REFRESHER COURSE FOR GENERAL PRACTITIONERS

CHILBLAINS

BY

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The incidence as well as the mystery and fascination of the chilblain is reflected in the advertisements and sale of proprietary remedies, but in its simplest form the lesion presents no great difficulty in diagnosis or treatment. An itching, erythematous, and congested superficial swelling on fingers and toes, it is a common winter affection experienced at some time by the majority of the inhabitants of temperate and cold climates.

Aetiology

The onset of chilblains is chiefly determined by temperature and humidity. Exposure to cold and damp followed by warmth—from a coal fire or hot-water bottle—is the common sequence. Cold causes a contraction of the smaller arterioles in the skin of the extremities, which slows the superficial circulation to conserve heat. In certain individuals cold or damp and subsequent warmth injure the superficial vessels and produce the characteristic signs and symptoms of a toxic erythema. Not all people will react in this manner, nor will the same individual react unchangingly throughout his life. It is difficult to provoke chilblain reactions experimentally in those not susceptible, and the same causative climatic conditions will provoke the condition in a certain proportion only of the population at one time.

The young, especially at puberty, are more susceptible than adults. There is a tendency for the susceptibility to recur (or manifest itself for the first time) at the menopause and in old age. States of moderate ill-health and debility may increase susceptibility: during pregnancy chilblains are rarely seen and the tendency may then disappear.

A poor peripheral circulation is not dependent entirely upon peripheral factors or exposure, though these factors play an important part in affections of the legs in girls and young women who wear short skirts and thin stockings. The peripheral circulation is, however, dependent upon and responsive to the general body temperature. Chilblains are not seen in warm climates and are uncommon in those who live or work in centrally heated buildings. Their rarity in North America is attributable to central heating in houses and buildings, to heated transport, and to suitable clothing. It would seem that the body as a whole must be kept at a reasonable temperature to maintain vascular tone in the extremities, especially in the legs, which are further embarrassed by the erect posture.

Exercise plays a large part in the maintenance of circulatory tone, and in this connexion occupation is important. Winner and Cooper-Willis (1946) in a valuable review of chilblains in Service women found the incidence higher in office workers than in those in active occupations. Office workers suffered from chilblains on their hands and those whose work involved much standing got them on the feet.

If general nutrition falls short of proper requirements vascular tone will undoubtedly be influenced, but in the ordinary way diet does not play a part in the development

of chilblains; nor is there convincing evidence that calcium is important, though it is highly favoured by many sufferers and this clinical evidence cannot be entirely ignored. Wright suggested that there was altered coagulation time in patients suffering from chilblains, but this has not been confirmed (Hallam, 1931). There is certainly no evidence of calcium deficiency in these patients, though it is true that thrombosis may be seen microscopically in the chilblain and there is an altered permeability of vessel walls.

The tendency to chilblains is essentially an individual affair. Under the same general climatic conditions lesions will arise in one area and not in another. This is probably dependent upon conditions of temperature and humidity, but may be caused by other physical factors, meteorological or geological. Again, the conditions of climate or location favourable to one individual may be unfavourable to another. There is often a familial tendency to chilblains, and occasionally the affection is persistently unilateral.

Psychological and nervous influences also bear upon the behaviour of the disease. It is partly due to the former that the determination of causative factors is difficult and that the effects of treatment are not easy to assess. It is natural that neurological factors should bear upon vascular tone and response. A striking illustration of this is the common observation of chilblains on a limb affected by anterior poliomyelitis. After sympathectomy the release of constrictor influences protects against chilblains. There is often a close link between nervous influences and endocrine factors.

Differential Diagnosis

The diagnosis may not be easy when chilblains appear on the ears or nose, on the breasts, buttocks, upper arms, or lower legs, or when fat impairs a naturally sluggish circulation—for example, on the inner aspects of the knees. The conditions determining the lesions are the same, however, and it is the anatomical features of the site affected which modify the appearances. On the lower legs, breasts, buttocks, and upper arms the lesions are much larger and more diffuse and may involve an area some inches in diameter. For this reason, no doubt, they are often symptomless. On the ears there is little tissue to allow swelling; burning and irritation may be intense, blistering may occur, and atrophy or calcification may follow. Vesication or blistering may occur spontaneously or from friction or treatment. This may lead to superficial erosion, or to ulceration and secondary infection.

Atrophy and calcification following chilblains of the ear.

Inflammatory lesions of chilblain type on the legs may be confused with erythema nodosum or erythema induratum (Bazin's disease), which occur within the same age period.

Haemorrhagic chilblains of legs.

fading, the lesions give the characteristic appearance of bruising.

