The ankle

- Arthritis of the ankle and foot is a common cause of walking problems in rheumatics.
- Uncorrected malalignment in the ankle and foot may jeopardize the gains from hip and knee surgery.
- Arthritis in the ankle is seldom isolated, but usually follows after arthritis of the hindfoot and midfoot.
- Arthrodesis of the ankle requires careful surgical technique and postoperative casting over an extended period. It may also create a risk for acceleration of symptomatic arthritis in more distal joints of the foot.
- Arthroplasty may be an alternative in rheumatics having involvement of multiple joints, but the risk for prosthetic loosening, particularly on the talus side, is significant, and revision of loose prostheses is technically demanding.

Patients with RA seldom have an isolated foot problem. When the feet cause symptoms, there is usually involvement of the hip and knee joints, which may both worsen and be worsened by concurrent foot problems. A non-corrected malposition of the hindfoot may, eg, jeopardize gait improvement after a hip and knee arthroplasty. It is a good rule to manage malpositions of the knee joint before correcting malpositions of the ankle–hindfoot–midfoot.

Usually, many joints of the foot are affected, often with varying degrees of destruction in different joints and often asymmetrically distributed between the feet.

Arthritis of the ankle seldom occurs isolated, but follows arthritis of the hindfoot and midfoot. It may be severely debilitating and is perhaps the most common cause of more significant gait difficulties among rheumatics [19,25]. The ankle is affected by malalignment of the hind and midfoot to a high degree, and it is usually appropriate to manage these before considering surgery of the ankle.

Scope of the problem

Inflammatory joint changes in the ankle and foot are a common cause of walking difficulties in rheumatics. After 10 years of disease, nearly all patients show clinical signs of arthritis in one or more joints of the foot. Kerry et al investigated 100 rheumatics having a mean age of 58 years and an average duration of disease of 11 years [19]. 76 percent reported walking difficulties, which were due exclusively to pain from placing weight on the foot (15 patients already had an implanted knee prosthesis and 11 had a hip prosthesis). In a similar study of 99 rheumatics, Michelsen et al found that 94% had foot pain, 79% reported pain in the ankle, and 42% that the ankle was the joint of the foot causing most symptoms [25].

Indications and surgical methods

Synovectomy of the ankle is seldom performed. The opportunity for radical treatment is small, and joint destruction has usually progressed too far when the patient seeks help.

Tenosynovectomy around the medial tendons is likely to be valuable in preventing rupture of the tibialis posterior tendon [16]. Such rupture is uncommon and not the genesis of rheumatic valgus foot, but may cause an acute and further accentuated valgus malalignment of the foot.

For more than one hundred years, *arthrodesis* of the ankle has been performed due to severe joint disease or residual states after injury. A number of techniques have been described. Basic to all of them is that the joint is cleaned from remaining cartilage, the position of the joint is adjusted, and the ends of the bones are brought into stable contact with each other by means of external fixation or some osteosynthetic method with pins, medullary nails, screws, plates, or transplanted cortical bone. Further fixation may be achieved by transcutaneous pins and a compression device such as

eg Charnely's or Calandruccio's external fixators. Cancellous bone can be transplanted to stimulate bone healing.

Arthrodesis is the most established treatment for rheumatic destruction in the ankle. The choice of method is probably of lesser significance for healing, but may influence the degree and type of complications. Special consideration should be given to the decreased bone quality and possible malalignment in adjacent joints in rheumatic patients. A malaligned heel can be corrected and fixed in the same session as the ankle arthrodesis by driving the fixation screws down through the talus and into the calcaneus. Mechanical studies have shown that good fixation is achieved by two or three crossed screws, by both angling and twisting, and is fully comparable to that achieved with an external fixator [28,35,36]. Further stability can be obtained by screwing the distal fibula over the arthrodesis [35]. Healing is usually completed with 3 to 4 months of cast treatment. The latest attempt at method improvement involves arthroscopic cleansing of the joint followed by percutaneous screw fixation, aiming to minimize the risk of disrupting healing in the skin and bone [38].

