Management of Lisfranc injury with anterolateral calcaneal compression fracture

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To the Editor: The mechanism of Lisfranc injury is complex and may cause different patterns of fractures or dislocation of the midfoot complex. Abduction force injury is a special injury pattern, which may cause the fracture or (and) dislocation of the lateral column of the Lisfranc joint, especially the cuboid.[1-3] However, the fracture or (and) dislocation of the lateral column of the Lisfranc joint is the reduction and internal fixation of the facet. The mechanism of Lisfranc injury is complex and may cause different patterns of fractures or dislocation of the midfoot complex. Abduction force injury is a special injury pattern, which may cause the fracture or (and) dislocation of the lateral column of the Lisfranc joint, especially the cuboid.[1-3] However, the fracture or (and) dislocation of the lateral column of the Lisfranc joint is the reduction and internal fixation of the facet. The mechanism of Lisfranc injury is complex and may cause different patterns of fractures or dislocation of the midfoot complex. Abduction force injury is a special injury pattern, which may cause the fracture or (and) dislocation of the lateral column of the Lisfranc joint, especially the cuboid.[1-3] However, the fracture or (and) dislocation of the lateral column of the Lisfranc joint is the reduction and internal fixation of the facet.

In this study, all the patients underwent the final follow-up for a mean period of 27.69 ± 14.41 months postoperatively (range: 12–60 months). Two patients suffered from an early soft-tissue complication and were cured by conservative management. The plain radiographs showed a bony union in all patients at 3rd month postoperatively (Figure 1D).

The average Visual Analogue Scale (VAS) score of the final follow-up was significantly improved (1.8 ± 1.4 pre-operative vs. 5.9 ± 1.3 pre-operative, t = 17.05, P < 0.05). The final American Orthopaedic Foot & Ankle Society (AOFAS) midfoot score was 82.1 ± 10.9 (range: 56.0–97.0). All patients returned to work at an average of 7.5 ± 2.2 months postoperatively (range: 5–12 months). The symptoms and AOFAS midfoot score had a correlation with the time of returning to work (r = 0.744 and 0.871, respectively, P < 0.05).

Twelve cases obtained an implant removal on the average of 11th month postoperatively (range: 8–14 months), three of which was found an implant breakage during the removal with no obvious symptoms. Two cases (15.4%) of posttraumatic arthritis of the Lisfranc joint were observed and suffered from a moderate symptom, which was relieved by application of analgesic medication and orthosis support. Three patients (23.1%) complained about the midfoot rigidity. No complications of nonunion, malunion, or midfoot deformity were noted during the follow-up.

To our knowledge, the most common pattern of the lateral column compression fracture is the “nutcracker fracture” of cuboid, which may cause the shortening of the lateral column and forefoot deformity with a high complication
A particular fragment was accessed (a), reduction and rafting was exposed Tarsometatarsal. union with an anatomical restoration of the midfoot alignment and the CC joint facet (a, b). 3D-CT: Three-dimensional computed tomography; CC: Calcaneocuboid; TMT: Sometimes is difficult. In this study, 5/13 cases (38.5%) of anterolateral calcaneal fracture were neglected on the initial plain X-ray. We considered that two reasons might cause the misdiagnosis. First, surgeons tend to pay more attention to the Lisfranc joint and possible involvement of the Chopart joint could be overlooked; thus, detailed physical examination is also a crucial method to avoid misdiagnosis. The anterolateral calcaneal fracture should be strongly suspected when any tenderness is detected on the lateral side of the foot. Furthermore, the fragment sometimes might be too small to be manifested on the plain X-ray. Therefore, we suggest that three-dimensional computed tomography scanning be routinely applied to evaluate midfoot injuries.

