DEFICIENCY SCROTAL DERMATITIS IN P.O.W.s IN THE FAR EAST

BY

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The condition here called deficiency scrotal dermatitis has not, so far as I am aware, yet received an adequate clinical description. Its prevalence among Allied prisoners of war in the Far East presented unrivalled opportunities for clinical observation, and it seems desirable to record a study of 551 cases. It is to be regretted that observations on the specific nature of the syndrome were precluded by the circumstances of the situation. Scrotitis is an ugly word, and "the urogenital syndrome," a term used by Mitra (1943), seems an inadequate description of many of the cases that were seen. For these reasons the term "deficiency scrotal dermatitis" has been adopted for the condition to be described.

Scrotal dermatitis first appeared among prisoners of war on Singapore Island in May, 1942, three months after their capture. During the six months from July 1 to Dec. 31, 1942, 1,371 cases were admitted to the skin ward at the main hospital for British personnel. Of these, 551 were primarily admitted for scrotal dermatitis. It should, however, be stated that many medical officers ran their own camp reception stations, so that not all cases were admitted to the main hospital. Pavillard (1946), writing of a camp in Singapore Town where 650 men remained for six months before going to Siam, states that "practically the whole camp suffered from scrotal dermatitis." This would not be an overstatement for most of the camps on Singapore Island.

After leaving the main camp at Changi in November, 1943, no cases of scrotal dermatitis occurred in any personnel under my care, though in Changi in 1944 there was a severe outbreak of new cases. Vegetables were difficult to get, and Clarke (1946) concluded that "scrotal dermatitis with its concurrent lesions was due to a deficiency of greens." Scrotal dermatitis was, however, still present in some prisoners of war on Singapore Island one month after their release (Mitchell and Black, 1946).

Symptoms and Signs

The first symptom noticed was an irritation of the scrotum, always worse at night and often becoming so severe as to make sleep impossible. In the daytime men were often seen subconsciously scratching the affected part, but during work or if the patient got hot the irritation would become temporarily worse, and was unrelieved by scratching. In its mildest form the scrotal dermatitis would last for only a few days and then would relapse and last days or weeks. Heavy work, heat, and illness were the chief precipitating causes of the onset or a relapse. It is important to recognize the mild early stage because the condition is not simulated by a tinea or an eczema due to other causes. If untreated it developed in a number of different ways, making it possible to classify the more advanced cases. It should be understood, however, that the distinction between the different forms was not always clear.

1. Mild Acute Dry.—This form was present in almost all prisoners of war in Malaya six months after captivity. The front of the scrotum became red, with the medium raphe showing as a smooth white line dividing the slightly raised and thickened erythematous surface. This condition might persist for a few days or weeks. Finally, with or even without treat-

ment, a fine desquamation would leave an apparently normal-looking scrotum. In the coloured races the erythema could not be recognized, though the stage of desquamation could easily be seen.

2. Severe Chronic Dry.—The front of the scrotum looked a bright red. Where the scrotal skin came in contact with the inner sides of the leg a few erythematous punctate areas appeared which later joined together to form a continuous blush. In more severe cases the skin round the anal margin and internatal cleft became red and painful, and fissures were often present. The under surface of the skin of the penis as it rested on the front of the scrotum commonly became red and irritable. The condition seemed to spread around the corona and on to the glans penis. In the uncircumcised, cracks appeared at the free margin of the prepuce, so that balanitis and phimosis often made circumcision necessary.

3. Chronic Wet.—This was the condition for which patients were admitted to hospital, though ambulatory treatment was of necessity often employed. The whole surface of the scrotum became wet and the inner sides of the legs were similarly involved. In the mild forms the scrotum might become dry again in a few days, in which case desquamation would occur, leaving a smooth shiny scrotal skin. If the moist state continued for over a week before the scrotum became dry a crepitant sensation, like egg-shells crackling under the skin, was observed. When the wet condition, persisted the skin became macerated and fetid, and the cracks in the skin around the anus, cruro-scrotal junction, and preputial margin spread and became more painful. Without treatment the area of weeping and of infection increased until the condition developed to type 4.