Erythema Induratum.—This lesion (commonly a gummatous tuberculous reaction) is deep-seated and infiltrating, and may proceed to form a deep ulcer with a sloughing base. In chilblains the affection is superficial. The more superficial and smaller gummatous tuberculide of the dermis (papulo-necrotic tuberculide) may also be mistaken for chilblains on fingers and toes, but it is firmer, infiltrated, ulcerates, and does not itch.

Nodulo-ulcerative lesions on the legs of obscure aetiology occur predominantly in middle-aged women, but are sometimes seen in the young. The condition resembles erythema induratum, and is thought to be vascular in origin, probably arising from thrombosis and necrobiotic changes; it may be associated with a "chilblain circulation" and may respond to sympathectomy.

Drug Rashes.—Some drugs, in particular sulphathiazole, provoke lesions intermediate in character between erythema nodosum and erythema induratum. But these lesions are larger and more widely scattered; they are symptomless, and inquiry will elicit the history of drug therapy.

Erythema Multiforme.—Toxic erythema of the erythema multiforme type affects extremities and may be confused with chilblains. The eruption is usually more profuse and of a particular pattern, there is less irritation, and attacks recur at long intervals, not necessarily in the chilblain season.

Lupus Erythematosus.—Chronic toxic erythema (lupus erythematosus) on the backs of the fingers may simulate chilblains. It is more defined, occurs between the joints and about the nail-folds, is symptomless, persistent, and commonly associated with follicular horny plugs.

Perniosis.—A state of impaired peripheral circulation termed pernios (Haxthausen, 1930) or "chilblain circulation" is common at puberty and sometimes appears at other times in life. The condition is frequently accompanied by an increased susceptibility to chilblains. In pernios there is a persistent tendency to contraction of the smaller arterioles, with consequent slowing of the blood flow through the surface vessels. This causes the characteristic

Erythema Nodosum.—

The tenderness, pain, pyrexia, and distress in the patient should serve to differentiate erythema nodosum, which often follows an acute upper respiratory infection or may be a manifestation of tuberculosis. On

purplish congestion with vermilion spots representing the occasional uncontracted arterioles. Some impairment of permeability in the vessel walls causes a slight, chronic oedema which further impedes the circulation. The oedema may become pronounced, and the condition is often associated with general obesity. In the legs this may ultimately give rise to fibrosis with chronic erythrocyanosis and coldness of the limbs. Apart from the predisposition to chilblains which accompanies this state, it carries its own considerable disabilities by reason of the weight, size, and coldness of the limbs, and may precede infection and other dermatoses.

Complications

Chilblains and the chilblain circulation may be persistent and resistant to treatment. The state may continue with exacerbations throughout the winter and may extend into the summer. The impaired health of the tissues may give rise to secondary septic complications, particularly perionychia, and may increase the patient's susceptibility to eczematous dermatoses. In some cases spasmodic contraction of the smaller digital arteries gives rise to Raynaud's syndrome.

Another complication arising from persistent pernios is the deposition of calcium salts, calcinosis cutis. These deposits appear as nodules, which may break down and discharge their contents on the surface. There is no doubt that circulatory factors of this type exercise an important predisposing role in the development of lupus erythematosus and of the lupoid type of sarcoidosis described by Schaumann (1924). In lupus erythematosus the erythema across the nose and cheeks, on the backs of the fingers, and on the ears may closely resemble chilblains at the onset, but a follicular hyperkeratosis and scarring usually develop and in a high proportion of cases the scalp is involved. In sarcoidosis there is a purplish swelling in similar sites, associated with a firm, fixed, and persistent infiltration. There is no itching, and investigation commonly discloses other features characteristic of the disease—for example, involvement of the small bones and the hilar glands, and a negative Mantoux reaction. A similar circulatory disorder underlies the rosacea of middle life, but the papulo-pustular eruption on the face distinguishes the complaint from simple pernios.

Prophylaxis

From the above observations it is clear the chilblain is an expression of an individual susceptibility to react to cold in a particular pattern. The tendency is influenced, as are all constitutional diseases, by a large and varying number of other factors, internal and external. For this reason there is no specific effective treatment in all cases. There are some prophylactic measures which may be applied and certain empirical treatment may benefit a considerable proportion of sufferers, but each case demands individual consideration. Even so, a small proportion of cases will prove intractable.

Chilblains on calf of leg.

The patient's present health, his medical history, and his family history are significant. His occupation, recreations, and amount of exercise, and the physical conditions of heat and ventilation in his home and place of work all require consideration. The climatic conditions of temperature and humidity can be countered only by protective measures. Warm clothing on the body and the extremities is important. Many soldiers on active service found two pairs of socks effectively prevented chilblains. In cases of severe chilblains of the legs in women, elastic understockings may be desirable in the winter for warmth and to prevent the stagnation of fluid in the tissues. Tight and restricting garments are unwise, and the application of warmth to cold extremities by fire or hot bottles is to be avoided.

