Bone and Joint Diseases

Surgery of the forefoot

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British Medical Journal, 1977, 1, 276-280

The portion of the foot distal to the tarsus is the forefoot. It is a small area packed with problems that often give rise to a degree of misery and disability out of all proportion to the severity of the local condition. Kelikian¹ has written a 500-page monograph on surgery of the forefoot. I can give only the broadest outline of what I consider the best practice in surgical management.

Injury

Unusually, trauma does not play a large part in forefoot surgery. Most injuries are amenable to conservative management, and fatigue fracture (the march fracture of those unaccustomed to prolonged walking) of the metatarsals (fig 1) should be remembered when analysing forefoot pain. Foreign bodies should be removed under general anaesthesia with a tourniquet applied and preferably with major theatre facilities and all possible aids to location, such as an image intensifier and sonic detector. Unnecessary physical injury to the patient and psychological injury to the surgeon will thus be avoided. Subungual haematoma should be released by nail trephine, lacerations may require suture, and crushed devitalised toes or forefoot may need excision. Unlike the hand, however, repair of severed tendons or nerves rarely seems necessary.

THE "OVERBONE"

The "overbone" is an annoying lump that lies on the dorsum of the foot and commonly occurs in the young male. It abuts on the tongue of the male-pattern lace-up shoe and is caused by exostoses arising from the dorsal margin of the first tarsometatarsal joint and may acquire a "protective" adventitious bursa. Sometimes padding the tongue of the shoe with sponge rubber will allow the overlying bursitis to settle and will relieve symptoms. If the exostoses are large, however, they are best excised together with the overlying bursa.

GANGLION

Ganglia may arise on the dorsum of the forefoot in relation to the extensor tendons and tarsometatarsal and metatarsophalangeal joints. Needle rupture should be tried, surgery being confined to the recurrent troublesome ganglia.

HALLUX VALGUS AND BUNIONS (FIG 2)

The great toe drifts laterally at the metatarsophalangeal joint and also rotates externally. The metatarsal head is "uncovered" medially,

and a bursa forms over the prominence of the metatarsal head that may become inflamed and occasionally becomes infected and discharges. This bursa is termed a bunion. The deformity presents in two age groups—in the teens and in middle age. It is much more common in the female. For the adolescent form alone over 130 different operations have been described.

FIG 1—Metatarsal stress fracture or "march fracture."

FIG 2—Hallux valgus.

An understanding of the pathological anatomy helps in devising a rational approach to the problem. The condition gives rise to symptoms only in the shod. Indeed, valgus of the great toe and the bunion formation, both of which are secondary phenomena, arise because of footwear. It is well known that external forces can alter the shape of the foot—witness the curious custom of the Chinese in binding the foot to produce a small, high-arched foot that was apparently of erotic significance²—a Far-eastern equivalent of "kinky boots." The forces applied, however, must be unremitting, and abandoning binding while there is still growth potential in the foot will allow restoration to a normal shape.

In the hallux valgus deformity the basic "fault" is a separation of the first and second metatarsals—that is, a varus deformity of the

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first metatarsal. In the adolescent the metatarsus varus tendency is inherited³; in the older person it occurs as part of a general splaying of the metatarsals owing to loss of muscle tone, stretching of ligaments, and increase of stress on the foot caused by overweight (a form of middle-aged foot spread). Once this has occurred, then the forces acting across the metatarsophalangeal joint, principally the long tendons, are mechanically at an advantage to maintain the deformity. The condition of metatarsus primus varus is equally frequent in shod and unshod people.

The bewildering number of operative options led me and my colleagues to study the problem with special reference to adolescents.⁴ The conclusions were that an osteotomy was the best procedure. This is carried out at the level of the first metatarsal neck and designed so as to displace the head proximally, laterally, and plantarwards. The advantages are that the procedure is simple and does not interfere with the joint itself, which is usually painless and mobile, and remains so. There is a minimum of soft-tissue dissection and a relaxation of soft tissues by the slight shortening that occurs, which helps to maintain mobility. The feature most valued by patients after freedom from pain is the ability to wear a fashionable shoe in comfort so that this procedure, which also narrows the forefoot, was found to be the most successful. In the adult type of hallux valgus the same procedure may be used provided the joint is mobile and exhibits no signs of degeneration clinically or on x-ray examination.