Arthroplasty using endoprosthesis of the ankle is an appealing alternative since postoperative rehabilitation is short and retaining mobility of the ankle is functionally beneficial. A stiff ankle involves a risk for compensatory overmobility of the joints in the midfoot with the risk for secondary arthrosis, a risk which may be avoided by using a prosthesis. However, implantation of a prosthesis involves a risk for deep infection after disrupted wound healing, loosening, prosthetic migration, and prosthetic wear. To date, ankle prostheses have shown to be inferior in longer term follows, and their use may be characterized as experimental surgery [10].

Revision surgery after loose or infected ankle prostheses is technically difficult and often demanding for the patient. Unhealed arthrodesis on the other hand can, in some cases, be fairly pain-free and may be compensated by an orthosis or sturdy shoes.

Rehabilitation

Arthrodesis of the ankle often requires long-term cast fixation and keeping weight off, which does not permit rapid rehabilitation in walking. There is a risk for wound infection and a risk for pressure sores under the cast. This often results in extended hospitalization, and long healing times cause long-term functional impairment. Upper extremities, upon which pressure can be put, are also necessary for the patient to manage to keep weight off the foot postoperatively. Arthroplasty has the advantage of a fairly immediate mobilization allowing the patient to put weight on the ankle. Good cooperation with an orthopedic shoemaker is important for achieving optimal results from ankle surgery.

Surgical treatment results

Ankle arthrodesis

Arthrodesis of the ankle usually relieves pain and is a good alternative in patients with somewhat well maintained hindfoot and midfoot with possibility for these joints to overtake some of the lost flexion and extension capacity of the ankle. Through these movements of the midfoot, the patient retains a good walking ability on flat ground. If midfoot movement is lacking due to previous arthrodesis or spontaneous stiffening, walking may still function with the help of adapted shoes. A long-term risk with ankle arthrodesis is progression of pathological changes in the midfoot due to this compensatory mobility. The magnitude of the risk in the long run is not clear. Positioning of the arthrodesis is very important and shall be neutral with a natural valgus and slight outward rotation [3]. Healing rates are far from 100 percent and the frequency of complications is not insignificant (Table 1 and 2). Arthrodesis remains a safer surgical option than arthroplasty, since late complications are seldom observed in a successful arthrodesis. Arthroscopic methods aim at decreasing surgical trauma and hence postoperative complications in cases where there is little malalignment. Percutaneous screw fixation, per se, may offer the same advantages.

To clinically evaluate the function of an ankle, scoring systems are used to give points for function, mobility, and freedom from pain. Although mobility is also included, Mazur and Evanski & Waugh use the scores to evaluate results after ar-

Table 1. Healing of ankle joint arthrodesis in RA

Author	n	Followup (years)	Age	Method	Time in cast	Healed (%)
Iwata et al. 1980	10	5	53	Screwed fibular graft	6 v	100
Sowa & Krackow 1989	6	4	60	Blade plate with screws + scewed fibular graft	3 m	100
Smith & Wood 1990[a]	11	5	51	Charnley compression		82
Carrier & Harris 1991	5	6		2 vertikal Steinmann pins (3 mon)	10 m	100
Moran et al. 1991[b]	30	5	53	Various (mostly external fixation)		60
Stone & Helal 1991	13	6		1 vertical three-flanged nail	3 m	100
Turan & Blomgren 1991	7	4	65	Chevronosteotomi + skruvar och märlor	4 m	100
Cracchiolo et al. 1992	19	3		External fixator	(5 m)	78
	13	3		Cross-screws	4 m	77
Stranks et al. 1994	8	2	59	Cross screws+ bone plug	3 m	100
Juutilainen & Pätiälä 1995	6	1	57	Cross absorbable screws	2 m	67
Turan et al. 1995	10	1	54	Arthroscopic cleansing + screws	3 m	100

[a] Remaining healed after reoperation
[b] 20% re-arthrodesis, 3% further attempts to arthrodesis

