for many reasons is intolerant of such disturbance, but we have found that, if we employ a local interference which ensures relief of tension without unduly disturbing the local reaction, the results are often surprisingly good. I have therefore gone upon the principle of regarding acute osteomyelitis as a local infection which is a reaction to a septicaemia. I have viewed the local error as having a certain potential value by increasing resistance to the general infection, and on this assumption we have been satisfied with an operative procedure which ensures relief of tension and as free drainage as is possible without unduly disturbing the local tissue reactions.

Other Operative Procedures

I have abandoned the gutter operation because it did not appear to afford any more efficient drainage than that provided by the method of multiple punctures, while the trauma necessitated by the operation lessened the degree of reaction and encouraged sequestrum formation. In the same way any attempt at curetting the infected marrow encourages an embolic spread of the disease and removes the tissue segments upon which an efficient reaction depends. It has been suggested that, instead of guttering the bone, more efficient drainage might be obtained by removing $3/4$ in. of the bone circumference.

As a matter of fact this was attempted in one case, but the result was a sequestration of the remaining segment, with a state of affairs which amounted to an extensive pathological fracture.

The suggestion which has been mooted and in some cases practised, that a metaphysectomy or partial diaphysectomy should be carried out, is to my mind a wrong procedure, and the high mortality which is associated with the operation is probably due to the fact that by this means we remove the actual segment of tissue upon which the patient's resistance to the general infection may well depend. This procedure, if considered at all, should be restricted to late cases in which the entire diaphysis has become necrotic and is lying in a large subperiosteal abscess. In this event the dead shaft is already detached at each metaphyseal extremity, and the operation amounts to nothing more or less than a sequestrectomy.

Results of Operation

I conclude this somewhat disjointed discussion of the disease with a summary of the operation results. In a total of fifty-six cases observed over the last twelve years there have been thirteen deaths, a mortality of 23.2 per cent. In those who succumbed, death was due to a progressive septicaemia which ultimately passed into a pyaemia with secondary abscesses in such varied situations as voluntary muscle and subcutaneous tissue, the heart muscle, the lungs, and the brain.

S. Bueno (*Thèse de Paris*, 1934, No. 606) states that two bodies were responsible for the prophylaxis of malaria in Cuba—the State, which supervises the towns and suburbs, and the sugar companies, which are concerned with the regions in which the sugar cane is cultivated. The areas occupied by small proprietors have hardly any prophylaxis. The campaign undertaken in the towns has caused a complete disappearance of yellow fever and the almost complete eradication of malaria, especially in Havana. Considerable improvement has taken place in the country districts as the result of the measures undertaken by the American sugar companies. The apparent increase in the incidence of malaria during the season in which the sugar is produced is due to the movements of the workmen, a large proportion of whom are infected. The selection of workmen therefore appears to be desirable, only those being taken on who are free from malaria.

FUNGUS INFECTION OF THE FEET: PROPHYLAXIS AND TREATMENT*

BY

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Fungus infection of the feet has loomed large in the practice of dermatologists during the last twenty years or so, and in no subject in this branch of medicine has investigation been more insistently pursued and more fruitful results obtained. At the same time there are many lines of investigation which remain to be followed, and, until certain further problems are solved, many difficulties as to prophylaxis and treatment will continue.

It is not necessary for me to enter into a description of the fungi which attack the skin of the feet: suffice it to say that a considerable number of different fungi of the hyphomycetes group have been found present in these cases, and also that yeast-like organisms, generally classed under the name "monilia," including the organism of thrush *Monilia albicans*, have also been incriminated. Inflammations of the skin by fungi can take place in two ways: first, by the growth of the fungus in the horny layer and on the horny appendages (the hair and nails), the fungus having been implanted from without on the affected area; or secondly, by transmission of the fungus or its toxins from a local site of infection by way of the blood stream to a distant site. In this latter case some sensitization of the epidermal cells appears to be a necessary preliminary to the production of the inflammatory reactions. Reactions of this type are spoken of as "dermatophytids."

Clinical Types

Clinically, fungus disease of the feet may occur in several forms. For the sake of convenience they may be divided into three types, though some dermatologists prefer a more elaborate classification: C. J. White (*Arch. Derm. and Syph.*, April, 1927, xv, 387), for example, describes eleven types.

The types most commonly seen are: (1) the intertriginous, (2) the vesicular, and (3) the hyperkeratotic. It may be noted, however, that various combinations of these types may occur.

