Supramalleolar Osteotomy in Patients with Varus Ankle Osteoarthritis

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Introduction

Supramalleolar osteotomies have been reported to be effective in the treatment of moderate primary and traumatic osteoarthritis of the ankle joint¹⁻⁵. The osteotomy is designed to shift the weight-bearing axis to the lateral side of the ankle joint and unload the medial side of the joint. However, Tanaka et al.³ reported that the joint space cannot be restored to normal in ankles with $>10^\circ$ of talar tilt.

In our experience, a supramalleolar osteotomy has been effective clinically and radiographically in the treatment of moderate ankle osteoarthritis with a small amount of preoperative talar tilt and varus or normal heel alignment. The reconstruction occurs in five stages (Video 1):

- Step 1: Arthroscopic examination
- Step 2: Fibular osteotomy
- Step 3: Tibial osteotomy
- Step 4: Fixation and bone-grafting of tibial osteotomy site
- Step 5: Postoperative care

Step 1: Arthroscopic Examination

Perform an arthroscopic examination prior to the osteotomy in every patient to evaluate the status of the articular cartilage of the tibia and talus. In our patient series⁶, a cartilage lesion involving more than half of the anteroposterior length of the talar dome on the medial side of the ankle joint was found in each ankle, and the severity of this lesion was greater on the talar side than on the tibial side. We did not perform a supramalleolar osteotomy if >1 cm of the mediolateral width of the superior weight-bearing portion of the talus was denuded of articular cartilage.

Step 2: Fibular Osteotomy

Bend a seven-hole plate slightly more than the natural contour of the distal part of the fibula, insert screws, and complete the osteotomy.

- With the patient supine on the operating table, with a bump under the ipsilateral buttock, make a 5-cm incision over the posterior margin of the distal part of the fibula (Fig. 1).
- Insert a 1.6-mm Kirschner wire to mark the site of the oblique fibular osteotomy, starting 1 cm above the proximal margin of the tibiofibular syndesmosis and pointing in an inferomedial direction. Aim the Kirschner wire 5 mm above the proximal margin of the tibiofibular syndesmosis. Check the position of the Kirschner wire with fluoroscopy.
- Drill multiple holes in the fibula under continuous irrigation to avoid bone necrosis in the fibula.
- Bend a seven-hole semitubular plate slightly more than the natural contour of the distal part of the fibula to adapt to the lateral surface of the distal fragment after displacement at the osteotomy site (Fig. 2). Insert screws in the holes proximal to the osteotomy site, and complete the fibular osteotomy with a thin osteotome (Fig. 3).

Step 3: Tibial Osteotomy

Attempt to achieve a tibial-talar angle of 95° (5° of valgus).

- Make an 8-cm curvilinear incision on the anteromedial surface of the distal part of the tibia, curving it anteriorly to avoid prominence of the plate, which could lead to wound problems (Fig. 4). Reflect the skin and subcutaneous tissue as a single layer.
- Mark the osteotomy site with a Kirschner wire and confirm its position using fluoroscopy (Fig.

5). Make an incision in the periosteum of the anteromedial surface of the tibia, and reflect the periosteum for 1 cm on each side of the osteotomy. Do not strip the soft tissue from the distal fragment and preserve as many soft-tissue attachments to the distal fragment as possible. Start the medial side of the tibial osteotomy slightly proximal to the level of the tibiofibular syndesmosis and advance to the superior margin of the syndesmosis; this slight obliquity of the osteotomy provides a larger medial surface for plate fixation of the distal fragment.

- Protect the posteromedial neurovascular structures with a small Hohmann retractor during the drilling and osteotomy. Drill multiple holes at the osteotomy site, and connect the holes with a thin osteotome while sparing the lateral tibial cortex (Fig. 6). Then split the medial tibial surface by inserting stacked thin osteotomes into the gap (Fig. 7). Preserve a lateral osseous hinge by gentle osteoclasia. Maintain the opening of the osteotomy site with a bone spreader. If the osteotomy site seems unstable, insert a 2.7-mm Steinmann pin for temporary fixation, extending from the medial malleolus proximally. Check the degree of correction of the tibial plafond with fluoroscopy and assess the heel alignment clinically by holding the heel in the palm of one hand.
- Determine the appropriate size of the opening wedge on the basis of the preoperative weight-bearing anteroposterior radiograph. Usually, the base of the wedge will be 7 to 9 mm. Initially, we overcorrected the distal fragment into valgus to avoid continued talar tilt after correction. However, after we noted that greater valgus angulation did not result in better correction of the talar tilt, we now attempt to achieve a tibial-talar angle of 95° (5° of valgus) intraoperatively.

