PROCEDURES IN GENERAL PRACTICE

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RINGWORM OF THE FOOT

BY

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The dermatologist's chief concern with infections of the foot is in regard to those attributable to ringworm. This, it might be thought, should represent a relatively simple problem in diagnosis and treatment, the invasion of the skin by a specific organism causing a characteristic and recognizable local reaction. We need only examine a portion of the extensive literature to perceive how devoid of this apparent simplicity the subject has become. As there can be few practitioners who do not number among their patients one or more victims of this prevalent scourge a knowledge of the clinical picture and of the methods of prevention and treatment is of great importance.

Although often looked upon as a recent problem, this is far from the truth, for so long ago as 1892 Djelaleddin-Moukhtar clearly described the condition and its parasitic nature in a communication to the French Dermatological Society. His pioneer work, and indeed his just claim to priority of discovery, were generally overlooked, and it was not until some few years before the war of 1914-18 that the significance and importance of the characteristic lesion between the toes began to be appreciated. I well remember, when as a bacteriologist I assisted the late Dr. J. J. Pringle, hearing him say that foot ringworm first appeared in London after the South African War, and, further, that both it and tinea cruris were remarkably uncommon in women. The relative freedom of women from infections of this kind is perhaps worthy of comment, and in this connexion some observations collected by W. N. Goldsmith may be recorded here. Thus in the University of California in 1928, 51.5 per cent. of the new men students and 15.3 per cent. of the new women students had clinical evidence of foot ringworm (Legge, Bonar, and Templeton). After one term with attendance at the gymnasium the percentage in the men increased to 78.6, but in women only by 2. Similar figures are given for other American universities, showing that this difference between men and women was not attributable to local conditions or modes of dress. So much for Dr. Goldsmith's collected records. To these I would add a personal observation. While outbreaks of tinea cruris are embarrassingly common in boys' schools I have never heard of or come across a similar epidemic in establishments for girls. This may be mere chance, and the above statements may be criticized and corrected by others with a contrary experience. Although unconnected with the present problem there is evidence from another direction that the soil profoundly influences the growth of the ringworm fungus—in the spontaneous cure of ringworm of the scalp at or about puberty, and in the complementary phenomenon of the immunity from ringworm infection of the hair on the adult head.

From what has been said it will be appreciated that ringworm infection of the foot is now a widely distributed complaint: it has something in the nature of a social qualification, being commonly met with among the upper and middle classes, but only rarely in hospital patients. This is, however, not a question of a predisposed soil as in the sex distribution, but rather an effect of the habit of taking baths, the bathroom floor providing

a common medium for spread of the disease. It may thus be said paradoxically that foot ringworm is a penalty of cleanliness.

Of the very many varieties of ringworm fungus, amounting to more than forty species, only two are now accepted as the responsible agents for the disease as it affects the foot. This is a simplification of the former mycology, and is justified on the grounds that previous investigators had sometimes independently described the same parasites under different names. The two varieties responsible are *Epidermophyton inguinale* and *Trichophyton pedis*, the latter being probably identical with the better-known *Trichophyton gypseum*. Besides being distinguished by their different cultural characteristics these two varieties differ somewhat—in theory at least, and probably to a large extent in practice—in their clinical reactions. Thus *Epidermophyton inguinale* is held to produce the white patches between the toes and *Trichophyton pedis* the vesicular lesions. Of greater importance, because of its effect on prognosis and treatment, is the affinity of the *Trichophyton pedis* for the nail substance, and, in contrast, in theory at least, the opposite quality of *epidermophyton*. In its simplest form ringworm of the foot is characterized by a patch of thickened white skin between the little and next toe, sometimes accompanied by a painful fissure. In more pronounced degrees the sodden epidermis accumulates in similar fashion within the other interdigital spaces; and a further stage is marked by exfoliation, with some degree of redness of the skin at the base of the toes. On the instep and sole exfoliating and vesicular patches add to the complexity of the clinical picture, the different phases and degrees being governed by the variety of organism and the reaction of the patient. A remarkable feature observed in some cases is the unilateral distribution, only one foot becoming infected. Asymmetry such as this, especially when of long standing, is not easy to explain, because the interchange of socks from foot to foot should easily and constantly carry infection from one side to the other. Finally, in a considerable proportion of cases the nails are secondarily infected, becoming in consequence brittle, opaque, and deformed.

