CALCANEUS FRACTURES:  DELAYED TREATMENT

George E. Quill, Jr., M.D.

Delayed problems after calcaneus fracture can result from inadequate or inappropriate initial treatment. There may be problems after certain calcaneus fractures, however, regardless of the initial treatment, even if it is the most optimal.

Late problems after calcaneus fracture include nerve complications such as the iatrogenic neuroma pictured here. Soft tissue impingement of the shortened, widened healed after calcaneus fracture is also another common problem.

Late problems with calcaneus fractures also include calcaneofibular or subfibular abutment of the os calcis against the fibula and compromise of all the subfibular anatomic structures, including the as the peroneal tendons.

Another common problem is altered tibiotalar mechanics. When the talus is driven down into the body of the os calcis, it is dorsiflexed relative to the ankle, and these patients often have anterior tibiotalar abutment. There are also some very difficult to treat problems associated with the so-called smashed heel pad.

Osteoarthritis is a very common late problem occurring in at least 74 percent in most salvage series. This commonly affects the subtalar and/or transverse tarsal joints.
These patients with old calcaneus fractures also often suffer from the sequelae of unrecognized compartment syndromes, leading to intrinsic atrophy and clawtoe deformity. These patients may also have reflex sympathetic dystrophy or chronic pain syndromes.

Late surgical treatment for the patient with old calcaneus fracture is done for arthritis, mechanical problems and maybe for certain nerve problems. The late surgical treatment usually consists of ostectomy or decompression and debridement or arthrodesis or in the worst case scenario, amputation.

Nonsurgical treatment for delayed problems after calcaneus fractures usually consists of using a molded arch support or total contact orthoses. Certain heel pads or cushions can also be tried.

Often the patient with significant arthritis would benefit from a patellar tendon bearing type of ankle-foot orthosis with double metal uprights attached to a shoe. Shoe wear modification in itself is often quite a help for these patients and may take the form of a steel shank with a rocker sole or medial or lateral out-flare of the heel. More recently we have been trying to incorporate a single axis cushioned heel in the shoe for these patients. Injections can not only help these patients and, therefore, be deemed therapeutic, but in the course of trying to delineate the primary focus of the patient's pain, one might perform diagnostic injection with local anesthetics and sometimes cortisone derivatives to pinpoint the area of greatest pain.
The problem of reflex dystrophy and chronic pain may be treated with sympathetic blockade or sympathectomy or referral to a pain treatment center. These fractures are usually sustained in young, working age adults, and one must always consider in management of these patients the potential for litigation and secondary gain.

We should make a note here about the diagnosis of compartment syndrome in the foot. Several authors have described the calcaneal compartment of the foot, which actually consists of the muscle belly of the quadratus plantae. This compartment has been shown by Art Manoli and others to communicate with the posterior deep compartment of the leg. Perhaps late in the presentation after compartment syndrome we may need to concern ourselves with clawtoe surgery to correct the sequelae of compartment syndrome.

I also want to touch on the unique anatomy and function of the heel pad itself. This is a photograph taken from Serrafian's text that demonstrates the rather intricate fibroareolar or honeycombed network of cells in the normal heel pad. Each of the cells in this honeycomb is filled with water and fat globules that act as a very efficient hydraulic shock absorber. These cells may be ruptured in a patient who sustains a calcaneus fracture in falling from a height. Surgery for plantar heel pain is often only done for osteotomy of a protruding plantar spike of bone in the case of calcaneal fracture malunion.
Nerve complications include incisional neuromata, the tarsal tunnel syndrome, and crushing injuries of the nerves. About the only nerve surgery we would really consider doing with any degree of frequency would be resection of a neuroma and transposing the proximal segment into a healthy, well-padded muscle belly. I feel that tarsal tunnel release should only be done with appropriate documentation; that is with history, physical examination and neurodiagnostic studies that support the diagnosis.

Also, in treating calcaneus fractures late, one will often have to address the sequelae of concomitant injuries sustained at the time of the calcaneus fracture. We have classically been taught to look for ipsilateral hip or tibial pilon injuries and injuries to the lumbar spine often consisting of compression fractures. Easily overlooked are osteochondral talus fractures, transverse tarsal joint problems, and the problems with infection in the case of open fracture.