Simple excision of the bunion and metatarsal head exostosis has been widely practised but has proved only of temporary benefit; the valgus deformity and degeneration of the joint is often accelerated by the necessary encroachment on the joint and most come to further, more radical surgery. Gross deformation or arthritis of the joint is an indication for arthroplasty—that is, excision of the diseased joint with or without replacement by an artificial joint or “spacer.” Keller⁵ described an excision arthroplasty with removal of the proximal portion of the proximal phalanx of the great toe and Mayo⁶ described an excision of the first metatarsal head. Both procedures produce relief and mobility; the Mayo operation often has the edge cosmetically but has to be carried out with more precision and skill to produce a functional result comparable with the Keller procedure. There is both a functional and cosmetic improvement if the great toe can be kept out to length; also the sesamoids do not displace, the muscles maintain good mechanical advantage, and there is less shift of stress on to the lateral metatarsals. A spacer of silicone rubber will achieve this effect. When there is a severe varus of the first metatarsal, an osteotomy of the metatarsal near its base and the insertion of a wedge of bone (the metatarsal head exostosis may be used for this) on the medial side will correct this and may be combined with an arthroplasty of the great toe metatarsophalangeal joint. This procedure is especially appreciated by the older woman who enjoys wearing an elegant shoe.⁷

HALLUX RIGIDUS

The great toe metatarsophalangeal joint is commonly rigid or very stiff and in some degree of fixed flexion. To compensate, the interphalangeal joint may adopt a position of hyperextension. The great toe alignment is usually straight. The condition may arise secondary to osteochondritis dissecans of the metatarsal head—a condition of adolescence. There is infraction and sometimes separation of a wedge of bone from the dome of the metatarsal head. The disease may also arise secondary to sesamometatarsal joint degeneration.

Arthrodesis or arthroplasty may be performed but arthroplasty is favoured since both men and women's shoe styles may require alteration of the heel height that in turn necessitates a change of metatarsophalangeal joint position. Simple excision arthroplasty may be enhanced by suturing the great toe to the second toe while the great toe is held out to length, thus ensuring a long fibrous and so more mobile arthroplasty. Alternatively a silicone rubber spacer may be used.

SESAMOIDS OF THE GREAT TOE

The sesamoids of the great toe have a large mythological significance. In 400 AD the Rabbi Ushaia began a search for the seat of the soul. Because they are relatively the best preserved bones in ancient graves, the worthy Rabbi felt certain that they provided a suitable abode for the soul, and that on the Day of Judgment they would be sprinkled with celestial dew whereupon the rest of the body would “reconstitute” around them. He said this with such conviction that his statement still appeared in Caspar Bauhinus's classical anatomical textbook 1000 years later (so typical of much textbook information).

These little bones lie like small kneecaps on the metatarsal heads and suffer much the same diseases as the patella. These are presesamoid bursae, chondromalacia of the articular cartilage, degenerative arthritis of the sesamometatarsal joints, fractures, and osteomyelitis—any of which may require removal of the affected sesamoid.

MORTON'S METATARSALGIA

The patient complains of a sharp sometimes excruciating pain on weight bearing that radiates into the toes usually affecting one cleft—commonly the second or third. They may feel paraesthesia or have numbness in the affected cleft. Occasionally transverse compression of the metatarsal heads reproduces the symptoms. There is usually a pain felt on the plantar aspect between the metatarsal heads or just distal to them. Sometimes an intermetatarsal bursa can be felt that, if sizable, will splay the affected toes on weight bearing. Exploration is carried out through a longitudinal plantar incision between the affected metatarsal heads. The bifurcation of the nerve that supplies the adjacent sides of the toes to the affected cleft is identified; this bifurcation may be flattened and elongated (fig 3).

