TARSAL AND ANKLE JOINT INVOLVEMENT IN RHEUMATOID ARTHRITIS

D. Scot Malay, D.P.M.
Alfred J. Phillips, D.P.M.

Pedal and ankle involvement in rheumatoid arthritis (RA) are well documented, and can lead to significant disability (1-3). Prior to refinements in the techniques of total hip and knee replacement, rheumatoid destruction of the foot was, for the most part, ignored as these patients became essentially nonambulatory. It is now recognized that pedal complaints, most commonly affecting the forefoot, can be the presenting symptom in previously undiagnosed RA. This chapter describes the symptomatology and surgical management of the rheumatoid ankle and tarsus.

It is actually quite difficult to separate the foot into functionally distinct segments—forefoot, midfoot, hindfoot, and ankle, as these structural components are integrally related with respect to common capsuloligamentous tissues and tendons. Nonetheless, it is convenient for a discussion of diagnosis and treatment to arbitrarily divide the symptomatic rheumatoid foot into the forefoot, midfoot, hindfoot and ankle joint. Adults with RA generally develop a plano valgus deformity along with symptomatic tenosynovitis about the ankle and hindfoot. They also develop heel pain and a multitude of forefoot abnormalities.

It has been reported that significant arthritic destruction affects the midtarsal joint in about 65 percent, subtalar joint in about 35 percent, and ankle in about 29 percent of patients with RA (3). Moreover, the degree of pedal involvement increases with the duration of the RA, due to stress-related mechanical breakdown that progresses over the course of the disease (2). As the disease process progresses, the deformities tend to convert from what was initially an unstable joint toward ankylosis and a fixed, occasionally asymptomatic, position of severe planovalgus.

CLINICAL PATHOLOGY

Reactive and proliferative synovitis adversely affects surrounding connective tissues. In the synovial joint, periarticular soft tissues are stretched and distended such that instability develops upon initial resolution of the synovitis. Peripheral subchondral erosive changes induce articular microfractures upon load bearing. Synovitis diminishes hyaline cartilage nutrition via biochemical and mechanical alteration of the synovial fluid diffusion gradient, and actual cathepsin mediated degradation of articular cartilage occurs.

Within tendon sheaths, synovitis deep to retinaculae leads to stenosis and subsequent compression-induced necrosis and eventual tendon rupture. The space-occupying effects of synovial proliferation also compress peripheral nerve trunks coursing deep to fibrous retinaculae-most notably inducing anterior or posterior tarsal tunnel syndrome. Entrapment of the posterior tibial nerve and its branches may also develop secondary to pes planovalgus related traction of the structures as they pass through the tarsal tunnel. Mononeuritis multi-plex due to rheumatoid vasculitis induced peripheral nerve ischemia may also affect lower extremity sensorimotor abnormalities. Similarly, rheumatoid vasculitis may induce cutaneous ulcerations and distal eschemia, as well as subcutaneous nodule formation.

Bursitis associated with adjacent joint inflammation can also effect osseous erosive and proliferative changes, as well as dystrophic calcification, at fascial and tendinous attachments to bone (Fig. 1).

PATIENT EVALUATION

The diagnosis of RA has usually been made prior to presentation with a symptomatic ankle and/or tarsus. This scenario, however, need not necessarily be the case, and the podiatrist must be aware of the historical, clinical, and laboratory findings associated with RA (4). These patients will often relate a rather rapid progression of pedal deformity, notably flattening and turning out of the feet subsequent to acute inflammatory phases of the disease. It is often difficult, from a clinical standpoint, to pinpoint the exact location of synovitis and/or articular degeneration due to the close proximity and reciprocal function of the structures of the tarsus and ankle. The necessity for accurate evaluation of the entire lower extremity, bilaterally, cannot be overemphasized. The surgeon must keep in mind that RA is a systemic disease that may affect the vertebral column as well as any extremity, upper or lower.

Fig. 1. Erosion of posterosuperior aspect of body of os calcis, with proliferative changes at attachments of tendo Achillis and plantar fascia, in rheumatoid arthritis.

