Ankle arthrodesis in rheumatoid arthritis

30 cases followed for 5 years

Christopher G. Moran, Ian M. Pinder and Stephen R. Smith

We have reviewed the results of 30 ankle arthrodeses performed on 26 patients with rheumatoid arthritis. This procedure was associated with a high morbidity, with wound breakdown and infection occurring in 12 cases. Eighteen ankles had fused, six had pain-free fibrous union, and six required further surgery for nonunion. Clinical evaluation, at an average follow-up of 5 years, was based on a modified ankle-grading system with good or excellent results in 14, fair results in nine, and poor in two. Only 4 patients had some residual pain in the ankle, and so, despite the high complication rate, arthrodesis is an effective method of treating the painful, rheumatoid ankle.

Department of Orthopedics, Freeman Hospital, Newcastle Upon Tyne, NE7 7DN, Great Britain
Correspondence: Mr. Stephen R. Smith
Tel +44–91 284 3111. Fax +44–91 213 1968
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Severe rheumatoid arthritis of the ankle is uncommon, but may become the most important factor in determining the mobility of a rheumatoid patient (Adam and Ranawat 1976). If treatment with anti-inflammatory drugs and orthotic devices fails to control the symptoms, then there are a number of surgical alternatives.

Synovectomy will give good results in patients with recurrent painful effusions of the ankle (Tillmann 1979). However, many patients are referred for surgery with advanced degenerative disease. This group is less likely to benefit from simple synovectomy.

The early reports of total ankle replacement were very encouraging, with good short-term results. Unfortunately, further studies have not borne out this early promise (Newton 1982, Bolton-Maggs et al. 1985). Most authors now believe that replacement arthroplasty should not be used in the rheumatoid patient, and so arthrodesis has been recommended as the treatment of choice in the painful, disabling, rheumatoid ankle (Hamblen 1985).

Few studies have described the results of ankle arthrodesis in this specific group of patients. Recent reports (Morrey and Wiedeman 1980, Lynch et al. 1988) on ankle arthrodesis for posttraumatic arthrosis have emphasized the technical problems associated with this procedure. We have undertaken a study to assess the results, and complications, of ankle arthrodesis in rheumatoid patients.

Patients and methods

From 1977 to 1986, 26 patients with rheumatoid arthritis underwent ankle arthrodesis at our hospital. Four patients had bilateral ankle fusions, giving a total of 30 primary operations. There were 22 females and 4 males. The mean age at operation was 53 (28–69) years.

The indication for surgery in all the patients was severe, disabling ankle pain (Figure 1). No arthrodesis was performed for deformity alone. All the cases underwent a diagnostic/therapeutic trial of plaster cast immobilization prior to surgery. Pantalar arthrodesis was performed in patients with destruction or deformity of the subtalar joint in association with ankle arthritis. These patients have been excluded from the present series.

The preoperative function of this group of patients was limited, and polyarthropathy was the most important factor in limiting mobility. Twenty-two patients had proximal joint replacements; and, in general, ankle arthrodesis was delayed until after this reconstructive surgery. Surgical management of the ankle was performed between 4 and 36 years (mean 16 years) after the onset of the polyarthropathy.

Several surgical techniques were used to obtain fusion (Table 1). The majority were modifications of the compression technique of Charnley (1951). These modifications were employed in an effort to improve the cosmetic and functional results by correcting deformity and maintaining the height of the hindfoot (Marcus et al. 1983, Stewart et al. 1983). In order to decrease the complications that were encountered

