

CONSERVATION OF METATARSAL HEADS IN SURGERY OF RHEUMATOID ARTHRITIS OF THE FOREFOOT

RAYMOND J. NEWMAN & JOHN M. FITTON

St. James's University Hospital, Leeds, U.K.

A new method of forefoot reconstruction for rheumatoid arthritis in 79 patients is described in which the metatarsal heads are preserved. The first metatarsophalangeal joint is fused and the bases of the proximal phalanges of only those rays involved with disease excised together with cysts and synovium. Post-operatively traction is used to maintain the length of the operated lateral toes. The results in 71 patients followed for 3-5 years after operation are reported. Excellent pain relief, improved stability and feet of normal length are achieved.

Key words: forefoot reconstruction; metatarsal heads; rheumatoid arthritis; hallux-fusion; proximal phalanx

Accepted 9.ix.82

Rheumatoid arthritis affects the forefoot in at least 90% of patients with the disease (Vainio 1975). It may produce a combination of hallux valgus, subluxation or dislocation of the metatarsophalangeal joints and clawing of the lateral toes. Plantar callosities, cysts and sinuses are commonly associated (Tillmann 1981).

Many techniques have been suggested for correction of these deformities ranging from tenolysis and synovectomy (Tillmann 1979) and metatarsal osteotomy for early cases (Helal 1975) to prosthetic replacement of totally destroyed metatarsophalangeal joints in patients with advanced disease (Swanson et al. 1979). The consensus of opinion, however, is that excision of the metatarsal heads with (Arnuso et al. 1971, Marmor 1975, Waxman 1977, Gschwend 1980, Vahvanen et al. 1980) or without (Schwartzmann 1964) excision of all or part of the proximal phalanx is the procedure of choice. Other methods include the excision of an ellipse of plantar skin both to remove callosities and to relocate the plantar fat pads which have shifted an-

teriorly (Kates et al. 1967, Lipscomb et al. 1972, Tillmann 1979).

The pain relief derived by these operations is almost uniformly good but the foot is shortened by one or two shoe sizes (Marmor 1975) and this is considered by many to initiate or worsen pre-existing unsteadiness (Fowler 1959, Barton 1973). The operation described here does not cause this and possesses the significant advantage that it can be performed on early cases in which the disease is localised to only two or three rays.

PATIENTS AND METHODS

A questionnaire was sent to all 79 patients with serologically or histologically-proven rheumatoid arthritis who had undergone the operation during 1975-78. Four had died and of the rest replies were received from 71 who had undergone 130 forefoot operations. In 97 feet all toes had been operated upon and in the rest only three or four. Fifty-nine patients underwent bilateral procedures and 12 had unilateral procedures. There were 57 females and 14 males. The average age at the time of surgery was 53 years (range

29–72 years) and the average length of follow-up was 3.5 years (range 3–5 years).

Patients were asked to assess the result of their operation as (a) excellent, i.e. marked improvement with satisfaction, (b) fair, i.e. some improvement with satisfaction and (c) poor, i.e. no improvement or deterioration with dissatisfaction. The completed questionnaire was then evaluated by an impartial surgeon.

Operative technique

The foot is exsanguinated and a dorsal longitudinal incision about 3 cm long made over each affected metatarsophalangeal joint. The joint of the hallux is exposed and sufficient bone removed from each surface to allow the toe to be fixed with an intramedullary Kirschner wire in 10° of valgus and less than 10° of dorsiflexion. The lateral extensor tendons are divided and the proximal half of the proximal phalanx of each of the affected lateral toes removed.