The podiatric clinical examination should involve assessment of dermatological, neurological, vascular, and orthopedic components of the lower extremities. We typically subdivide our orthopedic examination of the rheumatoid patient into three main categories: static, dynamic, and gait observation. Static observation will reveal fixed deformities such as planovalgus and midfoot abductus, gross edema, nodules, prominent osteophytes, and associated dermatological abnormalities. Dynamic observation entails active and passive range of motion to assess flexibility versus rigidity, the presence or absence of peroneal (usually brevis) muscle spasm (5), crepitus, and pain. Stress manipulation of the tarsus and ankle joint may reveal articular instability.

Palpation of boggy edema is indicative of proliferative synovitis and chronic effusion. It should be noted that midfoot synovitis and edema are generally more difficult to identify by palpation, in comparison to synovitis affecting the sinus tarsi and/or ankle joint. Occasionally, dystrophic calcification of tendon, most notably the heel cord, can be palpated as local induration and topographical irregularity (Fig. 2). Percussion of peripheral nerve trunks should also be performed to rule out the possibility of entrapment neuropathy, especially about the posterior and anterior tarsal tunnels.

Observation of the patient's gait enables the clinician to assess the attitude of the lower extremities during weightbearing. It should be noted that severe hindfoot and/or ankle valgus may lead to lateral malleolar-

Fig. 2. Nodular induration and tendo Achillis thickening at calcaneal attachment.

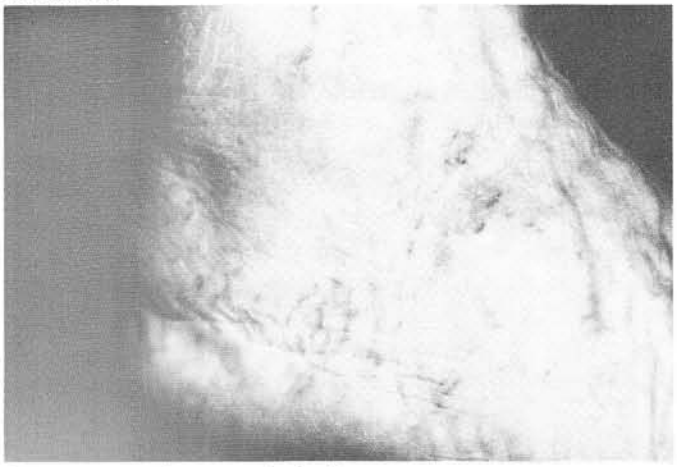

Fig. 2. A. Lateral aspect right heel.

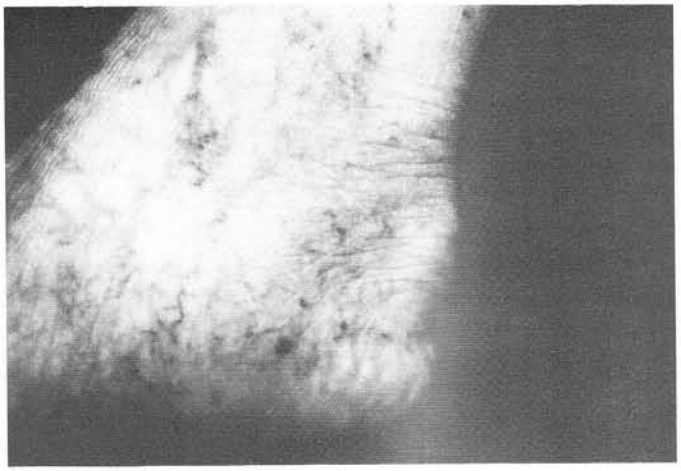

Fig. 2. B. Medial aspect right heel.

calcaneal impingement, with focal tenderness at the distal tip of the fibula upon weightbearing (Fig. 3). The clinical examination is usually supplemented with standard weightbearing radiographs, and occasionally stress radiography to assess ligamentous integrity. More recently, we have found magnetic resonance imaging (MRI) to be very useful in identifying synovitis, joint effusion, and cystic tendon degeneration (see update on MRI and CT).

INDICATIONS FOR SURGERY

Should systemic and local medical treatment, in conjunction with appropriate physical and biomechanical therapy prove to be inadequate, and if persistent weightbearing stress threatens permanent malalignment, surgical intervention should be strongly considered. If there are no general medical contraindications (such as severe amyloidosis), and the patient is not suffering an acute systemic inflammatory exacerbation, surgery can be performed at any time in an effort to alleviate pain and limit joint or tendon destruction.