Table 1. Observations in 26 cases of ankle arthrodesis for rheumatoid arthritis

Case	A	B	C	D	E	F	G	H	I	J	K	L	M
1[a]	F	54	R	1	0	1	2	12	155	0	5°Vg	54	83
			L	1	0		2	12	155	0	N	56	85
2[a]	M	80	L	1	1		2	16	129	0	N	52	83
			R	1	1	2	0	0	57	1	5°Vg	48	80
3	M	69	L	2	0	2	1	17	D				
4	F	51	L	3	1		2	15	103	0	N	67	86
5	F	28	R	4	1	3	2	11	78	2	N	64	62
6	F	35	L	4	1	3	1	16	76	0	N	70	86
7	F	42	L	4	1	2	2	15	47	0	4°Vr	76	91
8	F	56	L	4	1		1	18	D				
9	F	54	L	5	0	2	2	12	D				
10	F	66	R	4	1	2	2	14	73	0	8°Vg	68	93
11	F	62	L	5	0	2	0		69	0	40°Vg	56	72
12	F	66	R	5	0		0		D				
13	F	58	R	4	1		2	15	67	0	N	68	77
14	M	60	L	5	0		0		63	0	10°Vr	58	70
15	F	50	R	5	0	2	2	11	52	0	N	62	74
16	F	31	R	3	1	2	0		52	0	5°Vg	63	83
17	F	51	L	6	1		0		50	1	10°Vr	64	74
18	F	45	R	6	1	2	1	15	50	0	N	74	92
19	F	62	R	6	0	2	2	14	48	0	N	57	74
20	M	48	R	6	1	2	2	25	47	1	N	54	67
21[a]	F	58	R	3	1		2	14	43	1	10°Vr	50	71
			L	3	1		2	14	43	0	N	53	80
22	F	58	L	5	1		1	12	39	0	5°Vg	67	86
23	F	66	R	3	1		2	18	D				
24[a]	F	59	R	3	1		2	11	33	0	N	55	77
			L	3	1		2	11	33	0	N	55	77
25	F	38	L	7	1	2	1	16	32	0	N	66	88
26	F	56	L	3	1		2	14	26	0	10°Vg	76	85

[a]Bilateral.
A Sex
B Age at operation
C Side
D Operative technique
1 fibula osteotomy
2 Watson-Jones
3 Charnley
4 Campbell clinic
5 chevron
6 Hoffmann
7 bone block + screws
E Bone graft
0 none
1 autogenous
F Complication
1 subtalar deformity
2 infection
3 tibial fracture
G Union
0 nonunion
1 fibrous union
2 union
H Time to union (weeks)
I Follow-up (months)
D dead
J Pain
0 none
1 mild
2 moderate
K Position of fusion
N neutral
Vg valgus
Vr varus
L Mazur's score
M Rheumatoid ankle score

using percutaneous pins, techniques using internal fixation were also employed.

The records of all the patients were reviewed. Five patients, all having had unilateral ankle arthrodesis, had died (deaths unrelated to surgery). The remaining 21 patients (25 ankle arthrodeses) were reviewed by a single, independent observer (CGM) at a mean follow-up time of 5 (2–12) years.

The clinical assessment was based on the Mazur ankle grading system (Mazur et al. 1979). Unfortunately, we found that this system did not accurately reflect the limited functional requirements of patients with polyarthropathy. We have therefore modified the Mazur score to produce a rheumatoid-ankle grading system (Table 2). We have continued to evaluate pain, gait, activity, and range of movement, with a maximum score of 100 points.

Radiographic evaluation included standing anteroposterior, lateral, and modified Cobey views of both ankles (Morrey and Wiedeman 1980). Measurements were taken of the talotibial angle, talar shift, and coronal angulation. Sclerosis, loss of trabeculation, and collapse were taken as radiographic markers for avascular necrosis of the dome of the talus.

Results

Clinical

The mean time to clinical union was 15 (11–25) weeks. Eighteen ankles achieved solid bone union after the primary procedure. A further six ankles had radiographic evidence of fibrous union, remained free

Table 2. Rheumatoid-ankle grading system (assessment wearing shoes). Maximum points 100

Pain				*Walking distance*				
None		60		Outside house > 200 m		10		
Mild—no restriction of activities		50		Outside house < 200 m		8		
Moderate—on stairs, slopes, etc.		40		Mobile inside house only		4		
Moderate—level gait		30		Toilet unaided		2		
Moderate—rest pain		20		Transfer bed to chair		1		
Severe		0		Unable to walk		0		
Walking aids		*Stairs*		*Slopes*				
None	5	Able to ascend	3	Normal gait	4			
1 cane	4	Able to descend	3	Sideways/backwards	2			
2 canes	3	Unable to negotiate	0	Unable to negotiate	0			
Walking frame	2							
Wheelchair	1							
Total range sagittal motion		*Coronal deformity*		*Clinical grading*				
> 30°	10	< 5°	5	< 70 points	Poor			
20°–30°	8	5°–9°	2	70–79 points	Fair			
10°–19°	6	> 10°	0	80–89 points	Good			
1°–9°	2			90–100 points	Excellent			
None	0							

from pain, and did not require further surgery. Six ankles failed to unite and remained painful (Figure 2). These six ankles were revised 3–12 months after the primary arthrodesis. Five ankles went on to sound bone union. The remaining case required further revision surgery at 36 months, and developed a pain-free fibrous union.