Step 4: Fixation and Bone-Grafting of Tibial Osteotomy Site

Apply a seven-hole plate and pack graft into the osteotomy gap.

- Apply a seven-hole dynamic compression plate for tibial fixation (Fig. 8), with three holes located on each side of the osteotomy and the central hole located in the gap. As the plate is secured to the tibial surface proximal to the osteotomy with screws, the distal fragment is pushed laterally by the plate and becomes stable.

- After the distal tibial screws have been placed, insert screws into the distal part of the fibular plate to provide additional stability to the osteotomy site.
- Pack autogenous iliac crest bone graft or allograft into the osteotomy gap (Figs. 9 and 10).

Step 5: Postoperative Care

After routine wound closure, apply a short leg cast and do not allow weight-bearing for six weeks after surgery. A weight-bearing cast or ankle-foot orthosis is used for an additional four to six weeks.

Results

In our series of sixteen patients with moderate medial ankle osteoarthritis⁶, the mean American Orthopaedic Foot & Ankle Society (AOFAS) score, radiographic stage, and values for all radiographic parameters measured improved significantly after surgery. The postoperative AOFAS score was higher ($p = 0.02$) and the radiographic stage was lower ($p = 0.03$) in the subgroup with a lower postoperative talar tilt as compared with the subgroup with more talar tilt.

The optimal threshold for predicting high postoperative talar tilt was 7.3° of preoperative talar tilt, with a sensitivity of 100% and a specificity of 91.7%. The mean AOFAS score in the group without lateral subfibular pain and with low postoperative talar tilt was higher than that in the other patients.

What to Watch For

Indications

- Moderate ankle osteoarthritis and varus deformity of the tibial plafond with minimal talar tilt and neutral or varus heel alignment.
- An active patient.
- Intact lateral tibiotalar articular surfaces.

Contraindications

- Ankle osteoarthritis with obliteration of the entire joint.
- Talar tilt exceeding 8°.

Pitfalls & Challenges

- Overcorrection or undercorrection. We attempt to achieve a tibial-talar angle of 95° (5° of valgus).

- Intra-articular fracture of the tibial plafond. Before the osteotomy gap is opened medially, there should be some motion at the gap when the heel is manually pushed laterally.
- Osteotomy extending into the tibiofibular syndesmosis. The level of osteotomy should be checked carefully with fluoroscopy before the drill holes are made.
- Inadequate fixation. Both the tibia and the fibula should be fixed with a plate and screws.

Clinical Comments

- What is the treatment for persistent talar tilt after supramalleolar osteotomy?
- What is the ideal amount of correction of the tibial plafond position?

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Figures

Fig. 1 Exposure of the distal part of the fibula through a longitudinal incision along its posterior border.

Fig. 2 A seven-hole semitubular plate is bent slightly more than the natural contour of the distal part of the fibula.

Fig. 3 The plate has been applied to the fibula, and screws have been inserted into the holes proximal, but not distal, to the osteotomy.

Fig. 4 A curvilinear incision is made over the anteromedial surface of the distal part of the leg for exposure for the tibial osteotomy.

Fig. 5 Use fluoroscopy to confirm the position of the Kirschner wires used to mark the position of the tibial and fibular osteotomies.

Fig. 6 Connect the drill holes in the distal part of the tibia with a thin osteotome.

Fig. 7 Split open the medial surface of the tibia with stacked thin osteotomes.

Fig. 8 Secure fixation of the tibia with a seven-hole dynamic compression plate while a bone spreader is used to maintain the opening of the osteotomy site.

Fig. 9 Preoperative anteroposterior ankle radiograph showing medial joint-space narrowing with talar tilt.

Fig. 10 Postoperative anteroposterior ankle radiograph showing the gap in the osteotomy site packed with bone graft.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10