4. Ulcerated and Oedematous.—The scrotum might now become as big as a football. Walking was almost impossible, as fluid and pus oozed from the fetid area. The scrotal skin was extremely painful from ulceration. In some cases flies had laid their eggs in the scrotal ulceration, and the maggots as they moved about caused an extremely painful contraction of the cremaster muscle. Serum exuding from the scrotum was thus an ideal culture medium for *Corynebacterium diphtheriae*. In the worst cases a spreading gangrene from the scrotum to the legs and lower abdominal wall, with marked generalized toxic symptoms with or without diphtheritic infection elsewhere, terminated in death.

Associated Vitamin-deficiency Diseases

A detailed analysis of the other stigmata of vitamin-deficiency disorder occurring in patients with scrotal dermatitis was confiscated by the Japanese. It is, however, possible to give an approximate picture of the associated syndromes.

Oral Lesions.—The commonest lesions found associated with deficiency scrotal dermatitis were those of angular stomatitis, sore lips, and sore tongue. Stannus (1912) originally used the term "angular stomatitis" to describe a soreness at the commissures of the lips, with redness and desquamation along the line of closure. The angles of the lips became fissured and secondary infection was common. This condition must be distinguished from a cheilosis, which is an affection of the vermilion of the lips. The tongue lesions were so common that few subjects of established scrotal dermatitis had a normal tongue. In its mildest form the tip of the tongue only was involved. The tip looked tender, but only hot fluids and highly seasoned food actually caused pain. Later the whole surface of the tongue became either bright red or, more commonly, magenta-coloured. The thickened epithelium would flake off in patches, giving the so-called "geographical tongue." On the other hand, in a minority of cases the tongue was remarkably smooth and glazed in appearance. An infrequent finding was a bright redness of the soft palate and anterior pillars of the fauces. These cases had often been referred to the ear, nose, and throat department with the diagnosis of "pharyngitis." They were quickly cured by adequate doses of "marmite."

Skin Lesions.—Mild superficial desquamation on the nasolabial folds and on the skin adjacent to the pinna was a common finding. A rather similar condition of the skin described by other observers, was very rarely seen.

patients who had been severely ill developed a fine dry scaling mosaic pattern of the skin of the body which did not quickly respond to any form of treatment. In some of the accounts of syndromes related to deficiency of the vitamin-B complex scrotal dermatitis, if mentioned at all, has been included in the term "pellagra." This is unfortunate, since the aetiology of the two diseases is not the same. Of the 551 cases under review only two had associated pellagroid skin changes. These consisted of a pigmentation and roughening in those areas of the skin most exposed to the sun. If thus exposed for any length of time the pigmented areas became painful and a patchy desquamation spread from the centre towards the periphery of the lesion. Five cases showed a follicular hyperkeratosis. This was most pronounced on the forearms just below the elbows and on the outside and back of the legs. The rough porcupine condition of the skin could be felt better than seen. It was cured by giving adequate doses of vitamin A in the form of red palm oil.

Painful or Burning Feet.—Cruickshank (1946), in a review of 500 cases of painful feet under his care while a prisoner of war, states that 30% suffered from scrotal dermatitis. Cases were admitted to the skin ward primarily for skin complaints only. Of the 551 patients under review six complained of painful feet. Nicotinic acid or its amide cured four and relieved the other two.

Ocular Manifestations.—These were of two types: the more common one, for lack of literature, was called granular cornea; the other, retrobulbar neuritis. Granular cornea, retrobulbar neuritis, and scrotal dermatitis were in many cases present together, but the three diseases seem to bear little relation to one another with respect to date of onset and peak number of cases seen in any one month. In those suffering from granular cornea or keratitis the presenting symptoms were photophobia, itching and burning of the eyes, and a sensation of eye-strain. The eyelids were kept half shut, but beyond a general conjunctival injection, and without using slit-lamp investigation, no gross changes could be seen. If obvious corneal ulceration occurred the usual curative methods were found to heal extremely slowly. Permanent scarring did occur in some cases. The retrobulbar neuritis was in many cases more difficult to diagnose because the symptoms often arose without evidence of structural change. Although the maximal disability sometimes appeared suddenly, the symptoms generally took weeks or months to develop fully. Blurred vision or inability to recognize faces was the usual complaint. Sometimes patients suddenly found that they could not read, while others were unaware of any disability when a central scotoma was found on examination.

