Feature

Arthroscopic ankle arthrodesis: A gold standard in current management?

Amit Chauhan, **Prasad Karpe** and **Rajiv Limaye** look at the well-established technique of arthroscopic ankle arthrodesis, which has recently become the benchmark for managing end-stage ankle arthritis patients

Arthritis of the ankle can result in pain, decreased motion, gait abnormalities and reduced function. It can result from a traumatic event leading to cartilage damage or ligamentous insufficiency [1]. Other secondary causes of arthritis include infection, talar osteonecrosis and Charcot neuroarthropathy [2].

Arthrodesis and total ankle arthroplasty are the main surgical options for end-stage arthritis. Total ankle replacement has gained popularity because of technological advancements in design and techniques; however, it is generally reserved for older, less-active patients and has been associated with higher complication and revision rates [3,4]. Contraindications for ankle replacement include extremity malalignment, marked ankle instability and osteonecrosis of the talus.

Review of literature

Ankle arthrodesis has remained a well-established technique with good results. Many surgical techniques have been described to make the technique less invasive.

Henry Park is said to have performed the first arthrodesis of a tuberculous knee joint in Liverpool in 1781 [5]. After the first description of ankle arthrodesis by Edward Albert in 1879, the procedure has received numerous modifications in terms of approach and techniques to address clinical situations with different levels of complexity [6]. Open arthrodesis has been the mainstay for many decades using a variety of techniques but with unfortunate and significant higher complication rates for both infection and non-union. On the other hand, arthroscopic ankle fusions have come up as an attractive option, offering numerous advantages, such as shorter hospital stays, quicker time to union with equivalent or higher union rates, faster recovery and (possibly) shorter operation time and, ultimately, lower costs [7–9].

In 1983, Schneider performed the first arthroscopic ankle arthrodesis. The initial belief of ankle fusion for minimal deformities no longer exists, with some surgeons fusing ankles up to 25 degrees or even more.

The most common indications for an arthroscopic approach include articular cartilage destruction from degenerative arthritis, post-traumatic degenerative arthritis and rheumatoid arthritis. Other less common indications are joint destruction resulting from haemophilic arthritis, infection, or crystalline-induced arthritis. Contraindications to arthroscopic ankle fusion include active infection or significant deformity [10]. Also, collapsed ankle not allowing entry of arthroscopic portal is a relative contraindication, although this can be overcome by distraction of the ankle.

The advantages of the arthroscopic technique include a high fusion rate, decreased time to fusion and decreased cost. Patients also report better pain control during the post-operative period and generally show a faster return to return to a normal life after rehabilitation; in comparison with open arthrodesis, morbidity rates are lower and costs are reduced.

Recent literature related to arthroscopic approach reveals good results. Ogilvie-Harris and colleagues presented an 89 per cent union rate among 19 arthroscopic fusions with a mean time to union of 10.5 weeks [11]. Zvijac and colleagues [12] reported a 95 per cent union rate among 21 arthroscopic fusions with an average time to fusion of 8.9 weeks. Myerson and Quill [13] retrospectively compared arthroscopic versus open arthrodesis in 33 patients. The arthroscopic group showed 100 per cent union at a mean of 8.7 weeks, while the open population had a 94 per cent union rate at a mean of 14.5 weeks after surgery. Patients who had more deformity or osteonecrosis were placed selectively in the open population, because of the study's inherent retrospective nature. These studies clearly show arthroscopic ankle arthrodesis becoming a gold standard for this purpose. In one of the largest studies to date, Winson and colleagues described a non-union rate of 7.6 per cent in 105 arthroscopic ankle arthrodesis [14].

Dannawi et al. reported good to excellent post-operative results (using Mazur's grading system) with the arthroscopic technique in over 80 per cent of the patients [15], while Kats et al. obtained 100 per cent excellent or good results according to the Morgan score [16] in their series.

Surgical technique

In our practice, ankle arthroscopic arthrodesis is performed as a day case procedure. The patient is placed supine under general or spinal anaesthesia and pre-operative intravenous antibiotic prophylaxis is administered. A tourniquet is positioned around the thigh and a sand bag is placed under the ipsilateral buttock. As a matter of routine, we place the ankle in a Ferkel non-invasive traction device for distraction and better visualisation of the ankle joint. Surface marking of the joint line with anterolateral and anteromedial portals is done along with other landmarks such as the tips of both

Case 1 – A high BMI patient with previous ankle fracture: (a) Pre-op; (b) intra-op; and (c) post-op.

malleoli, tibialis anterior tendon, superficial peroneal nerve and great saphenous vein.

