Total ankle replacement.
Early experiences with STAR prosthesis

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SUMMARY
Early designs of Total Ankle Replacement (TAR) had a high failure rate. More recent experience with the 3-piece, meniscal bearing, total ankle replacement has been more promising. We report a review of the early results of our first 22 prostheses in 20 patients undergoing Scandinavian Total Ankle Replacement (STAR) in Northern Ireland. There was a mean follow-up time of 26 months. Seventeen patients are pain-free at the ankle joint during normal daily activities. Two of the early cases have required revision surgery due to technical errors. Other complications have included malleolar fractures, poor wound healing and postoperative stiffness.

These early results show high levels of patient satisfaction, and we are encouraged to continue with total ankle arthroplasty. There is a steep initial learning curve and use of TAR should be restricted to foot and ankle surgeons.

INTRODUCTION
End-stage degenerative disease of the ankle is uncommon when compared with the hip and knee. Common causes include trauma, primary osteoarthritis, rheumatoid arthritis and other inflammatory arthropathies. However, unlike degenerative disease in the larger joints such as the hip and knee which is frequently due to primary osteoarthritis or inflammatory disease, the ankle is most frequently affected by post-traumatic arthritis (up to 80% of cases). This tends to occur in the younger patient, and is commonly associated with trauma to the soft tissue envelope. In the ankle this is thin, and often becomes scarred and inelastic.1,2 This in itself can lead to a decreased range of motion of the joint and can also be a predisposing factor to wound healing difficulties during subsequent surgery.

Many patients obtain good symptom relief from non-surgical care including orthotics, shoe modifications, splints, physiotherapy and judicious use of intra-articular steroid injections. Ankle arthrodesis remains the gold standard for treatment of intractable pain unresponsive to non-surgical care, and has been reported as producing a painless stable foot in 59-95% 3,4,5,6 of patients. Unfortunately ankle arthrodesis has a significant complication rate with problems in both the short and long term. Specifically it has been reported to be associated with a non-union rate of 0-20%.7,8 There is a requirement for prolonged immobilisation, and loss of ankle motion results in difficulties on inclined surfaces and loss of proprioception that can contribute to a sense of imbalance and loss of stability. Fusion of the ankle leads to greater force transmission through adjacent joints with Bauer reporting up to 80% of patients developing radiological evidence of arthritis at these joints 12 years following ankle arthrodesis.9 While arthrodesis may provide good early pain relief, it is associated with premature

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with high rates of loosening, due to a failure fully to appreciate normal ankle biomechanics. In the 1980’s second generation ankle prostheses were developed. These devices allow both flexion-extension and also a degree of rotation (via a polyethylene meniscus) and attempt to replicate the complex multi-axial motion that occurs at the ankle. Prostheses were implanted without the aid of cement which is believed to be partly responsible for a decrease in loosening rates. It is one such three-component, uncemented prosthesis that is implanted in our institution (see Figure 1). We report our early experiences of the first 20 patients in Northern Ireland undergoing Scandinavian Total Ankle Replacement (STAR).

MATERIALS AND METHODS

The ankle joint is approached under spinal anaesthesia via an anterior mid-line incision, between the anterior tibial and extensor hallucis longus tendons. Following appropriate preparation of the bony surfaces the metal tibial and talar prostheses are inserted. The polyethylene bearing is then introduced between the components by forceful distraction of the ankle joint. Postoperatively the ankle is immobilised in short-leg plaster of paris for up to 6 weeks, allowing increasing weight bearing as tolerated. Review with clinical assessment and screening x-rays is arranged postoperatively at 6 weeks, 3 months, 6 months and yearly thereafter (Figures 2a-d).

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We present the results of the first 22 Scandinavian Total Ankle Replacements (STAR) in our institution (two patients required revision surgery), looking at outcome as assessed by patient satisfaction, mobility and complications. This has been performed by retrospective chart review and clinical assessment at a follow-up clinic.

All patients had an assessment of their ankle function using the Kofoed scoring system. This scoring system has been widely published in reviews of ankle replacement and therefore allows for comparison of our results to that of the world literature. Review of x-rays was performed to assess any complications at the time of surgery and subsequent subsidence or loosening.

RESULTS

Of the 20 patients, 12 were male and 8 female. Osteoarthritis was the diagnosis in 14, while six had rheumatoid disease. Patient's age at surgery ranged from 31 to 77 years with a mean of 60 years. Eight of the cases had previously undergone other joint surgery. All patients had undergone preoperative treatment including joint injections and ankle-foot orthosis with limited effect. All patients had complained preoperatively of decreased and painful mobility with 12 of the cases complaining of night pain.