Intertriginous Type.—This is by far the most common, and is found between the toes, often only in the fourth interdigital space, and nearly always bilaterally. In more advanced cases other interdigital spaces are involved, as is also the fold beneath the toes. In the mildest cases perhaps only slight scaling is visible in the fourth interdigital spaces; in more chronic cases the skin of the sides of the toes becomes much thickened, appearing as a dirty white layer, owing to a great thickening of the horny layer. This thickening may occasionally become much more marked at one spot, and a so-called "soft corn" may develop. Generally the skin in the web between the toes cracks, and this crack may extend beneath the toes. In the more active cases an eczematous eruption, of either a dry or a moist character, may spread over the dorsum of the toes and anterior part of the foot, and on to the anterior part of the sole. In the most acute cases the lesions may be vesicular or bullous from the start; in fact, Whitfield states that most cases commence in this way, though on this point I am not in entire agreement with him. In this type of case secondary pyogenic infection is liable to occur, and lymphangitis may be an occasional complication. In the intertriginous

* Read in opening a discussion in the Section of Dermatology, at the Annual Meeting of the British Medical Association, Bournemouth, 1934.

cases there is frequently involvement of the toe-nails; this is not always obvious clinically, though in many cases thickening, opacity, and brittleness of the nails may be present, but the fungus can often be found in nails which show little variation from the normal.

Vesicular Type.—In its most typical form this variety is seen as a collection of deep-seated vesicles, from pinhead to a lentil in size, usually occurring in fairly circumscribed groups on the soles of the feet, most commonly on the instep or ball of the foot. There is usually some diffuse redness surrounding the vesicles, and the patch may be sharply circumscribed and may spread by peripheral extension, or the patch may be less well defined. The vesicles vary from quite a few up to a large number. They usually appear slowly, but sometimes the whole skin of both soles may become covered with vesicles in a few hours. Although in some cases fungus can readily be demonstrated in the scales, in others repeated examinations fail to reveal its presence, and the same applies to similar lesions on the hands. It has been shown without much doubt that some of the cases belong to the group of dermatophytids, and are not direct infections. Many cases which in the old days were called cheiropompholyx or dysidrosis are now known to be fungus infections. It is not possible here to enter into a discussion on the differential diagnosis of other vesicular and pustular eruptions of the feet.

Hyperkeratotic Type.—This form also occurs on the soles as a chronic eczematous condition, associated with much thickening of the horny layer, which is imperfectly formed and therefore liable to fissuring and exfoliation. It is most marked over points of pressure—the ball of the foot and heel. Luckily it is not such a common type as the two preceding ones.

This is a very cursory survey of the great variations which may be seen in fungus infections of the feet, but it will be noted that they are all types of an eczematous reaction, and although some of them are sufficiently typical to enable a clinical diagnosis to be made readily, others require a careful hunt for fungus before a definite diagnosis can be arrived at.

Treatment

I will now turn to consider the main subject of this paper, prophylaxis and treatment, and as the former depends to a great extent on the eradication of the disease from the infected persons I will first deal with the latter.

In order to treat the disease we must realize as completely as possible the conditions with which we are dealing. In the vast majority of cases the fungus lives entirely in the horny layer of the skin and the nails (the hairs do not require consideration in this connexion). It is true that, as I mentioned above, fungus may get into the blood stream and be conveyed to distant sites, but in these cases, for various reasons I need not discuss now, the fungus does not develop at these distant sites, and if the local supply is stopped the distant effect ceases. When fungus attacks thin skin—such as, for example, the thighs, as in *tinea cruris* (dhotie itch)—the fungus can be killed off in the horny layer with comparative ease by the use of appropriate fungicides, and can be killed off permanently. Recurrence, apart from reinfection, is rare when smooth, thin skin is involved.

It is the experience of everyone, however, that fungus affection of the feet is often difficult to cure and is prone to recur. The difficulty of cure is largely due to the great tendency that the fungus has to produce marked hyperkeratosis, which prevents the active agents from reaching it. Further, it is only in very severe cases that it is possible to prevent the patient walking about; sweating, pressure, and movement cause the disturbance of any applications in use, and also militate against the

resolution of inflammatory products. The tendency to reinfection, in my opinion, is due to the frequent involvement of the nails. It is still an open question whether it is possible to cure infected nails, except by their removal, and it would be very difficult to persuade a patient to undergo this form of treatment for what appears to him an extremely trivial condition, one which he may never even have noticed himself.

Application of Antiseptics

The difficulties which have arisen in clearing up some cases have caused dermatologists to try a very large number of different antiseptics in the treatment of these infections, but I think it is more important to lay stress on the method of applying a few known antiseptics, rather than to ring the changes on a number of different substances. My personal experience has been confined to the use of relatively few antiseptics, and I propose to confine myself to these, rather than give a list of the various remedies recommended by different observers. One must first note that one is dealing with an eczematous condition, and where the inflammation is very acute strong antiseptics and greasy preparations are not well tolerated. This applies equally to eczematous conditions caused by other micro-organisms.