Illustrative Case.—A patient was admitted in November, 1942, complaining of a weeping scrotal dermatitis and blurred vision. At the end of a fortnight's treatment the scrotal condition had healed but the sight was becoming worse. One morning he failed to see his bed, walked into it and injured himself. Three months later, when vision had improved to counting fingers, there were still no abnormal disk changes.

Smith (1946) states that in the civilian internment camp, Hong Kong, where similar dietary conditions prevailed, of the 370 cases of retrobulbar neuropathy 143 (38.7%) had suffered from the orogenital syndrome. Ridley (1945) found that, although 48 out of 100 cases of amblyopia in former prisoners of war showed definite pathological pallor of the temporal halves of the disks, the appearance of the disks was sometimes normal even in severe and prolonged cases. Similar findings were noted a year before release in 46 patients who complained of blurred vision. Only one of these showed marked optic atrophy in both eyes; 16 showed slight temporal pallor in one or both eyes; and in the remainder the fundi appeared normal. Night-blindness was never complained of, though it is said to have occurred in other camps in the Far East. It was found that men with eye symptoms asked to go on the unpopular night working parties if there was a chance of getting off the following day's work in the glaring sun, probably because of the associated photophobia or a more rare mydriasis.

Nerve Manifestations.—Patients suffering from painful feet, retrobulbar neuritis, peripheral neuritis, or nerve-deafness were admitted to the skin ward for scrotal dermatitis if the latter disease was considered the more serious one. No case admitted primarily for scrotal dermatitis developed symptoms of a

pyramidal-tract disorder with signs of spastic paraplegia, although in an account of this syndrome by Graves (1947) two of the four fatal cases showed evidence of scrotal dermatitis.

Differential Diagnosis

So far as is known no other disease simulates the mild form of deficiency scrotal dermatitis already described, though by the time the condition becomes chronic, or more severe, it is possible that it will not be recognized as a deficiency disorder. Chemical dermatitis was produced in some of our mild cases by the application of various medicaments, particularly a paste the base of which was an anti-malarial ointment containing citronella. Eventually its use had to be prohibited. Dhobie itch, prickly heat, and intertrigo are commonly seen in hot countries, especially under Service conditions. Tinea cruris (dhobie itch) can usually be recognized by the sharply defined growing margin of the ringworm on the legs.

Many of the cases that had begun as a deficiency scrotal dermatitis developed a superadded ringworm infection, and this was in fact presumed to have occurred in cases refractory to the usually effective treatment. Prickly heat rarely affects the crutch only, and an intertrigo, when it occurs in that part, is not quickly cured by adequate amounts of vitamin B. Eczema of the perianal margin is not infrequently seen in any dermatological clinic. This condition tends to start around the perianal margins and not to spread there from the scrotum. Furthermore, the skin later may become lichenified—a condition which apparently did not occur with true deficiency scrotal dermatitis. A seborrhoeic or exogenous dermatitis involving the scrotum might well be mistaken for the type of scrotal dermatitis seen among prisoners of war, especially as there were other seborrhoea-like lesions on the body.

As already mentioned, as soon as the scrotal condition became moist, secondary infection with *C. diphtheriae* was apt to occur. A routine culture in all cases when this was possible showed that some patients with weeping scrotal dermatitis were chronic diphtheritic carriers. More commonly, however, the clinical condition resembled cutaneous diphtheria elsewhere, except that once infected the scrotal skin was liable to become extremely thickened from oedema. This oedema differed from the gross oedema seen in some of the cases of oedematous beriberi in that the skin was weeping and ulcerated to start with and the oedema followed. In a few cases of oedematous beriberi the skin ruptured and became infected later. In some cases the scrotal condition had not reached the weeping stage, but the men reported sick with a sore mouth and a white diphtheritic membrane spreading over and completely occluding the red lips. These men generally had a diphtheritic angular stomatitis and cheilosis, and a redness or crusting or frankly diphtheritic membrane inside the nose—a sign that always had to be looked for, because there was rarely any complaint about the nose.

