Metatarsal head excision for rheumatoid arthritis

4-year follow-up of 68 feet with and without hallux fusion

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Thirty-four painful deformed rheumatoid feet treated by excision of all five metatarsal heads were compared with 34 similar feet in which the lesser metatarsal heads were excised and the first metatarsophalangeal joint was arthrodesed. In the latter group, one third had failure of fusion of the hallux, and this produced the worst results. Metatarsalgia and plantar callosities were more common after excision arthroplasty, but shoe fitting and correction of deformity were better in this group. However, the results were more variable in the fusion group, and the complication and reoperation rates were higher. For this reason, excision arthroplasty, rather than fusion of the hallux, is recommended when the lesser metatarsal heads are removed.

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In rheumatoid feet many surgeons favor excision of the metatarsophalangeal joints. Although the results are generally satisfactory, the foot is shortened (Marmor 1975), the toes are defunctioned (Dwyer 1970, Cracchiolo 1982), and the gait is impaired (Barton 1973). Furthermore, recurrent deformity may occur owing to loss of the lateral support from the lesser toes (Brattström and Brattström 1970, Watson 1974).

All of these problems appear to arise from loss of stability of the forefoot. This has led some surgeons to arthrodese the first metatarsophalangeal joint when the lesser metatarsal heads are excised (Dwyer 1970, Watson 1974, DuVries 1978, Lipscomb 1979, Beauchamp et al. 1984). This has been criticized on the grounds that the lateral four rays remain much shorter than the first ray, and leads to difficulties with shoe fitting and pain under the sesamoids (Cracchiolo 1982). To determine whether such an approach is justified, a direct comparison of forefoot arthroplasty with excision of all the metatarsal heads, both with and without fusion of the hallux, was undertaken.

Patients and methods

In a retrospective study, 38 patients with rheumatoid arthritis were reviewed. Thirty-four feet in 20 patients had been treated by excision of all five metatarsal heads. These were compared with 34 feet in 18 patients who underwent a modified forefoot arthroplasty in which the lateral metatarsal heads were excised and the first metatarsophalageal joint was arthrodesed. The two groups were generally comparable (Table 1).

Operative technique

A Mayo (1908) resection of approximately two thirds of the first metatarsal head, with trimming of the medial exostosis, was performed when all five metatarsal heads were resected. A screw fusion of the first metatarsophalangeal joint based on the technique of McKeever (1952) was performed in 24 feet of the modified arthroplasty group with threaded Steinmann pins being used in 9 feet and an external fixator in one.

Table 1. Comparison of excision arthroplasty with modified arthroplasty

	Excision	Modified
Number of feet	34	34
Number of patients	20	18
Sex (M/F)	4/16	1/17
Age	60 (35–76)	56 (31–76)
Side (L/R)	18/16	18/16
Mean duration of arthritis (years)	20	18
Mean duration of foot symptoms (years)	16	16
Previous foot operations	8	9
Hindfoot valgus	8	6
Mean duration of follow-up (years)	5 (3–9)	4 (2–6)

Figure 1. Radiographs following excision of all five metatarsal heads showing uniform resection of the metatarsal necks in a smooth curve.

The lesser metatarsal heads were excised to form a smooth curve (Figure 1), with trimming of the plantar condyles. All the patients remained non-weight bearing for 2 weeks. Plaster of Paris slippers were then worn for a further 4 weeks following the fusion arthroplasties.

Review

The follow-up averaged 5 (3–9) years after excision arthroplasty and 4 (2–6) years after fusion arthroplasty. All the patients attended for final review. Their pain relief, footwear, and overall satisfaction were noted. Overall satisfaction was recorded by the patients on a linear analogue scale (Downie 1978).

The feet were inspected for evidence of callosities, and the range of motion in the joints was recorded. Weight-bearing anteroposterior radiographs of the foot were taken, and from these the hallux valgus and first intermetatarsal angles were measured. Dynamic foot pressure patterns were recorded using a glass-plate pedobarograph with the Sheffield system of automatic analysis (Duckworth et al. 1982). Ten areas of interest in the forefoot were identified for analysis: viz., all the metatarsal heads and all the toes. Three walks with each foot were recorded for each subject, and a mean value was calculated for peak pressure, and also for contact time expressed as a proportion of stance phase. In a separate study, a pedobarographic analysis of 160 asymptomatic feet was performed.

Complications

Two feet in the excision arthroplasty group had a superficial wound infection, and three feet developed a painful exostosis arising from a metatarsal stump that required further resection. The complications in the fusion arthroplasty group included two feet with delayed wound healing, four wound infections, three painful pseudarthroses, four painful exostoses, and two feet with excessive dorsiflexion at the arthrodesis. Further surgery was necessary in 7 patients in whom 11 feet had a total of 16 operations. These included eight screw or wire removals, four removals of exostoses, three revisions of the arthrodesis, and one drainage of abscess.

Results

The degree of satisfaction averaged 83 percent for both groups but was more variable after fusion of the hallux (40–100 percent) than after excision (60–100 percent). At the time of follow-up, five feet in the excision arthroplasty group had metatarsalgia compared with only two in the fusion group. Footwear and shoe fitting improved in 8 patients following excision arthroplasty, whereas 10 were unchanged and 2 were worse. After fusion arthroplasty, 6 were improved, 8 were unchanged, and 4 were worse.

Shortening of the foot had occurred in all but 1 of the patients who underwent excision arthroplasty, and in all but 3 of those who had fusion arthroplasty.

Plantar callosities were present in only seven of the feet that had fusion arthroplasty, but in 20 of the excision group, in which they were more common at all sites under the forefoot (Table 2).

