SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

SURGICAL INFECTIONS OF THE FOOT

BY

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In considering infections of the foot it is almost impossible to avoid a comparison with the hand, and as a good deal more attention and study have been devoted to hand infections than to the corresponding infections of the foot it may be of some help to pursue the comparison.

Anatomically there are very obvious points of resemblance between hand and foot—the arrangement of the digits and their bones, joints, and tendons, etc.—but the sole of the foot presents differences due to the additional muscles there found—the flexor brevis digitorum, the accessorius, etc.—while the relative size of the corresponding structures in fore and hind limbs differs greatly. The general impression, however, is of the close resemblance, yet the problem of foot infection is by no means the same as that met with in the hand. The main reason for this is not anatomical but depends upon the very diverse functions of the hand and foot. Thus the hand, usually unprotected, is employed in all forms of work and occupation, whether designated “manual” or not. Infections introduced by external agents—needles, knives, tools, splinters, etc.—are therefore very common and constitute the chief source of hand infections.

The foot, on the contrary, is nearly always protected, not only by its thick layer of cornified tissue but additionally by the boot or shoe; nor does it come into immediate contact with potentially dangerous tools or mechanism. As a result it is rare to find infection of the thecal sheaths or of the deep lymphatic spaces of the foot, both of which are common in the hand. Foot infections usually arise in some pre-existing pathological structure such as a bursa under a corn or callosity, or an ingrowing toe-nail. The sites of origin and the planes of subsequent spread are thus different in the two extremities. It must not be overlooked that not only are the protective nervous reflexes of the body, which so readily withdraw the hand from potential danger, less developed in the case of the foot, but in addition the foot is usually carrying the body weight and so cannot be withdrawn from danger until the gravitational axis has been transferred to the opposite limb: a split second is thus lost, which leads to many a crushing injury to the foot. The increasing number of road accidents is a factor tending to multiply the cases of grossly infected contused wounds, often affecting the deeper structures. The motor bicycle appears to be particularly unkind to its rider in this respect, the feet being often badly damaged by contact with the various exposed and projecting parts of the mechanism.

There is a further reason why the spread of infection in the foot has not been so intensively studied as it has been in the hand—namely, the lesser economic importance of the foot. In most kinds of work the loss of a part of the lower limb does not interfere seriously with a man's ability to continue, but this is obviously not true of the loss of even a small portion of the upper limb.

The arrangement of the thecae in the toes closely resembles that in the fingers, but they are of necessity

much smaller; none of them extend back to the sheaths around the ankle corresponding to the extensions to the wrist bursae in the hand. The fascial spaces on the dorsum are subcutaneous and subaponeurotic as in the hand; on the plantar aspect, however, they are more numerous and differently arranged. Their position will be best appreciated by reference to Fig. 1, which may

FIG. 1.—Diagrammatic cross-section of the foot showing fascial spaces. *a*, extensor aponeurosis; *c*, plantar fascia, with *b* and *d*, deep extensions; *e*, flexor brevis digitorum; *f*, flexor longus digitorum and accessorius; *g*, adductor hallucis; *h*, abductor hallucis; *i*, flexor brevis hallucis; *k*, flexor longus hallucis. 1, dorsal subaponeurotic space; 2, central plantar space; 3, lateral plantar space; 4, medial plantar space; 5, deep plantar space.

with advantage be compared with the corresponding diagram of the hand given in the issue of October 1, 1938 (p. 717). The deepest spaces correspond to the thenar and palmar spaces in the hand, and are well displayed in the cadaver when injected with lipiodol as in the radiograph of which Fig. 2 is a drawing. The anterior

FIG. 2.—Radiograph of foot after injection of lipiodol into deep plantar spaces.

tibial, posterior tibial, and peroneal groups of muscle tendons have their separate sheaths as they pass over the vicinity of the ankle-joint, but in no case do they extend far enough forwards to become continuous with the sheaths of the digits.

