electric lamp, whilst its position is accurately maintained by the pressure of a light spring.

Such an arrangement eliminates entirely all risk to the operators, since the controls may be placed outside the treatment room, just as with modern x -ray apparatus. It also renders quite unnecessary the great masses of lead usually employed in these units, since all that is required is the protection of the patient. A unit of the size of

FIG. 2.—Short-beam unit. Radium advanced.

FIG. 3.—Short-beam unit. Radium retracted.

this model, if made of lead, could safely accommodate 5 grams of radium, with adequate protection for the patient and for persons at a reasonable distance. The convenience and economy of such a reduction in the size and weight are very obvious. A small refinement is the introduction of the radium along a curved track, eliminating the danger point which might otherwise lie behind the apparatus.

A Short-beam Unit

The methods I have so far described are for the most part well known, apart from the modification which I have indicated. On this very special occasion I should like to deal with the possibilities of the future, and show a model involving principles which I have only recently explored, but which I feel justifies serious consideration. It is based on the principle of pneumatic transference, so that the radium is only in the proximity of the patient when in actual use. It enables one to obtain from 1 gram of radium an effect almost equal to that in an ordinary 5-gram unit, although, of course, over a smaller area.

The body of the unit consists of a rounded cylinder of platinum 3 cm. in diameter and 5 cm. in length, with an axial cavity ending in a conical aperture 20 mm. in diameter. Radiation is effected through this aperture, whilst in every other direction there is an effective screenage of at least 10 mm. of platinum. Since the radium can be placed at will at any point from 15 to 35 mm. from the aperture, considerable variation is allowed in the surface and depth dose and in the dimensions of the beam. The aperture is closed by a glass plate, so as to permit of a visual setting of high accuracy.

The apparatus is sufficiently small to be actually introduced into the mouth, and the aperture placed in contact, for example, with the tonsil; the radiation from one gram of radium in this position is so intense that a few minutes' exposure would suffice. The small aperture of the instrument allows of a large number of ports of entry being employed, while with the varying position of the radium any depth dose desired may be obtained. Although the apparatus has not yet been employed in actual practice I am sufficiently confident of its physical soundness to suggest it to you as a fresh method of attack.

Conclusion

The methods of radium therapy are developing so rapidly that I have only been able to touch upon their broadest features. In combination with deep x rays and diathermy, we now have weapons by which we can attack cancer in almost all its forms, and in many with the certainty of success. But success will depend, above

everything else, upon a precision which is not demanded in any other branch of surgery, and an accuracy which challenges the resources of the physicist. It is upon the combined efforts of the surgeon, the radiologist, the biologist, and the physicist that the future of radium therapy will depend.

REFERENCES

- ¹ *Radium and Cancer*, Heinemann, London, 1934.
- ² *Brit. Journ. Radiol.*, 1935, viii, 385.

MYCOTIC INFECTIONS AND THEIR TREATMENT*

BY

JOHN C. BELISARIO, M.B., CH.M.SYDNEY

HONORARY ASSISTANT PHYSICIAN FOR DISEASES OF THE SKIN, THE ROYAL PRINCE ALFRED HOSPITAL; HONORARY PHYSICIAN FOR DISEASES OF THE SKIN, THE NEW SOUTH WALES MASONIC HOSPITAL

Since the time allotted for this paper is short, I propose to outline as far as possible the salient features of a type of dermatomycosis that has proved to be one of the most troublesome of all skin diseases with which the dermatologist has to deal. Vesicular eruptions of mycotic origin occurring on the feet and hands are often extremely rebellious to treatment of all kinds and, even when beneficially influenced, are frequently characterized by a seasonal recurrence. The condition is frequently encountered in Sydney, and I hope to put forward some helpful ideas on treatment.

Clinical Considerations

The different clinical varieties which are encountered in Sydney are as follows.

