Chapter 14
Lisfranc Fracture/Dislocation Treated with Primary Arthrodesis

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Case Presentation

A 66-year-old female presented to the outpatient clinic 4 days after a high-energy motor vehicle accident for evaluation of right-foot pain. She was a restrained driver who collided with a vehicle in front of her and had immediate pain and inability to bear weight on the right foot. She was initially evaluated at an outside hospital where she was informed that she dislocated her second metatarsophalangeal joint. A reduction was performed at the outside hospital, the right foot was splinted, and the patient was encouraged

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to follow up with a local podiatrist. The patient was evaluated 1 day prior to presentation by the podiatrist who recommended urgent surgical intervention for multiple fractures in the right foot. The patient presented to the orthopedic foot and ankle clinic for a second opinion. She has no prior injury to this foot until 4 days ago and no history of chronic foot pain. She has a history of controlled hypertension, depression, and hypothyroidism for which she takes appropriate medications. The patient is employed as a dental hygienist and denies tobacco, alcohol, or recreational drug use. She lives at home with her husband. She has been in overall good health until 4 days ago.

Physical examination of the patient shows her to have appropriate mood and affect. She has palpable pulses at regular rate and rhythm in all extremities and non-labored respirations. She has full range of motion of her neck without any tenderness to palpation. Her right foot shows significant swelling although her compartments are soft and compressible. There is ecchymosis extending plantarly from the toes to the heel. Her sensation is symmetric to her uninvolved extremity. She has significant tenderness to palpation in the midfoot as well as at the second metatarsophalangeal joint. There is no pain noted at her ankle, hindfoot, or base of the fifth metatarsal. Her second toe appears to be located clinically. She is able to dorsiflex and plantarflex her ankle and toes as well as invert and evert her hindfoot normally.

Injury Films

Non-weight bearing films were obtained in clinic secondary to the patient being unable to bear weight on the foot due to pain and are shown in Fig. 14.1. Interpretation of the

FIGURE 14.1 Injury AP, oblique, and lateral radiographs

radiographs shows widening of the first intermetatarsal space as well as between the medial and middle cuneiform. On the AP view, a line drawn from the medial navicular to the medial cuneiform and extended distally (Mills line) does not intersect the first metatarsal. There is an incongruous articulation between the navicular and medial cuneiform indicative of a longitudinal Lisfranc fracture dislocation with dislocation of the intercuneiform and naviculocuneiform joints. An avulsion-type fracture of the proximal medial pole of the medial cuneiform is apparent. The second MTP is reduced with slight varus angulation compared to the other MTP joints.

A CT scan was obtained to further evaluate the bony anatomy and is shown in Fig. 14.2. The fracture of the medial cuneiform is visualized, as is the shortening and dorsomedial translation of the naviculocuneiform joint consistent with a longitudinal Lisfranc injury pattern. Varus angulation of the second metatarsophalangeal joint is demonstrated.