Superficial Infective Conditions

Superficial infective conditions are found chiefly on the dorsal aspect and sides of the foot; the thick plantar skin with its intimate attachment to the plantar fascia is much less commonly affected. In most cases the infection

arises as a spread from an inflamed bursa or blister, an interdigital fissure, an ingrowing toe-nail, and such-like. The loose character of the skin in this situation allows of well-marked inflammatory oedema; the whole dorsum of the foot becomes puffed up and the depressions around the malleoli are obliterated. Such infections, particularly if streptococcal, may be associated with lymphangitis, usually seen on the front and inner side of the leg, and with enlargement of the inguinal lymphatic glands. A septicaemia, not uncommonly fatal, is the most serious complication. Oedema of the dorsum is also met with in deep infections of the sole or of the bones, and, as in the case of the hand, pus confined under the plantar fascia, especially in the deeper spaces, will make its way along the lumbrical tendons to the interdigital spaces or sometimes to the side of the foot. Thrombosis of the superficial veins on the dorsum may accompany or be the origin of the infection.

Inflammation of the end of the digit and nail-bed arises from an ingrowing toe-nail, but may also be secondary to a subungual haematoma. The ordinary thecal whitlow is rare; when it does occur there is no direct spread to the ankle region, for the anatomical reasons given above.

The bursae which commonly become infected are those (either true or false) associated with corns—that over a hammer-toe, the one over the head of the first metatarsal, and those around the insertion of the tendo calcaneus (tendo Achillis). As the overlying skin is nearly always pathologically thickened the infection is unable to reach the surface, and so spread in other directions is provoked.

Reference to Fig. 1 shows that the superficial musculature of the sole is divided into three parts by deep extensions of the plantar fascia. The medial and lateral compartments are continuous around the sides of the foot with the superficial fascial compartments on the dorsum; when suppuration occurs in them the pus tracks to the sides of the foot, and here the maximum swelling and tenderness are found.

As already noted, central infections spread forwards to the interdigital spaces. It must be remembered, however, that deep infection is rare in the absence of a penetrating wound, through which discharge naturally occurs. A state of affairs corresponding to the "Kanavel hand" is thus very rarely encountered in the foot.

Acute Suppurative Conditions

Although chronic affections of the joints of the foot are fairly common, acute suppurative infections are uncommon in the absence of injury. Occasionally suppuration in the bursa over the head of the first metatarsal spreads through the capsule into the underlying joint; this applies also to the bursae associated with hammer-toe and corns. Blood-borne streptococcal arthritis sometimes occurs in the ankle and other joints, and a gonococcal invasion of the capsules of the tarsal joints and the neighbouring ligaments and fasciae is a potent cause of acute flat-foot. Acute osteomyelitis of the tarsal and metatarsal bones is commoner than infection of joints, and leads to all the classical signs and symptoms of the condition. The only bone in the tarsus having an ununited epiphysis at the age when osteomyelitis is common is the calcaneus; for this reason both acute and chronic osteomyelitis occur more often here than in the other bones. A special feature of osteomyelitis of the tarsal bones is that the very intimate connexions between them allow infection to spread readily from one to its neighbours, and so several bones become involved. A word of warning may be

added, however, regarding the radiographic appearances, for even when one bone alone is involved the active hyperaemia induced causes a widespread absorption of calcium salts which, producing a diffuse rarefaction in the radiograph, may be very misleading. Pus arising from the bones tends to track under the dorsal aponeurosis, producing an extensive oedema which makes localization of its origin difficult. Such a collection spreads laterally and points on the sides of the foot.

Gangrene of the toes and foot is associated with infection usually only when of the moist diabetic variety; dry senile gangrene commonly remains uninfected. Localized patches of infected gangrene due to pressure may be found behind the heel or over the malleoli. In paralysed or bedridden patients they are produced by the mere weight of the leg resting on the heel; in other instances the pressure is caused by a badly fitting or improperly applied splint. The use of unpadded plaster splints is particularly hazardous in this respect, and calls for great care in application and constant subsequent supervision.