In the acute bullous and vesicular types I have found the most satisfactory results are obtained by baths of 1 in 4,000 potassium permanganate and moist dressings of the same solution. It is well to prick the larger blebs before treating in this way; it is important to keep such patients off their feet, and the permanganate dressings are applied in the same way as lead lotion is applied to acute eczematous conditions—namely, without oil-silk—the lotion being applied frequently, say every hour or half-hour, and free evaporation being permitted. When the acute phase has quieted down the baths should be continued night and morning, but linimentum calaminae, with 2 per cent. ichthyol added, may be substituted for the permanganate dressings. This is applied on lint, each toe being tied up separately, and the dressings changed only twice daily. When the redness has subsided and a dry scaly condition remains then Whitfield's ointment—which is made up as follows: ac. salicyl. grains 15; ac. benzoic., grains 25; paraff. moll. 32; ol. lavand. m4; coco-nut oil ad 31 (in summer white wax may be substituted for the soft paraffin)—should be cautiously applied. It is rubbed in gently once daily, and the permanganate baths continued once daily. If any irritation is produced a return to the ichthyol should be made, and after an interval Whitfield's ointment should be tried again and continued until all scaling has ceased.

This treatment should suffice to cure a case, provided the nails are not affected. In all acute cases the horny layer exfoliates, so the difficulty of penetration of the antiseptic does not arise. Two objections have been raised to reliance on Whitfield's ointment in the treatment of fungus affections of the feet; the first is that it is not a sufficiently good fungicide. This, I think, is disproved by those who have had much experience of it clinically, but it has also been found experimentally by Gould and Carter (*Archives of Dermatology and Syphilology*, August, 1930, p. 325, and February, 1932, p. 348) to be strongly fungistatic for three of the common fungi found on the feet. The second objection is to the use of an ointment. In the chronic cases localized to the interdigital spaces there may be some force in the argument, though from clinical experience I do not think there is much in it, but for diffuse subsiding eczematoid ringworms of the feet I am convinced that an ointment is superior to any lotion, as the latter produces uncomfortable cracking of the skin, which may delay recovery, and I doubt if penetration is so good. For dry eczematous cases affecting the feet the

treatment is the same as above, but the first stage—namely, permanganate dressings—can usually be omitted. When there is much diffuse hyperkeratosis of the soles associated with a good deal of underlying inflammation again the same line of treatment is adopted, but at a suitable stage small doses of x rays (one-quarter to one-third B given weekly for three or four doses) can be added. In some cases the use of salicylic plaster is indicated.

Localized Infections

I have referred above chiefly to the more diffuse types of eruption affecting extensive areas of the feet. We will now consider the more localized types. For superficial intertriginous cases, those with only slight scaling limited to the interdigital spaces and the groove beneath the toes, Whitfield's ointment again appears to me quite a suitable remedy. Here, however, it is well to continue the treatment for some months, even though no trace of the disease is visible. I usually also order a daily foot-bath of permanganate. Whitfield's ointment, owing to the salicylic acid which it contains, and to the keratolytic properties of which it partly owes its efficacy, tends to keep up the sodden appearance of the skin. I have therefore been in the habit of ordering a bland powder, usually one part of boric acid to seven parts of talc, and have told the patient to use this alternately with the ointment—usually alternate fortnights—but this depends rather on the condition when first seen. The treatment must be carried on for two to three months after the disappearance of all scaling. When there is much horny thickening it is first necessary to deal with this. I have found daily painting with salicylic acid spirit (1 drachm to 1 ounce), followed by friction with lint, or even pumice stone, effective.

Each day before the next application the foot is soaked in permanganate and as much of the thickened horny layer as possible is rubbed or scraped away. Sabouraud has recommended the use of a barium sulphide depilatory for the same purpose, and this is probably a quicker method. After the skin thickening has been reduced, Whitfield's ointment, either in normal or double strength, is applied as above. I have tried various other preparations—tinct. iodi, chrysarobin, mercurochrome-220 soluble, Castellani's fuchsine paint, and other preparations, but on the whole I am satisfied that Whitfield's ointment, if used conscientiously, is effective and less liable to cause complications than the other drugs. Whatever preparation is used, patience and systematic treatment is necessary to effect a cure. In those cases where a small crop of vesicles develop on the foot I have found painting with Castellani's paint gives good results. The small vesicles should be punctured and the paint applied night and morning. When the lesions are well I recommend three or four weeks' inunction with Whitfield's ointment.