In the home and at work central heating and the avoidance of draughts are desirable, though a current of air is preferable to stagnation. The maintenance of one posture over long periods is to be avoided, and exercise should be encouraged.

Treatment

Stimulation by electrical and radiation therapy, massage, and passive and active movements are useful. Ultra-violet light therapy to the whole body or fractional doses of x rays (100 r) to the affected areas may rapidly cure an attack, but the measures should only be employed by practitioners experienced in their use.

Where the affection is intractable and disabling the question arises of the patient's removal to a different location or climate, or of his reference to a surgeon with a view to sympathectomy.

Local stimulants are not indicated, except that the massage involved in their application may be beneficial. The risk of provoking dermatitis or blistering is considerable, since most of these preparations are irritants. Iodine (as ung. iodi denigrescens), menthol, and camphor are favourite measures.

Calcium by mouth or by injection, with or without vitamin D, has long been regarded as curative and is often demanded by the patient. There is no scientific evidence to support the claims for its efficacy, but this does not necessarily mean that it is of no value. Often, no doubt, the effect is psychological, the result of relentless advertisement upon profession and patient, but it would be rash to deny the possibility of some biological effect. Massive doses of calciferol, vitamin D₂, are said to produce remarkable results in many cases. Although Anning (1947) has shown that a high content of calciferol in the blood—as in patients with lupus vulgaris under treatment with the drug—does not protect against the development of chilblains, it may be that the metabolic shock occasioned by this therapy is effective in temporarily clearing the condition. It is not a measure that should be used for more than a short period, because of the dangers involved.

Equally dramatic results may follow the administration of thyroid extract in small doses ($\frac{1}{4}$ — $\frac{1}{2}$ gr.—16–32 mg.). This effect is seen more often in thin patients than in the heavy, exudative type of person, as would be expected from the slight stimulus to the circulation and the relaxation of the contracted arterioles caused by such therapy. Patients receiving thyroid do not feel the cold as readily as others. Nicotinic acid, 50 mg. t.d.s., acts as a peripheral dilator and may effect recovery in a proportion of patients. It is interesting to note that a purgative will often cut short an attack, probably by disturbing the fluid balance in the tissues.

It would not be possible to enumerate all the measures which have been advocated for the relief of chilblains. While each has a place in treatment if used with care, they should not be prescribed without regard to the physical factors concerned. It is important that these factors should be explained to the patient, who is best able to control them.

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AN APPROACH TO ELECTRON MICROSCOPY

BY

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The optical microscope is a supremely efficient instrument, but in the fineness of detail which can be distinguished it has already reached the limit of possible development. At the same time there has been progress recently in other directions. The phase-contrast microscope enables small transparent objects to be viewed intact and without staining. The reflecting microscope offers the special advantages that a longer working distance can be made available, and that focusing is independent of wavelength. But, with some qualification in the case of the reflecting microscope, they leave untouched the main problem of the fineness of detail, or resolution, attainable. The electron microscope, on the other hand, is a relatively crude instrument, judged by optical standards, which has completed only the first stage of its probable development. It is in the position of the optical microscope before the correction of lens faults became possible. Even so, it offers a gain in resolution of a thousand-fold. For an understanding of electron microscopy it is necessary to consider (1) requirements in microscopy; (2) theoretical limitations as they apply to particular forms of microscopy; and (3) the electron microscope in comparison with the optical microscope.

Requirements in Microscopy

For any section of material to be examined microscopically there must be formed a corresponding image. This image must be recognized by the human eye or recorded on a photographic plate, and each point in the object should be uniquely represented by a corresponding point in the image. The distances between image-points should be greater than those between object-points, and in their mutual separation and directions the pattern of image-points should provide a true rendering, apart from scale magnification, of the pattern of object-points. Since the object is three-dimensional and the image two-dimensional, it is further necessary that the thickness of the object should be limited. Finally, it is desirable that differences in the structure of the object, whether visible or not in the ordinary sense, should be represented by corresponding differences in the apparent structure of the image.

For an image to be formed, "something," whether waves or particles, must travel from the object to the image. This "something" can originate either in the object itself or in some outside "source of illumination." An example of the first type is the photomicrography of luminous material in its own light. But for general use the "something" must come from outside. Theoretically, whether neighbouring points in the object can, or cannot, be regarded as independently self-luminous makes a difference. But the difference introduced is numerically small, and for our purpose it is enough to state that the object must be induced to behave as if it were its own source of whatever radiation is to be used for its examination.

In the optical microscope these external requirements are met by the lamp and the condenser lens. These are independent of the main optical system in the sense that, if the object