Clearly perioperative management requires strict attention to the patient's overall medical status, maintenance of routine medications, corticosteroid supplementation if needed, and administration of prophylactic antibiotics. Coordinated management between the rheumatologist and surgeon is highly advisable. Moreover, consultation and/or joint participation with an orthopedic surgeon may be beneficial if the knee, hip, or other articulation requires surgical attention. Generally speaking, more proximal joints take priority over ankle and pedal structures. A deformed upper extremity may require surgical intervention prior to addressing lower extremity problems, should non weight-bearing postoperative management be necessary.

Careful manipulation during the operative procedures is necessary to prevent accidental injury of the anesthetized patient, especially with respect to cervical vertebral and temporomandibular joint positioning. Moreover, friable and occasionally slow healing integument requires special attention to atraumatic technique, hemostasis, and careful application of the principles of wound care (6).

The general goals of surgical intervention are first and foremost, elimination of debilitating pain, followed by maintenance or improvement of function, and, lastly, correction of deformity. Specific indications for surgery include progressive synovitis, stenosing tenosynovitis or bursitis; abnormal alignment (severe pes planovalgus or ankle valgus) and dysfunction due to instability or ankylosis; peripheral nerve entrapment; tendon rupture; and pain due to any of the above conditions as well as cutaneous compromise secondary to structural deformity.

Medical and biomechanical management is rarely beneficial following tendon rupture or the development of painful ankylosis. Rheumatoid candidates for surgical reconstruction should also be adequately motivated and prepared for the planned postoperative healing phase and rehabilitation, which often involves non weightbearing, as well as early range of motion and strengthening exercises.

TYPES OF SURGERY

There are three main categories of operative intervention applicable to rheumatoid patients with a symptomatic tarsus and/or ankle. These are: synovectomy (including bursectomy), arthroplasty and arthrodesis. Osteotomy is a fourth major category of surgical intervention, however, this technique is more applicable to the metatarsus, leg, and thigh segments of the lower extremity. Adjunctive procedures such as tendon repair, nerve trunk decompression, exostectomy, deep fascial release and excision of subcutaneous nodules may also

Fig. 3. Lateral malleolar-calcaneal impingement in severe hindfoot valgus deformity.

Fig. 4. Antalgic ankle equinus secondary to proliferative synovitis.

be performed. The surgeon and patient should realize that symptoms may recur following any type of surgery with the exception of successful arthrodesis. New symptoms may develop following any type of surgery.

Ankle and Tarsal Synovectomy (Tendon Sheath, Joint, Bursa)

Although controversial because of the tendency toward the recurrence of symptoms, synovectomy is generally acceptable as a means of delaying articular destruction in joints displaying early, recalcitrant, and progressive synovitis. Results at one year followup have been reported as favorable in 80 percent of cases (7). Synovectomy should be attempted in the presence of painful effusion with palpably doughy synovium, unresponsive to appropriate medical and physical therapy for six months or longer, or when early synovitis produces positional deformity or radiographic evidence of joint change becomes apparent (Fig. 4).

Our experience has been with local surgical excision of reactive/proliferative synovium in symptomatic joints

and tendon sheaths, as well as bursectomy. In the tarsus and ankle joint, we have experienced success performing synovectomy primarily in the tendon sheaths of the extrinsic pedal musculature, most commonly involving the tibialis posterior and peroneal tendons (Fig. 4).

The tendons deep to the flexor retinaculum are exposed by means of a curvilinear incision placed posterior to, and gently curving anteriorly just distal to the medial malleolus. The appropriate sub-retinacular compartments are opened individually. The peroneal tendons are exposed by means of a curvilinear incision placed posterior to, and gently curving anteriorly just distal to the lateral malleolus. Reactive synovium is then sharply excised using a scalpel and/or a sharp dermal curette. This method of synovectomy has also been used to alleviate symptoms related to tarsal tunnel syndrome. Intraoperative palpation should indicate whether or not the compartment containing the posterior tibial nerve and its major branches should be individually decompressed.

