Thursday, June 21, 2012

7:00 – 7:30 am

Video Technique 1:
Tips and Tricks: Hindfoot Fusion

Moderator:

Terrence M. Philbin, DO
Westerville, Ohio

7:00 am
My Anterior Ankle Fusion Technique
Mark E. Easley, MD
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Overview

_Pertinent References:_ (see annotated bibliography below)
(Tarkin, Mormino et al. 2007; Plaass, Knupp et al. 2009; Guo, Yan et al. 2010; Mohamedean, Said et al. 2010)

*Personal observations*
- Trend toward anterior approach and anterior plating for ankle arthrodesis but not universally accepted
- Perhaps will add stability to ankle arthrodesis construct when comparing to screw fixation
- Current techniques favor preserving anatomy (particularly malleoli) so that an ankle fusion takedown may be feasible with conversion to total ankle arthroplasty should ankle arthrodesis lead to adjacent hindfoot arthritis over time

*Exposure*
- Same as for Total Ankle Arthroplasty
- Crossing branch of SPN may need to be sacrificed
- Open extensor retinaculum over EHL
- Interval between TA and EHL
- Protect deep NVB
- Deep retraction only (no skin tension)

*Joint Preparation*
- Preserve joint anatomy (ie, do not resect fibula)
- Remove anterior osteophytes to improve DF
- Clean Gutters to optimize coronal (and sagittal) plane position
- Use joint distraction
- Carefully elevate posterior capsule to allow optimal sagittal plane position
- Maintain subchondral bone architecture if possible but remove all cartilage and fibrous tissue (maintain talar convex and tibial concave surfaces)
- Penetrate tibial and talar subchondral bone with drill +/- chisel to create vascular/marrow access and increase surface area for fusion
- If focal AVN present, then this bone should be resected
- Occasionally structural graft required to fill large defect
- Occasionally fibular osteotomy required to correct varus and allow satisfactory lateral tibiotalar joint contact for fusion (fixation of fibula often unnecessary)

**Positioning**

**General:**
- If convex talar dome surface and concave tibial plafond surface are maintained, then subtle changes in position are possible without sacrificing contact area for fusion

**Coronal:**
- Neutral with optimal tibiotalar contact
- If more valgus needed, then congruently remove more bone from lateral plafond +/- fibular osteotomy
- If you are going to err, err into valgus
- If you have even the slightest suggestion that there is neutral or varus position, then there is and you must correct it (this will not somehow spontaneously correct postoperatively through the hindfoot)

**Sagittal:**
- Neutral DF/PF with optimal bony contact between prepared tibial and talar surfaces
- Avoid anterior translation of the talus under the tibia
- If you are going to err, err into DF
- If it looks like you have even slight equinus position, then you do and you must correct this (equinus will not somehow spontaneously correct postoperatively through the TN joint)
- If it looks like you have anterior translation of the talus, then you do and you must correct it by freeing more posterior capsule or the gutters (caution with the medial release, though; avoid injury to the deltoid branch of the posterior tibial artery that provides perfusion to the medial talar dome)

**Rotation:**
- Neutral rotation with 2nd MT aligned with the tibial crest
- I do not aim for external rotation, particularly in a patient with a relative flatfoot alignment
- You can try to dial in the rotation to match the contralateral side, but in my experience I favor avoiding internal rotation and simply aligning the 2nd MT with the tibial crest
- In my experience, rotation is controlled quite well when the malleoli are left intact

**Bone Grafting**
- I recommend using bone graft when there are voids in the contact area between tibia and talus
- Frequently there may be a slight gap posteriorly, even with optimal joint preparation and well-preserved subchondral bone on both the tibia and talus
- I routinely bone graft posteriorly

**Provisional Fixation**
- I routinely use one or two Steinman pins from the anterolateral or anteromedial tibia into the talus, positioned so that my provisional fixation does not interfere with anterior plating
- Most commonly, I use two anteromedial pins
- I try to avoid penetrating the subtalar joint, but occasionally it is necessary to optimize provisional fixation

**Plate fixation**
- It is possible to place a compression screw from the medial tibia into the talus prior to plating, and placing this screw depends on surgeon preference (typically placed through a separate medial “stab” incision)
- If the plan is to compress through the plate(s) then a compression screw should not be placed prior to plating
- Advantage to placing the compression screw first: “locks the arthrodesis in place”
- Disadvantage to placing compression screw first: it may interfere with screws placed through the plate and will not allow for more compression through the plate
- Several anterior plating systems exist that are “precontoured” to match the anterior tibia and talar neck; in my experience often further “sculpting” of the anterior tibia is required
- If I use a dual plating system, I typically place the anterolateral plate first so that I promote valgus with compression.
- Talar screws are typically placed first so that the plate “sucks down” to the talar neck, then compression may or may not be applied via the plate proximally, and then the tibial screws are placed.
- Caution with anterior plate compression: it may lead to posterior gapping at the tibiotalar arthrodesis site, thereby diminishing contact area for fusion.
- Screws may be placed from the tibial portion of the plate through the tibia across the middle of the arthrodesis site and into the posterior talus to improve construct stability.
- After multiple screws through the plate into the talus and tibia, it is still feasible to add a supplemental positional screw outside of the plate to augment the construct’s stability (typically placed through a separate medial "stab" incision).

