Failed Microfracture for Osteochondral Lesions of the Talus – What To Do NOW

Richard D. Ferkel, MD
AOFAS/AOSSM Combined Session
San Diego, California
March 18, 2017

I. What Should You Do When Drilling and/or Microfracture Fails?
   A. Re-do drilling and/or microfracture
   B. Osteochondral autograft transplantation – OATS
   C. Osteochondral allograft transplantation
   D. Autologous chondrocyte implantation/MACI
   E. Particulated juvenile cartilage
   F. Micronized cartilage matrix
   G. Carti-One
   H. Focal resurfacing implant

II. Osteochondral Autograft Transplantation (OATS)
   A. Robs Peter to pay Paul
   B. Uses osteochondral graft plugs from the sulcus terminalis of knee, anterior talar head, or medial or lateral non-articulating portions of the talus for graft sources
   C. Advantage of single setting procedure
   D. Size limitations for autograft transplantations – usually between 8 and 20 mm
   E. Question of long-term problems with femoral plug holes and subsequent pain
   F. Anteromedial talar lesions
      1. Arthroscopy and debridement
      2. Arthrotomy establish lesion size
      3. Core out or drill out lesion to at least 10 mm deep
      4. Compact the base and measure depth
      5. Harvest donor graft from the knee or ankle
      6. Insert donor graft into the defect
   G. Posterolateral lesions
      1. Arthroscopy and debridement
      2. Arthrotomy and release the anterior talofibular and calcaneofibular ligaments
      3. Sublux talus anteriorly
      4. Insert graft as above
   H. Posteromedial talar lesions
      1. Arthroscopy and debridement
      2. Medial malleolar osteotomy, including pre-drilling the medial malleolus for later screw insertion
      3. Same as above
   I. Allograft OATS – core grafting or en bloc
      1. Steps as above
      2. Try to match the exact location and morphology on the allograft to the insertion site
   J. Retrograde OATS tibial plateau or tibial plafond
1. Arthroscopically define the size of the lesion
2. Use angle drill guide to retrograde drill at 70-degrees into the plateau or plafond lesion
3. Harvest graft and insert with special instrumentation, as described by Scranton

K. Results – OATS
1. Sammarco (2002) did 12 patients and harvested graft from medial or lateral facet of talus for OATS
   a. AOFAS scores 64 to 91
2. Scranton et al. (2005) did 50 OATS cases with 2 to 6 year follow-up
   a. 64% had failed one or more surgeries prior to grafting
   b. 90% good/excellent
   c. 15 required either screw removal or second-look for scar debridement
   d. 2 failed required ankle arthrodesis

L. Results – Allograft OATS
1. Gross (2001) did 9 patients; 6 patients remain in situ with mean survival 11 years. 3 cases required fusion;
2. Gortz et al. (2010) reported on 12 ankles in 11 patients with fresh osteochondral allografts for OLT; all involved partial unipolar grafts of the talar dome implanted through an anterior approach without osteotomy
   a. Mean follow-up 38 months
   b. Mean OMAS improved from 28 to 71
   c. 30% excellent; 20% good; 30% fair; 20% poor
3. El-Rashidy et al. (2011) reported on 42 patients using fresh osteochondral allograft for OLT
   a. Mean follow-up 38 months
   b. Mean AOFAS 52 to 79
   c. Graft failure in 4 patients

III. Autologous Chondrocyte Implantation
A. Definition – implantation of in vitro cultured autologous chondrocytes using a periosteal tissue cover or membrane after expansion of isolated chondrocytes
B. Cartilage Repair Registry (Genzyme Tissue Repair, vol. 6:3-00)
   1. Prospective multicenter data from 636 surgeons, 47 patients at 4 year follow-up
   2. Mean total defect size = 4.6cm²
   3. Average age 38 years (15-55)
   4. 81% of condyle group improved on Modified Cincinnati Score
   5. 78% had at least one associated procedure
   6. Overall debridement 4.3%, AF 1.9%, hypertrophy 1.3%, 3.2% failure