In addition to the coccal infections the foot is prone to invasion by the *Bacterium coli*, the *Clostridium welchii*, and the *Clostridium tetani*. As in the last two of these infections the prophylactic injection of antisera is of proved value this precaution should never be neglected in any penetrating injury. Recent work seems to show that the sulphonamide preparations are of value in cases of gas gangrene as in coccal infections; their prophylactic power, however, must still be considered as *sub judice*.

Chronic Infections

Of the chronic infections of the foot tuberculosis is the commonest. For reasons given above the calcaneus is more often involved than the other bones of the tarsus. In infancy tuberculous dactylitis may occur, affecting metatarsals or phalanges. As in the acute infections, the disease may spread to surrounding bones and joints, producing a general invasion of the whole tarsus. Apart from such widespread bone infection, the ankle-joint is not uncommonly the site of tuberculosis, and rarely the metatarso-phalangeal joint of the great toe is similarly affected.

Tuberculous tenosynovitis is not frequent in this region, but a "rheumatic" tenosynovitis is met with in the sheaths around the ankle-joint.

The sole of the foot is a common site for the secondary rashes of syphilis, but other syphilitic lesions, such as gummata, are rare. Typhoid fever occasionally causes a definite osteoperiostitis of the calcaneus, but usually the painful heels which may follow this and other fevers are, like those of influenza, due to renewed weight-bearing after prolonged rest rather than to local infection.

Treatment

As in other parts of the body, streptococcal cellulitis demands conservative treatment, and the same rule may be applied to those fulminating staphylococcal cases which occasionally result from infection with the *aureus* organism. The risk of opening up fresh areas to infection before the patient's general resistance is adequate and of thus causing septicaemia is so great that the older method of making multiple incisions to relieve tension is definitely hazardous. In such cases the use of chemotherapeutic agents of the sulphonamide group, and possibly also of antitoxic sera, should be adopted until there is definite evidence of localization and pus formation. Thenceforth the case may be treated as any other infection. In true erysipelas the infection is so superficial that it is both logical and of proved value to use ultra-violet rays.

Incisions for drainage should be made on the lateral aspects of the foot, for these are the positions to which natural drainage tends. Incisions through the sole should be avoided, not only to escape a scar in an area subject to pressure, but also because deep suppuration can be reached only at the risk of possible damage to the many important structures in this region. The best incisions for dealing with infections of the toes are analogous to those advocated for the fingers (*British Medical Journal*, 1938, 2, 798). In particular, infection of the pulp of the terminal phalanx should be drained by a horseshoe incision skirting the end of the toe, the whole pulp being turned back as a flap by raising it off the phalanx. Suppuration in a bursa under a corn may often be dealt with by paring down the cornified layer until the cavity is entered, since in many instances the pus lies in a mere cavity in the epidermis. For the larger true bursae in the dermis or subcutaneous layers a proper incision is necessary. In treating the infection associated with an ingrowing toe-nail the most important point is to remove the small "splinter" of nail which will be found to have penetrated the soft tissues in the lateral nail groove. When the acute condition has subsided it will be necessary to consider the performance of some radical procedure to prevent recurrence.

Acute osteomyelitis is usually treated by immediate drainage, but if localization is uncertain it is sometimes better, provided the patient's condition allows, to wait a little rather than to endanger important structures by exploratory dissection. Especially is this true since the introduction of chemotherapy for coccal infections, for there is no doubt that these materials help to overcome the general blood infection and assist localization. When the bone has been drained, further treatment may with advantage be by the closed method of Winnett Orr.

Lacerated wounds of the foot are first of all dealt with as soon as possible by surgical cleansing and débridement. Whether subsequently the case is treated by the modern method of enclosure in a plaster case after careful packing of the open wound, or whether the older methods of open drainage are adopted, is largely a matter of individual judgment and experience. The demoralizing effects of frequent painful dressings are certainly avoided in the newer methods, and the patient's resistance to spread of infection can usually be relied upon under the conditions of absolute rest to the part which they produce; but it is possible that the case in their favour has been a little overstated in the general enthusiasm for something new. The same criticism may be offered of the tendency to adopt an extremely conservative attitude in the presence of early infections, for there is no denying that very brilliant results can be obtained by courageous and well-designed operative measures in these cases. The whole subject is, however, in a state of flux, and it would be foolish to dogmatize either way.

