no signs or history of yaws, nine showed some degree of contracture of one or both little fingers.

The pustular rash was found to commence as multiple pigmented papules about 1 to 2 cm. in diameter, which were usually confined to the dorsum of the foot, the ankle and the lower leg, although in one severe case the buttocks and lower trunk were also involved. At first smooth and shiny, the papules later developed a dull granular surface and, with the appearance of successive crops, often became confluent. Pruritus was intense and in all cases had led to scratching and subsequent widespread secondary infection. In the cases seen the condition had been present from two to ten weeks.

Infected scabies and other forms of pustular dermatitis at first caused some difficulty in diagnosis. In yaws, however, the base of the pustule was always found to be raised above the surface of the skin owing to the underlying papule, the edge of which could be seen among the pustules. The granular appearance of the skin could not have been due to scratching alone as it was never observed among the very many cases of scabies seen at the same hospital. The positive Kahn test, the characteristic distribution of the rash and the rapid response to bismuth or arsenical preparations confirmed the diagnosis. Syphilitic eruptions, of course, are not associated with pruritus and were consequently not considered as an alternative diagnosis.

One case only of frambœsiform rash was seen. It resembled a classical secondary yaws rash in all particulars and would have been diagnosed as such had not the patient given a clear history of primary, secondary and tertiary eruptions at definite intervals during the past four years and had well established foot-yaws when seen.

The solitary sessile plaque commenced, in the two cases in this series, as a smooth raised area situated on the scrotum and varying from 2 to 3 inches in diameter. One of the cases also presented three smaller, almost confluent, plaques in the right deltoid area. At first deeply pigmented, the plaques soon became pink and shiny and progressed to ulceration which, in the scrotal area, was very superficial but, in the lesions in the deltoid area, the deeper layers had been involved and shallow indolent ulcers were present when the case was first seen. The process was quite slow and painless and pruritus was not a feature of the condition.

In the early stages the lesion could not be confused with any other condition except, perhaps, a keloid scar which it somewhat resembled. In the ulcerative stage, however, differentiation from syphilitic ulceration was difficult and the diagnosis was based on the presence of other yaws lesions and the lack of any history or signs suggestive of syphilis.

In this series all the ganglia were situated on the dorsum of the hand and wrist. They were all large, soft, ill-defined swellings, slightly tender on firm pressure and causing some pain on full movement of the wrist. On rolling the swelling under the thumb a soft, coarse crepitus could be felt due to the presence of numerous small solid bodies in the contained fluid.
In one case there was a clear history of teno-synovitis previous to the appearance of the swelling.

All of the four cases were treated with injections of Sobita and the swellings rapidly disappeared although the loose bodies could be felt for some weeks afterwards.

The juxta-articular nodules presented no special features of interest. They were all small, hard, fibrous swellings about the size of a pea, usually multiple and found in proximity to the knee, wrist and elbow joints. The nodules were either freely movable in the subcutaneous tissue or attached to joint structures.

Differentiation from the nodules of Onchocerca volvulus, which they closely resembled, was made only by biopsy as the two diseases might easily coexist.

All the four cases of bone-yaws in this series took the form of a sclerosing osteo-periostitis of the tibia and fibula. In three of the cases both the tibiae and the fibulae were affected and the right tibia alone was affected in the remaining case. All the patients had several weeks history of pain in the shins, which was worse at night, and of difficulty on walking. The shafts of the affected tibiae were very tender with some local heat; thickening of the shaft could also be felt and there was usually some antero-posterior bowing. X-ray showed sclerosis and widening of the cortical bone with narrowing of the medulla and irregularity of the periostial outline.

These cases were classified as yaws, rather than syphilitic osteitis, chiefly on account of the presence of other yaws lesions, e.g. foot-yaws, and the absence of any signs or history of syphilis.

The four cases of yaws ulceration of the lower limb all presented similar clinical appearances. They were situated on the shin (1), ankle (2), and the dorsum of the foot (1); only one case of multiple ulceration (two ulcers) occurred. The ulcers were deep and punched-out with sharp edges and with no local oedema; the floor was composed of cauliflower-like granulations, the discharge was yellow and purulent and there was little or no slough. The Kahn test was positive in all four cases and a rapid clinical response to Sobita, without local treatment, was obtained.

There was at first some confusion between yaws and tropical ulcer. The form of tropical ulcer most commonly seen at this hospital closely resembled the ulcer described by Earle (1942) as occurring in Trinidad and was quite distinct from the yaws ulcer described above. The acute form had a raised edge due to oedema of the surrounding tissues, the walls and floor forming a single smooth velvety concave surface frequently covered by a foul-smelling greyish or greenish slough. In the more long-standing cases the appearances were somewhat similar but without the oedema and often having an everted edge. Both forms were usually very painful and showed no response to Sobita.