An oval strip of skin and subcutaneous fat containing

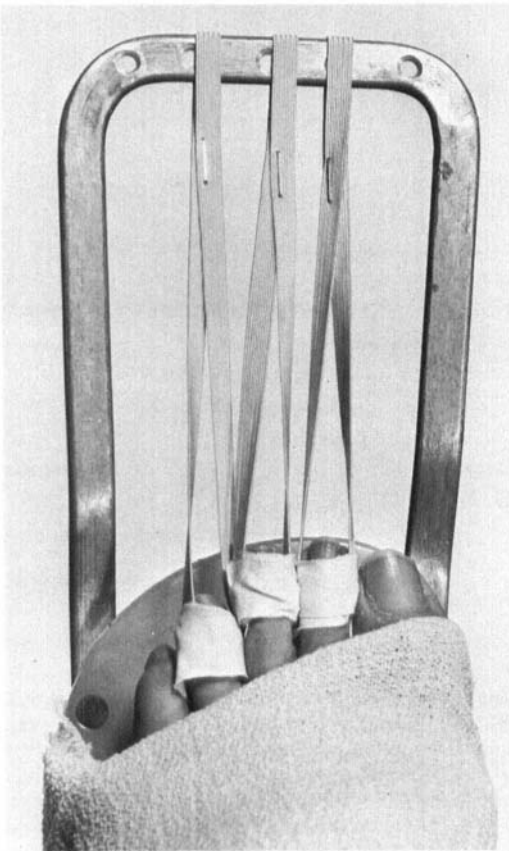


Figure 1. Traction applied to the operated lateral toes.



Figure 2. Post-operative radiograph showing the toes in distracted position.

the plantar callosities is excised from the sole under the metatarsal heads (if there are no callosities a linear transverse incision is made). The diseased joint capsule and synovium are removed together with any cysts and obvious bony excrescences. If either the second or third metatarsal head is unduly prominent relative to the other its condyles are shaved in a horizontal plane until level. Slight irregularity of the bones, however, is not an indication for surgical intervention. The long flexor tendons, which are usually displaced laterally into the inter-metatarsal spaces, are released and sutured to the subcutaneous fat under their respective metatarsal heads. The tourniquet is released, haemostasis secured and one layer closure performed with interrupted sutures.

The feet are elevated and on the third day skin traction is applied to the operated lateral toes (Figures 1 and 2) and continued until removal of the sutures. A below knee walking cast is then applied and together with the Kirschner wire retained until 5 weeks after the operation. If at that time the arthrodesis is not sound a second cast is applied for a further month.

Table 1. Overall results

Preoperative symptoms	Postoperative symptoms		
	Improvement	Same (Percentages)	Deterioration
Pain	88	9	3
Walking Distance	70	15	15*
Unsteadiness	59	—	20*
Footwear	35	54	11

* 50% of this figure is accountable by other morbidity.

RESULTS

The results of the operation are summarised in Tables 1 and 2. In 99% the most important pre-operative complaint was pain but other symptoms were also experienced, i.e. unsteadiness in 73%, inability to wear normal shoes in 37%, painful callosities in 19% and sinuses in 18%. Further analysis revealed the pain to be severe in 87%, moderate in 11% and mild in 1%. The operation had a dramatic effect on this and 88% claimed significant improvement. The pattern of the severity of the pain was also changed since 25% were pain-free, 25% experienced an ache, 45% had no more than moderate pain and 5% had pain of some severity.

Ninety one per cent of patients reported an improvement in their symptoms as a result of the operation but this beneficial effect was more marked in females (93%) than in males (76%).

Fifty-nine per cent who were unsteady before the operation could walk normally but 20% of the previously steady patients were worse. In half of the latter cases, however, the unsteadiness was due to extension of the rheumatoid disease to

other joints or intercurrent illness. Similarly, the number of patients whose walking distance decreased was artificially high by the same proportion.

The type of footwear worn pre-operatively was graded into slippers, surgical shoes, broad shoes and normal shoes. One third of patients reported improvement though many retained their original surgical shoes. The need for insoles and chiropody was reduced by approximately 20%.

Recurrent callosities were found in 30% of patients but were rarely painful. Second operations were required in five patients; four for prominence of the second or third metatarsal heads in the sole and one for a recurrent cyst.