IV. Indications for ACI in the Ankle
A. Indications
   1. Patients aged 15 to 55
   2. Focal defect
   3. Unipolar (only talus affected)
   4. Contained
   5. Edge loading
   6. Failed previous surgery
   7. Large lesions with extensive subchondral cystic changes
B. Relative Indications
1. Multifocal unipolar lesions
2. Uncontained lesions

V. ACI – Generations
   A. Generation 1 – Carticel suspended under a periosteal flap
   B. Generation 2 – Carticel inserted under a tissue patch or onto a carrier scaffold
   C. Generation 3 – Carrier-free, immature cartilage tissue

VI. Surgical Technique – ACI Generation 1
   A. Medial or lateral malleolar osteotomy performed under fluoroscopic control
   B. Defect preparation includes removing all damaged cartilage from subchondral bone
      and debriding defect on the calcified cartilage layer without penetrating bone
   C. Harvest periosteum from distal tibia along the medial malleolus or from just distal to
      the pes anserinus and the proximal anterior tibia
   D. Mark non-cambium layer of periosteum
   E. Periosteum fixation
      1. Place periosteum in the defect with the cambium layer down, suture with 5.0 or
         6.0 Vicryl suture and seal with fibrin glue
   F. BioGide membrane
      1. Absorbable porcine bilayer collagen I/III membrane used by dentists in the
         United States for a number of years
      2. Recently has been used in knee and ankle ACI in place of periosteum, but this
         indication is not FDA approved
      3. Has a rough and smooth layer
      4. Made by the same company as Chondro-gide and very similar
   G. Aspirate cell vial contents and resuspend cells
   H. Implant via catheter through opening in the periosteum
   I. Close hole in the periosteum and use fibrin glue; then reattach osteotomy
   J. Wound closure
      1. Re-insert pre-drilled guide pins and insert appropriate length screws in the
         medial malleolus
      2. Insert lag screws in fibula, then appropriate size plate and screws
      3. The patient goes into short leg cast in neutral position

VII. Postoperative Care for OATS and ACI
   A. Four phases
   B. Immobilization 2-3 weeks, until wounds are healed
   C. Then start partial weight bearing with removable CAM walker and TED stocking
   D. At 6 weeks, go to full weight bearing and start physical therapy
      1. Progress through Phase 1, 2, 3 and 4 with specific protocol

VIII. Results of ACI – First Generation (ACI-P)
   A. Baums et al. (2006)
      1. 12 patients
      2. Mean follow-up 63 months
      3. Hannover score increased from 40 to 86 points
      4. AOFAS increased 45 points
      5. Patients involved in competitive sports were able to return to their full activity
         level
B. Ferkel (2010)
1. 32 patients done; the first 11 patients have been reviewed and published in AJSM
2. Current study: Follow-up on 29 of 32 (91%)
3. Average age: 34 (18-54)
4. Average follow-up: 70 months (24-129)
5. 9 “sandwich” procedures done, with bone grafting of large cystic underlying defect and use of two periosteal grafts back to back
6. 2nd look arthroscopy on 90% of patients (26/29)
7. Results: Excellent: 8; Good: 15; Fair: 5; Poor: 1
8. Entire paper presented at AAOS 2011

IX. ACI Periosteal Problems
A. First Generation ACI complications include:
   1. Periosteal hypertrophy
   2. Delamination
   3. Graft failure
B. USFDA estimated 3.8 complication rate in knees
   1. 18% graft hypertrophy
C. Type I/III bilayer porcine collagen membranes available in United States to be used in place of periosteum
   1. Gomoll et al. compared subsequent surgeries with periosteum versus collagen membrane
   2. Results similar except hypertrophy related surgery: 52% with periosteum and 3.4% with collagen membrane

