Vascularized Pedicled Fibula Onlay Bone Graft Augmentation for Complicated Tibio-talo-calcaneal Arthrodesis with Retrograde Intramedullary Nail Fixation: A Case Series

Rachel B. Kang, DPM (PGY-II)¹, Thomas S. Roukis, DPM, PhD, FACFAS¹, Gundersen Medical Foundation, La Crosse, WI, ²Gundersen Health System, La Crosse, WI

STATEMENT OF PURPOSE

In select limb salvage cases deemed high-risk for non-union or complications, we have augmented tibio-talo-calcaneal arthrodesis procedures stabilized with a retrograde intramedullary locked compression nail with a vascularized pedicled fibular onlay bone graft. Since this specific approach has not been previously reported, the purpose of our study was to analyze the outcomes where this technique was employed.

LITERATURE REVIEW

The use of a vascularized free fibular bone graft with microvascular anastomosis for tibial defect reconstruction has been in clinical use since first being described in 1975. However, only a few single cases of ankle arthrodeses with osseous defects ≥ 4-cm enhanced with a vascularized free fibular bone graft has been published to date. Tibio-talo-calcaneal arthrodesis stabilized with retrograde intramedullary nail fixation is associated with a high incidence of complications, especially when performed with fibular structural allografts and hostile soft-tissues.

METHODLOGY

A retrospective review of prospectively collected data was performed at our institution to identify patients who had undergone tibio-talo-calcaneal arthrodesis fixed with a retrograde intramedullary compression nail in conjunction with a vascularized pedicled fibular onlay bone graft with indications listed in Table 1.

SURGICAL TECHNIQUE PEARLS

• The peroneal artery is identified with a sole Doppler probe.
• The periosteum to the fibular shaft and lateral malleolus is maintained intact (Figure 1).
• When the osseous defect involves a large cortico-cancellous bone void (Figure 2), employment of a bulk structural allograft augmented with bone marrow aspirate and allograft and/or synthetic bone graft is utilized (Figure 8).
• Performance of the vascularized pedicled fibular bone graft first involves removing a segment of fibular shaft 1-cm in length at the most proximal visualized portion of the fibula (Figure 4).
• Careful dissection must be performed to minimize damage to the peroneal artery and its branches. Once the fibular shaft is free, the posterior-inferior fibulotalar ligament and any remaining distal soft-tissues are carefully sectioned to isolate the fibular malleolus portion of the graft (Figure 5).
• The fibular graft is then stabilized and secured onto the tibia, talus/bulk allograft and calcaneus with multiple compression screws (Figure 6).
• Final intraoperative images are taken to assess for proper length, orientation, and alignment of the metallic fixation and close osseous apposition of all osseous surfaces (Figure 7).

RESULTS

10 patients (9 men, 1 woman) with a mean age of 59 ± 10.4-years (Range: 47 to 86-years) underwent tibio-talo-calcaneal arthrodesis fixed with a retrograde intramedullary compression nail in conjunction with a vascularized pedicled fibular onlay bone graft (Table 1). The mean follow-up was 10.9 ± 5.4-months (Range: 6 to 20-months). The mean length of the vascularized pedicled fibular onlay bone graft, measured from the distal tip of the fibula to the proximal fibular osteotomy site, was 10.2 ± 2.3-cm (Range: 8.2 to 14-cm). The mean time to radiographic union for all 10 patients was 2.6 ± 0.6-months (Range: 2 to 4-months).

ANALYSIS & DISCUSSION

The etiology was predominantly avascular osteonecrosis of the talus and/or distal tibia and resultant cavus deformity (8 ankles). The remaining patients had severe spastic equino-cavovarus contracture (1 ankle) or failed total ankle replacement associated with an equino-cavovarus deformity (1 ankle). When comparing our mean time to osseous union of 2.6-months (Range: 2 to 4-months) with prior published mean osseous union times following some version of fibular onlay of 5.3-months and 10-months, there appears to be a benefit to utilizing a vascularized pedicled fibular onlay bone graft as we describe here.

To our knowledge, this is the first case series to report the technique and results for vascularized pedicled fibular onlay bone graft augmentation of complicated tibio-talo-calcaneal arthrodesis fixed with retrograde compression intramedullary nail fixation. A larger patient series involving multiple surgeons is required to help determine the specific clinical situations when the added dissection and time required to perform a vascularized pedicled fibular bone graft would be beneficial.

REFERENCES