From syphilitic ulceration, owing to the similarity of clinical and microscopic appearances, diagnosis usually had to be based on the history and the presence of other yaws lesions.

Two cases of lingual ulcer were also admitted to the hospital. In both, the ulcer was situated in the centre of the tongue, was punched out and had a foul
black slough. In each case there was a similar smaller ulcer on the hard palate opposite the larger lesion. The Kahn was strongly positive in both cases. In neither case were there any other yaws lesions present nor were there any signs or history suggestive of syphilis. One case healed completely after two injections of NAB and the other equally quickly after two injections of Sobita. It was thought that these lesions might be an early stage of gangosa; but because of their doubtful nature they have not been included in the series.

TREATMENT.

In this series only NAB and Sobita (sodium potassium bismuth tartrate) were used. One case of each type of lesion was treated with NAB and the remainder with Sobita. In all nine cases were treated with NAB, the course consisting of an initial dose of 0·45 gram followed by weekly doses of 0·6 gram, up to a total of twelve injections. The remaining cases were treated with intravenous Sobita, the course being twelve weekly injections of gr. i.; a higher dosage, or injections at more frequent intervals, by the intravenous route proving too toxic. The solution used was made in the hospital dispensary with a concentration of 1 grain in 2 c.c. distilled water.

The intravenous route was preferred to the intramuscular as the latter can be very painful and may render the patient temporarily incapable of full duties. The exhibition of Sobita by any route, of course, is likely to produce renal damage; accordingly the urine was tested as a routine twenty-four hours after each injection. Albuminuria occurred in 8 cases; in 3 cases it was persistent and necessitated a change of treatment; in the remaining 5 cases the albuminuria was transient, clearing up after one or two days and not returning with subsequent injections. In the 3 cases in which the albuminuria was persistent it cleared up after the treatment was changed to NAB. These 3 cases are not included in the 9 cases mentioned above as being treated with NAB.

A clinical cure was obtained in all the 72 cases and the patients returned to full duties, reporting weekly for the remainder of their course. Unfortunately only 13 cases had completed the full course of injections when the investigation was interrupted by the writer being posted to another station. Ganglion and all the skin lesions, except foot-yaws, responded rapidly. With NAB a clinical cure was obtained after an average dosage of 1·75 grams and with Sobita the average dosage required was 4·2 grains. Foot-yaws often required more prolonged treatment before pain was completely relieved. Bone-yaws proved very resistant, 6 to 7 injections of NAB being required before much relief was obtained and no response at all was observed to Sobita after six weeks' treatment. Neither Sobita nor NAB had any effect on the juxta-articular nodules and treatment, where required, was by excision.

Of the 72 cases, 24 had received previous treatment. Ten had been treated as children with from 4 to 8 injections of some arsenical preparation and 14 had received treatment within the past five years. Of this latter group 9 cases had been given 4 to 10 injections of an arsenical, 4 cases had received 1 to 7 injections of intramuscular Sobita and 1 case had received a short course of each.
In all the 14 cases treated as adults there was a history of relief of symptoms followed by recurrence within one to three years. Most of these recurrences were in the form of foot-yaws.

SEROLOGICAL REACTION.

The Kahn test was used exclusively in this series and the blood was found positive in all 72 cases. The C.S.F. Kahn was done in the four cases of bone-yaws and proved negative in every instance. In 9 cases the Kahn was negative on the first test but became positive after a provocative injection. NAB 0·45 gram was used as a provocative in 3 cases and Sobita gr. i intravenously in the remaining 6. Whenever Sobita failed to provoke a positive reaction in a suspected case of yaws it was followed by an injection of NAB and in no case did the NAB succeed where Sobita had failed.

In every case the Kahn test was repeated as a routine after the third, sixth, ninth and twelfth injections; the most frequent response was an initial rise in the intensity of the reaction, followed by a fall; but in 3 cases there was a secondary rise about the ninth week of treatment. In only 2 cases did the Kahn reaction become negative after a full course of treatment; in 2 more it diminished from “four plus” to “doubtful.” In the remaining 10 cases that had completed a full course of treatment the final Kahn reaction was either “one plus” or “two plus.”

THE PATHOLOGY OF YAWS ULCERATION.

Evans and Knock (1943) in an examination of 17 cases of yaws ulceration found Vincent's organisms present in the smears in over half the cases. On dark ground examination of those cases in which Vincent's organisms were found they noted the presence of numerous spirochaetes which appeared to be of three different types: (a) Borrelia vincentii; (b) a spirochaete of the refringens type; (c) an organism morphologically indistinguishable from Treponema pallida.

They concluded that the presence of spirochaetes was of aetiological significance.

