METATARSAL OSTEOTOMY FOR METATARSALGIA

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An oblique osteotomy in the distal half of the metatarsal shaft is described for the treatment of metatarsalgia due to prolapse of one or more of the middle three metatarsal heads. Thirty-eight patients who have had this operation have been followed up for a period of from two to five years. The operation is simple, recovery is rapid and symptoms have been well relieved.

Prolapse of the metatarsal heads accompanied by callosity formation is a frequent and troublesome complaint. The pain is due primarily to the formation of callosities, which occur in association with distal migration of the metatarsal fat pad. This is commonly accompanied by clawing or hammer deformity of the toes with associated hyperextension of the proximal phalanges on the metatarsals. In the aetiology of metatarsal head prolapse, structural abnormalities and disturbances of foot mechanics due to postural, muscular, fascial and ligamentous failures have been incriminated. Once established the deformity seems to be irreversible.

TREATMENT

Conservative methods of treatment include faradism, exercises for the intrinsic foot muscles, and insoles to ease and to redistribute pressure in the forefoot. These methods give relief in a proportion of cases. The creation of an artificial fat pad by the subcutaneous injection of silicone oil (Balkin 1966) provides temporary relief, but has to be repeated every three to six months.

Numerous surgical methods have been tried, including excision of callosities, insertion of Silastic sponge to provide a cushioning effect between the skin and the metatarsals, tendon slings, tendon transfers (sometimes combined with joint fusions), partial or complete resection of the metatarsal heads, excision of the heads of metatarsals and bases of phalanges, and various forms of osteotomy of the metatarsals. Dissatisfaction with these procedures has led to the trial of an oblique osteotomy in the distal half of the shaft of the metatarsal (Fig. 1).

TECHNIQUE OF OPERATION

For osteotomy of the middle three metatarsals two longitudinal dorsal incisions, each two centimetres long, are made over the distal half of the shaft of the second

![Fig. 1](image1)

Oblique osteotomy in distal half of the metatarsal shaft (Helal 1967).

![Fig. 2](image2)

Oblique osteotomy through the distal half of the shaft of the metatarsal. It is essential that the distal fragment should slide up on the proximal fragment and not angulate.

![Fig. 3](image3)

Outlying metatarsals are osteotomised to allow telescoping of the distal fragments towards the adjacent metatarsal.


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metatarsal and between the third and fourth metatarsals. If only one metatarsal is to be dealt with, the incision is made over the affected bone. Blunt dissection of soft tissue down to bone is carried out and the metatarsal is divided with an oscillating saw, the osteotomy sloping at 45 degrees plantarwards and distally. After division of the bone, care is taken that the distal fragment should slide up at the osteotomy site and not angulate (Fig. 2). That portion of bone which protrudes dorsally from the distal fragment is trimmed off if prominent. Only the skin is closed. Gauze and wool dressing and a crepe bandage are applied. Foot exercises are taught before operation and are begun again the day after operation.

After osteotomy of the middle metatarsals the patient may be encouraged to bear weight from the outset. The usual practice is to operate on one foot at a time. When the outlying metatarsals—that is the first and fifth—require operation, separate incisions are made over them. Osteotomy of these metatarsals is slanted in such a way as to allow telescoping of the distal fragment towards the adjoining metatarsal (Fig. 3). A plaster cast is worn by these patients for six weeks.

RESULTS

Up to the end of 1973 the procedure had been carried out on 131 feet in eighty-eight patients (Fig. 4). For this review only those patients operated upon two or more years ago are included; thus the follow-up period is at least two years. Forty-seven feet in thirty-eight patients were available for review. There were seven males and thirty-one females. Nine patients had bilateral operations. The patients included fourteen with rheumatoid arthritis (twenty-two feet), two with congenital cavus (four feet) and two with recurrence of callosities under metatarsal stumps after Fowler’s operation (Fig. 5). The remainder were middle aged and elderly patients without any associated disease or congenital deformities. The age range was from fourteen to seventy-two years (average forty-eight). Primarily, no concomitant procedures were carried out on toes for clawing or for dislocation of the metatarso-phalangeal joints. In fourteen out of twenty-four patients with rigid deformities of the toes, there has been some spontaneous reduction of the degree of deformity since operation. In recent months, stiff deformed toes have been manipulated while the patient is anaesthetised; this aids correction. Mobile toe deformities usually become corrected at the time of operation. The distribution of osteotomies is shown in Figures 6 to 9. The clinical or radiographic features of four patients before and after metatarsal osteotomy are illustrated in Figures 10 to 19.

Physiotherapy—All the patients had had faradism and foot exercises before operation.

Silicone oil injections—Four patients had received injections of silicone oil at six-monthly intervals for two years.

Insoles—All patients had previously worn insoles. None requested them after operation.

Surgical shoes—Twenty patients had worn surgical shoes, and six had extra large shoes before operation. After osteotomy five patients continued to wear special shoes: the rest wore ordinary footwear. Of the five patients, three had clawed toes and two had dislocated metatarso-phalangeal joints. It is of interest that when there was
Distribution of osteotomies. Figure 6—Single osteotomies: seventeen cases distributed as indicated on the diagram. Figure 7—Osteotomies of the three central metatarsals: twenty feet (fourteen patients). Figure 8—Osteotomies of first, second, third and fourth metatarsals: three feet (two patients). Figure 9—Osteotomies of all five metatarsals: seven feet (five patients).

no shoe pressure upon these toes, there was no pain. Four other patients with dislocated metatarso-phalangeal joints were comfortable in ordinary shoes.