Synovectomy is followed by inspection and repair of stretched and/or frayed tendon. Tendon repair techniques vary with the degree of tendon damage. Typically, the frayed but intact (in-continuity) tendon is reefed and reinforced with a nonabsorbable suture (3-0 coated polyester) in a criss-cross fashion followed initially by 2 to 3 weeks of immobilization and gradual muscle strengthening exercises. Total rupture usually correlates with the need for arthrodesis.

Ankle joint synovectomy has been reported as useful in many patients with RA (8,9). We have found limited use for this technique as an isolated procedure, and usually perform ankle synovectomy in conjunction with ankle arthroplasty and/or tarsal arthrodesis. The majority of symptomatic ankles in our series have either responded favorably to conservative methods of stabilization (AFO, doubled upright brace, and even laced or velcro leather anklet) or, required arthrodesis to eliminate pain and instability or valgus deformity.

Should ankle joint synovectomy be undertaken, we recommend a sequential approach that allows access to any area of reactive synovium. First, an anterolateral longitudinal incision is placed over the fibula, providing exposure of the anterior, syndesmotic, and lateral malleolar synovium. If peroneal tenosynovitis is also present, the incision should be positioned more laterally over the fibula and elongated distally in curvilinear fashion to provide exposure of the peroneal tendons. Alternatively, an accessory curvilinear incision can be made (as described above) to expose the peroneal tendon. Similarly, if tenosynovitis exists deep to the flexor retinaculum, another accessory curvilinear incision should be made medially (as described above).

We have not found isolated tarsal synovectomy or bursectomy to be applicable to any significant extent. Synovitis in this region often responds favorably to local corticosteroid infiltration in combination with physical therapy and systemic medication. The multiplicity of synovial cavities throughout the midfoot and hindfoot almost precludes success via surgical synovectomy in this region, and arthrodesis may be necessary.

We have frequently encountered symptomatic retrocalcaneal synovial bursitis in our rheumatoid patients with RA. The lateral radiograph usually reveals osseous erosion at the posterior and superior portions of the calcaneal body (Bywater's lesion) and osseous proliferation at the attachment of the tendo Achillis (Fig. 5) (10). Occasionally, dystrophic calcification of the heel cord can be palpated clinically and confirmed radiographically. This condition is also quite responsive to conservative measures, namely local corticosteroid infiltration combined with temporary immobilization (14-21 days) and subsequent heel lift and padded shoe counter. If this regimen fails, and the risk of tendo Achillis rupture becomes imminent, surgery can be helpful. And, of course, the use of corticosteroids in the area of the Achilles tendon or the tibialis posterior carries some risk.

Exposure of the attachment of the tendo Achillis and the posterior aspect of the calcaneus is performed by means of a curvilinear incision beginning medial to the tendon, extending distally parallel to the margin of the heel cord, then gently curving laterally to traverse the tendon at the superior margin of the posterior surface of the calcaneus, then gently curving plantarly along the lateral margin of the tendon and the body of the calcaneus. Care must be taken to place the proximal and distal paratendinous portions of the incision at least one centimeter from the edge of the tendon in an effort to provide adequate subcutaneous vascular support to the overlying dermis along the wound edge. This area is prone toward dehisence and skin slough.

Occasionally, a rheumatoid nodule may be encountered in the subcutaneous tissue overlying the heel cord, although we have more commonly encountered this form of vasculitis induced granuloma on the plantar weight-bearing aspect of the heel (and metatarsal area). The rheumatoid nodule should be sharply excised en toto and histologically distinguished from adventitious superficial tendo Achillis bursitis. A midlinear tendon-splitting incision then provides access to calcification within the heel cord, as well as exposure of the inflamed retrocalcaneal bursa and the posterior and superior aspects of the body of the os calcis. Osseous remodeling is usually necessary to eliminate any erosive and proliferative irregularities which contribute to degeneration of the tendo Achillis during ankle dorsiflexion.

Fig. 5. Stenosing tenosynovitis affecting tibialis posterior. (See Fig. 7 in "Magnetic resonance imaging versus computed tomography: clinical applications", elsewhere in this *Update '89* for preoperative MRI of this patient).

Fig. 5. A. Incision plan to expose tendon in vicinity of spring ligament.