On pathological examination of the same series they reported the following findings:

The granulomatous ulceration of yaws was very difficult to differentiate, both macroscopically and microscopically, from syphilitic ulceration. Macroscopically the yaws ulceration was characterized by a more vascular granulation tissue which appeared in the form of numerous tufts of healthy capillaries forming the typical heaped-up granulations in the floor of the ulcer. Histologically, the ulcers were characterized by a cellular granulation tissue which extended to the base of the epithelium and showed, in parts, varying degrees of necrosis and thickening. In the central parts the cells were closely packed together but at the margins they were more diffusely arranged. Giant-cell systems surrounded by epithelioid cells, many plasma cells, lymphocytes and a few eosinophils, without any definite follicular arrangement, were found distributed throughout the tissue but occurred more frequently in the marginal areas. Central softening and necrosis were often seen. The tissue in general showed increased vascularity with many newly formed capillaries. The arterioles were surrounded by pale and
swollen cells and showed some intimal thickening and peri-arteritis. The smaller vessels were frequently thrombosed, especially in those patients who also showed the sickle-cell trait, and a varying degree of fibroblastic reaction was found, being more marked in lesions of long-standing.

It was concluded that the degree of peri- and end-arteritis did not occur to the same extent as in syphilis and that the ulcer tissue in yaws was much more vascular with considerable regeneration of capillaries.

DISCUSSION.

The salient feature of this series is the large proportion of foot-yaws (66 per cent), reflecting as it does the high incidence of this condition among West African troops; as much as 30 per cent of native personnel being affected in some units in this area. The incidence is highest among Cameroons troops, as might be expected, since yaws is almost universal in some parts of that country (Simpson, 1938). The majority of these cases, of course, have only seasonal disability and are treated without difficulty by their unit medical officers; but it must be remembered that even so the patient is usually unfit for long marches for several weeks and that, while treatment is easily obtainable under static conditions, it is by no means so easily obtained during active operations when the physical efficiency of the soldier is of the utmost importance. Foot-yaws is thus a most important condition from the military point of view, much more important than in civilian life, for a lesion such as a seasonal recurrence of foot-yaws, which would be a comparatively trivial complaint to a civilian, under military conditions may constitute a very real disability. Theoretically no soldier should be enlisted who is suffering from yaws but, in practice, it is impossible to exclude at the medical examination those men who have no active yaws lesions at the moment but who would be liable to a recurrence during their period of military service.

The treatment recommended by most workers for yaws in adults is three injections of one of the arsenical or bismuth preparations, this amount being likely to produce a cure (Moss, 1927, Rutter, 1941), and in most West African medical units this is followed, three to four injections of NAB or up to six injections of Sobita gr. ii intramuscularly being the usual course. Medical officers, however, do not seem to realize that, although there is about 50 per cent of cures with this dosage, there is also a very high relapse rate. Moss found 46 per cent of cases showing lesions when he re-examined them five years after treatment with three injections of neosalvarsan and, in this series, no less than 24 of the 72 cases (33 per cent) were relapses, many of them having received more than the usual course of treatment.

Quite apart from the above cases, the blood-reaction in yaws is known to be very unresponsive to treatment (Dempster, 1942) and it seems reasonable to suppose that this is because the treatment is not carried out for a long enough period. A similar state of affairs obtained in the early days of the arsenical treatment of syphilis, when apparent cure after a few injections was followed later by a recurrence of the disease. We now know that the treatment of syphilis
must be continued until the blood-reaction is negative and it is probable that
the same thing is true of yaws.

It should be realized that the rapid clinical cure obtained in yaws does not
mean that the disease has been eradicated and that, if relapses and a further
period of disability are to be avoided, treatment must be continued for a con­
siderable period and cases should be followed up as is customary in V.D. clinics.
It would be ideal of course for every native soldier suffering from yaws to continue
treatment until the Kahn is negative but military conditions and the high cost
of treatment may render this impracticable. In that case investigation should
be undertaken to find the minimum dosage required to prevent relapse during the
period of military service; and in the meantime it would be advisable for every
case to receive one full course of twelve injections either of NAB or of Sobita and
 Afterwards to report periodically for observation.

The cases in this series are too few in number for any conclusions of value to
be drawn as to the efficiency or otherwise of Sobita by the intravenous route but
it would seem clear that Sobita gr. i intravenously is just as effective a provo­
cative in yaws as NAB 0·45 gram.

SUMMARY.

A series of cases of yaws admitted to a West African Military Hospital is
analysed, the differential diagnosis discussed and a short note added on the
pathology of yaws ulceration. The treatment of yaws is also discussed and it
is suggested that the present treatment is insufficient to prevent relapse and that
it should if possible be continued until the Kahn is negative. The value of intra­
venus Sobita as a provocative in yaws is noted.

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BIBLIOGRAPHY.

Pront, K. J. "De buigcontractuur aan den pink, een typisch laatertiaar symptoom
Rutter, A. G. "Treatment of Yaws in Western Solomon Islands," Tr. R. Soc. of Trop.
Med., 1941.
Simpson, T. "Yaws in the Bamenda Division of the Cameroons under British Mandate,"