Fluoroscopy is checked for its readiness and, after sterile prepping and draping, the tourniquet is inflated. Arthroscopy is performed with a 2.7mm (30°) arthroscope. Before the two standard portals (anteromedial and anterolateral) are established, the joint is injected with approximately 20ml of saline solution to expand the joint space. The anteromedial portal, medial to the tibialis anterior tendon, is placed first – taking care of the great saphenous vein. The anterolateral portal (lateral to the extensor digitorum communis tendon) is established under direct vision. When creating the anterolateral portal, attention should be paid not to damage the superficial peroneal nerve. A vertical skin incision for the lateral portal minimises the risk of damage to the nerve. In skinnier patients, this can be appreciated in the subcutaneous tissue pre-operatively (with the foot inverted and the toes flexed); however, both portals are performed with a skin incision and a blunt dissection of the subcutaneous tissue with a mosquito clamp or a trocar.

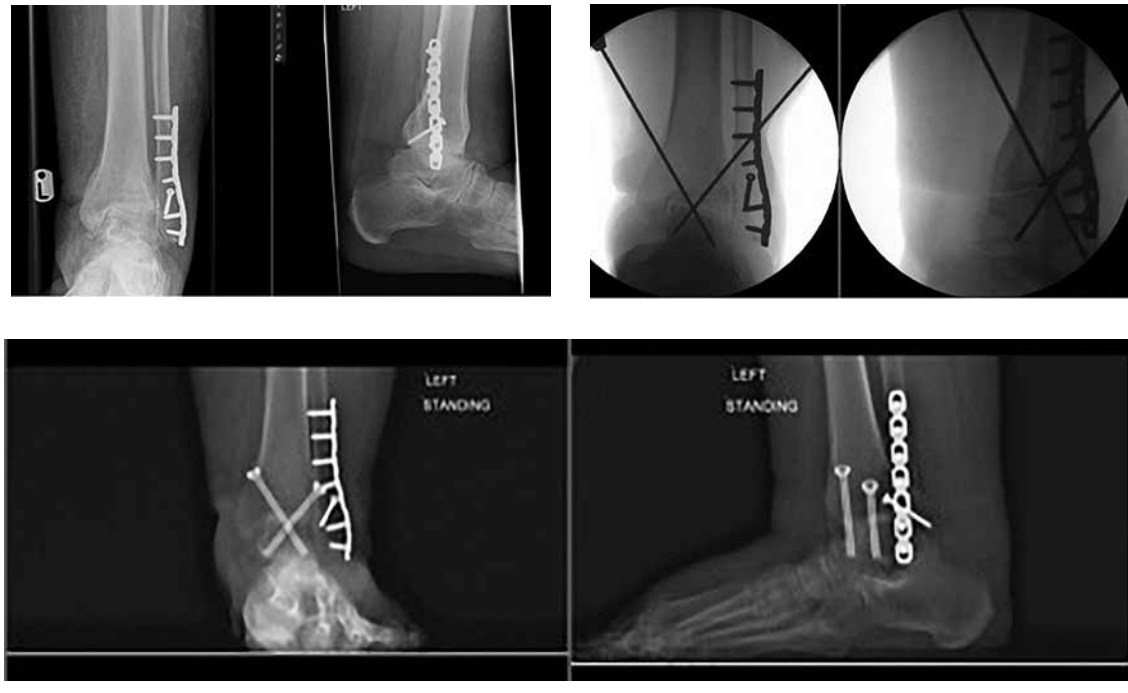
Once the portals have been established, debridement of the soft tissues is performed with a shaver in the anterior part of the joint, and the cartilage is removed with burr and curettes. Resection of anterior tibiotalar osteophytes is required to access the joint better in some cases. Early removal of the anterior osteophytes will aid in better visualisation of the joint. Microfractures are created over the talar and tibial joint surfaces. The tourniquet is let down in order to evaluate bleeding from the tibial and talar surface. Preparation of the fusion bed is key for the procedure and ample time is taken to prepare the surfaces.

