

MINI-Calc®

Detailed Surgical Technique

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STEP #1: PRIOR TO PROCEDURE

- Obtain appropriate lateral and axial views of the calcaneus.
- Obtain a CT of the calcaneus with reconstruction in the sagittal and coronal planes, in addition to plain radiographs.

STEP #2: PATIENT POSITIONING

- Place patient in the lateral position with the operative extremity up.
- Make sure the down extremities including the radial nerve in the upper arm and the common peroneal nerve at the fibular neck are well padded.
- A bean bag positioner typically makes positioning easiest.
- Multiple blankets can be used to establish a flat working platform for the operative leg.
- These blankets and pads also keep the operative or up leg from sliding off the table.
- Obtain axial, lateral views, and Broden's views of the heel with an intraoperative fluoro of choice. A standard C-arm or portable device will suffice.

STEP #3: EXPOSURE AND APPROACH

- Use a tourniquet if desired (thigh or calf tourniquet is adequate).
- Once extremity has been prepped and draped, exsanguinated, and tourniquet inflated (if desired), make an incision beginning at the tip of the fibula extending the incision towards the anterior process of the calcaneus and the calcaneocuboid joint.
- The incision can be slightly curved or straight.
- Incise the skin sharply and bluntly dissect through subcutaneous tissue, paying careful attention to any potential branches of the sural nerve or the more lateral branches of the superficial peroneal nerve.
- The fat of the sinus tarsi is taken with cautery or sharply.

- The extensor digitorum brevis muscle origin is identified in the sinus tarsi and may be taken off its origin sharply or with cautery.
- Alternately, the fibers may be split in line with their travel.

Note: While the interosseous ligament within the sinus tarsi is often damaged by the fracture, in some cases, it remains intact. That ligament can be taken sharply to improve exposure. A lamina spreader can be placed into the sinus tarsi and spread open. This typically improves exposure to the subtalar joint.

- Carry the dissection posteriorly until the peroneal tendons are encountered. If the peroneal tendons are dislocated, they will be encountered earlier in the dissection.
- To repair the peroneal tendons, extend the incision vertically up the course of the fibula and turn into a hockey stick shaped incision.
- If peroneal tendons are dislocated, they can be readily and easily repaired at the completion of the operative procedure.
- Once the incision is taken posteriorly to the level of the peroneal tendons, keep the peroneal tendons protected throughout the procedure.
- The calcaneofibular ligament is commonly taken sharply to improve exposure.
- If ligament is taken sharply, the ends can be tagged for later repair. Postoperative instability is rarely, if ever, encountered even if the ligament is not directly repaired.
- Facilitate exposure to the posterior facet with a Senn retractor or a Hohman retractor.
- The retractor is placed posterior to the posterior facet.
- In a joint depression type injury, the fractured fragment is readily identified and pushed inferiorly near the area of the angle of Gissane.

STEP #4: REDUCTION OF ARTICULAR SURFACE

- Use a combination of a freer or a K-wire as a joy stick, to elevate the articular fragment into its anatomic position and reduce it to the constant fragment (sustentaculum talus).
- With the fragment reduced, complete provisional fixation with the K-wire.
- After the fragment has been elevated and returned to its position or if there have been multiple fragments in a higher grade calcaneal injury, accomplish reduction under direct visualization of the posterior facet.
- Excellent cortical reduction can typically be obtained at the angle of Gissane.
- Investigate and reduce the axial length of the calcaneus.
- Typically, a Steinmann pin is utilized through the calcaneus. Alternatively a Schanz pin or Kirschner bow may be utilized.
- The Steinmann pin is typically placed from a lateral to medial direction 2 cm anterior from the posterior surface of the calcaneus, and 2 cm superior from the plantar surface of the calcaneus.
- If the heel is in varus, place the pin in slight varus as well.
- With the pin pulled into neutral position, the varus of the heel is thus reduced.

STEP #5: REDUCTION OF POSTERIOR TUBEROSITY

- The reduction of the tuberosity is not well visualized from within the wound, but can be well visualized with an axial or Harris view of the heel, supplemented with a lateral view.
- Obtain improved traction in difficult situations by using a fully threaded pin placed through the heel.
- Protect the sharp end of the pin so it does not penetrate the drapes on the down side.
- To gain length on the calcaneus, an assistant is commonly used to pull longitudinal traction.
- Flexing the knee to 90° and having the assistant pull counter traction is quite helpful as well.
- Once adequate reduction of the tuberosity is obtained, use an axial K-wire along the medial aspect of the tuberosity up into the sustentaculum or “constant fragment”.

STEP #6: REDUCTION OF THE ANTEROLATERAL FRAGMENT

- Once the posterior facet and the tuberosity have been reduced, attention should be focused on the anterolateral fragment, which can be easily reduced from the sinus tarsi incision.
- Extend the incision distally to incorporate the calcaneal cuboid joint, if visualization of that joint is necessary.
- Cortical reduction commonly can be obtained to the anterolateral fragment without visualizing the joint surface.
- Check the joint surface reduction using an oblique view with fluoroscopy.
- Obtain K-wire fixation to this fragment.
- At this point, the fracture is reduced.
- Use lateral, axial, and Broden's view scans, along with visual reduction aids to confirm reduction.
- Size the minimally invasive plate of choice to the lateral aspect of the calcaneus.
- Typically the first screw placed through that plate is placed in a lag fashion.
- Alternately, use a fully threaded screw if there are multiple comminuted fragments or a 3-part fracture to the posterior facet of the calcaneus where compression may cause malreduction to the central fragments.
- Locking or nonlocking options may be chosen based on surgeon preference. Typically 2 or 3 screws buttressing the posterior facet are necessary.

STEP #7: SCREW INSERTION

- Once those screws are in position, place one or two screws along the axial length to hold the tuberosity reduction. A supplement to the minimally invasive plate is an axially placed screw.
- This screw should be fully threaded with care taken to not over-compress.
- Depending on the plate chosen, the anterolateral fragment, if present, can be fixed with simple screws or through screws placed through an extension of the minimally invasive plate.
- Typically those screws are placed in a slightly dorsal to plantar direction in order to obtain reasonable purchase in the plantar medial aspect of the anterior aspect of the calcaneus.

- Of note, if a tongue type fracture is being reduced in this way, a second incision is often necessary and quite helpful when placed longitudinally near the lateral aspect of the Achilles insertion onto the calcaneus.
- The fracture line of the tongue type posteriorly can be easily identified and can assist greatly in reduction of the tongue type fragment.
- Place lag screws from a dorsal to plantar direction to reduce that tuberosity fragment.
- In addition to the reduction assistance from that incision, you can place a pin into the tongue type fragment in the manner of the Essex-Lopresti type technique. This can assist in the reduction of the tongue type fragment.

STEP #8: WOUND CLOSURE

- Verify adequate reduction and hardware placement.
- Close the wound in layers.

POSTOPERATIVE REHABILITATION REGIMEN:

- Patients are typically splinted for approximately 2 weeks after surgery.
- Beginning at 2 weeks, office x-rays are obtained verifying reduction.
- The patient is typically placed into a boot brace and encouraged full range of motion including inversion and eversion.
- Physical therapy may be utilized at this visit based on surgeon preference.
- If the peroneal tendons were dislocated, some restrictions on active eversion may prevent excessive strain on the retinacular repair.
- Non-weight-bearing is suggested for the first 6 weeks following surgery. At 6 weeks, repeat radiographs are obtained.
- If adequate healing is demonstrated, full-weight-bearing and boot brace situation is allowed.

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