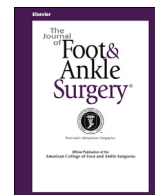


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## Case Reports and Series

## Combined Innovative Portal Arthroscopy and Fluoroscopy-Assisted Reduction and Fixation in Subtle Injury of the Lisfranc Joint Complex: Analysis of 10 Cases

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## ABSTRACT

Subtle injuries of the Lisfranc joint complex are uncommon and difficult to diagnose clinically and thus are easily missed even by experienced orthopedic doctors. Misdiagnosed injuries can lead to chronic disability until eventual fusion surgery. We describe 10 cases diagnosed with subtle injury of the Lisfranc joint that were treated with combined innovative portal arthroscopy and fluoroscopy-assisted reduction and percutaneous screw fixation in an interfragmentary fashion. The distance between the first and second metatarsals (the Lisfranc distance) and that between the medial cuneiform and fifth metatarsal base (foot arch height) was measured before and after surgery. The American Orthopaedic Foot and Ankle Society function score was evaluated perioperatively. The average preoperative and postoperative Lisfranc distance was  $4.38 \pm 0.39$  mm and  $2.68 \pm 0.9$  mm, the foot arch height was  $12.63 \pm 2.75$  mm and  $21.80 \pm 3.50$  mm, and the American Orthopaedic Foot and Ankle Society score was  $59.1 \pm 5.69$  and  $86.8 \pm 10.1$ , respectively. Of the 10 patients, 3 had excellent outcomes, 6 had good outcomes, and 1 had a fair outcome. In conclusion, we report a useful and minimally invasive surgery for acute, subacute, and even chronic subtle injury of the Lisfranc joint. The Lisfranc distance, foot arch height, and function of the foot were restored clinically, and all measurements showed statistically significant differences.

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The tarsometatarsal joint of the foot (Lisfranc joint complex) consists of 3 columns, the medial, middle, and lateral columns, which are associated with 3 distinct arches. Of these 3 arches, the horizontal arch is anchored by the base of the second metatarsal, which is recessed into a “mortise” between the medial and lateral cuneiforms and stabilizes the joint (1–10). Intermetatarsal and thin dorsal ligaments connect the second, third, fourth, and fifth metatarsals and tarsal bones. The tarsometatarsal joints are further stabilized by the plantar tarsometatarsal ligaments. Interosseous ligaments are also present between the intercuneiforms, but no intermetatarsal ligament is between the base of the first and second metatarsals. The main stabilizing structure of the first to second tarsometatarsal joint is a Y-shaped, plantar interosseous ligament (Lisfranc’s ligament). This ligament extends over the plantar surface from the lateral aspect of the medial cuneiform to the medial aspect of the base of the second metatarsal (5). The “mortise”

effect of the Lisfranc joint complex between the medial and lateral cuneiforms is considered to be key to the stability of the joint (3,11). Subtle injury of the Lisfranc joint complex results in injury to the Lisfranc ligament and induces widening of the distance between the first and second metatarsals (Lisfranc distance) on anteroposterior radiographic images. It is easily misdiagnosed clinically as an acute or a subacute ankle sprain in patients and can induce chronic disability or painful arthritis. Stable, nondisplaced injuries respond successfully to nonoperative management; however, unstable injury with diastasis of midfoot requires surgical reduction (8–10,12–14). We describe a prospective method to treat subtle injury of the Lisfranc joint using innovative arthroscopy portals and fluoroscopy-assisted reduction and fixation with an interfragmentary screw.

### Patients and Methods

We enrolled 10 prospective, consecutive patients from January 1, 2009 and February 28, 2013 from the outpatient department. All the patients were drawn from the clinical practice of one of us (L.-C.L.). The patients had sustained persistent forefoot pain and swelling after traumatic injury, and the subsequent clinical diagnosis pointed to subtle injury of the Lisfranc joint using the International Classification

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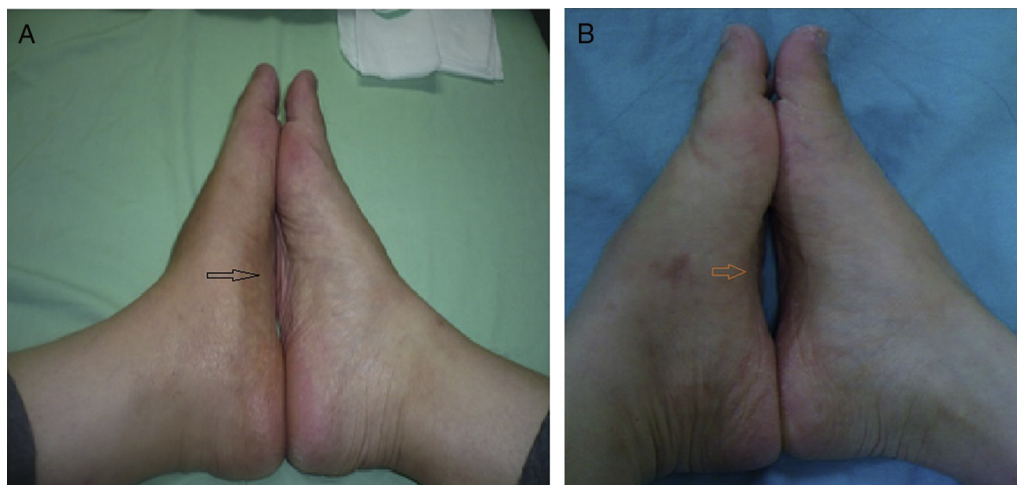
E-mail address: [LSB3612@yahoo.com.tw](mailto:LSB3612@yahoo.com.tw) (L.-C. Lin).



**Fig. 1.** (A) Widening of the Lisfranc distance in the left foot anteroposterior radiograph (black line). (B) The foot arch height was decreased on the left foot true lateral radiographs (black line). (C) Computed tomography scan showing an avulsed fragment located in the plantar region of medial cuneiform of the left foot (arrow). (D) A 3.5-mm cortical screw was inserted percutaneously from the medial cuneiform to the second metatarsal base. The Lisfranc distance appeared truly reduced. (E and F) The postoperative radiographs showed good reduction of the Lisfranc distance (black line) and restoration of the foot arch height in the left foot (black line).

of Disease, 9th revision (World Health Organization, Geneva, Switzerland), diagnostic code. All the patients received conservative treatment for the diagnosis of ankle and foot sprain injury, including cast immobilization, rehabilitation programs, and traditional Chinese herbal treatment before presenting to Dr. Lin's practice. Of the 10 patients, 7 were male and 3 were female, with a mean age of  $35.2 \pm 16.14$  (range 19 to 72) years. The injury was in the right foot in 6 patients and

the left foot in 4 patients, with 5 injuries caused by falling and 5 by a traffic accident. The mean interval from injury to surgery was  $7.6 \pm 4.38$  (range 3 to 16) weeks. All patients underwent standard full weight-bearing anteroposterior and true lateral and 45° oblique view radiographs of both feet (Fig. 1A and B). Computed tomography of both feet was performed before surgery to ensure all cases belonged to the subtle injury category and to check the fleck sign (Fig. 1C). The identified



**Fig. 2.** The preoperative gross appearance showed flattening of the medial longitudinal foot arch (arrow, A) and restoration postoperatively (arrow, B).

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