The essence of the management of midfoot complex injuries is the anatomical restoration of midfoot alignment and facet with a stable fixation. Reduction and fixation of the Lisfranc joint are generally performed first. Although a primary arthrodesis for ligamentous Lisfranc injury is recommended in recent years,[6,7] we still prefer an open reduction and internal fixation (ORIF) than primary arthrodesis for prevention of an early degeneration of the adjacent joints. Moreover, the patients in our country have a low acceptance level of primary arthrodesis. Management of the anterolateral calcaneal compression fracture is not easy, since the facet fragments are sometimes very small and comminuted. Dhillon et al[8] reported three cases of crush fractures of the anterior end of the calcaneus, in which acceptable clinical outcomes were achieved. In their study, K-wires were implanted for fixation of fractures, and a fixator was used to restore the length of the lateral column. However, we consider that this fixation technique still remains controversial. K-wire fixation or fixator is not stable enough and may cause some soft tissue problems, that is, pin tract infection. Screw fixation is an alternative for small fragment fixation. Nevertheless, if the fragment is too small or comminuted, or the patient also has osteoporosis, screw fixation may cause a high rate of failure. The mini-fragment plate system is our preference, which has several advantages. First, rafting fixation along the CC joint may provide rigid support for the fragment to prevent further re-displacement. Additionally, the compression effect of the plate can stabilize the fragment even without screw fixation into the fragment, which also could limit displacement. No cases of implant failure and redisplacement of compression fragments occurred in our patients. Furthermore, plate fixation also facilitates implant removal in the future. We achieved satisfactory outcomes by virtue of the anatomical reduction and stable fixation. The average VAS score was significantly improved than the preoperative one (P < 0.05) and most patients obtained a good to excellent AOFAS midfoot score. And all of them returned to work at an average of 7.5 months postoperatively. Furthermore, we found that limited symptoms and satisfactory AOFAS score indicated less time of returning to work, which had a significant correlation.

The complications still remain an issue for midfoot injury. For Lisfranc complex injuries, by consequence of high-energy trauma, the postoperative complication rate is still relatively high despite of a proper treatment.[9,10] In the present study, although we achieved a satisfactory clinical
outcome in most of our patients, two cases (15.4%) of the three-column Lisfranc complex injury still developed into posttraumatic arthritis during follow-up. However, the symptoms were moderate and controlled conservatively, therefore no salvage procedure was needed. Implant removal is another point. Removing the implant too early may cause the instability of the midfoot, while a long period of bridging fixation may cause a too rigid joint with no difference of arthrodesis. Three patients who removed their implants over 12 months postoperatively complained about a rigid midfoot. It may also cause an implant breakage. In this study, the implant breakage was demonstrated in three cases who removed the implants over 10 months without any symptoms. We suggest that the Lisfranc screw and intercuneiform screw should be removed before the full weight-bearing, while the final removal procedure should be performed earlier than 10 months. The clinical evidence of best removal time is still limited and attempted to be discovered in the future studies.

This study still had some limitations. First, the sample size was small because of the rarity of this pattern of injury. Second, we did not perform a comparative analysis, and our evaluation is not comprehensive. Third, the long-term clinical outcomes of this pattern of injury remain unclear. Furthermore, the current classification system is another problem. The three-column classification system is simple and precise in its description of tarsometatarsal joint disruction.\(^\text{[11]}\) However, this system only limits to the Lisfranc injury. For the midfoot complex injury involving the Chopart joint, whether this theory could extend to it is still under discussion. We attempt to modify the classification system based on more cadaver anatomy research and biomechanical study. Finally, the detailed mechanism of this pattern of injury is still undiscovered. We hope to overcome these limitations in our future work.

In conclusion, Lisfranc injury with an anterolateral calcaneal compression fracture is not common with a high rate of misdiagnosis. Thorough evaluation of the entire midfoot complex including both Lisfranc and Chopart joints is vital in clinical work. ORIF remains the gold standard for this pattern of injury, and acceptable clinical outcomes can be obtained with proper management.

Conflicts of interest

None.

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