Valgus angulation of both the hallux and the lesser toes was greater after *fusion arthroplasty* (Table 3). Failure of radiographic fusion occurred in 12 of the 34 feet in this group, with a fibrous union

Table 2. Location of plantar callosities and pedobarographic high-pressure spots following forefoot arthroplasty

	Metatarsal heads			
	First	First and central	Central	Total
Plantar callosities				
Excision	8	6	6	20
Fusion	3	1	3	7
Pedobarographic peak loading				
Excision	2	8	4	14
Fusion	5	5	3	13

Table 3. Radiographic measurements at follow-up (degrees)

	Excision	Fusion
First intermetatarsal angle	11	11
Hallux valgus angle	26 (3–58)	31 (6–65)
Valgus angle of 2nd toe	22 (4–49)	26 (7–60)

Table 4. Comparison of results following successful (n 22) and unsuccessful (n 12) first metatarsophalangeal joint fusion

	Successful fusion	Failed fusion
Mean patient satisfaction	85%	77%
Mean hallux valgus angle	27°	37°
Mean valgus angle of 2nd toe	22°	34°
Callosity below first metatarsal head	–	4 (33%)
High pressure below first metatarsal head	4 (18%)	6 (50%)

Table 5. Final objective gradings

	Excision	Fusion
Excellent[1]	8	9
Good[2]	16	15
Fair[3]	10	8
Poor[4]	None	2

[1] Patient and surgeon completely satisfied. No pain. No deformity.
[2] No pain. Mild recurrence or minor complication.
[3] Patient improved from preoperative status. Mild pain, or moderate recurrence, or further surgery.
[4] Patient dissatisfied. Moderate or severe pain, or severe recurrence.

in eight and a pseudarthrosis in four. The results in these 12 feet were less satisfactory (Table 4).

Fusion occurred in seven of the nine feet in which threaded pins were used and in 15 of the 24 screw fusions. There was failure of fusion in the foot treated by external fixation. There was generally a poor correlation between the level of resection of individual metatarsals and the presence of metatarsalgia, the location of plantar callosities, and the pedobarographic pattern.

Fusion of the hallux resulted in greater peak pressures under the big toe than after excision of the first metatarsal head. The second metatarsal heads in the fusion group showed decreased peak pressures compared with the excision group. There was a trend towards decreased pressure and contact time under the lateral four toes in the fusion group. Compared with a group of 160 normal subjects, both operated on groups had increased peak pressure under the metatarsal heads and increased contact times under the hindfoot.

Overall gradings

Despite the higher incidence of complications following fusion arthroplasty, objective overall gradings were similar in the two groups (Table 5). Two fused feet, however, had poor results because of patient dissatisfaction.

Discussion

Some of the claimed disadvantages of metatarsal head excision, whether or not the hallux is fused, include shortening of the foot, difficulties with shoe fitting, and impaired toe function. Shortening was almost universal in this series, and inevitably caused some problems in the few patients who had unilateral arthroplasty.

Difficulties with shoe-fitting generally improved after surgery, but the fused group fared slightly worse, which was possibly due to their more rigid, unyielding, and relatively long first ray.

Successful hallux fusion should in theory increase the loading on the pulp of the big toe while reducing the load transmitted through other parts of the forefoot. Conversely, forefoot loading might be expected to be more uniform following excision arthroplasty. In general, these observations were confirmed by the present study, with more feet developing lateral metatarsalgia and plantar callos-

ities following excision arthroplasty. Furthermore, relative protection of the second metatarsal head was confirmed pedobarographically in those feet with fused big toes. It is also of interest that those feet with failed hallux fusion had greater pressures and more callosities under the first metatarsal head than in feet with either a successful fusion or after an excision arthroplasty. This high localized pressure under the sesamoids reflects the effective defunctioning of all five metatarsophalangeal joints, with only minimal shortening of the first metatarsal as compared with the remaining metatarsals.

The lack of correlation between the location of plantar callosities and pedobarographic high-pressure areas was surprising. Toe-contact times, however, demonstrated that the lesser toes provided slightly greater load bearing after metatarsal head excision alone than following metatarsal head excision with hallux fusion. Our study supports the views of Fowler (1959), Dwyer (1970), and Cracchiolo (1982) that the toes are defunctioned following metatarsal head excision.

Another criticism of metatarsal head excision is gradual recurrence of valgus deformity in the toes. In this series, following successful hallux fusion, the valgus angles of the first and second toes, respectively, averaged the same as in the excision arthroplasty group. Failure of fusion, however, resulted in greater recurrent forefoot deformity. The results in these feet were less satisfactory than in those with sound bony union.

Resection of the metatarsal heads in a smooth curve (Figure 1) has been emphasized by many authors including Kates et al. (1967), Brattström and Brattström (1970), Barton (1973), and Watson (1974). Our study failed to demonstrate a consistent relationship between metatarsal protrusion or recession and the presence of pain, callosities, and pedobarographic high-pressure areas. Goldie et al. (1983) suggested new bone formation at the resected metatarsal necks could cause an uneven arc; but in our series, patient satisfaction did not depend on a smooth curve. Although this supports our findings, it would appear common sense to aim for even resection of the metatarsals.

In conclusion, although the patients' own subjective assessment and the surgeons' objective gradings in our study showed no clear advantage for either operation, the surgical result was more variable following fusion arthroplasty. Many patients were highly delighted with the result, but others were dissatisfied. It would appear that fusion either worked very well or complications occurred that often necessitated further surgery. We were unable to identify any preoperative factor that predicted a more satisfactory outcome after either procedure. We therefore conclude that excision of all five metatarsal heads with its more predictable results, technical simplicity, better correction of deformity, and lower complication and reoperation rates should be preferred.

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