Table 2. Complications to ankle arthrodesis in RA

Author	n	Method	Infection (%)	Nerve damage (%)	Malalign-ment (%)	Delayed healing (%)	Removal of screw[a] (%)
Iwata et al. 1980	10	Screwed fibular graft	10	10	–	–	–
Sowa & Krackow 1989	6	Blade plate with screws	17	–	–	–	–
Smith & Wood 1990	11	Charnley compression device	36	–	9	9	–
Carrier & Harris 1991	5	Steinmann pins[b]	–	–	–	20	–
Moran et al. 1991	30	Various (external fixation)	30/10[c]	–	–	–	–
Turan & Blomgren 1991	7	Screws + staples	14	–	28	–	14
Cracchiolo et al. 1992	19	External fixator	33[d]	16	16	–	–
	13	Screws	15	–	15	–	–
Stranks et al. 1994	8	Screws + bone plug	–	–	38	–	38
Juutilainen & Pätiälä 1995	6	Resorbable screws	33	–	–	–	–
Turan et al. 1995	10	Arthroscopy + screws	–	–	–	–	5

[a] Due to local problems
[b] Pin migration 60%
[c] Wound infection 30% and osteitis 10%. Pseudoarthrosis 20%
[d] All unhealed by external fixation had a deep infection

Table 3. Clinical effect of ankle arthrodesis in RA

Author from	n	Method	Score[a]	Before	After	Foot-mobility	Pain free
Iwata et al. 1980	10	Screwed fibular graft	Subjective		100% good		80%
Sowa & Krackow 1989	6	Blade plate with screws	Mazur	17 (8–43)	80 (71–95)	18° (0–30)	
Smith & Wood 1990	11	Charnley compression	Mazur		62 (44–84)	4° (0–20)	91%
Moran et al. 1991	30	Various (external fixation)	Mazur		61 (48–76)	12°	96%
Cracchiolo et al. 1992	19	External fixator	Mod. Mazur				63%
	13	Screws	Mod. Mazur				78%
Stranks et al. 1994	8	Screws + bone plug	Mazur		58 (32–80)		
Turan et al. 1995	10	Arthroscopy + screws	Subjective		100% good		100%

[a] Mazur score: Pain 50p, function 40p, and mobility of the ankle 10p. Hence maximum 90p for successful arthrodesis. Result: excellent 80-90, good 70-79, uncertain 60-69, and poor <60 points [23]

Table 4. Clinical results of ankle arthroplasty

Author	n	Follow-up	Age	Prosthesis	Type[a]	Score	Before	After	Good (%)	Mobility before	Mobility after
Demottaz et al. 1979	6	≈1		?	M	Mazur	28	67	–	22°	30°
	10	≈1		?	C	Mazur	23	66	–	20°	30°
Dini & Bassett 1980	5	3	45	Smith	M	–	–	–	40	–	–
Stauffer & Segal 1981	43	≈2	≈51	?	C	–	–	–	88	–	–
Herberts et al. 1982	14	3		ICLH	C	Own	–	–	57—		
Newton 1982	10	4		Newton	M	E&W	30	58	40	–	+4°
Kaukonen & Raunio 1983	28	2	46	Various		–	–	–	–	22°	30°
Lachiewics et al. 1984	15	3	52	Mayo	C	Mazur	24	79	100	24°	33°
Bolton-Maggs et al. 1985	22			ICLH	C	Venn	–	–	27	–	+5°
Helm & Stevens 1986	19	5	52	ICLH	C	E&W	36	60	–	–	poorer
Beuchal et al. 1988[b]	6	3	69	LCS cement free	M	Own	58	79	50	–	–
McGuire et al. 1988	10	3		Various		Own	–	–	90	–	–
Unger et al. 1988	23	6	51	Mayo	C	Mazur	–	–	65	–	–
(see Lachiewics)	15	6		Mayo	C	Mazur	–	–	87	–	–
Takakura et al. 1990[c]	11	≈7		Ceramic cement		Own	35	70/52	–	–	–
	9	≈4		Ceramic uncem.		Own	34	76/70	–	–	–
Jensen & Krøner 1992	23	5	62	TPR	C	E&W	33	63	–	–	+3°
Carlsson et al. 1994	52	≈4	62	Bath&Wessex	M	–	–	–	81	20°	30°
Kofoed 1995[d]	13	10		?	C	Own	26	86/77	–	–	–