Treatment

Curative; Specific.—It was soon found that marmite or "vegemite" given in 1-oz. (28-g.) doses daily for eight days cured mild cases of scrotal dermatitis. In the mild dry erythematous type the scrotal irritation had usually disappeared completely by the second night. A fine desquamation would follow, and then, if the condition had been present for some time, the scrotal skin lost its rugae and became smooth in appearance. A longer period of treatment was necessary for the more severe cases, some of the patients having to remain in hospital for over two months. This chronic state could not be accounted for by infection. With the low vitamin-B content of the diet relapses were apt to occur.

Non-specific.—Local treatment was limited to the availability of any drugs or dressings. Many men, by keeping themselves well washed and dusted with powder, were able to postpone the onset of the weeping condition. Calamine lotion when available had much the same effect as a dusting powder. In its dry or early moist stage scrotal dermatitis could be prevented from becoming worse, and in some cases was almost cured, simply by resting and keeping cool. This, of course, was often impossible. When the weeping variety had become established the ideal treatment was rest in bed—again impossible to obtain. Of the many local applications tried wet dressings of normal saline were probably the most effective, and had the added advantage that when all other drugs had been finished salt and water were always available, though the former was used at the expense of the already low salt ration in the diet. Hypertonic saline was used, but was found to be too painful, and it had no advantage over normal saline. Very dilute solutions of eusol, boric acid, mercury perchloride, mercury biniodide, lead lotion, silver nitrate, and mercurochrome were also used. A dilute solution of eusol was perhaps the best local application, but some patients became eusol-sensitive after using this form of treatment for a number of days. When the local condition had healed completely patients were allowed out of bed and only a dusting powder was applied; but relapses were liable to occur if the wet dressing was not kept on for the requisite time, which varied from two to three days to as long as two months.

Prophylactic.—Attempts to supplement the meagre diet with sources of the vitamin B complex were not very successful. Yeast brews apparently had no effect on scrotal dermatitis, and rice polishings in doses of 1 oz. (28 g.) a day made no appreciable difference. Extracts of macerated green leaves or grass, if in a concentrated form, were effective prophylactically and therapeutically in some cases.

Discussion

Stannus (1944) believes that the endothelium of the capillary system is the first tissue to suffer in a riboflavin deficiency, resulting in a loss of tone and dilatation. Normal cellular metabolism is upset and the tissue functions are disturbed—what he terms a “capillary dysergia.” He considers that the skin lesions of an ariboflavinosis occur where the skin is thin or highly specialized and at the mucocutaneous junctions of body orifices. He does not seem to have stressed that the lips, nares, prepuce, anus, scrotum, etc., are particularly liable to constant mild trauma. In scrotal dermatitis it may well be that there is the added factor of mild trauma in association with excess heat. It is known that warmth and exercise of the body may produce urticaria or eczema of the skin in a sensitive allergic patient. It has been suggested that when cellular nutrition is interfered with in these patients, although the various mechanisms are not fully understood, there is a release of histamine or H-substance into the tissue space. Arguing on a similar basis, it may be possible that, in a riboflavin deficiency, with the interference of cellular metabolism there is a production of histamine or H-substance. If this is so, here is an explanation of the similarity between the skin disorders of an eczematoid type seen in allergic conditions and some of the skin changes seen in hyporiboflavinosis, especially those round the mucocutaneous junctions of the body orifices.

In many written reports of the signs of vitamin-B deficiency scrotal dermatitis was not mentioned, though it may well be that it was not always looked for. Many observers had, however, noticed its appearance. Stannus (1912, 1913) described its occurrence. Purcell (1942), in reporting six cases of nutritional glossitis, noticed four cases of itchy or scaling scrotal skins. These were not benefited by

100 mg. of nicotinic acid, but cleared up on 5 mg. of riboflavin daily. Landor (1939) had previously noted ten cases with similar results. Sydenstricker (1941), writing on the B-group avitaminosis, remarks that pruritus of the vulva or scrotum may be present. Sebrell and Butler (1938) maintained a group of patients on a diet poor in riboflavin content. In their experiment the first sign of vitamin lack to appear was one of cheilosis. They then described the various other manifestations generally attributed to a riboflavin deficiency. They state that only rarely was there a dry brown itching dermatitis of the hands and scrotum. As they had already mentioned that a generalized extensive seborrhoeic dermatitis might be a manifestation of riboflavin deficiency, the scrotal condition was not particularly stressed. Fitzgerald Moore (1937), who was interested in the eye changes in vitamin-B deficiency, remarked that, among other symptoms, there were associated active signs or a past history of a scaly itchy scrotum.

