



## ORTHOPAEDIC TRAUMA GUIDANCE – CASE # 1

## Ligamentous Lis Franc injury: ORIF or Primary arthrodesis?

Brad Meulenkamp<sup>1</sup>, Jonny Sharr<sup>2</sup>, Richard Buckley<sup>3,\*</sup><sup>1</sup>The Ottawa Hospital – Civic Campus, 1053 Carling Avenue, Suite J129, Ottawa, Ontario, Canada<sup>2</sup>Forte Hospital, 132 Peterborough Street, Christchurch Central, Christchurch, New Zealand<sup>3</sup>University of Calgary, Canada

## Summary of Case

A 36 year old man (two meters in height and 200lbs (91kg)) sustained a closed right foot injury whilst playing rugby. He complained of tenderness and inability to weightbear. He attended the Emergency Department the same evening. On examination, there was tenderness over the right midfoot with the presence of local swelling but no other injuries. The rest of clinical exam of the lower extremity was unremarkable. Radiological examination (Figures 1,2,3) revealed a right foot Lis Franc injury.

His past medical history included no previous right foot injuries, no prescription of medications. He suffers from sport related exercise induced asthma. Family history was unremarkable.

The patient reported that he plays occasional rugby with friends but, is by his own admission, not very active. Occasionally, he will go for a run and he skis in the winter. He works as an accountant.

## Treatment Options

## I. Pro Fusion of the Ligamentous Lis-Franc Injury (Brad Meulenkamp)

The ligamentous Lis-Franc injury is a challenging dilemma to patient and clinician. In contrast to a bony injury, healing time is delayed due to the reliance of re-establishing the capsular-ligamentous attachments at each of the tarso-metatarsal (TMT) and/or inter-cuneiform articulations. This may lead to late arch collapse, and post-traumatic arthritis.

In the landmark paper by Ly and Coetzee, patients were randomized to either open reduction with internal fixation (ORIF) or primary arthrodesis (PA). At both two-year and mean final follow-up of 42.5 months, patients in the PA group outperformed the ORIF group for both AOFAS midfoot score and Visual Analog Pain Score, both reaching statistical (and clinical) significance. Perhaps most importantly, all patients in the PA group were satisfied with their outcome as opposed to almost half of the ORIF being neutral or dissatisfied with their surgical result [1].

The Ly and Coetzee study also addresses the matter of reoperation in ORIF vs. PA groups. There were far fewer secondary surgeries in the PA group, with 80% of ORIF patients requiring removal of hardware compared to only 19% in the PA group. This has been corroborated in more recent literature as well, with Buda et



**Figure 1.** AP radiograph right foot demonstrating widening of the first and second tarsometatarsal joint space.

al. finding 76% of ORIF patients returned to OR compared to 32% of PA patients [2].

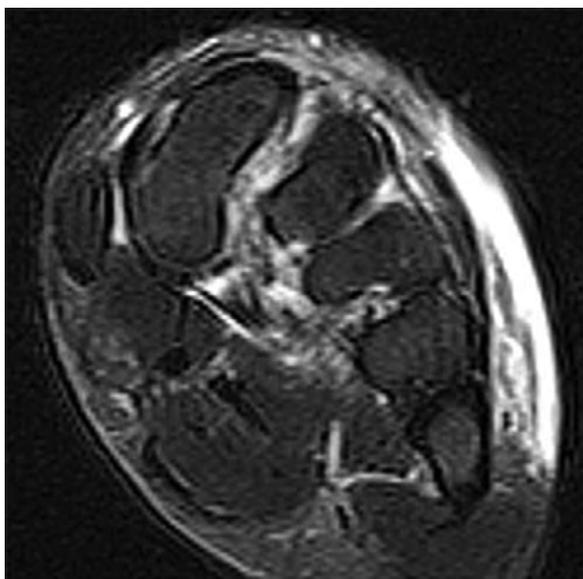
The Lis-Franc articulation has a low tolerance for malreduction, with high rates of post-traumatic arthritis if not reduced anatomically. Accurate reduction of the purely ligamentous injury is particularly challenging due to the complex articular morphology of the midfoot, and lack of an osseous ‘read’. This is also highlighted by Ly and Coetzee with a staggering 35% of ORIF patients either undergoing or planning to undergo delayed arthrodesis due to arch collapse and progressive midfoot arthritis [1]. Proponents of ORIF may state they prefer not to ‘burn a bridge’ with PA, as delayed arthrodesis remains an option for poor outcomes. While true, these patients are faced with a secondary surgery (and recovery) following a period of disability, with detrimental and expensive implications for both the patient and health care system.

A primary concern with PA over ORIF is the permanent stiffening of the medial column of the foot, restricting high-impact activities. The medial and middle columns of the foot are inherently stiff

\* Author Responsible for Correspondence.



