fluence upon the spread of knowledge as to the necessity of the early diagnosis of consumption and as to how best to ensure this. The ex-sanatorium patient sometimes more readily than the practitioner helps others to realize the importance of early symptoms, of the examination of expectoration and of complete rest when slight fever is present.

DEFORMED AND PAINFUL FEET.

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IF we accept the conventional view of a normal foot, as a structure built in the form of an arch, which at all costs must be maintained at or above a certain height, then undoubtedly the commonest painful deformities of the foot are: (1) Those in which the arch is too low, and (2) those in which it is too high, namely, flat foot and pes cavus respectively.

Whether we accept this conventional view or not, is a question to which I shall refer immediately.

The normal foot is described as having a longitudinal arch, that is to say, its inner border is raised in the form of an arch which gradually slopes away to the outer side, so that in standing the foot rests on the heel, the outer border, and the heads of the metatarsal bones.

It is commonly thought that this arch is maintained at least to some extent by the ligaments and fasciæ in the sole of the foot, and that when these give way the patient suffers from flat foot.

The height of the arch varies in different individuals, and no one can say precisely where a low arch ends and flat foot begins, nor where a high arch becomes pes cavus.

Nowadays, however, it is more generally recognized that the actual height of the arch is of comparatively little importance, and that mobility and muscular control of the foot are the essential features. I would go further, and say that the ideal foot should have no arch at all in an anatomical sense; it should be so supple that it can be completely flattened, or raised in the form of an arch, at will, and its muscles should be capable of maintaining its correct attitude in all circumstances.

The correct attitude of the foot in standing is a part of the postural reflex which maintains the upright position of the body as a whole against gravity. The body-weight is borne by the postural muscles which prevent excessive abduction and eversion of the foot. It is not the function of any ligaments to withstand continuous strain; this is always a function of muscles.

So that the position in which the foot assumes an arch is an attitude maintained by muscular activity, and it is maintained only so long as the muscles are in action. When they relax, the arch becomes flattened, and, if the foot is sufficiently supple, it becomes quite flat when standing at ease. Such a condition is seen normally in the feet of bare-footed races who have never worn boots or shoes, in the feet of the best ballet dancers, and commonly in children who are learning to walk. Their feet are quite flat when standing at ease, but, nevertheless, they are quite normal and efficient in use.

Unfortunately, in the majority of civilized people who wear boots and shoes, the range of movement at the tarsal joints becomes restricted, and by contracture or adaptation (call it what you will) of the soft parts in the sole, the arch of the foot becomes more or less fixed, so that it cannot be flattened without meeting the resistance of these shortened structures. Consequently, the individual is compelled to keep the arch of his foot always above a certain height, for otherwise the weight of his body will fall upon these shortened structures and will

stretch and strain them, causing pain which is commonly attributed to flat foot.

There cannot be a strain without resistance. If the foot is so supple that it can be flattened without resistance, there is no pain. On the other hand, if a foot is crushed down against the resistance of contracted soft parts, then there is strain, and the condition is painful.

Cases of foot-strain—not flat foot, but flattening foot—are among the commonest met with in practice. They are cases in which the muscles have failed to maintain the body-weight above the minimum arch for the particular individual. They frequently arise from slight injuries, such as twists or sprains, or from over-use of the foot, or as the result of general muscular debility. Pain is commonly felt at the inner border of the foot in the region of the astragalo-scaphoid joint, and also on the outer side below and in front of the external malleolus.

The higher the arch is to begin with, the greater the strain when it is crushed down, and in a high-arched foot there may be considerable strain before any sinking of the arch is apparent. Hence the paradox that the worst symptoms of "flat foot" occur in feet which are not flat.

The treatment of cases of foot-strain is usually simple and satisfactory. Most medical men, and even the public, have long been obsessed with the idea of supporting the arch of the foot, and various forms of so-called arch supports are still extensively used. The correct treatment, however, is to try to break down the arch—in other words, to increase the mobility of the foot, so that it can flatten without meeting resistance. Forcible manipulation under an anæsthetic, followed by massage and exercises for a week or two, suffices to cure the great majority of such cases, and it is found that, when the pain is relieved, the muscles soon begin to function normally.

It should be noted that while in practice the foot is actually manipulated in all directions, the principal manipulation is not in

the direction of restoring the arch, but exactly the reverse. Commonly, sounds as of the breaking of "adhesions" are heard during forcible abduction and eversion of the foot. This manipulation has been successfully employed by bonesetters for years; its efficacy is supported by an overwhelming mass of testimony, and moreover it is easily tested.