It is important to remember that treatment must not be confined merely to the affected skin, but must be extended to the areas surrounding it. A. Strickler and W. H. McKeever (*Arch. Derm. and Syph.*, April, 1934, p. 526) have shown fungus in the skin from one to two inches beyond the affected areas.

The Nails

The nails furnish us with a further problem. If these show clinical or microscopical evidence of involvement they should be dealt with. So great an authority as R. Sabouraud (*Med. Press and Circ.*, August 30th, 1933, p. 206) maintains that the only cure, when the whole nail is involved, is avulsion, followed by painting the nail-bed with 1 per cent. iodine in alcohol. Softening the nail with liquor potassae and scraping it away, afterwards applying antiseptics to the bed, can be used, but is more troublesome and less effective.

Recurrence

Having cured the clinical condition we still have to face the problem of recurrence. This may be due either to reinfection or to failure to kill the fungus in the skin in the first instance. Unfortunately, it is usually impossible to decide which it is; even the most careful microscopical investigations are not infallible. Knowing, however, how extensive the infection may be, and having carried out as complete a treatment as is possible, it only remains for us to try to prevent reinfection from the patient's footwear. While the patient is under treatment boilable socks should be worn next to the skin, and should be boiled frequently. When the disease is apparently cured it is best to destroy all old socks, and even then a boilable slip should be worn under the sock while any treatment is going on. Boots and shoes present a greater difficulty: if they can also be scrapped so much the better, but economic considerations cannot be entirely ignored. Short of destruction, swabbing out the boots or shoes with 2 per cent. formalin appears to be the most useful method of dealing with them.

By these methods we endeavour to prevent fungus from again becoming lodged on the feet. Can we further strengthen our defence by the use of substances which hinder the growth of fungus on the skin? O. C. Levin and G. H. Silvers (*Arch. Derm. and Syph.*, September, 1932, p. 466) find that the sweat in the fourth interdigital spaces of the feet is less acid than normal, and they believe that this encourages the growth of fungus in this region, admittedly the most common site of infection by fungi on the feet. They find that by dusting between the toes talc powder containing 1 to 2 per cent. salicylic acid the normal acidity of the sweat can be restored. It is no trouble to anyone to dust some powder between the toes each morning, and this appears to be a very useful method of diminishing the liability to reinfection. It should be continued indefinitely.

Prophylaxis

We now turn to consider the question of prophylaxis as applied to the population as a whole. Prophylaxis of foot ringworm presents very great difficulties for several reasons. It is a very common affection. It is difficult to say how common it is, because a large number of sufferers from it are unaware that they have anything wrong. Even those who notice some scaling or cracking between the toes consider it a normal event. It is certainly very common in private practice, and by no means so uncommon in hospital work as one is sometimes led to suppose. Further, even when one has pointed out to patients that they have this infection in a mild form it is exceedingly difficult to induce them to carry out a prolonged treatment for a condition which causes them no inconvenience. It is also a difficult matter, for those of us who treat these cases habitually, to say with any certainty that we have effected a cure with the methods at present available, and so long as any uncertainty on this score exists in the minds of the profession it diminishes its power in demanding protracted treatment from the patient.

Our first object in prophylaxis should be to remove all sources of infection. I have said that we have to face two difficulties: the failure of the public to recognize mild cases, and the difficulty of obtaining a certain cure. As regards the first of these difficulties, I can see no hope of slight cases coming for treatment in our present state of society. It would necessitate compulsory medical examination of the whole population and the education of the medical profession to recognize the condition, a stage which it has not yet reached. Before such a state of affairs has arrived, however, we may hope that dermatologists can offer a more successful and rapid cure of the

condition. Though it may take some time for the millennium to arrive, a great deal might be done, and in some places is being done, to diminish the dissemination of the disease by systematic inspection and treatment. It is well known that the disease is specially liable to spread in communities such as public schools, universities, sanatoria, etc. In these places systematic examination of the feet and treatment might be much more completely carried out than it is at present.

Assuming, therefore, as we must, that there are always a number of infected persons amongst us, we now have to consider how infection of the non-infected can be prevented. It is probable that most fungus infection is picked up by the toes from the floors of bathrooms, swimming baths, changing rooms, etc.—in fact, any place where infected persons may stand with bare feet and so leave scales about. There are two main methods of prophylaxis available: first, by preventing the naked foot from coming into contact with the floor, either by wearing rubber shoes or by having separate bath mats for each person; and, secondly, by using some antiseptic after contact with a possibly infected floor. For hotels and private houses the use of separate towels and bath mats would probably go a long way towards preventing infection, while the employment of rubber shoes in swimming baths might well be made compulsory. In America this question has been studied very carefully by a number of observers.