Soft tissue impingement is perhaps one of the more common mechanical problems after calcaneus fracture. Laterally the peroneal tendons and the sural nerve are involved. The posterior tibial nerve may be involved medially. There is always a short, widened heel that is very difficult to be accommodated in regular shoes. This slide demonstrates nicely the wide heel with calcaneofibular abutment.
Surgery for mechanical problems may consist of subfibular decompression. This is seldom successful when it is employed as the sole reconstructive procedure. We often combine lateral calcaneal wall ostectomy with arthrodesis of the subtalar joint. The lateral wall of bone may be saved and used as autogenous bone graft at the time of arthrodesis. This slide is a demonstration of how much bone actually needs to be taken in order to decompress the subfibular recess.

Another mechanical problem after calcaneus fracture includes that of the shortened heel cord. Persistent displacement of the tuberosity in the proximal direction results in a very shortened gastrosoleus muscle complex and diminished push-off strength. This can lead to a very severe gait disturbance.

I want to again address the problem of anterior tibiotalar abutment. The depression of the talus and the horizontal attitude it assumes can greatly alter the ankle mechanics and lead to anterior tibiotalar abutment and secondary arthrosis of the ankle.

Anterior tibiotalar impingement can be best quantified by determining the talar declination angle. This angle is formed by the longitudinal axis of the talus and the plane of support on a standing lateral radiograph. This angle is normally 25 degrees or greater, and we found that pathologic ankle mechanics occur when the angle is less than 20 degrees.
Locking of the transverse tarsal joint is another mechanical problem that occurs late after calcaneus fracture. With normal heel valgus, the transverse tarsal joints assume a relatively congruous position, and the midfoot joints are unlocked. With the displaced calcaneus fracture the talus is depressed into the os calcis, and it may no longer be possible for the transverse tarsal joint to unlock. This puts additional stress on the calcaneocuboid and talonavicular joints during weight bearing. On this slide with a depressed intra-articular calcaneus fracture, you can see that the transverse tarsal joints are no longer congruous.

Post-traumatic osteoarthrosis is a common sequela and can involve the subtalar, transverse tarsal, or ankle joints. Surgery for osteoarthrosis is usually aimed at arthrodesis. The subtalar joint may be fused in situ or with a bone block distraction technique that will be described later. A triple arthrodesis is reserved for the foot that not only has subtalar involvement, but also transverse tarsal joint arthritis. Often one can sometimes perform an anterior distal tibiotalar debridement or cheilectomy to improve dorsiflexion.

The technique of the subtalar bone block distraction arthrodesis includes a straight lateral, longitudinally oriented incision. Identify and protect the sural nerve. In cases of revision surgery, the nerve may need to be sacrificed, and the proximal nerve transposed into the belly of the peroneus brevis muscle. Usually the peroneal tendons are reflected in their sheath anteriorly.
The lateral wall is exposed completely, and subperiosteal dissection done distally so that a lateral wall ostectomy may be completed with a chisel. One usually has to take a great deal more bone than might have been anticipated from preoperative films.

The retrocalcaneal recess is debrided with a rongeur, and we try and identify the location of the subtalar joint. Osteotomes, chisels, and rongeurs are used to prepare the subtalar joint for arthrodesis.

A lamina spreader is placed in the wound and used to distract the subtalar joint. The debridement is completed, and often I will take a lateral x-ray of the foot to determine the height of the bone block I am going to need to harvest from the pelvis.

A tricortical iliac bone graft is taken, and I try and contour the piece of bone to a trapezoidal shape and place it in the arthrodesis site and then remove the lamina spreader.

One must take great care to place the bone graft either centrally or on the medial side so that we can avoid the tendency to tilt the joint into varus. I fix this usually with a fully-threaded 6_ millimeter cancellous screw or with a fully-threaded 7 millimeter cannulated screw. X-rays are obtained in the operating room.

One can see that the heel height for this gentleman was improved with the bone block distraction technique from 60 millimeters preoperatively to 73 millimeters postoperatively.
The slide on the left demonstrates the preoperative and postoperative appearance of a foot that underwent an in situ subtalar arthrodesis for the sequelae of osteoarthrosis after calcaneus fracture. On the right, this patient underwent a triple arthrodesis with the distraction technique.

In summary, the delayed treatment after calcaneus fracture is intuitive and must be individualized according to logical algorithmic protocol.

The surgeon needs to address the wide, short heel and the abnormal ankle mechanics, as well as the horizontal talus. One needs to address incongruous joints and soft tissue scarring. Usually we just correct the mechanical problems, fuse painful joints, and protect the soft tissues.