References


BACKGROUND: More than 40 fusion techniques for the ankle joint have been reported. The purpose of this retrospective study was to review our preliminary clinical and radiographic results using an anatomically contoured anterior plate for ankle arthrodesis. MATERIALS AND METHODS: Ten ankle arthrodeses with an anatomically contoured anterior plate performed by a single surgeon were reviewed with an average of 14 months followup. One underwent revision surgery due to screw loosening by reapplying the same plate. Plain radiographs were taken to help determine the stability of fixation and time of fusion. The AOFAS clinical rating system was applied to evaluate patients preoperatively and postoperatively. RESULTS: Nine of ten patients achieved solid fusion radiographically and clinically at an average of 15 (range, 12 to 22) weeks. Bony healing was achieved after additional 12 weeks for the patient who underwent revision fusion. There were no postoperative wound problems or infections. All patients reported an improvement in their pain level following successful fusion. CONCLUSION: The application of an anatomically contoured plate provides many advantages, including less soft tissue disruption by using a single anterior incision, ease of deformity correction, early rehabilitation, and high rate of union.


Clinical and biomechanical trials have shown that rigid internal fixation during ankle arthrodesis leads to increased rates of union and is associated with a reduced infection rate, union time, discomfort and earlier mobilisation compared with other methods. We describe our technique of ankle arthrodesis using anterior plating with a narrow dynamic compression plate (DCP). Between 2004 and 2007, 29 patients with a mean age of 24.4 years (range 18-42) had ankle arthrodesis using an anteriorly placed narrow DCP. Twenty-two patients were post-traumatic and seven were paralytic (five after spine fracture and two after common peroneal nerve injury). Follow-up was between 12 and 18 months (average 14 months). A rate of fusion of 100% was achieved at an average of 12.2 weeks. According to the Mazur ankle score, 65.5% had excellent, 20.7% good and 13.8% fair results. Ankle arthrodesis using an anteriorly placed narrow DCP is a good method to achieve ankle fusion in many types of ankle arthropathies.


BACKGROUND: Arthrodesis is the most common procedure used to treat end-stage osteoarthritis of the ankle, particularly in patients with difficult conditions such as poor bone quality. While many techniques are available to fuse the ankle, current recommendations favor the use of internal fixation with screws and/or plates. Despite of progress, the complication rate remains a major concern. Non-union is one difficult problem especially with difficult bone conditions, particularly the loss of bone stock on the talar side. Therefore, fusion of the tibiotalar joint is often extended to the talocalcaneal joint to provide
sufficient stability. To preserve the subtalar joint, an anterior double plate system for rigid fixation of isolated tibiotalar arthrodesis was developed. This is a preliminary report on the clinical and radiological outcome with this technique. MATERIALS AND METHODS: Twenty-nine patients (15 men, 14 women; one ankle per patient) were treated from October 2006 to September 2007. We converted 16 ankles with osteoarthritis and difficult bone conditions, four non-united ankle arthrodeses, and nine failed total ankle replacements to an isolated tibiotalar arthrodesis using anterior double plating. If necessary, we used solid allograft to fill bony defects. Outcomes included bone union as assessed by radiographs, pain as indicated by the American Orthopaedic Foot and Ankle Society scores, and patient satisfaction. RESULTS: Solid arthrodesis was achieved after an average of 12.3 (eight to 26) weeks in the 16 ankles without bone graft interposed between the tibia and talus, and 14.3 (range, 8 to 26) weeks in the 13 ankles with interpositional bone allograft. Radiographs showed that the position of arthrodesis obtained at the time of surgery did not change in any patient up to one year after surgery. The mean American Orthopaedic Foot and Ankle Society (AOFAS) Hindfoot Score increased from 37 (range, 20 to 63) preoperatively to 68 (range, 50 to 92) at the last followup. Twenty-seven patients (93%) were satisfied with their outcome and indicated they would have the operation again. No complications were noted. CONCLUSION: The anterior double plating system was shown to be a reliable method to achieve solid isolated tibiotalar arthrodesis, even in ankles with difficult conditions such as loss of bone stock due to failed total ankle arthroplasty.


BACKGROUND: The success of ankle arthrodesis for the treatment of post-traumatic ankle arthritis depends on achieving and maintaining rigid fixation of the prepared tibiotalar interface. The purpose of this study was to examine the biomechanical effect of anterior plate supplementation of a popular three-screw fusion construct. METHODS: Six fresh-frozen cadaver ankles were prepared and instrumented with three partially threaded screws compressing the tibiotalar interface. Testing was done with and without supplementary anterior plate fixation under three different decoupled loading conditions: plantarflexion/dorsiflexion, inversion/eversion, and rotation. Motion at the tibiotalar interface was recorded. RESULTS: Anterior plating increased construct stiffness by a factor of 3.5, 1.9, and 1.4 for the sagittal, coronal, and torsion modes, respectively. Less motion occurred at the tibiotalar interface in all to the three different loading conditions (p = 0.031) with plate supplementation. CONCLUSIONS: Compared to screws alone, anterior plate supplementation increases construct rigidity and decreases micromotion at the ankle fusion interface.