Diagnosis

This may rely entirely on the objective characters of the eruption or on laboratory methods, or on both. Diagnosis which only takes into account the appearances of the lesions is open to some degree of error because there are various non-parasitic conditions that closely mimic ringworm. In cases of suspected but unconfirmed ringworm the application of a fungicide becomes both a method of treatment and a therapeutic test. Fungicides have necessarily a high concentration of active principles: as such they exercise a beneficial action on an infection but an injurious action on non-parasitic lesions, such as eczema or dysidrosis. It is thus important to take note of the form of the reaction and to avoid the continued imposition on the affected skin of a remedy against which it has clearly declared its resentment. The observer will, however, usually endeavour to confirm the clinical diagnosis by direct microscopical examination. For this purpose a small curette is used, material being taken preferably from the more active part, or margin, of the eruption. To reach the skin containing the fungus fairly

vigorous use of the instrument is required. The superficial tissue so gathered is spread on a slide, soaked in liquor potassae, covered with a slip, and gently heated to accelerate the clearing of the specimen. If mycelium is present the observer may be so fortunate as to discover it at once, but it is more often necessary to go over the whole specimen methodically, and some time may be spent before the fungus is found. It should be pointed out that the presence of mycelium in the scrapings so examined is not unequivocal proof of a ringworm infection: the mycelium may represent one of the common skin monilias which are present in both damaged and healthy skin, especially in regions where heat and moisture favour their growth. Thus the final and complete proof may rest upon the cultivation of the specific organism on laboratory media, a procedure requiring special technical knowledge and the resources of a pathological laboratory. Research of this kind can only be required in special cases and circumstances. The practitioner will as a rule be content to rely upon the local signs, confirming the diagnosis, so far as this can be done, by direct microscopical examination of material removed with the curette from the affected regions.

Differential Diagnosis

At least three conditions have to be considered under this heading. The first, *acrodermatitis perstans*, bears a very close resemblance to the ordinary conception of palmar or plantar ringworm. Although often classified among the rarer skin diseases *acrodermatitis perstans* is by no means very uncommon, and thus may be met with from time to time in general practice. Its characteristic features are briefly summarized as follows. The eruption is confined as a rule to the palms and soles, showing a preference for the palmar and plantar margins, and the instep. One or all of the extremities may be affected, and the eruption, although free from any contagious quality, may spread from one region to another. The patches of affected skin are red, with some degree of scaling, often with a well-marked peripheral scale: within the patch are numerous little pustules, or lesions resembling pustules, the contents of which in their early stages are invariably completely sterile. A mild chronic form of *acrodermatitis perstans*, with vesicular and pustular elements only, has been described by S. E. Dore. The remarkably persistent and rebellious qualities of the eruption distinguish it from *dysidrosis*, while the absence of fungus on direct examination or on culture excludes ringworm. In doubtful cases the therapeutic test, as mentioned above, can be of considerable service. The chronicity of the eruption and its irregular course, characterized by the development of fresh patches in new regions while others in the original positions are clearing up, suggest an endogenous factor (*acrodermatitis perstans*) rather than a local infection (ringworm).

The second condition to be considered in the differential diagnosis is *eczema*, and in this connexion it is significant that in many of the earlier descriptions of foot ringworm the qualifying term "*eczematoid*" has been used. Of the *eczema* reaction nothing special need be said: it is of such a kind as comes within the ordinary clinical conception of this state—a red, swollen, weeping surface either confined to the toes or extending backward over the foot. The accompanying white sodden skin between the toes seems to disclose the causal ringworm infections, and such an eruption may in fact be a true *eczematoid* ringworm. This should not at once be assumed, for all these objective characters may represent an *idiopathic eczema*—that is,

one in which the ringworm fungus plays no part either as a causal or as a contributory factor. Nor should it be forgotten that a moist skin of this kind invites the company of one of the common skin monilias, the mycelium of which may on microscopical investigation be found in the interdigital skin, leading to some confusion because of its resemblance to ringworm. These several conditions, although they share a common reaction, call for very different, and indeed antagonistic, kinds of treatment; prudence will therefore demand a cautious approach, using, at first at least, simple rather than severe remedies.

