Lisfranc injury classifications

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Abstract

Lisfranc or tarsometatarsal (TMT) joint injuries are a spectrum that range from subtle sprains to high-energy crush injuries. Several classifications of Lisfranc injuries exist in the literature; these have been evaluated in this paper. The current classifications are not prognostic, guide treatment, or encompass all the types of injury. Anatomical reduction is recommended and this is regardless of injury pattern. Therefore, either stability based or anatomical classifications are proposed for this injury.

INTRODUCTION

Lisfranc or tarsometatarsal (TMT) joint injuries range from subtle sprains that may be easily missed on initial radiographs to high-energy injuries that cause severe disruption of the midfoot. Several classifications of Lisfranc injuries exist in the literature. None of these systems are prognostic, guide treatment, or encompass all the types of injury.

The aim of this paper was to review the original papers on Lisfranc injuries and the literature evaluating the classification systems

METHOD

English-language papers reporting Lisfranc classifications were obtained and a systematic search was made on Medline for papers evaluating these classification systems.

THE LISFRANC CLASSIFICATIONS

Lisfranc was a French surgeon serving in Napoleon's army who described an amputation through the tarsometatarsal (TMT) joint where the five metatarsals articulate with the three cuneiforms and the cuboid [17] .

Early attempts to classify Lisfranc injuries focused on the mechanisms of injury. Wiley [35] classified the injuries into direct forces, which crush the metatarsals and displace them plantar wards and indirect forces with the foot in plantar flexion. Experiments by Jeffreys [12] showed two patterns of injury: simple lateral dislocation produced by pronation of the hindfoot and medial dislocation of the first metatarsocuneiform joint produced by supination of the hindfoot.

Quenu and Kuss [28] divided the injuries into 3 groups based on radiographic findings: homolateral, isolated and divergent. Hardcastle et al [11] modified this classification to produce three groups:

Type A: Total - There is incongruity of the entire TMT joint.

Type B: Partial – There is incongruity of part of the joint. There are two kinds: medial displacement which affects the first metatarsal either in isolation or combined with displacement of one or more of the second, third or fourth metatarsals; lateral displacement which affects one or more of the lateral four metatarsals but not the first metatarsal.

Type C: Divergent – There may be partial or total incongruity. The first metatarsal is displaced medially with any combination of the four lateral metatarsals displaced laterally.

Myerson et al further modified this classification:

Type A: Total Incongruity in any plane or direction.

Type B: Partial Incongruity/ Homolateral incomplete. This was divided into type B1: affects the medial articulation alone and type B2: affects the lateral articulation alone.

Type C: Divergent/ Total or partial displacement when medial and lateral metatarsals are displaced in opposite directions and opposite planes. This was further divided into whether all four (type C2) or fewer (type C1).

Wilson [36] produced an injury pattern based classification that included divergent, homolateral and isolated fracture-dislocations of the TMT joints. Only one study has used this

classification in reporting their results [10].

Low velocity injuries that occur in athletes can produce subtle injuries with little or no displacement. For these injuries Nunley and Vertullo [25] introduced a classification that used radiographs and clinical examination:

Stage 1 – patients are able to weight bear, are tender at the 1st TMT joint space and diastasis <2mm.

Stage 2 – patients have similar clinical examination and >2 to 5mm diastasis.

Stage 3 – patients have >2 to 5mm diastasis and additional collapse of the longitudinal arch.

DISCUSSION

Classification systems should help to diagnose a clinical problem, direct treatment, predict prognosis, aid in communicating clinical data and be valid and reliable.

RELIABILITY

A classification system is useful if an appropriate amount of interrater reliability exists among the clinicians who use the system. Reliability can be measured by the kappa statistic ( ) which varies from -1 to +1 based upon the agreement of two different reviewers: -1 indicates complete disagreement, 0 is random agreement, and 1 is complete agreement. Interrater reliability for the modified Hardcastle classification system was assessed by Talarico et al. [34] The mean weighted value was 0.54, which represents a moderate degree of reliability. They concluded that this system should not be used to direct treatment and did not attempt to stratify outcomes on the basis of fracture pattern. No other Lisfranc classification has been assessed for reliability or validity.

INJURY PATTERNS

There are many associated fracture configurations involving the Lisfranc joint that prevent classifications based on injury pattern from being comprehensive. At the most extreme end of the spectrum are open crush injuries which have a poor prognosis [6]. Subtle sprains may occur in athletic injuries that may be missed on plain radiographs [15].

Radiographic variants of Lisfranc injuries produce unusual midfoot dislocations patterns. A naviculocuneiform dislocation combined with TMT joint injury resulting in complete dislocation of the cuneiform [2,5] and medial dislocation of the first ray through the naviculocuneiform joint with an intact first TMT joint [7] have been described.

Linked toe dislocations can occur when the proximal displacement of the interossei muscles at the time of the TMT joint dislocation puts tension on their proximal phalangeal insertions onto the adjacent toe resulting in dorsal metatarsophalangeal (MTP) dislocation of the toe adjacent to that with the TMT joint disruption [9,29]. A floating metatarsal injury is one in which the 1st TMT and the 1st MTP joints are dislocated together [16].

Fractures of the tarsal bones of the Lisfranc joint have been published as case reports. These include isolated medial cuneiform fractures [26,27] and plantar medial subluxation of the medial cuneiform with associated compression fracture of the navicular [19]. Fracture-dislocation of the intemediate cuneiform usually occurs dorsally [5,8,32] .Isolated fracture of the lateral cuneiform [20] and isolated cuboid fracture [22] are rare.

Lisfranc fractures form a spectrum of injuries and a useful classification needs to incorporate all of these types.

PROGNOSIS

To provide a prognosis, a classification needs to demonstrate a relationship between injury pattern and clinical results. Myerson et al. [24] modified the Hardcastle classification but in a retrospective analysis of 55 Lisfranc joint injuries over a 10 year period found no relationship between injury pattern and clinical results. Other studies have also found that the Hardcastle classification of Lisfranc injuries was purely descriptive, not prognostic and did not direct treatment decisions [14]. Rajapakse et al [30] reviewed patients undergoing open reduction and internal fixation and found that there was a poorer outcome for Type C2 injuries only using the Myerson classification. Outcomes using the Quenu and Kuss classification have also found no relationship between injury pattern and clinical results [1,3,35]. One study used Wilson's classification but did not report their results according to the injury pattern [10].

TREATMENT

Currently, most authors recommend anatomical reduction for displaced fractures [1,11,14,24]. For the subtle sprain with <2mm displacement cast immobilisation has produced reasonable results [33]. Arthrodesis may produce better results than fixation for severe or ligamentous Lisfranc injuries [18,23]. Fixation methods for displaced injuries include K-wires [24,31], screws [1,14] and primary fusion [18,23].

CONCLUSION

Lisfranc classifications are not clinically useful. They are not reliable or prognostic. Anatomical reduction is recommended and this is regardless of injury pattern. Two limbs of research may be useful to direct future attempts at classification. One would be to consider a stability based classification similar to that recommended by Michelson [21] for ankle fractures. The second would be an anatomically based classification based on ligament sectioning studies [13]. Validated experimental methods are required in the future to produce a more reliable fracture classification for this injury.

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