A study by Shepherd and Vernon-Roberts⁸ failed to show any true neuroma formation histologically. In those patients in which bursae were found they could show that microscopical evidence of rheumatoid arthritis was present in 40%. In 16% it was undiagnosed clinically but diagnosed histologically. Subsequently these patients developed the clinical manifestations of rheumatoid arthritis, so that intermetatarsal bursae may herald the onset of rheumatoid disease.

FIG 3—Morton's metatarsalgia showing area of numbness after excision of so-called neuroma.

METATARSALGIA WITH CALLOSITIES

Metatarsalgia with callosities is common and troublesome; loss of intrinsic tone leads to dorsiflexion of the proximal phalanges of the toes, which claw. The metatarsal fat pad migrates distally, and the metatarsal heads come to lie subdermally. The epidermis undergoes a compensatory hypertrophy and cornifies in response to the excessive pressures. Local excision of callosities or trimming down or excision of the metatarsal heads has proved unrewarding or afforded only temporary relief since if the problem is confined to one or two metatarsal heads excision of these will throw an increased load on those remaining. A telescoping metatarsal osteotomy⁹ has helped in dealing with the problem. In the rheumatoid forefoot it is seldom the joints or the deformities that create the distress on weight bearing but the painful callosities that form under the metatarsal heads. If there is a shortage of skin with ulcer formation then excision arthroplasty as described by Fowler,¹⁰ in which the heads and bases of the metatarsals are removed with an ellipse of plantar skin, or a modified version described by Kates *et al.*¹¹ in which only the metatarsal heads are removed, is the procedure of choice.

The remainder respond well if the bone section is carried out at the level of the metatarsal neck and the obliquity of the osteotomy is such that it allows the metatarsal head to slide proximally and dorsalwards away from the sole. If the procedure is confined to any or all of the middle three metatarsals the patient is allowed out of bed within 24 hours. Surprisingly little discomfort occurs on weight bearing, which helps in correctly levelling the metatarsal heads.

BUNIONETTE (FIG 4)

Bunionettes are caused by a prominence of the fifth metatarsal head, the fifth metatarsal being in valgus. Trimming the lateral portion of

the head has been done only with moderate success. A more rewarding procedure is to do an oblique osteotomy through the neck of the metatarsal and slide the head medially towards the fourth metatarsal head.

FIG 4—Bunionette overlying fifth metatarsal heads.

OSTEOCHONDRITIS OF THE METATARSAL HEADS

Osteochondritis of the metatarsal heads (Freiberg's infraction, Kohler's second disease, and Panner's disease) affects children, usually from the age of 8 into the early teens. The condition commonly affects the second but may occur in the third or fourth metatarsal heads. The cause is probably a fracture of the head epiphysis, starting dorsally with progressive collapse of the epiphysis. When the condition is discovered, protection by a metatarsal support may be offered. If arthritis of the joint occurs owing to incongruity then excision arthroplasty of the joint may be carried out or, preferably, a telescoping osteotomy that will relieve symptoms without throwing stress on the other metatarsal heads.

If discovered early, before severe collapse and distortion occurs, a useful procedure described by Smillie¹² will sometimes restore the head to normal. He believes that this is a form of stress fracture and that bone collapse starts dorsally. If the epiphysis is carefully levered plantarwards, a cancellous wedge graft inserted, and the forefoot protected in a walking plaster for six weeks a gratifying normal metatarsal head usually results.

OVERLAPPED LITTLE TOE (FIG 5)

The overlapped little toe is a common congenital deformity that may never trouble the patient. More often, however, it impinges on the shoe and gets chafed and sore. Removal of the toe is the simplest and most reliable solution provided cosmetic factors are unimportant. Alternatively, the toe may be realigned by a skin lengthening V-Y plasty. This is best combined with extensor tenotomy and dorsal capsulotomy of the metatarsophalangeal joint. An additional helpful manoeuvre is to transfer the flexor tendon to the extensor on the lateral side at proximal phalanx level.