The result of arthrodesis of the first metatarsophalangeal joint was also assessed. In 86% there was bony fusion and in the remainder a painless fibrous ankylosis. This compares with the figure of 64% by Newman & Fitton (1979) for successful arthrodesis of the proximal interphalangeal joint for hammer toe.

Superficial infection occurred in the plantar incision in two patients and in the wound on the dorsum of the first metatarsophalangeal joint in a third. There were no healing, thrombo-embolic or other problems.

Table 2. Patients' assessment

Excellent	49%	} 91%	
Fair	42%		
Poor	9%		
		Male	Female
		76	93

DISCUSSION

Apart from the prescription of local and systemic drugs, surgical shoes and physiotherapy (Gschwend 1980, Thomas 1981) conservative treatment has little to offer patients with rheumatoid arthritis of the forefoot – a condition which may be extremely painful and disabling

even before obvious deformities have developed.

The most radical treatment – amputation of the toes (Flint & Sweetnam 1957) is rarely acceptable for cosmetic reasons and forefoot arthroplasty in some form is the only alternative. Review of the literature reveals that removal of the metatarsal heads with or without excision of the bases of the proximal phalanges achieves satisfactory results in 90% of cases though figures as low as 67% have been recorded (Ananthkrishan & Wiedel 1978). The operation described here achieves patient satisfaction in excess of 90% of instances and has several advantages.

Firstly, stability is enhanced. This is particularly important and together with good pain relief accounts for the increased walking distance. Fowler (1959) described a patient who as a result of forefoot shortening tended to fall forwards and Barton (1973) recorded a similar case. In the latter's comparison of the techniques of Fowler (1959), Clayton (1967) and Kates et al. (1967) overall instability was found to be 20%, more than twice as high as in the procedure described here. Similarly, improvement in stability occurred in fewer patients, only 40%.

Secondly, the longitudinal dorsal incision obviates wound healing problems. The commonly used transverse dorsal approach fails to heal primarily in 30% of instances (Barton 1973) and loss of toes from gangrene has been recorded (Kates et al. 1967). In this series all wounds healed primarily in spite of 15% of patients taking the equivalent of at least 10 mg prednisone per day.

The third advantage is versatility for it can be used in the relatively early case in which only two or three rays are involved. Such limited operations are not possible if metatarsal heads are removed since excessive weight transmitted through the remaining heads causes recurrent pain and callosities.

Fourthly, the risks of metatarsal spur and sinus formation are reduced if the metatarsals are left intact. This is of considerable advantage since Vahvanen et al. (1980) reported that palpable excrescences proliferated at the cut surface of the bone in 61% following resection of the metatarsal heads.

The ellipse excised from the sole contains skin

and subcutaneous tissue and so differs from Fowler's procedure (1959) in which skin only is removed. The plantar part of this operation is particularly important since not only are the toes pulled down into better position but the fat pads and flexor tendons are relocated under the metatarsal heads. This reduces the tendency to recurrent displacement and pain (Kates et al. 1967, Tillmann 1979).

Fusion of the first toe maintains foot length and avoids the recurrent hallux valgus and lateral deviation of the outer toes that occurs in 50% of patients undergoing excision arthroplasty of the first toe as part of their treatment for forefoot rheumatoid arthritis (Vahvanen et al. 1980). Post-operative traction, a technique not described before in this situation, prevents overlap of the metatarsal heads by the stumps of the phalanges. This occurs in 68% following excision of the metatarsophalangeal joints (Vahvanen et al. 1980) and tends to produce toes that are short and misshapen. Postoperative traction minimizes this and results in longer and better shaped digits (Figure 3).

Funk stated in 1971 that the aims of surgical treatment of the rheumatoid foot should be stability and relief of pain. This operation certainly meets these requirements and in addition the significant improvement in walking distance is objective evidence of return of function of the foot as an organ of gait.



Figure 3. Typical post-operative result.

ACKNOWLEDGEMENTS

We wish to thank Mr. H. S. Shucksmith for advice, the Departments of Medical Illustration and Photography at St. James's University Hospital, Leeds and the Nuffield Orthopaedic Centre, Oxford for producing the figures and Mesdames Sandra Newman and Mary Wood for typing this manuscript.