1. The superficial vesicular type, which occurs on the fingers, palms of the hands, toes and soles of the feet, and even extends on to the backs of the hands, the forearms, and the dorsa of the feet and legs when the process is severe.
2. The more deeply seated vesicular eruption, which is more limited to the fingers, palms, toes, and soles. Both

* Paper read in the Section of Dermatology at the Annual Meeting of the British Medical Association, Melbourne, 1935.

types may occur simultaneously, either generalized or with a patchy, circumscribed distribution. The size of the vesicles ranges from that of pin-points to sago grains, which may resolve without rupture, up to that of large bullae produced by the confluence of many vesicles.

3. The scaling of eczematoid type, in which clusters of vesicles are found at some stage or other, principally in the eruptive stage. The eruptions commonly occur in discrete patches on the palms of the hands, the wrists, and the soles and sides of the feet. I have found this type the most resistant to treatment.

4. The intertriginous type, which remains localized to the interdigital spaces.

5. The hyperkeratotic or verrucose type, which is again based on primary vesiculation and localized in circumscribed discrete form.

Allergic or Sensitization Eruptions.—Many of the vesicular manifestations represent an allergic reaction of the tissues to toxins liberated from primary foci of infection, which are most commonly found in the toe interspaces or nails. Most will agree that mycelium or spores are frequently difficult to demonstrate under the microscope in scrapings from many vesicular lesions on the hands, even when they are found in abundance on examination of material from the toes of the same individual. While admitting that many of these cases are epidermomyces, it is often difficult to prove this fact, even with the aid of trichophytin, if the patient has been engaged in an occupation in which the skin may be exposed to external irritants, when the clinical appearance of the hands is often indistinguishable from some types of mycotic infection. If, however, the serum from either type of case is tested, it will be found to have a neutral or alkaline reaction comparable to the reaction of sweat on the palms and soles, as will be seen in due course.

Seasonal Occurrence.—The usual time for mycotic eruptions to make their appearance is in spring or early summer. Latterly, however, I have noticed more frequent outbreaks occurring in autumn and even in winter, both as new eruptions and in cases of old standing. This may possibly be accounted for by an increased amount of exercise, either in occupational or pleasurable pursuits, as will be seen from the aetiological factors to be mentioned.

Aetiological Factors

These may be summarized as follows. Warm weather exerts an aggravating effect, which produces seasonal recurrences. The condition is found more commonly in men than in women. It is mainly seen during the period of greatest activity and possibility of exposure to external irritants, as is evidenced by the comparative rarity with which children and people over 50 are affected. (This statement does not include tinea circinata or tinea tonsurans in children.) Certain foods, toxic foci, and neuro-circulatory disturbances, such as worry and overwork, may be predisposing factors. Intestinal toxæmia and heredity also play their part. Orthopaedic conditions of the feet are frequently present. Lastly, occupation and mode of exercise exert a definite influence.

I believe that the explanation of all these factors lies to a great extent in the composition of the individual's sweat. Levin and Silvers, Marchionini, and others have shown experimentally that the normal reaction of sweat on the glabrous skin has a pH value ranging from 3.5 to 5.5. This is largely due to evaporation, the natural acid reaction of the horny cells, and the sebaceous gland secretion, since sweat alone is neutral or faintly alkaline. When the continuity of the keratin layer is broken evaporation is delayed. It is likewise delayed between opposing surfaces such as the toe interspaces and axillae, and the natural acid protecting cloak of the skin

in these areas verges toward the alkaline side. The sweat of the palms of the hands and soles of the feet has been found to be neutral or frankly alkaline. It seems logical to consider that this is due to the absence of sebaceous glands, and also, in the case of the feet, to prevention of evaporation. Cornbleet has shown that the natural acid cloak of the skin has a certain inactivating influence on the growth of staphylococci, and Levin and Silvers have demonstrated that the epidermophyta grow best in a medium with a pH value ranging from 6.8 to 7.2. Marchionini also found the reaction of infected fungal vesicles to have a pH value of 7. In the case of the serum from the vesicles of epidermomyces, he found the pH value between 7.2 and 8.2.