Mitra, writing on what he termed the orogenital syndrome in avitaminosis, noticed, as have other observers, that nicotinic acid may make the condition worse, while on riboflavin all cases were cured or showed much improvement. It is interesting that Thomson (1944), in a description of beriberi among naval ratings in Malaya, described two cases of eczema of the scrotum without demonstrable signs of any other deficiency. Landor in 1939 described eczema of the scrotum and stomatitis occurring in Singapore Gaol which was not cured by nicotinic acid but responded to yeast or marmite. Owing to lack of literature it was quite a time before some of the doctors in the prison camp who had been working in Malaya before the war recognized scrotal dermatitis as a disease with which they were already familiar in the local gaols.

Scrotal Dermatitis as a Manifestation of Riboflavin Deficiency

It may be argued that the foregoing account of scrotal dermatitis adds little to our knowledge of a vitamin-deficiency disease or even that it does not prove the disease described to be due to vitamin lack. It has already been explained that the circumstances of the situation precluded a scientific study of the specific nature of scrotal dermatitis. All that has been attempted is a description of an almost universal complaint suffered by prisoners of war while living under conditions in which diseases due to vitamin-B deficiency were certain to occur. It is only by recording other workers' observations on scrotal dermatitis that an assessment can be made of the aetiology of the disease.

Purcell, Landor, Sebrell and Butler, and Mitra have all produced evidence that scrotal dermatitis occurs in patients on a low riboflavin diet and that the condition can be cured by riboflavin. Burgess (1946) has shown from the detailed analysis of the diet at Changi camp that scrotal dermatitis occurred inversely with the riboflavin intake, though, at Hong Kong, Smith's graph of the riboflavin content of the diet and the incidence of new cases of the orogenital syndrome show no very close correlation.

It was unfortunate that pure riboflavin was not available at the camp, and that of the three preparations which were effective for the cure of scrotal dermatitis the riboflavin content of one of them—namely, green-leaf extract—was unknown. However, the following figures supplied by the makers represent the range of riboflavin content for marmite and vegemite. Marmite contains 0.055 to 0.067 mg. per g. and vegemite 0.045 to 0.06 mg. per g., or a probable minimal value of 1.5 mg. per oz. Williams and others (1943) suggest that 0.5 mg. per 1,000 calories is an adequate intake of riboflavin, so it is not unreasonable to suppose that the quantity of riboflavin contained in 1 oz. of marmite or vegemite would, together with the riboflavin

of the diet, be adequate to produce signs of cure in a case of riboflavin deficiency. It must be remembered that riboflavin, nicotinic acid, pyridoxin, pantothenic acid, choline, and folic acid are some of the known factors present in any extract such as marmite which, together or alone, may be responsible for any observed therapeutic effects.

Summary

Scrotal dermatitis was a common complaint among prisoners of war in Malaya six months after captivity. It was noted that no cases of scrotal dermatitis occurred when the riboflavin content of the diet was maintained at a sufficiently high level.

A description of the different types of deficiency scrotal dermatitis seen is given, together with the associated vitamin-deficiency diseases.

Previous workers who have described the complaint have suggested that it is due to a deficiency of the riboflavin content of the diet. The curative effect of marmite (or vegemite) was found to be specific in mild uncomplicated cases.

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Addendum. Since writing the above description of deficiency scrotal dermatitis this condition has also been commented on by Sefton, L. (*Brit. J. Derm. Syph.*, 1947, 59, 85).

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quantities were given until the bubo healed. Results were favourable on the whole, but the condition of three patients, admitted when very seriously ill, deteriorated rapidly in spite of treatment. It was decided, therefore, to administer streptomycin. The results in all three cases were remarkably good.