EXTRA TOES (POLYDACTYLY) (FIG 6)

The additional toe is removed.

SYNDACTYLY (FIG 7)

In the foot, unlike the hand, no appreciable disturbance of function results from syndactyly of the toes. Surgery is for cosmetic reasons and is generally confined to girls. Simple division with a Thiersch graft to the raw areas suffices.

CLAW TOES (FIG 8)

Claw toes come in two varieties—those with mobile and those with stiff joints. Muscle imbalance is the cause, and the stages in its development have been described in the section on metatarsalgia with callosities. Callosities form on the dorsae of the interphalangeal joints and sometimes at the apex of the pulps of the toes due to chafing on footwear. If the toe joints are passively mobile then a good correction may be achieved by flexor to extensor tendon transposition. The flexor should be taken to the dorsum of the toe over the proximal phalanx where it reproduces "intrinsic action" holding the proximal phalanx

FIG 5—Overlapped little toe.

FIG 6—Extra toe.

FIG 7—Syndactyly.

FIG 8—Clawed toes.

in flexion and at the same time extending the interphalangeal joints. If the joints of the toes are stiff then excision of the articular surfaces of the interphalangeal joints and transfixion of both joints by a Kirschner wire for six weeks until bony fusion occurs is the procedure of choice. Because the phalangeal bones are threaded on to the wire, the procedure has inevitably been nicknamed the "kebab" operation.

HAMMER TOE (FIG 9)

A hammer toe consists of fixed flexion at the proximal interphalangeal joint of the toe and a compensatory hyperextension of the terminal

FIG 9—Hammer toe.

joint. It is caused by a relatively long toe and is produced by abutment of the tip of the toe upon the shoe forcing the proximal joint to fuse. An arthrodesis of the proximal toe joint suffices.

MALLET TOE

A mallet toe is caused by a dropped terminal phalanx of the toe. It comes from muscle imbalance and not, as in the hand, because of rupture of the extensor apparatus, though occasionally the extensor apparatus to the terminal phalanx is congenitally deficient. Pain arises from a callosity on the apex of the pulp. Excision of the terminal phalanx or wire fusion of the terminal interphalangeal joint in correct alignment is carried out if the cosmetic appearance matters. The former procedure is complete in the time it takes the skin to heal whereas wire fusion will take six weeks to heal.

INTERDIGITAL SOFT CORNS AND PERSISTENT MYCOSIS

Interdigital soft corns and persistent mycosis are often localised to the fourth cleft and are caused by closely crowded digits that do not permit adequate drainage. Persistent trouble despite good conservative treatment and medication is best treated by an abduction osteotomy of the proximal phalanx of the little toe.

SUBUNGUAL EXOSTOSES (FIG 10)

A bony excrescence occurs under the nail and pressure will lift the nail and cause pain. It is usually located under the nail of the great toe but may occur under other toenails. An attempt should be made to preserve the nail bed intact since splitting or other damage may result in defective nail growth. The best approach is to make a horse shoe incision round the apex of the pulp, lift a flap, and remove the exostosis. The flap of nail bed is then sutured back into place.

FIG 10—Subungual exostosis.

INGROWING AND GOAT-HORN NAILS (ONYCHOGRYPHOSIS)

(FIGS 11 AND 12)

Ablation of nail growth either partially or completely is the permanent solution to ingrowing and goat-horn nails. The nail of the great toe is the most often affected but others may also be. In removing the growing portion of the nail the lateral recesses must be cleaned

FIG 11—Ingrowing toenails with infective granulation.

FIG 12—Onychogryphosis or goat-horn nails.

scrupulously, otherwise there will be a regrowth and nail remnants may be troublesome.