To quote only one published paper: R. T. Legge, L. Bonar, and H. J. Tempington (*Journal of the American Medical Association*, July 20th, 1929, p. 170), examining the feet of 3,100 entrants to the University of California in one session, found 53.3 per cent. of the men and 15.3 per cent. of the women had foot ringworm. At the end of a year they again examined 1,000 of these men and 997 of the women who had access to the showers, swimming pools, and gymnasiums. Of these, 78.6 per cent. of the men and 17.3 per cent. of the women were found infected. The increase in the case of the men is striking. The authors point out that the women students occupied a gymnasium with every known sanitary device. The women students and attendants were obliged to wear rubber shoes, and in no circumstances were they permitted to walk with bare feet on the floors or runways leading to the swimming pools or gymnasiums. On the other hand, the men occupied an antiquated gymnasium, where, on account of the lack or non-use of bathing shoes, and inferior sanitary facilities, the students constantly walked on their bare feet and became infected.

With regard to the use of antiseptics in public bathing establishments, these have been tried with considerable success in America. W. L. Gould (*Journal of the American Medical Association*, October 18th, 1931, p. 1300) recommends baths of 10 to 15 per cent. sodium thiosulphate solution to be placed in such a way that all users of the baths must walk through them on their way to their dressing rooms. E. D. Osborne and B. S. Hitchcock (*ibid.*, August 13th, 1931, p. 453) and E. D. Osborne, E. D. Putman, and R. J. Rickloff (*ibid.*, November 1st, 1933) in the same way use 1 per cent. sodium hypochlorite. Both claim to have prevented any spread of the disease by these methods. Needless to add, the proper flooring, and cleaning of dormitory floors, bathrooms, swimming baths, etc., adds materially to a reduction in the risks of spreading infection.

Conclusion

To sum up, we are dealing with a very common affection which, though it does not terminate fatally, and therefore appear in the Registrar-General's returns, may cause a good deal of suffering and loss of work. Owing to its insidious onset a great number of cases escape detection, and, even when detected and treated, for various

reasons do not get completely cured. We have to face the fact, therefore, that for the present there will be a large number of individuals infecting the floors of our private bathrooms, public bathing places, etc. I have pointed out that a good deal could be done to limit the spread of infection in such places, but in order to get such measures adopted on a large scale the public would have to be educated, and this can only be done through the medical profession, and the profession as a whole is still barely aware that the problem exists. Possibly the solution of the problem really rests with the dermatologist. I find myself very much in agreement with Weidman, who, in a discussion on the subject in America, made the following remarks:

"The hygiene of the problem is so complicated that I doubt whether the difficulty can be met by that route. It is impossible to sterilize all the wearing apparel of the patient; even so, there would still remain the floor coverings in our homes, hotels, shower baths, etc. It seems to me that the real approach to the millennium in the way of treatment is to establish conditions in the intertriginous locations in which the fungi work and mobilize, which will make these locations undesirable to the fungus."

May it not be that in this direction lies the solution of our problem?

MUCO-PURULENT TUBO-TYMPANIC INFECTIONS*

BY

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When the president suggested for this discussion the subject of tubo-tympanic infections I understand he had in mind its limitation to the class of ear case in which we have reason to believe that the anterior part of the tympanum is mainly involved—cases in which the perforation, if any, is present, is demonstrable, is anteriorly placed, and the discharge, if any, is predominantly mucoid or muco-purulent. We have to include also, of course, cases of low-grade infection in which perforation of the membrane does not occur, although from the appearances, the impairment of function, and the auscultatory signs on inflation we are able to presume the presence of secretion in this part of the middle ear. Further, the president suggested that we might include in the category those unsatisfactory cases exhibiting a continued or recurring muco-purulent discharge from the anterior part of the cavity after the radical mastoid operation.

We are not directly concerned on this occasion with the acute otitis media arising in the course of common colds, influenza, and the exanthemata, nor with chronic otitis media showing more or less destruction of the posterior part of the membrane with perhaps granulations or polypus. The differentiation cannot be very rigid, however, as many cases properly included may have begun as conditions indistinguishable from the cases we are excluding, and may be looked upon as residuals from the latter.

Why should a middle-ear infection spend its energies on the anterior part of the cavity in preference to the posterior, or (as may be the more correct form of the question for some cases) why should the infection of the anterior part of the cavity continue when it has subsided in the posterior part?

* Read in opening a discussion in the Section of Oto-rhinolaryngology at the Annual Meeting of the British Medical Association, Bournemouth, 1934.