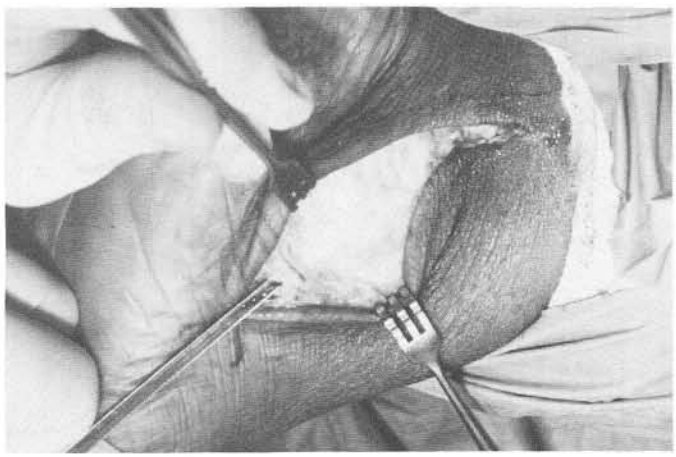

Fig. 5. B. Deep fascial-sheath incision.

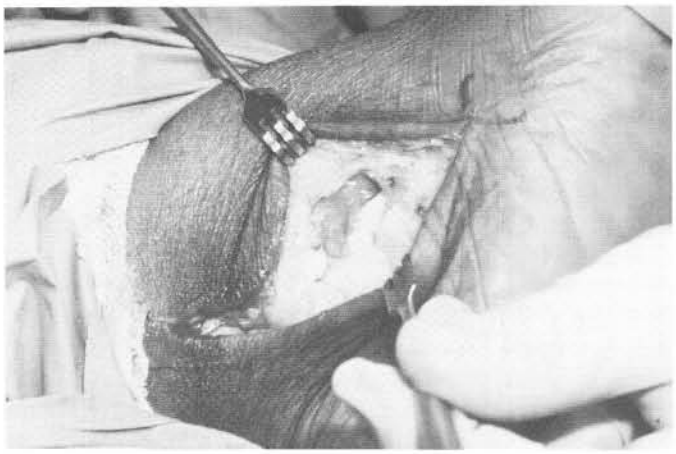

Fig. 5. C. Sheath opened and reactive synovitis exposed.

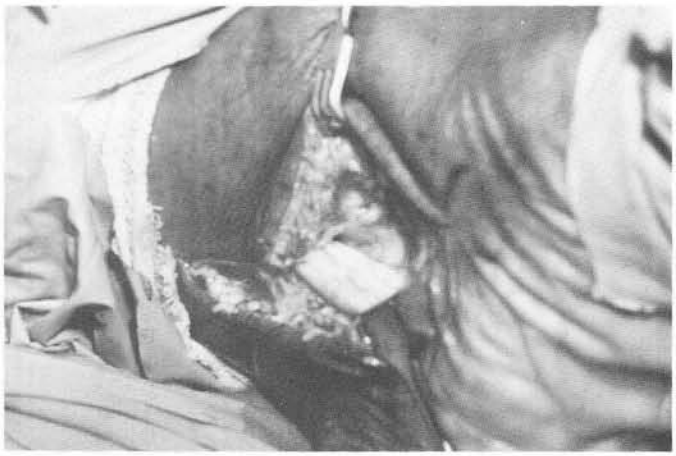

Fig. 5. D. Frayed tendon exposed following synovectomy.

The symptomatic plantar calcaneal heel spur (Fig. 1) and fasciitis can also present in the patient with RA. Plantar bursitis and/or rheumatoid nodule must also be considered in the differential diagnosis of plantar heel pain, although plantar rheumatoid nodules are typically located more posteriorly on the heel. Enthesopathy tends to progress from erosive pes planovalgus induced traction periostitis to proliferative osseous spurring. Rarely have we found it necessary to surgically address this condition, as conservative management usually proves to be adequate. In recalcitrant cases, the semiclosed approach to plantar fascial release and exostectomy is recommended (11).