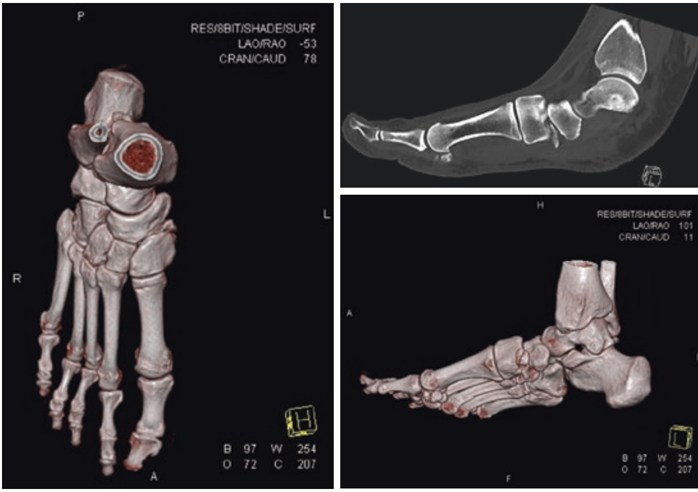

FIGURE 14.2 CT scan right foot

Treatment and Timing of Surgery

The patient was placed into a well-padded short leg splint. A long discussion was held with her regarding treatment options ranging from conservative to surgical. Due to the demonstrated instability at multiple joints, recommendation of surgical intervention with open reduction and internal fixation versus arthrodesis was given with determination of procedure based on assessment of cartilage intraoperatively. Risks of neurovascular injury, infection, persistent pain, and irritating hardware were discussed in detail and the patient signed informed consent for the procedure. Surgery was scheduled for 1 week later (12 days post-injury) to allow time for her soft-tissue swelling to resolve.

Surgical Technique

Position

After marking the surgical site and induction of general anesthesia with a popliteal block for postoperative pain control, the patient was positioned supine on the operating table with the feet at the edge of the bed. A right-thigh tourniquet was applied, intravenous antibiotics were given, and the extremity was prepped and draped in the standard surgical fashion. A time-out was taken to identify the correct patient, operative site, and other items per protocol. The limb was exsanguinated with an Esmarch and the tourniquet was insufflated to 275 mmHg.

Approach

An approximately 10 cm incision was made on the dorsum of the right foot and care was taken to protect the crossing branches of the superficial peroneal nerve. The interval between the extensor hallucis brevis and longus was identified and the brevis, along with the neurovascular bundle, was mobilized laterally with the longus taken medially. Significant disruption of the deep capsular structures was noted and hematoma was evacuated. Instability of the entire medial ray was visualized with disruption of the first intermetatarsal space, intercuneiform, and naviculocuneiform joints along with cartilaginous injury in the same. The first and second tarsometatarsal articulations were stable. The fracture of the proximal medial pole of the medial cuneiform was identified, found to be multifragmentary, and excised. Given the amount of instability, cartilage injury, and patient's age, the decision was made to proceed with arthrodesis of the intercuneiform, medial, and middle naviculocuneiform joints. Residual cartilage on the proximal and medial aspect of the medial cuneiform, lateral and proximal aspect of the middle cuneiform, and distal aspect of the medial and middle facets of the navicular was removed with a ¼" curved osteotomy and small curettes. A small lamina spreader and K-wire distractor were utilized as well to create enough distraction to ensure complete removal of cartilage from the plantar aspects of these joints. The subchondral bone of these articulations was then perforated using a water-cooled 2.0 mm drill bit. A 3 cm incision was made over Gerdy's tubercle on the right proximal tibia and dissection was carried down through the fascia onto the tubercle. The lateral wall was perforated by hand using a 6.5 mm drill guide and cancellous bone graft was removed using a large pituitary rongeur. The graft was morselized and packed into the interstices of the medial and middle naviculocuneiform, intercuneiform joints, and first intermetatarsal space.

Fracture Reduction and Fixation

Figure 14.3 shows the disruption of the medial ray as identified in the procedure, as well as provisional reduction obtained using a shoulder hook with an adduction and internal rotation maneuver to the medial ray. Attention should be paid to the restoration of Mills line (a line from the medial navicular to the medial cuneiform extended distally) as it now intersects the first metatarsal. The provisional reduction was held temporarily with 1.6 mm K-wires. An external compression device was utilized with appropriate wires to provide controlled compression of the medial ray. A medial incision was made just proximal to the navicular tuberosity and a 3.5 mm position screw was placed from the navicular into the medial cuneiform. Through the same medial incision, another 3.5 mm screw was placed from the navicular into the middle cuneiform. A clamp was placed across the first intermetatarsal space to compress the base of the second

FIGURE 14.3 Provisional reduction

metatarsal to the medial cuneiform and a 3.5 mm position screw was placed through a stab incision medial to the cuneiform into the base of the second metatarsal. Retrograde 3.5 mm position screws were placed from the medial