MONILIASIS

Moniliasis, to be considered last in the differential diagnosis, perhaps merits a separate place on the ground that it is an independent infection. It is taken here as a matter of convenience. Although Langenbeck discovered the parasite of thrush as long ago as 1839—without, it may be added, appreciating its significance—it is only within comparatively recent times that dermatologists have sought to attribute certain dermatoses to pathogenic monilias. While several varieties of the fungus have been described, a differentiation into types has not the same practical importance as in ringworm, because there is no specific connexion between the nature of the lesion and the variety of the fungus. Thus in the foot diverse monilias are met with both in the vesicular eruption and in the patches of interdigital white skin indistinguishable from ringworm. And, as it may be supposed, in such cases a false diagnosis of ringworm has often been made on clinical grounds and seemingly confirmed by finding mycelium in skin taken for direct microscopical inspection. *Monilia* is present on the skin of every individual, and in the absence of any abnormal condition can be cultivated from beneath the nail folds and from regions such as the groins, axillae, and scalp. The pathogenicity of the fungus is of a low order, and it would seem to require a special soil—for example, a moist seborrhoeic skin—for its profuse development. It is thus found in seborrhoeic and other eruptions, and it is then not easy to decide how far it is directly causal and how far merely a contributory factor. It is therefore evident that, short of the evidence of a culture made on laboratory media, the differentiation between moniliasis and ringworm may be very difficult.

Side-effects

Mycotic infections of the foot may remain strictly localized or they may induce distant reactions, either by the direct spread of the infection or indirectly by dissemination of the fungus or some derivative of the fungus through the blood stream, inducing a distant allergic eruption in a sensitized skin. Direct infection from the foot to the groins, axillae, and, in women, to the submammary regions is not uncommon, and thus an unsuspected and unrecognized foot ringworm may account for repeated attacks of *tinea cruris* in an individual or even an epidemic in a school or institution. In all these cases inspection of the feet should form a part of the ordinary routine. The indirect or allergic reactions have an academic as well as a practical interest. It has long been known, indeed since Jadassohn first described the lichenoid trichophytid more than twenty years ago, that an inflammatory ringworm might be followed by a generalized (allergic) eruption. Recently it has been sought to explain certain *eczemas* on the basis of a similar allergic mechanism: thus it is held that a proportion at least of the *dysidrotic* eruptions occurring on the hands are *epidermophytid*—that is, an allergic *eczema* secondary to *epidermophyton* infection of the foot. Every form of *dysidrosis* cannot be explained in this way, because

an associated ringworm of the foot is often wanting. The critical test should rely upon the disappearance of the hand eruption when the foot infection is cured, a result by no means always met with. There is also described a dysidrotic moniliid of the hands considered to be similarly related to a moniliasis of the foot. In both these cases theory has possibly outmarched its legitimate bounds and some of these supposed allergic reactions may perhaps be attributed as much to wishful thinking as to an exact pathology.

Treatment

The treatment of ringworm and allied infections should take into consideration the destruction of the fungus with a suitable fungicide and the prevention of reinfection from socks, stockings, and even shoes and floors. Of the various fungicides Whitfield's ointment still takes pride of place. A useful modification consists of benzoic acid, 15 grains; salicylic acid, 15 grains; petroleum jelly, 1 oz. This can be applied to the foot at night and is usually well tolerated. It may also be applied to ringworm of the groin and axillae. Where a desiccating effect is sought—for example, in the treatment of the interdigital infections with accumulations of sodden white skin—the same amounts of the above ingredients are dissolved in an ounce of spirit and the solution is used as a paint. In this form the remedy is more active and more severe. Castellani's fuchsin paint is an alternative treatment, and may be substituted for the above ointment or solution. The thickened white skin which protects the buried fungus from the action of the fungicide has been referred to. Mechanical removal of this skin may be attempted, or a barium sulphide depilatory preparation may even be required. As a measure against reinfection the patient should wear cotton toe-caps, which must be boiled. The patient should also have a rubber bath-mat for exclusive personal use, so as to avoid infecting others.

Eczema Reactions

Mention has been made of the eczema reactions which are superimposed upon a foot ringworm or are mistaken for that condition. Where such reaction is present preliminary treatment is called for on the following lines. The toes are separated by strips of gauze, and the foot is covered with gauze, kept constantly wet with the following: glycerin of subacetate of lead, 1 oz.; glycerin, 1 oz.; water to a pint. This lotion can be replaced at a later stage by Lassar's paste, to which liquor picis carbonis 20 to 40 minims to the ounce may be added. Sometimes the following paste is found useful as a drying and decongesting application: glycerin of subacetate of lead, 2 drachms; glycerin, 2 drachms; powdered starch and powdered zinc oxide, 1 drachm of each.