Many cases that have been treated in orthodox fashion by surgical boots, valgus pads, wedges, arch supports, and by manipulation and fixation in plaster, without success, have been promptly cured by manipulation alone.

The practice of manipulating a foot so as to increase its arch, and then putting it in plaster in a so-called corrected position, is utterly futile. As soon as the plaster is removed, the body-weight comes down upon at least as great a resistance as before, and the condition of foot strain at once recurs.

Cases complicated by chronic arthritis of the tarsal joints are much more difficult to deal with. The question must first be decided whether it is advisable to attempt mobilization at all. If mobilization is attempted, it may be necessary to manipulate the foot two or three times or more, and the after-treatment will be prolonged. Alternatively, it is only possible to keep the foot in the position which gives the greatest ease. It is absurd to put an arch support under a rigid foot which cannot adapt itself to the surface upon which it rests.

Besides actual foot strain there are many other consequences of a falling arch or flattening foot. When a high arch is flattened, the length of the foot is obviously increased, and a great longitudinal strain is thrown upon all the soft parts which are adapted to the high-arched position of the foot. Thus, longitudinal strain on the long plantar ligament may cause pain, either at its anterior or posterior attachments, giving rise in the one case to anterior metatarsalgia, and in the other to calcodynia or painful heel.

In calcodynia of this type there is pain under the heel in walking, and an acutely tender spot on pressure on the under surface of the os calcis at the attachment of the long plantar ligament. An X-ray photograph may show no abnormality of the bone, or it may show an appearance of "fluffiness," indicating traumatic periostitis at the site of attachment of the ligament, or it may show a definite spur of bone extending into the attachment of the ligament. Such cases are nearly always relieved by wearing shoes with moulded insoles and "cups" or depressions, instead of the usual flat surfaces, under the heels. Even when definite spurs are present, it is hardly ever necessary to remove them.

While on this subject we may note some other causes of pain in the heel :—

(1) Enlargement of the posterior tubercle of the os calcis. The size of this normal prominence of bone varies considerably in different individuals. In some types of foot it is so prominent that it suffers from the pressure and friction of any ordinary boot or shoe. Pressure and friction then cause it to become still further enlarged, and a bursa may form between it and the skin, just as in the case of a bunion to be considered presently. The slighter degrees of the deformity require only that the shoe shall be blocked out so as to avoid undue pressure on the swelling. Exceptionally the enlargement is so troublesome that it has to be removed.

(2) Apophysitis of the os calcis is a condition which occurs in children of about 8 to 14 years. At this age the posterior extremity of the os calcis is cartilaginous, and into it the tendo Achillis is inserted. In some cases, owing to excessive strain on the tendon, the cartilaginous apophysis becomes enlarged and painful, and the X-rays show irregular growth of the cartilage. There is pain, especially on rising on the toes, tenderness and swelling. The condition is self-limiting, and subsides when the cartilage joins the bone, if not long before. The

treatment consists in raising the heel, rest, and strapping.

(3) Achillo-bursitis is inflammation of the bursa which lies between the tendo Achillis and os calcis. There is pain and local swelling which projects on each side of the tendon just above its insertion. The treatment is rest, strapping, and elevation of the heel. Occasionally such a bursa becomes chronic, with firm, thick walls, and it may then have to be excised.

(4) Tenosynovitis of the sheath of the tendo Achillis sometimes occurs as the result of strain or excessive use. There is a tender swelling extending along the tendon, and there is creaking on movement. The treatment is rest, strapping, and elevation of the heel, and later, if the condition has become chronic, counter-irritation.

Tension on the long plantar ligament may be a contributory factor in anterior metatarsalgia, i.e., pain beneath the heads of the metatarsal bones or in the metatarsophalangeal joints, but tension on the long tendons going to the toes is far more important.

When a high arch sinks, the long flexor and extensor tendons draw the toes backwards, causing them to become clawed, i.e., hyperextended at the metatarsophalangeal joints and flexed at the interphalangeal joints. This is the so-called contracted type of flat foot, and it indicates simply that the foot originally had a high fixed arch, so that the retraction of the soft parts was proportionately great when the arch became flattened.

Now, the free borders, i.e., the inner and outer borders, of the foot always become drawn up more than the more fixed central portions, so that the sole under the heads of the metatarsals becomes convex from side to side, instead of flat. This is often spoken of as "dropping of the transverse arch" of the foot. But, as there is no transverse arch normally in this situation, it cannot drop, and the use of this phrase gives an erroneous idea of the pathology of the condition. The convexity of the sole is due, not to depres-

sion of the middle metatarsals, but to elevation of the inner and outer ones, and it is brought about by the retraction of the tendons consequent upon the flattening of a high arch.