Figure 14.4 Final fluoroscopic images

cuneiform into the navicular as well as across the middle cuneiform and into the navicular. A 4-0 burr was used to create dorsal troughs in the navicular and medial/middle cuneiforms for additional strain-relieving bone graft to be packed into the interstices. The stability was tested and found to be excellent. The second MTP joint was held in a concentrically reduced position and a 1.6 mm K-wire was placed percutaneously retrograde from the tip of the toe, across the DIP, PIP, and MTP joints. Reduction and hardware position were checked fluoroscopically in multiple planes as shown in Fig. 14.4. All wounds were copiously irrigated and closed in a layered fashion. Sterile dressings were applied and a well-padded below-knee splint was applied.

Postoperative Plan

The patient returned at 2 weeks after surgery for wound inspection and suture removal. No wound complications were encountered. She was placed into a tall boot that was worn at all times other than when bathing for four additional weeks with strict nonweight-bearing precautions for the first 8 weeks after surgery. At 6 weeks boot removal for range of motion was allowed and the K-wire across the second MTP joint was removed. Progressive weight bearing began at 8 weeks after surgery.

Outcome

Radiographs were obtained at 6 weeks, 3 months, and 6 months post-op as shown in Figs. 14.5–14.7. A solid arthrodesis was obtained and at latest follow-up the patient had minimal pain and no limitations to her activities.

FIGURE 14.5 AP, oblique, and lateral radiographs 6 weeks post-op

FIGURE 14.6 AP, oblique, and lateral radiographs 3 months post-op

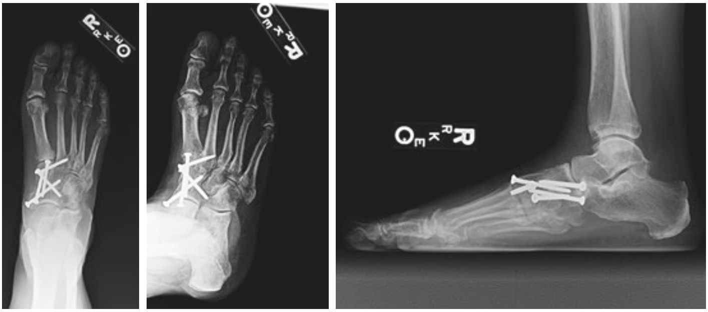

FIGURE 14.7 AP, oblique, and lateral radiographs 6 months post-op

Salient Points/Pearls

- A line drawn tangential to the medial navicular and cuneiform and extended distally should normally intersect the first metatarsal. This line is useful in detecting subtle Lisfranc injuries as well as in evaluating reduction during surgery [1].
- Both ORIF and arthrodesis are described as treatment for acute Lisfranc injuries. There is debate as to which is superior [2, 3]. Supporters of arthrodesis point out that there is poor potential for healing of the Lisfranc ligament back to bone with ORIF leading to later degenerative changes that may require arthrodesis. Many cases treated without arthrodesis undergo a second operation for planned hardware removal [4].
- Several studies have compared arthrodesis to ORIF, with arthrodesis having been shown to have a lower reoperation rate, similar patient outcomes, and similar rates of anatomic alignment obtained [4–8].
- Assessment of instability of midfoot joints should be made during surgery. All joints that demonstrate instability should be incorporated into the arthrodesis. Leaving an unstable joint will increase the likelihood of adjacent joint arthritis and need for future surgery.

- All articular cartilage from involved joints should be removed during arthrodesis procedure. Adequate joint distraction is imperative to visualize the most plantar aspects of the joint and assure that all cartilage is removed. Remaining plantar cartilage may increase the risk of nonunion.
- Cases of delayed diagnosis of a Lisfranc injury with degenerative changes of the articular surfaces should be treated with arthrodesis [9, 10].
- Most patients are able to return to their previous activities after arthrodesis for Lisfranc injuries however some patients do have limitations to activities after this injury which should be discussed preoperatively [11].

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