The clinical results were very disappointing, with a mean score of 61 points. Only 4 patients achieved a good result, while nine ankles were fair and 12 ankles were rated as poor. Despite this assessment, 19 of the 21 patients who were available for review were satisfied with the result. Twenty ankles were pain-free, 4 patients had intermittent mild pain, and 1 patient suffered moderate pain. The mean walking distance was 50 meters before surgery and 240 meters after ankle fusion; no patient's walking distance decreased postoperatively.

Using our modified system (Table 2), the mean score was 80 points, with results graded as excellent in three ankles, good in 11 ankles, and fair in nine ankles. Two patients had a score of less than 70 points, and

Figure 1. Case 8: Female, aged 56 years, with rheumatoid arthritis of 10 years' duration. Destruction of the ankle and subtalar joints.

Figure 2. Case 2: Nonunion following the use of autogenous bone graft. Sclerosis and loss of trabeculation of the dome of the talus suggest avascular necrosis, and thus the avascular bone graft has failed to unite with the avascular talus.

Figure 3. Case 6: Peroperative fracture of the tibia associated with the use of transfixing pins.

were considered to have poor results. One patient continued to have mild hindfoot pain despite fusion of the ankle. His mobility was severely limited by destruction of the ipsilateral knee joint. A second patient continued to suffer moderate hindfoot pain on weight bearing. This occurred despite an adequate fusion of the ankle. In both cases the source of this persistent pain was thought to be the subtalar joint. Radiographically, there was no evidence that the arthritis effecting the subtalar joint had progressed following ankle fusion. These patients may require conversion to a pantalar arthrodesis.

In spite of the clinical improvement after ankle arthrodesis, patients were using more walking aids at follow-up. Only 12 patients had increased their general level of activities. This was due to two factors: gait problems following ankle fusion and progression of the polyarthropathy. No ankles were fused in dorsiflexion; but, despite the use of appropriate footwear, only 4 patients found it easier to negotiate stairs. All the patients found it more difficult to walk on slopes.

The clinical examination at the follow-up review showed no evidence of calf muscle atrophy on the side of ankle fusion. The mean sagittal motion of the unfused ankle and foot was 46°. On the side of arthrodesis, there was a mean sagittal motion of 12°, due to movements in the other joints of the hindfoot and midfoot. Clinical measurement of ankle rotation showed 13 ankles had fused in the neutral position, six in external rotation (5°–20°), and six in internal rotation (5°–20°).

Surgical complications

The major source of postoperative morbidity was wound breakdown and infection. This occurred in 12 ankles. *Staphylococcus aureus* was isolated from 10 of these wounds: 3 patients went on to develop chronic osteomyelitis with a discharging sinus. *Pseudomonas aerugosa* was cultured from the other two infected wounds, but there was no evidence of osteomyelitis.

Additional surgical procedures were required in 5 of the patients with infection; in 2 cases internal fixation devices were removed. Repeat fusion was performed for painful, infected nonunion in 3 patients. The 12 patients with wound infections had undergone a total of 23 proximal, lower limb, replacement arthroplasties. In no instance was there hematogenous spread of the infection to the arthroplasty site.

Analysis of the results has failed to reveal any particular factor(s) associated with this high wound breakdown and infection rate. Arthrodesis was not performed on patients with active vasculitis. Infection was no more common in patients receiving systemic steroids, and occurred whether or not external or internal fixation devices were used (Table 1).

Surgical technique (Table 1), the use of steroids, and the occurrence of wound infection did not influence the final clinical outcome. The mean rheumatoid ankle score was 82 in infected cases and 78 in cases without an infection.

An autogenous bone graft was used in 21 ankle fusions. Thirteen of these cases went on to achieve bone union after the primary arthrodesis. Bone grafts were not used in nine ankles. Despite this, 5 patients achieved a successful primary fusion.

Recurrent deformity leading to major disability was a problem in 1 patient who had a subluxation of the subtalar joint with valgus deformity. This increased dramatically after ankle fusion, and required conversion to a pantalar arthrodesis 18 months postoperatively.

Fracture of the tibial shaft occurred in 2 cases (Figure 4). Both fractures were minimally displaced and resulted when transfixing Steinmann pins were used to correct coronal deformity. The fractures were treated nonoperatively, and they healed without complications.

Radiographic review

Following arthrodesis, the mean tibiotalar angle was 8° plantar flexion (3°–14°). The clinical result was not dependent on the sagittal/coronal plane alignment: Eight ankles were fused in valgus (5°–40°), and had a mean rheumatoid ankle score of 83 points; four ankles were fused in varus (4°–10°), and had a mean score of 77 points; and 13 ankles were neutral, and had a mean score of 79 points.