**Walking**—Before operation, thirty-four patients restricted their walking as much as possible. The four patients who had had silicone oil injections were symptom-free for two to four months after the procedure and during this time their walking was unrestricted. After operation, six patients, all with rheumatoid arthritis, continued to be restricted in their walking, for causes not associated with their feet.

**Further operations**—Four patients (six feet) had further operations for toe deformities: all were women who wore surgical shoes.

**Complications**—Complications occurred in five patients (six feet) and included infection, fibrous union and stiffness.

**Infection**—In one patient whose second foot was operated on three months after the first, the wounds of both became superficially infected; both responded to antibiotic treatment.

**Fibrous union**—One patient had fibrous union of the osteotomies in one foot but, although clinically mobile, they gave rise to no pain. Eighteen months later she had an oblique osteotomy of the first metatarsal neck for a varus metatarsal with hallux valgus, and during the six weeks in plaster following this operation, the middle metatarsal osteotomies united (Figs. 20 and 21).

**Stiffness**—In three patients (four feet) there was some increase in stiffness of the metatarso-phalangeal joints compared with pre-operatively.

**DISCUSSION**

Chronic painful plantar callosities under the middle metatarsal heads which do not respond to conservative methods of treatment have posed a difficult problem especially in the young active patient. Excision of
A 58-year-old patient who wore surgical shoes with soft insoles and who could walk only a few yards. Four months after the operation she was able to shop painlessly and wear a "wide fit" strap shoe. Figure 17—Before operation. Figure 18—Ten weeks after refashioning of the forefeet. Figure 19—Radiographs after operation. Nothing was done for the dislocated metatarso-phalangeal joints, which remain symptomless.
callosities produces only temporary relief. Insertion of silicone rubber sponge to provide a permanent cushion between the metatarsal heads and the skin (Fig. 22) has proved disappointing because the material compresses and hardens, and the problem recurs.

Tendon sling procedures (Barbieri and Federzoni 1960), the operation for claw toes described by Lambrinudi (1927) and partial excision of the metatarsal head (Du Vries 1953) have also proved disappointing and unreliable in my experience.

Excision of metatarsal heads or of the heads together with the bases of the proximal phalanges (Fowler 1957) may provide some advantage in those deformed rheumatoid feet in which symptoms are severe, so that the patient is loath to walk. Recovery after such ablative procedures is slow and the toes remain floppy and functionless. Ablations of one or two middle metatarsal heads result in excessive pressure being thrown on those that are left. It seems excessive to subject a person with painful callosities under one or more middle metatarsals to the mutilation and dysfunction of a radical excision procedure on all the metatarsals, some of which may be quite normal. Also, there have been patients in whom further callosity formation and pain occurs under the stumps of the metatarsals (Fig. 5). In this series six feet in sixteen rheumatoid patients were so affected.

Attempts to alter the weight-bearing characteristic of the metatarsals by various forms of osteotomy have been tried. Meisenbach (1916) and Thomas (1969) described a transverse osteotomy at the junction of the middle and distal thirds, allowing dorsal tilt of the distal fragment (Fig. 23). Unaware of the earlier work, I carried out a similar osteotomy on six feet in four patients in 1965. The best results were in those feet in which the osteotomy displaced completely, allowing the metatarsals to shorten. Later, Borggreve (1949) modified the operation by removing a dorsal wedge of bone (Fig. 24). Both these procedures tend to increase bone length and soft-tissue tension and to aggravate toe deformities. Giannestras (1954) recommended shortening the metatarsal by

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**Fig. 20**
Fibrous union of second and third osteotomies; these proceeded to bony union after osteotomy of the first metatarsal.

**Fig. 21**
Insertion of silicone sponge to create an artificial fat pad between the broad callosity and the head of the first metatarsal.

**Fig. 22**
Insertion of silicone sponge to create an artificial fat pad between the broad callosity and the head of the first metatarsal.

**Fig. 23**
Meisenbach procedure.

**Fig. 24**
Borggreve procedure.

**Fig. 25**
Gagnon procedure (1968).
1.5 centimetres and used internal fixation for the proximal "Z" osteotomy. The procedure seems correct in principle but complicated, and the patient has to be protected from weight-bearing for two months. Gagnon (1968), who ascribed the idea for the procedure to Gariepy, recommended an oblique osteotomy close to the base of the metatarsal; this was tried on cadaver feet (Fig. 25). Osteotomy at this level makes adequate displacement difficult, and if it succeeds, may produce a thickening on the dorsum of the foot at an awkward spot for normal footwear.

The osteotomy described in this paper has the advantage of being technically simple. Metatarsal alignment is maintained and the shortening produces adequate soft-tissue relaxation which helps to realign deformed toes and to reposition the metatarsal fat pad. A short stay in hospital is followed consistently by rapid convalescence and relief of pain.

REFERENCES