Case Records

Case 1.—A male Arab aged 20 was admitted to hospital in July, 1947, with the history that three days previously he had had a severe rigor, a rise of temperature up to 39° C., and an intense headache. On the following day, on discovering a painful lymphadenitis in the right groin, his physician placed him on 400,000 units of penicillin daily. In spite of this his condition deteriorated and severe continuous vomiting started. The day before admission he became delirious.

On admission his pulse was 124, respirations 26, and temperature 40° C.; he was delirious and was vomiting. His face was haggard, the conjunctivae injected, the tongue dry and heavily coated. In the right inguinal region there was a tender solitary lymph gland the size of an almond, but the skin over it was not inflamed. Bubo puncture fluid was positive for *Pasteurella pestis*.

The patient was given a course of "soludagenan" (soluble sulphapyridine) 1 g. intravenously every four hours. Nothing could be given by mouth on account of the vomiting, therefore glucose and normal saline were also administered intravenously.

On the same evening his general condition deteriorated and streptomycin 200 mg. was administered every three hours. The following morning the temperature dropped to 38° C. and in the evening it was normal. The patient, though still vomiting occasionally, was so much better that he was able to sit up in bed. Streptomycin was therefore discontinued on July 9. As the temperature rose 24 hours later, a further 2 g. was given. From this stage recovery was uneventful. The bubo resolved and the patient was discharged on July 16.

Case 2.—A male Arab 8½ years old became ill on June 28, 1947, with a sudden and severe rigor, fever, vomiting, and headache. On June 29 he developed a painful swelling in the left groin, for which he received 1 g. of sulphathiazole thrice daily for 6 days. As there was no clinical improvement he was referred to hospital.

On admission on July 4 his temperature was 39.5° C. and pulse 130; his face was congested, the eyes were bloodshot, and breathing was rapid and shallow. He was conscious but apathetic, and vomited repeatedly. The left inguinal glands were enlarged, tender, and inflamed. Bubo puncture fluid was found positive on direct smear and culture. Sulphadiazine 4 g. daily was prescribed.

The day after admission his condition became worse. The pulse was thready and vomiting continued, and he was incontinent of urine. On July 6 his condition deteriorated further; his temperature was 40° C. and delirium had set in. Streptomycin 200 mg. every three hours was therefore started at 8 a.m. By 4 p.m. the same day the temperature had fallen to 37.5° C. and the vomiting had ceased. Improvement was maintained during the next three days, during which the patient fed and took an interest in his surroundings. On July 10 his temperature rose again to 38° C. and an intermittent fever was maintained until July 14, when fluctuations became evident in the bubo, which was then incised. After that recovery was uneventful and the patient was discharged on July 26. Streptomycin had been discontinued on July 17.

Case 3.—A male Jew aged 35 was admitted to hospital on July 19, 1947, on the fourth day of his illness, which had started with a rigor followed by fever and vomiting. A painful swelling appeared in the left groin on the second day of the disease. The patient had been given sulphathiazole and penicillin for two days without effect.

On admission his temperature was 39.5° C., pulse 120, and respirations 24. The patient looked very ill. His face was congested, his tongue was heavily coated, and he complained of a very severe headache. In the left inguinal region there was a large hard swelling which was inflamed and tender. *P. pestis* was cultured from the bubo puncture. The patient was given sodium sulphathiazole 1 g. every four hours intravenously.

STREPTOMYCIN IN BUBONIC PLAGUE

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In 1947 bubonic plague broke out suddenly in Haifa and later spread to Affula, a village 30 km. to the south-east. The outbreak was suppressed quickly by the extensive use of D.D.T., but it gave us the opportunity of observing the effect of streptomycin in three severe cases. As little experience has been gained in the use of this antibiotic against plague (Herbert, 1947; Karamchandi and Rao, 1948) a brief report on our observations may be justified in spite of the small number of cases presented.

The outbreak started explosively. The first case, the only fatal one, was admitted to hospital on June 23, 1947. Within the next 13 days 13 more cases, all from Haifa, were admitted, and there were 3 from Affula on July 19.

Sulphonamides, especially sulphadiazine, which is now considered the most potent sulpha compound against plague (Platzer, 1946; Huangl and Chu, 1946), were administered as a routine to all cases. Where possible the initial dose was 2 g., given orally, followed by 1 g. every four hours during the acute stage. Later, smaller