In normal walking the foot "takes off" from the head of the first metatarsal. The body-weight passes across from the outer border of the foot to the head of the first metatarsal, which takes practically all the weight at the end of the step. The heads of the middle and outer metatarsals are not constructed to bear the whole weight of the body. But, if for any reason pressure on the first metatarsal is avoided, then the body-weight is thrown on to the middle and outer ones and they become painful.

Anterior metatarsalgia is either an acute traumatic neuritis of the digital nerves, or a traumatic synovitis (arthritis) of one or more of the metatarsophalangeal joints, usually the fourth, as the result of faulty distribution of the body weight.

In any case of anterior metatarsalgia, i.e., pain in one or more of the middle or outer metatarsal heads, look at once at the sole of the boot or shoe which has been worn, and it will nearly always be seen that the inner border of the tread has hardly been marked at all, while the outer border has obviously been worn down, showing that, in walking, pressure on the big toe-joint has been avoided, and the body-weight has been thrown on to the outer side of the foot.

Anterior metatarsalgia is frequently associated not only with contracted foot, but with hallux valgus or hallux rigidus, in both of which conditions the patient may avoid pressure on the big-toe joint, and it may also occur after operations for these conditions, if the patient is not made to bear weight upon the new joint which has been formed.

The treatment of anterior metatarsalgia is, firstly, to mobilize the foot by manipulation followed by massage and exercises; and, secondly, to ensure that the body-weight is borne on the head of the first metatarsal, even to the extent of wedging up the outer

side of the shoe, if necessary. The acute pain is best relieved by electrical (faradic) stimulation in a foot-bath.

The two common deformities, hallux valgus and hallux rigidus, are directly attributable to the lengthening of the foot which occurs in flat foot, although other factors may contribute to their origin.

The first phalanx of the great toe is held, as it were, in a sling by the long flexor and extensor tendons which pull it backwards against the rounded head of the first metatarsal bone. When great tension is thrown simultaneously upon these two tendons, as in the flattening foot, the base of the phalanx is pulled forcibly against the head of the metatarsal and, if the toe remains straight, the intra-articular pressure in the metatarsophalangeal joint is greatly increased. This gives rise to traumatic osteoarthritis, frequently, though not necessarily, aggravated by a slight injury, such as stubbing the toe against some hard object. The head of the metatarsal, and to a less extent the base of the phalanx, becomes eroded and enlarged by osteophytic outgrowths around its margin, so that the movements of the joint are greatly impeded and eventually abolished. The toe thus becomes fixed in the straight or slightly flexed position, and dorsiflexion of the metatarsophalangeal joint becomes impossible or much restricted and very painful, if forced. This makes normal walking impossible, because dorsiflexion of the toe is essential when the foot takes off from the head of the first metatarsal.

The treatment of hallux rigidus is excision of the head of the first metatarsal, and the formation of a new joint which allows dorsiflexion of the toe in walking.

Hallux valgus is much more common than hallux rigidus, because in most people there is a slight inclination of the great toe outwards, owing to the pressure of the boot or shoe. The line of pull of the long tendons is therefore a little to the outer side of the long axis of the first metatarsal, so that, when tension is thrown upon them, they pull the

first phalanx round to the outer side of the head of the metatarsal. The toe is then deflected outwards, and in extreme cases of this deformity it may be actually at right angles to the metatarsal—a position, be it noted, which could not possibly be brought about by the pressure of any boot or shoe.

The angulation of the toe with the metatarsal bone forms a prominence on the inner border of the foot, the head of the metatarsal becoming the most prominent point on the inner border. It is, therefore, bound to be pressed on by the boot or shoe. Friction and pressure then cause the inner side of the metatarsal head to become enlarged by new bone; the skin over this becomes thickened, and an adventitious bursa forms between the skin and the prominent bone on the inner side of the head of the metatarsal. This is what is commonly called a bunion, and it is liable to repeated attacks of inflammation as the result of the friction and pressure to which it is continually exposed. Occasionally a bunion becomes infected and suppurates, but usually the inflammation subsides with rest and local applications, only to be followed sooner or later by another attack.