Tuberculous osteitis of the foot, in the absence of general contraindications, often needs surgical intervention, which consists in thorough curettage of the cavity, followed by packing with some such antiseptic as formalin 2 per cent. in glycerin. General constitutional treatment and local rest are as important here as in other regions, and in many cases, especially in the young, will be all that is required.

Tuberculosis of the ankle-joint is treated conservatively with good results; but in the adult, and especially in the senile, sinuses are apt to form, and then the question of amputation must be seriously considered.

PARANASAL APPROACH TO INTRA-SELLAR TUMOURS

SEMON LECTURE BY PROFESSOR NAGER

The annual Semon Lecture of the University of London was delivered at the house of the Royal Society of Medicine on May 2 by Dr. F. R. NAGER, professor of otorhino-laryngology, University of Zurich. The chair was taken by Mr. T. B. LAYTON, president of the Laryngological Section. Professor Nager dedicated his lecture to the memory of Harvey Cushing, and quoted a sentence from his *Consecratio Medici*: "There is only one thing that can effectively bind people, and that is a common devotion."

In view of the successful approach of neurosurgery in the treatment of pituitary tumours by the trans-cranial method, said the lecturer, it might seem superfluous to deal with the extracranial approach; but he claimed that these less dangerous methods were not only justified but even indicated for special cases.

The method which he had himself followed was that of Chiari, originally published in 1911, but not generally known; it was a method of approach to the sellar region by the trans-ethmoidal and the trans-sphenoidal route.

Technique of Operation

The operation is performed under local anaesthesia, eventually combined with evipan. By a curved incision the soft tissues are removed following the lamina papyracea and going very deeply into the orbit. With special spatulas the contents of the orbit are kept to the side. All the ethmoidal cells are removed so that in the depth of this funnel the anterior wall of the sphenoidal sinus is visible. By resection the posterior wall becomes exposed, especially if the inter-sphenoidal septum and the rostrum, including the end of the nasal septum, are removed also. The whole anterior wall of the sella is then clear. Very often pituitary tumours lead to alteration of its colour or cause it to bulge. The very thin lamella has to be removed very carefully. The floor and the anterior wall should be eliminated as much as possible, but the upper part avoided because of the danger of haemorrhage from the cavernous sinus. The sensitiveness of the now exposed dura may be ameliorated by applying a gauze saturated with 10 per cent. cocaine for a few minutes. After painting with iodine solution the dura is punctured. If by aspiration a clear cerebrospinal fluid issues it proves that there is no tumour, but an internal hydrocephalus is present, and further procedure is contraindicated. If, on the other hand, it results in a dry puncture or in a little brownish-red liquid a tumour is present and the dura may be opened up by a cross-section. The contents of the sella will be removed so far as possible, either by long curettes or by suction, until the posterior wall of the sella can be felt by the probes. At this instant the dura collapses. After spraying some iodoform powder and applying a strip of gauze, the end of which protrudes from the nostril, the external wound can be sewn up. Following the operation the patient is given urotropin and calcium to prevent bleeding, although the lecturer had observed no considerable haemorrhage. The course is usually normal, and the stitches are removed on the third day and the strip of gauze on the eighth. The scar is almost invisible, even if a second operation should be necessary. The operation may be easily performed in about one hour, and the physical and mental strain on the patient is not severe, especially if compared with any trans-cranial procedure.

Professor Nager described thirty-eight trans-sphenoidal exposures which he had performed on thirty-four patients with pituitary tumours. With one exception—death after eight days of pneumonia from heart failure—there was no direct post-operative mortality, and Chiari's method might therefore be taken to be without real danger. Five patients died within a year, but in three of them the adenoma was of a decidedly malignant character. Within from two to five