These findings, together with my own experience of the alkalinity of vesicles produced by fungi, point strongly to the assumption that the predilection of mycological infections for the palms and soles is due to the alkaline tendency of the sweat in these areas. In the groins and axillae, where epidermomyces is also commonly found, the apocrine glands secrete a sweat with a lower hydrogen-ion concentration than that of the eccrine glands distributed over the rest of the body. In areas which are richly supplied with sebaceous glands, such as the face, scalp, upper back and chest, the epidermophyton is rarely, if ever, found. Another fact worthy of note is that acne vulgaris, which commonly affects these latter areas, is not an accepted inhabitant of the more alkaline axillary regions.

In passing, it is interesting to bear in mind that the hyperactivity of the sebaceous glands at puberty, through increasing the hydrogen-ion concentration of the scalp sweat, may afford a feasible explanation of the disappearance of certain small-spore ringworms at that age. The experiments of Cornbleet and of the Lieberthals, and common daily experience, show the large part which orthopaedic abnormalities play in the increase in sweating of the feet, which, in company with a diminution of the vascular circulation, lowers the skin resistance and improves the pabulum for the growth of fungi. Here again it seems apparent that the fourth toe interspace is most frequently selected by fungi because it is generally the most compressed by footwear and suffers greater diminution of both the circulation and sweat evaporation. It will readily be seen from these findings that the aetiological factors mentioned may all play some part in the alteration of the sweat reaction towards the alkaline side.

Treatment

I do not intend to deal with the legion of applications and remedies which have been used in the treatment of these conditions, but will confine myself to those methods which have proved most successful in my hands. I wish to lay particular stress on the use of fresh lemon juice, which appears to offer an inviting field for further research. General treatment has little effect on the condition, with the possible exception of the theoretically beneficial influence of a diet tending to increase the acidity of the tissues. Local treatment has been mainly directed towards mildly acidifying the affected parts with medicaments of a fungicidal nature. This may be seen from the work of Levin and Silvers, in which they showed that the pH value of the commonly used preparations was mostly less than 7. Likewise, it is interesting to note that the independent experiments of Liechti and Gans showed that one of the immediate actions of x rays was to increase temporarily the acidity of the tissues. Kaplanski and Solowitshik have also demonstrated an increase in the hydrogen-ion concentration after the application of ultra-violet rays.

Marchionini and Cornbleet mention the use of weak acids such as boric acid. This acid, possessing buffer

qualities, seems theoretically the most rational type to employ, but it soon loses its effect owing to an inherent compensatory ability of the skin to assume a permanent alkaline reaction. On the other hand, the use of hydrochloric, lactic, tartaric, carbolic, and other acids, the acid effect of which is due rather to their molecules than to their hydrogen-ion content, tends later to become irritating. In view of these facts, and after reading an article by Armstrong in the *British Medical Journal* which described the relief obtained by the use of lemon juice in vesicular dermatoses of external irritant origin, I decided to try its effect on those of mycotic origin.

For the last four months I have compared the results of therapeutic concentrations of some of the aforementioned acids with those obtained by the use of lemon juice, which were definitely superior. Although I have not treated a sufficient number of cases to draw any accurate conclusions it would seem that the vitamin content in fresh lemon juice might play some minor part in addition to the citric acid content. This acid has the added advantages of possessing buffer qualities, as well as being endowed with a greater number of hydrogen ions than boric acid.

It is my practice to advise the patients to bathe the affected parts in a pint of hot water to which is added a drachm of liquor plumbi subacetatis fort. night and morning. This serves to increase the vascular supply, and is shortly followed by a sedative effect. An application is then made of 1 per cent. of ammoniated mercury in lanolin to prevent possible pyococcal superinfection. In addition, the patients are instructed to rupture the vesicles with a sterilized needle, and to rub the affected parts four or five times daily with half a lemon from which the peel has been removed. Where irritation is a marked feature the relief is dramatic, even though a temporary sensation of smarting may be experienced. The vesicular stage of the disease resolves under this treatment more quickly than with any other I have used.

In the later stages, when a certain amount of eczematization has supervened, the lemon juice is diluted, or dispensed with, and weak tar or ichthyol applications to which salicylic acid may be added are then employed. These applications may be supplemented if necessary by the use of x rays. However, the use of lemon juice materially lessens the duration of the condition: assisted by an acid powder it is particularly beneficial in the intractable toe infections.