The treatment of hallux valgus, like that of hallux rigidus, is excision of the head of the first metatarsal. It is practically impossible to avoid friction and pressure on a bunion by any adjustment of the boot or shoe. Of all the operations that have been devised for this condition, excision of the head of the metatarsal is the best. Its success or failure depends, first on the amount of bone removed, and second upon the after-treatment. If too little bone is removed, a stiff joint results; if too much is removed, there is a flail toe which sticks up and is a nuisance. If the whole head is carefully removed, leaving a smooth, rounded stump, a useful movable joint is formed, upon which the patient can walk. It is unnecessary to interpose any soft parts, such as the bursa, between the stump of the metatarsal and the phalanx.

After this operation, the new joint is naturally rather tender for some time, and the patient will try to avoid it in walking. Indeed, in many cases the patient has avoided pressure on the great-toe joint for a long time before the operation. It is, however, absolutely essential that he should be made to bear pressure on it. The shoe must be made so that the drop under the joint comes in the right place, and in some cases it is necessary to put a wedge on the outer side of the sole to throw the foot inwards.

Pes cavus has been defined as a condition in which the arch of the foot is abnormally high. It is not always easy to say where a high arch ends and pes cavus begins, but there is a stage in the development of a high arch when all or nearly all the pressure of the body-weight becomes concentrated on the heel and the heads of the metatarsals, and for practical purposes this may be held to constitute pes cavus.

The foot then presents a high arch which cannot be flattened by any reasonable pressure or manipulation that can be applied to it, and the patient suffers, not from foot strain, but from excessive pressure beneath the heads of the metatarsal bones. The skin covering the ball of the foot becomes thickened and in many cases affected with painful callosities. The toes become clawed and corns develop over the interphalangeal joints from pressure against the shoes. The gait is awkward and inelastic.

Pes cavus is a congenital or acquired contracture of the sole of the foot. The congenital variety usually becomes apparent at about the age of 7 or 8 years. It is often hereditary and familial, always bilateral and slowly progressive. The acquired form is usually attributed to paralysis of the interossei and lumbrical muscles. These muscles prevent the clawing of the toes which results from the unopposed or uncorrected action of the long flexors and extensors, and when they are paralysed the

toes become drawn back towards the heel, the arch of the foot is increased, and the high arch is fixed by secondary contraction of the soft parts in the sole.

When at all marked, the deformity causes considerable disability and suffering. The treatment consists in straightening out the sole by operation. To prevent relapse the soft parts must be completely detached from the under surface and sides of the os calcis and the deformity is then forcibly corrected, either with the hands or a wrench (Steindler's operation). Afterwards the patient must wear shoes with reasonably flat soles, and any tendency to walk on the outer border of the foot must be corrected by raising the outer side of the sole, if necessary. On the whole, the results of this treatment are very satisfactory.

THE CINEMATOGRAPH IN MEDICAL EDUCATION.

SPEAKING in New York, Dr. J. F. Montague discussed the possibilities of moving pictures, and said that the textbooks of the next generation may be printed on celluloid instead of paper.

Anatomical dissections, physiological experiments, technique in clinical examination or surgical operation, may be well demonstrated by the film, and there is no doubt that this method of demonstration will be more used in the future. We have seen some excellent films showing clinical examinations. For example, the routine examination of a case of nervous disease. Here the student gets an excellent idea of method and routine. And we have seen some very interesting films showing technique in such procedures as lumbar puncture, artificial pneumothorax, &c.

Teaching by means of pictures can never replace the ordinary training at the bedside. The student who sees a physician examine

a patient, and then under the supervision and criticism of the physician makes an examination himself, will learn considerably more than one whose knowledge is obtained from seeing a film demonstration. The cinematograph can at the most be an aid in the teaching of students, and useful as it may become, we feel that the student will waste valuable time and opportunities if he neglects bedside training in order to attend long courses of film demonstrations.

Dr. Montague points out that the films may also be used as an aid to public health, and here their value is more appreciated at the present time. Films have already been found of great value in teaching the public the importance of campaigns against disease and instructing them in the art of personal hygiene. Some of those films must strike terror in the stoutest heart, but as time passes and improvements occur, it will be possible to produce many films which are both interesting and instructive to the public without being too alarming or unpleasant.

EDITORIAL NOTES.

THE Cancer Conference which was held in London this month brought together a large number of delegates from all over the world.

The mornings were devoted to discussions, which were held at the Royal Society of Medicine and the College of Nursing, on the various aspects of malignant disease; and the afternoons were given up to visits to the Radium Institute, the Lister Institute, the Royal College of Surgeons, and various hospitals. During the Conference exhibits were to be seen at the museum of the Royal College of Surgeons and the Wellcome Museum of medical science.

The importance of cancer research is well recognized by the public, and a conference of this sort will be welcomed by the lay as well as the medical population, for there has been a growing feeling that, unlike other