DIABETIC AND "NEUROPATHIC" FOREFOOT

Prophylactic care is the keynote to successful management of the diabetic foot that has lost sensation. It must be remembered that diabetes, leprosy, cord disturbances such as spina bifida, syringomyelia, etc, and local nerve lesions may all produce a roughly similar picture. Perforating ulcers at points of pressure have to have the point pressure relieved and the load spread by suitable insoles, realignment of bones by osteotomies, or excision if there is secondary infection and especially if there is an underlying osteomyelitis. In diabetes small vessel infarction may cause gangrene of toes. In both the neuropathic and diabetic foot with vascular or infection problems, a conservative surgical approach will often solve the problem. Toe amputations or removal of a ray may be necessary. It is wise to leave such wounds unsutured as they heal rapidly.

TUMOURS OF THE FOREFOOT

I have on several occasions had a tumour present with a metastasis in a toe, sometimes in the terminal phalanx. These have arisen from carcinomata of bronchus, breast, kidney, and colon. Melanomata of the sole of the foot or in relation to the toenail bed may be most sinister. All of these should be removed without delay and by adequate excision with skin graft if necessary.

PLANTAR WARTS

Plantar warts are most certainly, and rapidly, cured by curette excision.

FIBROMA OF THE SOLE (FIG 13)

Fibroma of the sole may be part of Dupuytren's disease when the syndrome may affect many structures and present with epilepsy, palmar nodules and contractures, plantar nodules, Peyronie's fibrosis of the carpus cavernosum, and retroperitoneal fibrosis. Sometimes plantar nodules may occur alone. These do not cause contracture and may occur in the very young. They are best left alone. Surgical

FIG 13—Fibroma of plantar fascia.

excision carries a high recurrence rate, and the histology is difficult to interpret as the nodules are cellular and may be reported as fibrosarcomata when needless amputation and irradiation may ensue.

Conclusion

Less than a century ago the type of surgery described above was considered beneath the dignity of the professional man and was relegated to barbers and bootmakers; indeed, this attitude persists in part today, for many delegate forefoot surgery to the

most junior and inexperienced surgical house officers. When C H Mayo, one of the famous Mayo brothers who founded the Mayo Clinic, read his paper on hallux valgus in 1920,¹³ a colleague was so surprised that he commented that it was strange that so celebrated a surgeon should consider the treatment of bunion an important procedure. The adage that there is no such thing as minor surgery, only minor surgeons, is alas still true.

I thank Miss D Bellamy, my secretary at Enfield District Hospital, for her help and Mr Martin Moor at Enfield District Hospital and Mr Ray Ruddick at the London Hospital for the photographs.

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Letter from . . . Chicago

Buttering opsonins

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British Medical Journal, 1977, **1**, 280-282

On 24 March 1976 at the height of the primary elections, President Ford wearing his TV-blue shirt and facing the cameras announced his decision to ask Congress for \$135m to vaccinate every American man, woman, and child against swine influenza. "We cannot afford to take a chance with the health of the nation," said the President, explaining the need to stimulate the phagocytes, butter the germs appetisingly with opsonins, and neutralise the deadly ptomaines arising from infected nuciform sacs. But it was reported—in this revisitation of George Bernard Shaw's *Doctor's Dilemma*—that the decision to march against the swine virus had not been made lightly; that there were anxious moments of consultation with Sir Colenso Ridgdon, Sir Patrick Cullen, and Sir Ralph Bloomfield Bonington; that

Mr Cutter Walpole, a surgeon, opposed the measure and advocated wholesale amputations of uvulae and extirpations of immunologically incompetent nuciform sacs; and that Dr Blenkinsop, an impoverished and overworked general practitioner, insisted that a pound of ripe greengages taken every day half an hour before lunch would be just as good and far less expensive.

Reasons for vaccination

Yet the events precipitating the President's decision were suspicious and alarming. A serious outbreak of influenza, the third worst in 50 years, had raged during the winter months, and over 20 000 people had died from respiratory illness. The virus had found its usual fruitful soil among the nation's military camps, and at Fort Dix, New Jersey, some half of the recruits had come down with upper respiratory complaints. Among these recruits was young private David Lewis, whose illness at first had seemed to be an ordinary cold. Several days later, however, his malaise increasing, he wrote to his fiancée

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