Follow-up ranged from eight to 46 months with a mean of 26 months. 75% of patients expressed complete pain relief at the operative site during normal activities of daily living (Table I), and only 10% require walking aids during their ADL’s due to difficulties in the ankle joint (Table II). The patient’s postoperative range of flexion-extension was from 10° to 51° with a mean of 28° resulting in a mean postoperative Kofoed score of 75 (range 19-96).

| Pain levels | Patient Number |
|-------------|----------------|
| Painfree during ADLs | 15 |
| Anterior impingement | 1 |
| Loading/start-up pain | 2 |
| Lateral discomfort | 2 |

| Mobility | Patient Number |
|----------|----------------|
| Full ADLs without aids | 15 |
| Crutches (due to discomfort/instability of ankle joint) | 2 |
| Crutches (due to co-existing arthritis in other joints) | 1 |
| Wheelchair (due to co-existing arthritis in other joints) | 2 |

COMPLICATIONS

Revisions subsequent surgery

Three patients required secondary surgery with two of these requiring revision of the prosthesis.
Case 1. The tibial plate inserted too posteriorly such that the anterior lip was behind the anterior tibial cortex and as a result the tibial plate developed marked and progressive anterior tilt and loosening. He also sustained an intraoperative bimalleolar fracture. The lateral malleolus healed with conservative management; however the medial malleolus developed a non-union requiring open reduction and internal fixation at the time of revision. Following revision the patient progressed well, the lucency has regressed, the fracture healed and he is now pain free, and mobilising without aids.

Case 2. The tibial plate failed to seat properly on the cut surface posteriorly, and there was an undisplaced intraoperative fracture of the lateral malleolus. The fracture healed with conservative management; however the tibial tray was revised. The patient is now mobilising without any aids and has minimal start-up pain only.

Case 3. The patient complained of significant lateral discomfort while mobilising X-rays suggested a fibular impingement, and this along with some dense scar tissue was excised via a lateral approach. He now has no rest or nocturnal pain though does complain of pain while walking on uneven ground.

Fractures

Five patients suffered intraoperative fractures of the malleoli. (The two referred to above and 3 others). All, aside from the patient in case one, healed satisfactorily following treatment in POP.

Lucency

Six patients were noted to have lucent areas around the tibial plates on postoperative films; however in all but one of these this lucency resolved, and there was no clinical suggestion of infection or loosening. In one case (referred to above) this lucency did progress; however it resolved following revision.

Wound healing

There were two cases of delayed wound healing, one patient developed a small anterior ulcer, which resolved within four weeks and the other patient developed a superficial wound infection in the early postoperative period that resolved with oral antibiotics.

CONCLUSIONS

Early models of Total Ankle Replacements had a high failure rate, with early loosening and failure. They also had difficulties in wound healing. More recent experience using a 3 component design such as the STAR prosthesis has been more successful. It has been in use for 17 years and has good intermediate term results. Anderson et al quote a mean survival of 70% at five years using the uncemented STAR prosthesis, though did note a very steep learning curve and significantly better results were obtained when he analysed his last 31/51 cases. Kofoed 14 on the other hand describes a 95% survivorship rate at 12 years using the same implant, while Knecht et al, using a slightly different prosthesis (Agility Ankle), quote a 92% survival at a mean of nine years. These figures are not greatly dissimilar from those reported for more common joint replacements. Total hip arthroplasty has survival figures ranging from 96% at 10 years 16 to 90% at 20 years, while long term results for total knee replacement are in the range of 95 to 88% at 10 and 15 years respectively.18,19

The indications for ankle arthroplasty are expanding and it has now been shown to be equally effective in patients both under and over 50. The ideal patient is an elderly person who has low physical demands, good bone stock, normal vascular status, no immuno-suppression and excellent hindfoot-ankle alignment. The patient who has bilateral ankle arthritis or ipsilateral hindfoot arthritis requiring fusion is particularly likely to benefit, as the results of bilateral fusion or pan-talar fusion are often poor. Contraindications to surgery include talar avascular necrosis, neuropathic degenerative disease (Charcot joint), sensory or motor dysfunction of the lower leg, severe tibio-talar malposition, and acute or chronic infection.

Ankle arthroplasty has now been performed in our institution for four years, with 28 cases being completed. In this early review of the first 20 patients with an average of follow-up of 26 months, 15 of the patients are now entirely pain free during normal activities of daily living while only two of the patients require use of walking aids due to difficulties at the operative joint. These results, although still only short-term, are comparable to those in the world literature. On the basis of these early results ankle arthroplasty will continue to be offered as an alternative to ankle arthrodesis in our institution. It is clear however that TAR is technically demanding and has a steep learning curve. It is also clear that TAR should be limited to centres where surgeons with an interest in foot and ankle disease have the caseload to master this steep curve.
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