X. Second Generation ACI
A. A variety of scaffolds being used in Europe, implanted either through a small arthrotomy or arthroscopically.
   1. Used as a patch and cells inserted underneath
   2. Cells seeded onto the scaffold membrane
B. Collagen-covered autologous chondrocyte implantation (CACI or ACI-C)
   1. Absorbable porcine bilayer collagen I/III membrane
   2. Chondro-Gide membrane with one compact and one porous surface
   3. Gooding found no difference in results between periosteum and membrane cover in knees with CACI
C. Hyalograft C
   1. Benzyl ester of Hyaluronic acid
   2. Bioabsorbs in 3 months
   3. Marcacci et al. presented 175 patients with grafts in the knee with 46 month mean follow-up. Results were 93% improvement at ICRS 2006
   4. Giannini et al. (2008) – 46 patients in ankle
      a. Mean age 32; follow-up 3 years
      b. Preop 57; postop 90 mean AOFAS score
      c. Biopsies collagen type II
D. Membrane/matrix autologous chondrocyte implantation (MACI)
   1. Highly purified type I/III collagen membrane
   2. Guillen and Abelow presented first 50 cases (42 knees; 8 ankles)
   3. 8 ankles (ages 22-46)
4. Large full thickness cartilage lesions of the talus (2-6 cm)
5. 5/6 good & excellent results with follow-up 4 months-2 1/2 years
6. Giza et al. did MACI on 10 patients; AOFAS 61 to 73

XI. Third generation ACI
   A. Use carrier-free, immature cartilage tissue
   B. Lack of carrier scaffold
   C. Avoids carrier integration, degradation and biocompatibility complications
   D. Jubel et al. used an alginate matrix to produce cell-rich chondrocyte disc in MFC of 48 sheep
   E. Chondral defects treated with De Novo cartilage transplantation showed qualitatively better micro and macroscopic regeneration than those with periosteal flaps alone
      1. Farr and Yao reported earlier results in the knee
      2. Adams et al. reported particulated juvenile articular cartilage allograft transplant for OLT with early good results
   F. DeNovo particulated juvenile cartilage results
      1. Coetzee, Giza, Schon et al. reported on 24 ankles, average age 35
      2. 14 failed at least one prior bone marrow stimulation procedure with average lesion size 125 mm² and average depth 7 mm
      3. AOFAS score 85 with 18 (78%) ankles showing G-E scores
      4. 92% G-E in lesions 10-15 mm

XII. Micronized Cartilage Matrix
   A. Allograft cartilage extracellular matrix contains key components of cartilage
   B. Cartilage dehydrated then micronized with five year shelf life
   C. Provides scaffold over microfracture defect
   D. Signals autologous cellular interactions within scaffold
   E. Costs significantly less than particulated juvenile cartilage and ACI
   F. Little human research available

XIII. CartiOne – New cartilage technique
   A. One-step cell-based cartilage repair
   B. Cartilage biopsy taken at surgery along with bone marrow aspirate
   C. Technician isolates and mixes the cells
   D. The cells are implanted on the scaffold into the defect
   E. Chondro-Gide is often used as the scaffold into which the cells are placed
   F. Clinical trials currently in place in U.S. and overseas

XIV. Focal Surfacing Implant
   A. Consider for primarily large OLT cases that have failed
   B. Newer, investigational
   C. Primarily for superomedial talar dome lesions
   D. VanBerken et al. (2013) reported using implant after failed previous surgery on 20 patients with a mean follow-up of 3 years
      1. AOFAS went from 62 to 87
      2. FAOS improved in all subscales

XV. Recommended reading on current and future innovations on ACI and treatment of osteochondral lesions of the talus
XVI. Is there a critical defect size for poor outcome?
A. Chuckpaiwong et al. (2008) did debridement and microfracture on 105 patients with mean follow-up of 32 months.
   1. Lesions smaller than 15 mm, no failures
   2. Lesions greater than 15 mm, one patient successful
   3. Factors affecting negative outcome: increasing age, higher BMI, trauma history and presence of osteophytes
B. Guo et al. (2010) treated 43 patients arthroscopically with mean age of 32 years
   1. AOFAS 70 to 90; 81% good/excellent
   2. Strong correlation with size of lesion (<10 mm) and successful outcome
C. Choi et al (2009) found initial defect size is important prognostic factor for OLT and can serve as a basis for preop surgical decisions
   1. OLT defect of 150 mm² or greater as calculated from MRI has a high correlation of having a poor clinical outcome
   2. OLT defect of <150 mm² has a high correlation of a good clinical outcome
D. Ramponi et al recently published a review suggesting that bone marrow stimulation may best be reserved for OLT sizes <10.7 mm²

References


Recommended Reading