ANKLE AND TARSAL ARTHROPLASTY

We have successfully used a wide variety of arthroplastic procedures, including cheilotomy, joint excision, osteochondral grafting, and implantation of partial or, more commonly, total joint prostheses in the rheumatoid forefoot. We have had very limited success with these techniques in the rheumatoid tarsus and ankle. In the past, total ankle arthroplasty (Fig. 6) has been essentially unsuccessful, although we have not experimented with the latest ankle implant designs. Similarly, we have found minimal use for subtalar joint blocking implants designed to decrease pathological pronation, in out patients with RA.

Rheumatoid destruction of the ankle is the main impetus behind the experimental research and attempts at development of a functional total ankle prosthesis. Because arthrodesis of the ankle increases the load-bearing forces on adjacent joints, that subsequently tends to aggravate the rheumatic process in these stressed articulations. Fusion of any joint in the rheumatoid patient must be undertaken only after very careful evaluation of both lower extremities, the upper extremities, and the patient's activity level.

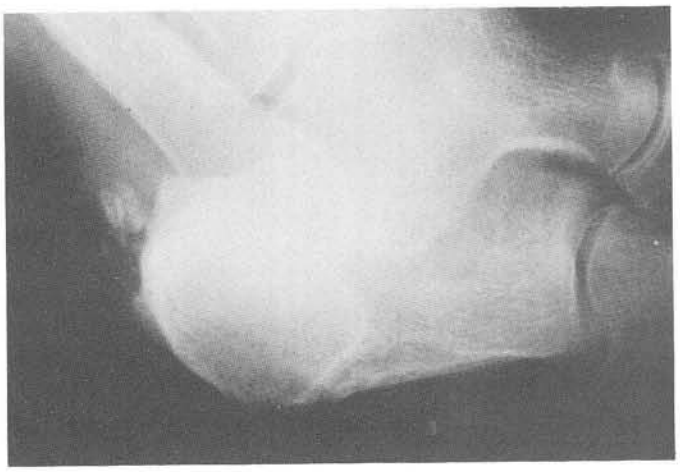

Fig. 6. A. Calcification of tendo Achillis at calcaneal insertion.

The development of destructive changes in adjacent joints following arthrodesis often detracts from the surgical success in the patient with RA. For instance, ankle fusion frequently aggravates tarsal rheumatoid arthritis, and less commonly aggravates the ipsilateral knee. Current ankle implant designs yield an approximately 70 percent rate of satisfactory results (11). Refinements in the design of implants and the technique of ankle arthroplasty are being actively pursued (12, 13).

ANKLE AND TARSAL ARTHRODESIS

Arthrodesis is a salvage procedure used to eliminate pain, correct deformity, and stabilize. It is not uncommon for the limited-activity adult rheumatoid arthritic patient to undergo spontaneous intertarsal fusion in a deformed (pes planovalgus) position with alleviation of pain. Spontaneous fusion of the ankle joint is much less common, although varying degrees of incomplete ankylosis are frequently encountered. Consideration for surgical arthrodesis requires exhaustion of conservative measures or an instability of the joint that can only continue to increase.

The need to accurately assess the status of the remaining joints in the ipsilateral lower extremity, as well as the contralateral hip, knee, and ankle cannot be over emphasized. Moreover, upper extremity function should be evaluated with respect to the ability to use crutches or a walker in the non weight-bearing postoperative phase. One should strongly consider total ankle implant arthroplasty if the patient suffers severe polyarthropathy, especially if significant hindfoot arthritis is present, or if either knee joint has already undergone total implant arthroplasty. Ankle arthrodesis is the procedure of choice in the patient with RA that suffers gross ankle instability and pain or in the presence of painful partial ankylosis.

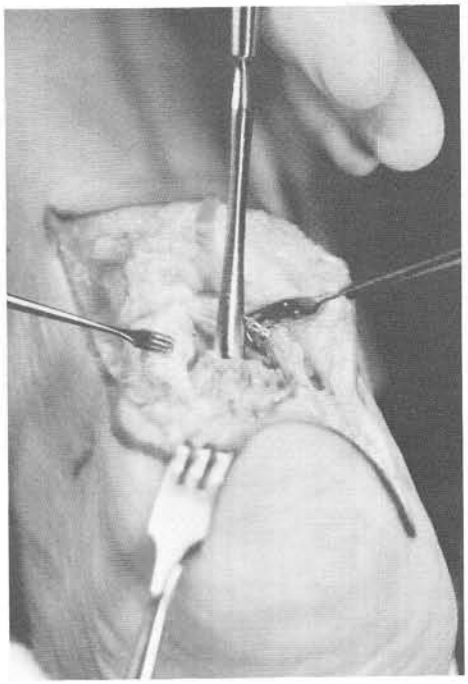

Fig. 6. B. Remodeling posterior aspect of calcaneus via tendon-splitting incision following removal of calcification within tendon.

