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Combined Medial Column Primary Arthrodesis, Middle Column Open Reduction Internal Fixation, and Lateral Column Pinning for Treatment of Lisfranc Fracture-Dislocation Injuries

Troy J. Boffeli, DPM, FACFAS [1], Ryan R. Pfannenstein, DPM, FACFAS [2], Jonathan C. Thompson, DPM [3]

[1] *Director, Foot and Ankle Surgical Residency Program, Regions Hospital/HealthPartners Institute for Education and Research, St Paul, MN*
[2] *Attending Faculty, Department of Foot and Ankle Surgery, Regions Hospital/HealthPartners Institute for Education and Research, St Paul, MN*
[3] *Chief Resident, Foot and Ankle Surgical Residency Program, Regions Hospital/HealthPartners Institute for Education and Research, St Paul, MN*

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ABSTRACT

Lisfranc fracture-dislocation can be a devastating injury with significant long-term sequelae, including degenerative joint disease, progressive arch collapse, and chronic pain that can be potentiated if not effectively treated. We present a case to demonstrate our preferred surgical approach, consisting of combined medial column primary arthrodesis, middle column open reduction internal fixation, and lateral column pinning, with the primary goal of minimizing common long-term complications associated with Lisfranc injuries. We present the case of a typical patient treated according to this combined surgical approach to highlight our patient selection criteria, rationale, surgical technique, and operative pearls. A 36-year-old male who had sustained a homolateral Lisfranc fracture-dislocation injury after falling from a height initially underwent fasciotomy for foot compartment syndrome. The subsequent repair 16 days later involved primary first tarsometatarsal joint fusion, open reduction internal fixation of the second and third tarsometatarsal joints, and temporary pinning of the fourth and fifth tarsometatarsal joints. He progressed well postoperatively, exhibiting an American College of Foot and Ankle Surgeons forefoot score of 90 of 100 at 1 year after surgery with no need for subsequent treatment. Lisfranc fracture-dislocations often exhibit primary dislocation to the medial column and are conducive to arthrodesis to stabilize the tarsometatarsal complex. The middle column frequently involves comminuted intra-articular fractures and will often benefit from less dissection required for open reduction internal fixation instead of primary fusion. We propose that this surgical approach is a viable alternative technique for primary treatment of Lisfranc fracture-dislocation injuries.

Injuries to the tarsometatarsal (TMT) joint complex are often severe and complex injuries that have frequently been linked to chronic lower extremity dysfunction, particularly when not effectively identified and managed (1). The TMT joint consists of the medial column, or first metatarsocuneiform joint, the middle column, or second and third metatarsocuneiform joints, and the lateral column, or fourth and fifth metatarsocuboid joints. Insufficient treatment frequently destabilizes the midfoot complex and places the patient at risk of midfoot instability, arch collapse, gait abnormalities, and osteoarthritis (2). Treatment of the injury traditionally consisted of closed reduction and immobilization or closed reduction with percutaneous fixation (3), which was associated with a high rate of repeat dislocation (4), residual midfoot instability, prolonged immobilization, and limited functionality (5). Consequently, the need for open reduction to sufficiently realign the deformity has since been recognized and accepted as necessary for effective management (6,7). Although open reduction internal fixation (ORIF) of the medial and middle columns is currently a mainstay of treatment, a relatively high rate of post-traumatic osteoarthritis has been reported in this patient population (8), imposing the need for delayed fusion. Thus, to minimize the need for revision surgery, primary fusion has recently been advocated for both Lisfranc fracture-dislocations (9) and primarily ligamentous Lisfranc injuries (8). This has fostered a discussion regarding which surgical treatment is more advantageous from a functional standpoint.

The investigators have anecdotally observed that the typical Lisfranc fracture-dislocation often exhibits a primarily ligamentous or

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Address correspondence to: Jonathan C. Thompson, DPM, Regions Hospital/HealthPartners Institute for Education and Research, 640 Jackson Street, St Paul, MN 55101.

E-mail address: jonathan.c.thompson@healthpartners.com (J.C. Thompson).

