Treatment of Lisfranc Fracture Dislocation and Associated Compartment Syndrome: Single Stage Vessel Loop Technique

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INTRODUCTION / PURPOSE

Compartment syndrome (CS) is an unfortunate consequence of foot trauma (1). CS is a condition where increased pressure in closed fascial compartments reduces perfusion and threatens tissue survival leading to permanent atrophy and dysfunction. According to the literature, only 6% of pedal compartment syndromes are due to motor vehicle collision (MVC) (2). Commonly, once compartments are released, delayed closure is often performed followed by adjunctive split thickness skin grafting (STSG). In keeping with other anatomic sites, we report an alternative technique for adjunctive procedure in a patient with CS associated with Lisfranc fracture dislocation (3).

CASE REPORT / PATIENT PRESENTATION

A 66 year-old male presented to the Emergency Department (ED) complaining of abdominal pain and right foot pain after involvement in a MVC with a forced axial load reported **(Fig 1)**. Upon presentation, the right foot exhibited all clinical signs of CS to include edema, progression to pulselessness, and intractable pain (**Fig 2a,b).** Preoperative radiographs showed a Lisfranc fracture dislocation with fractures of metatarsal necks of 2,3,4 and medial cuneiform **(Fig 3a,b,c).** Computed tomography (CT) was obtained to assess extent of osseous injury **(Fig 4).** Compartments were measured within the 10 pedal compartments. Correlating with clinical findings, pressures were elevated and required urgent surgical intervention to include multiple compartment fasciotomy with closed reduction and percutaneous stabilization of fractures **(Table 1)**.

Fig 1. Patient automobile at time of motor vehicle collision illustrating high velocity nature of this injury

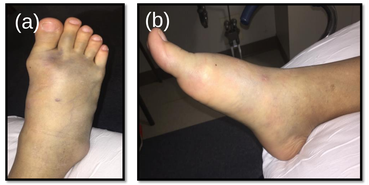

Fig 2a,b. Clinical evaluation of patient at time of presentation in the ED. Ecchymosis, pain out of proportion, progressive loss of pulsatile flow, and dysesthesia was appreciated.

PREOPERATIVE EVALUATION

Fig 3 (a) Initial anterior - posterior (AP) view illustrating positive "fleck" sign consistent with Lisfranc fracture dislocation. (b) Initial medial oblique view demonstrating medial cuneiform comminution and intra-articular extension. (c) Lateral x-ray injury films.

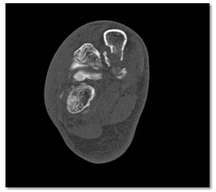

Fig 4. Coronal view of CT demonstrating comminution and high energy osseous injury.

COMPARTMENT PRESSURES

Compartment	Intracompartmental pressure (mmHg)
Interosseous	42
Medial	44
Lateral	50
Plantar Superficial/Deep	62/60

Table 1: Intra-compartmental pressures preoperatively

METHODS: OPERATIVE INTERVENTION

All compartments were released through two dorsal incisions along the 2nd and 4th metatarsals and another along the proximal plantar arch. Muscle was sent for surgical pathology and findings were consistent with mynoecrosis. The Lisfranc fracture was stabilized at the time of the index surgery and fasciotomy; whereas, the metatarsal fractures were stabilized subsequent to incision healing. Percutaneous reduction and pinning was implemented **(Fig 5a,b).** The incisions were managed postoperatively with gradual closure and progressive weekly tensioning using vessel loops **(Fig 6a,b,c).**

METHODS: OPERATIVE PROCEDURES

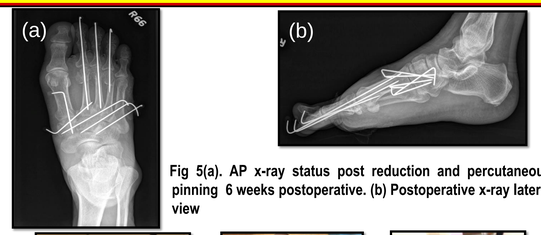

Fig 5(a). AP x-ray status post reduction and percutaneous pinning 6 weeks postoperative. (b) Postoperative x-ray lateral view

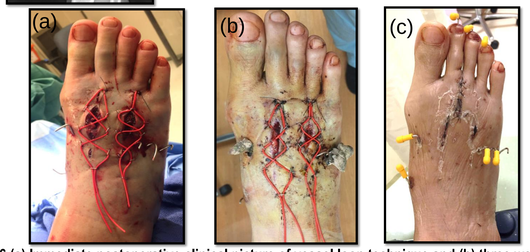

Fig 6 (a) Immediate postoperative clinical picture of vessel loop technique and (b) three weeks post-op. (c) Six weeks status post reduction, pinning, fasciotomy, and open metatarsal fixation.

RESULTS: 1 YEAR FOLLOW UP

At 12 month follow-up, the patient reports the ability to weight-bear unassisted without pain. Healing of all incisions was established in under six weeks through local wound care consisting of xeroform without the use autogenous STSG. Radiographs revealed healing of all fractures with restoration of anatomic alignment. **(Fig 6a,b)**

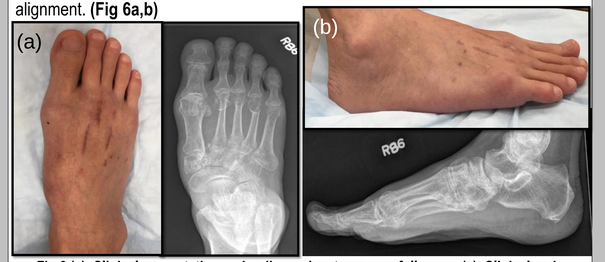

Fig 6 (a). Clinical presentation and radiographs at one year follow up. (a). Clinical and radiographic assessment: AP and (b). Clinical and radiographic assessment: lateral.

DISCUSSION

Acute traumatic compartment syndrome of the foot after Lisfranc fracture dislocation, has been shown to occur in as high as 34% and may result in significant motor and sensory deficits, chronic pain, stiffness, and deformity (4,5). In the case presented, the patient presented to the ambulatory section of the ED for evaluation after the injury. Based on pedal edema, common practice would dictate applying a compression dressing and splint as a means of temporizing the swelling in preparation for surgical reconstruction. In this case, the patient was meticulously worked up for compartment syndrome given the presenting signs and symptoms. As a result, he was urgently taken to the operating room, reduced, stabilized, and decompressed. Traditionally, fasciotomy sites of wounds such as this have been treated through healing by secondary intention, or split-thickness skin grafting (3). In this case, fasciotomy wound management, consisted of gradual closure with progressive weekly tensioning using vessel loops. The patient went onto complete soft tissue healing within 6 weeks.

CONCLUSION

Typically, patients return to the operating room 24-72 hours following fasciotomies for delayed closure versus split thickness skin grafting (1). With the vessel loop technique, it allows reduction of skin defect with adequate healing by secondary intention or reduction in size to perform delayed primary closure, without the need to apply a skin graft. It is an option that can be considered in patients that are compliant, healthy, or have a large defect that would otherwise require a skin graft. To our knowledge, this is the first application of the "vessel loop shoelace" technique described for pedal fasciotomy closure.

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