Should significant tarsal arthritis be present, pantalar arthrodesis, or triple arthrodesis combined with total ankle implant arthroplasty should be considered. Should severe bilateral ankle arthritis be present, all attempts should be made to maintain at least one mobile ankle by means of implant arthroplasty in an effort to avoid a bilateral solid foot syndrome which greatly aggravates knee joint symptomatology and inhibits many activities of every day life (14).

We have found the use of internal fixation in the form of crossing compression screws to be the best technique for ankle or pantalar arthrodesis (Fig. 7). The procedure has been previously detailed by Mahan (15). A

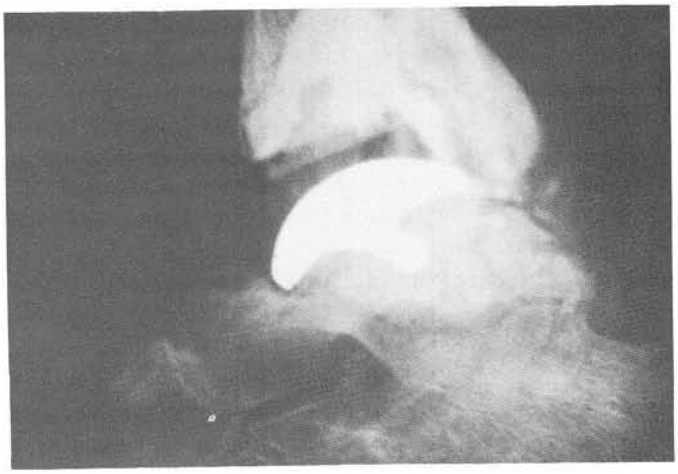

Fig. 7. Failed total ankle implant arthroplasty.

Fig. 8. Ankle arthrodesis.

Fig. 8. A. Preoperative lateral radiograph revealing ankle arthritis, and relatively normal subtalar and midtarsal joints.

Fig. 8. B. Postoperative radiograph (9 months) revealing internal fixation and successful fusion.

transfibular approach is used, and the distal portion of the fibula is fashioned into an onlay graft to enhance stability. The articular surfaces are appropriately resected and fixation achieved. An accessory medial incision is used to insert the medial compression screw. Care must be taken to assure slight subtalar valgus (obviously eliminating any lateral malleolar-calcaneal impingement), neutral to slight plantarflexion, and a 12-15 degree pes abductus alignment. Postoperative management requires non weightbearing for approximately three months while the cast is bivalved as soon as possible to initiate motion exercise in the presence of rigid internal fixation.

We have found triple arthrodesis to be very useful in the presence of severe, unreducible pes valgo planus deformity, often with peroneal spasm. Rarely have we found isolated midtarsal arthrodesis to be indicated in the symptomatic rheumatoid foot with the exception of an occasional fusion of the talonavicular joint. Triple arthrodesis is performed via a two incision approach, and internal fixation devices are used to achieve rigidity. The surgical technique is thoroughly described by McGlamry et al (16). Care must be taken to assure appropriate positioning prior to achievement of internal fixation. The hindfoot should be placed in slight valgus, obviously eliminating any lateral malleolar-calcaneal impingement, and the forefoot must be appropriately positioned on the rearfoot. Once again, postoperative management usually involves three months non weightbearing with a bivalved cast to allow early range of motion exercises.

SUMMARY

Surgery can be very useful in alleviating pain, restoring function, and correcting deformity in the patient with RA. Co-management by a rheumatologist is desirable, and orthopedic consultation may be helpful. Tarsal and ankle joint surgery revolves around synovectomy, arthroplasty, and arthrodesis. There is a major need for the development of a functional total ankle joint prosthesis.

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