The swollen toes and foot may also represent an eczema complicated by a staphylococcal infection, possibly superimposed on interdigital ringworm. In these cases good results are obtained with dressings of acriflavine solution in water, 1 in 20,000. When the pronounced effects of the eczema phase have been brought under control and the skin has settled down to a stage when it will tolerate such things, then, if any actual ringworm infection is revealed, treatment with a fungicide can be begun. On these lines most such foot infections, and their companion processes, can be cleared up, but there will always remain a considerable proportion which continue to provide a problem not easily solved. In some of these cases the rebellious quality may result from infections of the toe-nails, which constantly reinfect the skin.

MEDICAL BENEVOLENCE IN WARTIME

Sir Thomas Barlow presided at the annual meeting of the Royal Medical Benevolent Fund, which took place at the house of the Royal Society of Medicine on April 22. The treasurer, Dr. Lewis G. Glover, said that the financial position of the Fund, notwithstanding war strain, was not altogether unsatisfactory. The subscriptions and donations for last year, which amounted to £13,192, were lower by £440 than the year before, and the allocation of £1,237 from the Charities Committee of the British Medical Association was down by £296. It had been the practice of the Fund to invest all legacies so as to have a capital sum the interest from which would ensure the annuities which the Fund provides, but this arrangement has been temporarily suspended. Legacies received during 1939 before the outbreak of war, amounting to £3,491, have been passed to capital as usual, but those accruing during the last four months of the year, amounting to £2,255, have been kept in liquid form as an emergency reserve to supplement diminishing subscriptions. On the other side of the account the administration expenses are down by £129, and expenditure on appeals and publicity by £54. The excess of expenditure over income is only £548. The value of the Fund's investments at the end of the year was £225,377.

Sir Thomas Barlow mentioned appreciatively the work of the Ladies' Guild, which does much to augment the Fund, and also testified his gratitude for the response to his Christmas appeal, which, although made in wartime to a profession very largely scattered, and with many uncertain of their future, brought in £1,061, or practically the same as the year before. He took the Christmas offering to the Fund as an expression of confidence in its administration. Mr. Handfield-Jones, the honorary secretary, described the evacuation of the Society's offices from its long-familiar haunts in Chandos Street, Cavendish Square (the termination of the lease of which coincided, rather fortunately, with the dispersal), and the carrying on of the secretary's work in a cottage in Essex. The staff and records, however, have now been reassembled on the outskirts of London, at Putney, where they will probably remain for the duration of the war. He spoke in terms of high praise of the members of the staff, who had carried on under difficult conditions without the neglect or overlooking of any item of the Fund's work.

A vote of thanks was accorded for various assistance to the Fund rendered by the British Medical Association and its Charities Committee, the Medical Insurance Agency, and the medical and lay press. The officers and committee of management were re-elected, and two ladies—Miss Elizabeth Bolton and Dame Janet Campbell—were added to the vice-presidents.

Speaking at the annual meeting of the Central Council for the Care of Cripples, Dame Georgiana Buller said that the clinical treatment of cripples had made enormous strides during the past twenty-five years, but this was only half of the problem. There remained the problem of the permanently disabled. Remedial work helped the injured person to the maximum restoration of function in the shortest possible time and also to recovery of the habit of work. In many cases results could be achieved much more quickly by manual occupation suited to the particular disability than by massage and physical therapy alone. Remedial work as part of rehabilitation was quite distinct from vocational training, but the two phases were so closely interdependent that they could not be entirely separated without detriment to both. The results of short-term training for many different types of employment had shown that even very seriously disabled men could hold jobs on equal terms with the able-bodied. A small number of cripples would always need sheltered conditions of work, with perhaps a certain amount of medical supervision. The rehabilitation centre, said Dame Georgiana, should include, in addition to the occupational therapy or remedial department, the vocational training department, and sheltered workshops, hostels for residents, recreation facilities, a medical block, a workshop for repairing and adapting surgical appliances, and an advice bureau.