Anterior translocation of the talus on the tibia (to a maximum of 1.5 cm) occurred in three ankles, and did not have any clinical significance. Posterior translocation of the talus did not occur. A review of the preoperative radiographs suggested the possibility of avascular necrosis of the dome of the talus in six of the 12 ankles that failed to achieve bone union after the primary arthrodesis. None of the patients who achieved a primary fusion had radiographic evidence of avascular necrosis.

Discussion

Good results from hip and knee reconstructions have placed new emphasis upon the need for a functional foot to complete rehabilitation of the rheumatoid patient. Thus, surgical treatment of the rheumatoid

ankle has become more important. However, the reported incidence of ankle destruction is low (Tillmann 1979), and few studies have reported the results of ankle arthrodesis in this group of patients (Hamblen 1985).

The present series is the first to use an objective scoring system to assess the clinical outcome of ankle fusion in rheumatoid arthritis. There are a number of grading systems designed for the assessment of ankle surgery. The most widely used was introduced by Mazur and his colleagues (1979). This excellent system was specifically designed to evaluate the results of ankle arthrodesis for posttraumatic arthrosis. Mazur et al. (1979) evaluated activities such as hill climbing, running, and standing on tiptoe.

The Mazur system tends to down grade patients with a polyarthropathy. Because of this problem, we have modified the scoring system to evaluate rheumatoid patients. We have continued to use a 100-point scale, while allowing for the more limited functional requirements of these patients. Thus, the clinical grade accurately reflects pain relief and increased mobility—the major aims of rheumatoid surgery.

Our results are similar to those described by Vahavanen (1969) and Adam and Ranawat (1976). Vahavanen reported no problems with wound healing or infection, the most common postoperative complication in our series. Morrey and Wiedeman (1980) and Lynch et al. (1988) reported infection in over 20 percent of their fusions for posttraumatic arthrosis. A higher incidence of wound breakdown and infection has been reported following ankle arthroplasty (Bolton-Maggs et al. 1985).

From a retrospective analysis, it is impossible to differentiate between wound breakdown, with subsequent bacterial colonization and primary wound infection. During ankle arthrodesis, meticulous care should be taken when handling all the soft tissues. The positioning of external fixator pins is particularly important, and must allow wound closure without tension. Prophylactic antibiotics were not used in the present series. Their role in the prevention of wound infection needs to be evaluated in a prospective study.

Adam and Ranawat (1976) have recommended the use of Charnley clamps to correct severe coronal deformity. We found this technique effective, but it must be used with caution, as there is a significant risk of fracture of the tibial shaft. The chevron osteotomy (Marcus et al. 1983) avoids some of these problems, as this method relies upon internal fixation with staples and screws to provide stability. Unfortunately, the results using this technique were poor: 3 out of 6 patients required revision surgery for painful nonunion. Although effective in posttraumatic arthrosis, we believe that this technique gives inadequate fixation in the osteoporotic bone of rheumatoid patients. Thus, we have abandoned its use in this specific group of patients.

In an attempt to improve upon the linear external fixation provided by the Charnley technique, Hoffmann's external fixation was used in 4 cases. Infection was a major problem in this group. Russotti et al. (1988) have reported similar problems when using this device.

In our experience, autogenous bone grafts have not significantly increased the rate of bone union. Attempts to maintain joint height failed because of collapse of the bone graft. Vahvanen (1969) reported similar problems after blocking the joint with a graft from the iliac crest or tibia.

Careful assessment of the hindfoot must be performed prior to ankle arthrodesis. Clinically, it can be difficult to localize the origin of hindfoot pain. Thus, a small number of patients in whom the ankle joint was successfully fused continued to have pain from the subtalar joint. Intraarticular injection of a local anesthetic was not used, but may help to differentiate this subgroup of patients in whom a pantalar fusion should be considered.

The site of deformity in the hindfoot must be assessed using standing radiographs. If there is significant subtalar subluxation, then the result of ankle arthrodesis may be unsatisfactory, because the subtalar deformity increases rapidly after proximal fusion. Adam and Ranawat (1976) have also noted this problem, and they recommended pantalar fusion for this complex deformity.

The results of our radiographic review suggest that avascular necrosis of the talar dome may be an etiologic factor in the development of nonunion. The incidence of avascular necrosis of the talus has not been reported in rheumatoid arthritis. We acknowledge that radiographic analysis is an unreliable guide to bone vascularity; but, in view of the high incidence of nonunion, this problem warrants further investigation.

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