Once the surfaces are prepared and adequate bleeding obtained, the traction is released and the ankle is realigned. Guide wires are passed from medial and lateral distal tibia aiming into the body or head of the talus. Ideally, the wires should converge, for better stability. Wire position is confirmed with an image intensifier. The ankle is held in neutral dorsiflexion, with 0–5 degrees hindfoot valgus and external rotation equal to the opposite side while the guide wires are passed. Fixation is achieved with two cannulated, partially threaded, cancellous interfragmental compression screws (diameter 6.5mm) placed under image intensifier control. The first (or 'home run') screw is placed from the posterior aspect of the tibia and directed into the head and neck of the talus. The second screw is placed from the opposite side, taking care to avoid the first one. The threads of the screws should be in the talus for better compression. The screws are passed under X-ray control as the talus can tilt with tightening of the screws; if the talus tends to tilt, then the opposite screw is tightened sequentially.

We have never felt the need for bone grafts for our routine primary ankle arthroscopic fusions. The incisions are closed with simple sutures, a sterile dressing with a below-knee back slab is applied, and generally patients are discharged home on the same day with non-weight-bearing crutches. Low-molecular-mass heparin subcutaneous injections are given for the first six weeks for prevention of deep vein thrombosis. Sutures are removed at two weeks and the plaster changed to a light-weight cast. At six weeks, the ankle is placed in a removable boot; the patient begins exercises and gradually moves to full weight-bearing as pain allows. At three months, union is confirmed with X-rays.

Discussion

Numerous orthopaedic studies have shown arthroscopic ankle arthrodesis to be associated with better pain control during the post-operative period, lower morbidity rates, a faster return to a normal life after rehabilitation and reduced costs



Case 2 – pre-op

compared with open arthrodesis [17,18].

In the study by Peterson et al., the analysis of cost differences between arthroscopic and open ankle fusion revealed statistically significant reduction for total charge, reimbursement to the surgeon and reimbursement to the hospital in the case of outpatient procedures [19]. A multi-centre comparative series with 30 patients in each group and a follow-up duration of two years has reported significantly greater improvement in the Ankle Osteoarthritis Scale score at one year and two years, and shorter hospital stays in the arthroscopic arthrodesis group. Complications, surgical time and radiographic alignment were similar between the two groups [7].

Despite these advantages, this procedure does come with some complications and concerns, most common of which is non-union or pseudoathrodesis. Nerve injury at the portal sites causing diminished sensation or painful neuroma, sinus tract formation and infection are a few others [10]. Some concerns have been expressed regarding the ability of arthroscopic ankle fusion in correction of significant angular deformities or bone loss. The literature highlights that the arthroscopic approach is not really suitable for patients with greater than 5–10 degrees of angular deformity; however, we would like to point out several reports focused on extending arthroscopic ankle arthrodesis to correcting significant angular deformity with and without bone loss [15,20].

Dannawi et al. reported reliable and reproducible results for the arthroscopic technique in a district general hospital setting – with high union rates, short time to union and low complication rates – and found it to be satisfactory even for patients with significant ankle deformity. They reviewed 62 patients who had ankle arthroscopic fusion, and divided them into two groups: with or without significant deformity. Their study reported uniform good to excellent results in both groups with an overall union rate of 91 per cent (94 per cent in the group without deformity and 88 per cent in the group with significant deformity). The time to union was 8.8 weeks in the first group and 12.7 per cent in the later group, with an average union time of 10.4 weeks [15].

In addition, it has been shown that both arthroscopic and open ankle arthrodesis lead to early osteoarthritic changes in adjacent joints, mainly the subtalar joint [21,22]. The arthroscopic technique itself is technically demanding and has a steep learning curve [1]. Because a burr is used to prepare the distal tibia and talar dome surfaces, there is a genuine concern about thermal injury to the bony surfaces, which can increase the risk of non-union [23].

Our own experience has been very satisfactory with arthroscopic ankle arthrodesis. In our series of 18 patients so far, 17 have demonstrated union; these procedures were carried out as day cases and have shown good results with patient-related outcome scores. One patient had non-union at 12 weeks and was later revised with implant removal, and open ankle arthrodesis with bone grafting. No case had

any infection, nerve injury or wound-related problems. Our case series had less than 10 degrees of angular deformity on average.

To summarise, arthroscopic ankle arthrodesis has recently become the gold standard for end-stage ankle arthritis patients with a lot of significant advantages. In carefully selected cases and with good surgical technique, it results in short hospital stays, faster recovery tiems, fewer wound-healing problems and reduced pain, and at the same time provides equivalent union rates at a low cost.

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Authors

Amit Chauhan is a fellow in foot and ankle surgery at North Tees and Hartlepool NHS Foundation Trust.
Prasad Karpe is an orthopaedic surgeon at Northern Deanery
Rajiv Limaye is a consultant orthopaedic surgeon the University Hospital of North Tees and Hartlepool.