[a] M multiaxial, C constrained, ie, single axis
[b] Own score (100p): pain 40p, function 40p, mobility 15p, and malalignment 5p
[c] Followup 1 year / latest examination
[d] Followup 1 year / 10 years

throdesis [9,23]. The same scores are also used for evaluation of ankle arthroplasty (Table 4). Several authors have introduced modifications to the above mentioned scorer for their own purposes.

Ankle prosthesis

Ankle prostheses usually consist of a convex metal talar component and a flat or concave plastic tibial component. Some prostheses are congruent with a fixed mobility to provide good stability, but at the price of increased pressure on the contact surfaces between bone and cement, with a subsequent risk for loosening. Multiaxial mobility has been attempted as a means of reducing this problem, but resulting in decreased stability and the risk for impingement between the prosthetic components and the malleoli, causing pain and the potential for fracture. The rates of loosening and migration are high, especially on the talus side, and increase with observation time, negatively affecting the early, promising results [4,22,39,40]. There is, however, a significant discrepancy between radiographic findings and clinical results. Prosthetic survival after 10 years has been estimated at 60% in a mixed ankle study, where patients below the age of 57 years had only 42% prosthetic survival. Rheumatic patients did not differ significantly from arthritic patients [20]. Carlsson et al found 78% prosthetic survival at 5 years in a pure RA material with the Bath & Wessex prosthesis [4]. At 10 year followup of a mixed patient material treated by the St. Georg prosthesis, Hay & Smith found that 75% had been or should be converted to ankle arthrodesis [11]. The lateral access to the foot with fibular osteotomy was considered to contribute to the failure.

The ankle is more prone to disturbances in wound healing than other joints, and frequency of infection is high regardless of implant type. Late infection via blood-borne contamination also occurs in the ankle, and it is not uncommon for infections to end in amputation. Cases where loosening occurs can be made to heal only by arthrodesis involving massive bone transplantation and extended fixation.

Table 5. Complications to ankle arthroplasty in RA

Author	n	Follow-up (years)	Age	Prosthesis	Type[a]	Infection (%)	Zone (%)	Loose-ning (%)	Compl. (%)	Revision/ arthrod. (%)
Demottaz et al. 1979	6	≈1		?	M	0	67	0		0
	10	≈1		?	C	0	100	10		10
Dini & Bassett 1980	5	3	45	Smith	M	?	?	?		20
Stauffer & Segal 1981	43	≈2	≈51	?	C	7	–	–	23	9
Newton 1982	10	4		Newton	M	10	60	30		40
Kaukonen & Raunio 1983	28	2	46	Various		0		18	25	0
Lachiewics et al. 1984	15	3	52	Mayo	C	0	73	40	–	0
Bolton-Maggs et al. 1985	22			ICLH	C	–	–	–	40	15
Helm&Stevens 1986	19	5	52	ICLH	C	0	37	58	26	16
Beuchel et al. 1988	6	3	69	LCS cement free	M	17	?	0	33	0
Unger et al. 1988	23	6	51	Mayo	C	–	93	93	21	0
Jensen & Krøner 1992	23	5	62	TPR	C	0	22	22	17	8
Wynn & Wilde 1992	18	11	61	Conaxial	C	11	–	90	55	?
Carlsson et al. 1994[b]	55	≈4	62	Bath&Wessex	M	5	20	47	9	18

[a] Multi-axial, C "constrained", ie, single axis

[b] Survivorship study with 35% with loose tibial component, 67 % with loose talus component and 19% revised at 5 years out of 52 followed

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