**Figure 2.** Oblique radiograph right foot demonstrating widening of the first and second tarsometatarsal joint space.



**Figure 3.** CT scan right foot axial cut demonstrating widening of the first and second tarsometatarsal joint space and ligament disruption with no fractures.

with just a 4-degree arc of motion at the first TMT joint and 1-2 degrees at the second and third TMT. MacMahon et al. addressed return to physical activity in their retrospective review of 38 PA patients following Lis-Franc injury. The majority of patients were able to return to their activity of choice, including high impact activities such running, weightlifting and basketball. Overall, 97% of patients were satisfied with their outcome following PA [3].

For these patient and system-centered reasons, there is clear and high level evidence to offer patients with a primarily ligamentous Lis-Franc injury a primary arthrodesis.

## II. Pro ORIF for Ligamentous Lisfranc injuries (Jonny Sharr)

The only published prospective RCT to strongly suggest primary arthrodesis (PA) had better outcome for patients than ORIF was published over a decade ago [1].

Subsequent studies have not been so forthright in their support for primary arthrodesis for these injuries. Accepting that ORIF frequently involves a second, planned surgery of hardware removal to maximize outcomes, other studies have identified similar outcome scores in the short to medium term, between the two management strategies [4, 5]. An earlier study, in fact found poorer outcomes in their PA group [6].

Hardware removal in ORIF patients should almost be acknowledged as the relatively straight forward second stage of a two-stage process. Leaving hardware in situ, can result in screw breakage that may create significant symptomatology. If removal of hardware is excluded from assessment, then re-operation rates are comparable, and may be as high as 30% in both groups [7]. The incidence of nonunion in primary arthrodesis for traumatic etiology is reported to be as high as 33%, but is more commonly reported at about 15%. Therefore, any subsequent surgery for patients treated with PA, as in any revision situation, is likely to be of a more significant nature.

There are several concerning factors with proceeding to primary arthrodesis for these primary ligamentous midfoot injuries. Although the medial midfoot has limited motion at the tarsometatarsal joints, the movement that is present allows for a cushioning effect to the forefoot with respect to forefoot balance and prevention of metatarsalgia. There is a recognized incidence of metatarsalgia in patients following midfoot arthrodesis for both traumatic and atraumatic etiologies.

Those advocating for PA vs ORIF suggest screw violation of tarsometatarsal joints creates joint surface compromise which increases the risk of development of arthrosis. Stabilization of these joints with bridging plate constructs removes this factor although, to allow restoration of the desired TMTJ motion may still require second surgery for removal of this restrictive construct. Even looking at this viable alternative to fixation, post-traumatic arthrosis has been reported in up to 49.6% of patients, but only 7.8 % of those may warrant progression to salvage arthrodesis [8].

Coetzee and Ly [1] in their study primary arthrodesis vs ORIF concluded that the ligamentous-osseous interface had a poor healing potential with a higher rate of correction loss and increased deformity. The timeframe of ligament healing is in the duration of months and the potential for midfoot deformity and tarsometatarsal joint incongruity needs to be countered. Literature continues to suggest mobilization enhances the strength and quality of ligament tissue through the process of healing. Therefore, prolonged immobilization and complete prevention of weightbearing should be avoided. Protected weightbearing with arch maintaining orthotics is likely to be a required feature for many weeks to months.

## III. Editor Conclusions (Richard Buckley)

An RCT in this area [1] opened a real debate almost 2 decades ago. This paper is the best evidence that fusions for the ligamentous Lisfranc injury are a very good option for many patients. Certainly, this study has proven to be very helpful clinically for my practice.

However, Smith et al (2016), with their systematic review and meta-analysis of all of the literature in this area concluded that patient outcomes are slightly better with fusions than with ORIF (risk ratio 1.48 with wide confidence intervals (0.34-6.38)) [9]. We do not have enough information about outcomes to be certain that fusions are better than ORIF for all patients.

But we do have some information that needs to be bundled into a discussion with patients and families that can help the surgeon make a case by case decision when encountering this entity.

- 1 Fusion disadvantages – very final single surgical decision (no going back); bone graft must be harvested or bone substitute must be used to help with fusion; fusions do stiffen the midfoot slightly more than fixation (Meulenkamp (above) states a loss of only 2–4 degrees of motion).
- 2 Fusion advantages – bony fusion is much more assured after as little as 6 weeks immobilization versus 10–12 weeks for ligamentous healing after ORIF (quicker recovery may be possible); single surgery; midfoot stiffness after fusion has not been proven to affect return to sport [3].
- 3 ORIF disadvantages – Hardware removal (second surgery) is much more common as few joints in the body accept screws across joints (risk ratio 0.36 with confidence intervals (0.08–1.59) [9]); Broken screws can be a consequence of ORIF but bridge plating rather than intra-articular screws may solve this problem in the future.
- 4 ORIF advantages – Motion across the midfoot can be preserved as much as possible (once the second operation has removed hardware) to cushion the forefoot and prevent metatarsalgia; If ORIF is not successful clinically, then fusion can always be performed as a final definitive step.

The results of well designed, large prospective RCTs will be required to broaden our knowledge of these treatment modalities.

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