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Fig. 1. Initial prereduction radiographs revealing a homolateral dislocation of the Lisfranc joint with mild dorsal dislocation of the second tarsometatarsal joint.

minimally comminuted injury to the first TMT joint and that the second and third metatarsal bases are frequently comminuted with intra-articular involvement. Given this fracture pattern, achieving a stable first ray becomes a priority in re-establishing stability to the midfoot complex. In contrast, the comminuted fractures involving the second and third TMT joints are often more conducive to the relatively atraumatic approach of ORIF than to primary fusion. This method avoids the joint distraction required for fusion that can act to further disrupt important midfoot ligamentous structures, small periarticular fracture fragments, and adjacent neurovascular structures. Thus, our preferred method for the treatment of most Lisfranc fracture-dislocations consists of a combined approach between the 2 standard surgical treatment options. It comprises a primary medial column fusion, middle column ORIF, and temporary pinning of the lateral column. The goals when using this approach are to re-establish a stable, plantigrade foot that provides reasonable functionality and minimizes the need for subsequent surgery or the development of midfoot osteoarthritis. We report a typical case that highlights our patient selection criteria, procedure selection, rationale, surgical technique, and operative pearls for acute Lisfranc injuries.

Surgical Technique

The combined surgical treatment approach has been our preference for most patients sustaining Lisfranc fracture-dislocations. The indication for the procedure mainly consists of acute Lisfranc fracture-dislocation. Contraindications include pediatric patients with open metaphyseal growth plates, Lisfranc injuries with a delayed diagnosis and the resultant presence of osteoarthritis, Charcot neuroarthropathy, or medial column comminution surpassing that seen in a typical injury. The computed tomography studies typically obtained after the initial closed reduction can be used to aid surgical planning. If necessary, definitive treatment should be delayed until the soft tissue edema has decreased and the tissue is conducive to primary surgical intervention. In the situation of excessive soft tissue

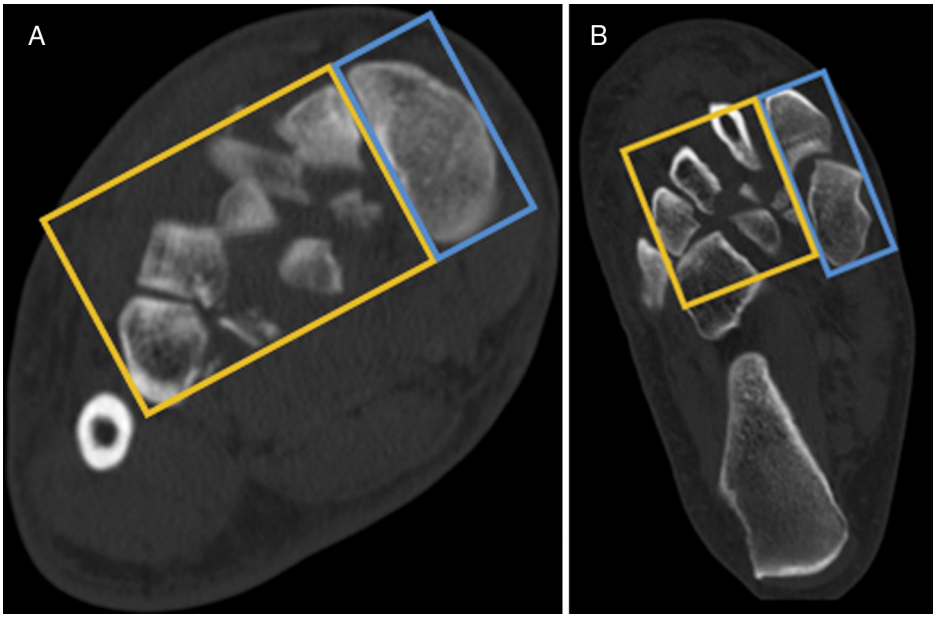

Fig. 2. Postreduction computed tomography scans. (*A*) Coronal and (*B*) axial computed tomography images revealing primary dislocation to the first tarsometatarsal joint (*blue box*) and comminuted intra-articular fractures to the second through fourth tarsometatarsal joints (*orange box*).