The other applications which I have found most beneficial are one part in four thousand aqueous perchloride of mercury baths in the acute stages, associated with the weak mercurial ointment previously mentioned. This is followed later by a weak salicylic acid and tar or ichthyol ointment, assisted by fractional doses of x rays preferably delivered as one-quarter of an erythema dose weekly for four or more doses. I have found x rays to be almost infallible in the temporary alleviation of the condition. Sometimes a permanent cure will result, although the great majority of cases recur, occasionally within several weeks, but more commonly when the next summer approaches.

If an infected focus remains between the toes or in one or more nails this must be eliminated to prevent recurrence. As far as the nails are concerned the difficulty is known to all, since surgical removal, radiation, and other means may have to be employed. Curettage of the toe interspaces twice weekly, and the application of 2 per cent. of cignolin in benzol night and morning, followed by the application of a powder containing salicylic acid 8 parts, boric acid, thymol di-iodide, and zinc oleate—of each ten parts—in prepared talc, has produced the most satisfactory results in my hands, until recently, when lemon juice was substituted for the cignolin lotion.

In those cases where the fungus element has died out, and eczematization or sensitization to external irritation remains, the removal of toxic foci, such as infected teeth roots or tonsils, will sometimes help to eradicate the condition. This is often assisted by the administration of an autogenous vaccine made from the organisms present in the toxic focus, and will sometimes produce a cure in chronic lesions in which fungus is still present. Intravenous injections of calcium either as the chloride (afenil), the gluconate (Sandoz), or the combination of gluconate and thiosulphate (ifah) in doses of 10 c.cm. thrice weekly in conjunction with fractional doses of x rays, will often produce excellent results. One further treatment, with which I have had complete success in four very chronic eczematized cases, is high colon lavage three times a week for several weeks with two pints of normal saline solution, followed by one pint of normal saline solution containing one drachm of ichthyol, which is left in the colon. This routine is accompanied by a restricted but nutritious diet and copious fluids.

SOME TOXAEMIAS OF ANIMALS DUE TO ANAEROBIC ORGANISMS

A COMPARATIVE PATHOLOGICAL STUDY OF RECENT WORK WITH PARTICULAR REFERENCE TO THE TOXAEMIA OF INTESTINAL OBSTRUCTION IN MAN*

BY

H. A. WOODRUFF, M.R.C.S., L.R.C.P.
M.R.C.V.S., B.Sc.

PROFESSOR OF BACTERIOLOGY, UNIVERSITY OF MELBOURNE

The conditions in which these organisms are of material importance in human infections fall into three main groups: (1) wound infection with gas gangrene, (2) puerperal infection, and (3) toxæmia in intestinal obstruction and peritonitis.

Of the first I shall say little. The circumstances or accessory factors favouring infection of wounds with the anaerobic sporing bacilli are well known, and this type of infection presents no particular problem. It is nevertheless desirable to keep in mind the fact that there are such essential accessory factors when considering other types of anaerobic infection. Of the second group—puerperal infections—it may at once be said that they are in the main complications or sequelae of abortion, and not of normal labour. They are therefore very closely allied to the first group of wound infections. Attention cannot fail to be attracted to them because of the very high mortality associated with them, and the difficulty of devising any very successful treatment.

The third type of anaerobic infection—namely, that alleged to cause the toxæmia associated with intestinal obstruction and general peritonitis—is easily the most interesting group, and despite a very considerable amount of experimental work and clinical observation there are many points relating to it which are obscure. At present it may safely be said that there is no agreement with regard to the pathogeny of the toxæmia associated with intestinal obstruction. The most noteworthy contribution to the subject of recent years was that by B. W. Williams (1926), in which he pointed out, in the first place, the striking resemblance of these cases to the toxæmia of gas gangrene; secondly, the frequent presence of many species of anaerobe in the alimentary tract; and thirdly,

* Abstract of a paper read in opening a discussion in the Section of Pathology and Bacteriology at the Annual Meeting of the British Medical Association, Melbourne, 1935.