REFERENCES

- Ananthakrishnan, C. V. & Wiedel, J. D. (1978) Forefoot resection in rheumatoid arthritis. A long term follow up. *Orthop. Trans.* **3**, 243–244.
- Arnuso, S. J., Wissinger, H. A., Margolis, H. M., Eisenbeis, C. H. & Stolzer, B. L. (1971) Metatarsal head resection in the treatment of rheumatoid arthritis. *Clin. Orthop.* **74**, 94–100.
- Barton, N. J. (1973) Arthroplasty of the forefoot in rheumatoid arthritis. *J. Bone Joint Surg.* **55-B**, 126–133.
- Clayton, M. L. (1960) Surgery of the forefoot in rheumatoid arthritis. *Clin. Orthop.* **16**, 136–140.
- Flint, M. & Sweetnam, R. (1960) Amputation of all toes. A review of forty-seven amputations. *J. Bone Joint Surg.* **43-B**, 90–96.
- Fowler, A. W. (1959) A method of forefoot reconstruction. *J. Bone Joint Surg.* **41-B**, 507–513.
- Funk, F. J. Jr. (1971) Surgery of the foot in rheumatoid arthritis. *Semin. Arthritis Rheum.* **1**, 25–43.
- Gschwend, N. (1980) Rheuma-orthopädie heute. *Beitr. Orthop. Traumatol* **6**, 321–337.
- Helal, B. (1975) Metatarsal osteotomy for metatarsalgia. *J. Bone Joint Surg.* **57-B**, 187–192.
- Kates, A., Kessel, L. & Kay, A. (1967) Arthroplasty of the forefoot. *J. Bone Joint Surg.* **49-B**, 552–557.
- Lipscombe, P. R., Benson, G. M. & Sones, D. A. (1972) Resection of proximal phalanges and metatarsal condyles for deformities of the forefoot due to rheumatoid arthritis. *Clin. Orthop.* **82**, 24–31.
- Marmor, L. (1975) Resection of the forefoot in rheumatoid arthritis. *Clin. Orthop.* **108**, 223–227.
- Newman, R. J. & Fitton, J. M. (1979) An evaluation of operative procedures in the treatment of hammer toe. *Acta Orthop. Scand.* **50**, 709–712.
- Schwartzmann, J. R. (1964) The surgical management of foot deformities in rheumatoid arthritis. *Clin. Orthop.* **36**, 86–95.
- Swanson, A. B., Lumsden, R. M. & Swanson, G. de G. (1979) Silicone implant arthroplasty of the great toe. *Clin. Orthop.* **142**, 30–43.
- Thomas, W. H. (1981) Reconstructive surgery and rehabilitation of the ankle and foot. In: *Textbook of Rheumatology* (Ed. Kelley, W. N. et al.), pp. 1999–2013. Saunders, London.
- Tillmann, K. (1979) *The rheumatoid foot. Diagnosis, pathogenesis and treatment.* Thieme, Stuttgart.
- Tillmann, K. (1981) Surgical treatment of the foot in rheumatoid arthritis. *Reconstr. Surg. Traumatol.* **18**, 195–204.
- Vahvanen, V., Piirainen, H. & Kettunen, P. (1980) Resection arthroplasty of the metatarsophalangeal joints in rheumatoid arthritis. *Scand. J. Rheum.* **9**, 257–265.
- Vainio, K. (1975) Orthopaedic surgery in the treatment of rheumatoid arthritis. *Ann. Clin. Res.* **7**, 216–224.
- Waxman, J. (1977) Joint surgery for rheumatoid arthritis. *South. Med. J.* **70**, 270–273.

Correspondence to: Mr. R. J. Newman, FRCS, FRCSEd., Nuffield Department of Orthopaedic Surgery, Nuffield Orthopaedic Centre, Headington, Oxford, OX3 9DU, U.K.