Case Report

Open fracture dislocation of the calcaneocuboid and naviculocuneiform joints: A case report

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ABSTRACT

Combined fracture and dislocation of the calcaneocuboid (CC) and naviculocuneiform (NC) joints is a very rare injury; therefore, it is under-reported. We present a case of rare open fracture and dislocation of the CC and NC joints by discussing the diagnosis, evaluation, management and prognosis.

Introduction

Chopart injuries are traumatic injuries and dislocations of the mid-foot that result from high-energy trauma and can be classified into different types \cite{1,2}. In particular, combined fracture and dislocation of the calcaneocuboid (CC) and naviculocuneiform (NC) joints is a very rare injury; therefore, it is under-reported \cite{3}. The uncommonness of this injury and its relation to high-energy trauma are attributable to the robust bony support and firm ligamentous attachments surrounding the CC and NC joints \cite{3–13}. Combined fracture and dislocation of the CC and NC joints were reported by eight studies previously \cite{4–10}. However, only one study has reported an associated open fracture \cite{6}. The current report aims to present the case of rare open fracture and dislocation of the CC and NC joints by discussing the diagnosis, evaluation, management and prognosis.

Case presentation

A 25 year old healthy male presented to the casualty department of the Level II trauma center in Kuwait with a left foot open fracture on the 27th of January 2021. The patient sustained a crush injury due to a large sized forklift loaded with about 10 to 12 tons of pipes backing into his left foot while he was standing behind it. The back tire of the forklift went over the patient's foot once. The patient's foot was flat on the ground, and he made no attempt to remove it during the incident. No other injuries were sustained. The patient was immediately unable to bear weight on his foot and reported significant blood loss and bluish discoloration of the foot; no resuscitative measures were performed. He was brought to the emergency department (ED) immediately via his own transport.

Upon arrival at the ED, the patient was alert, conscious, vitally stable, and complained of severe pain in his left foot. On
Fig. 1. Emergency room clinical images and radiographs: a) clinical photograph showing left foot deformity and the two open wounds on the medial side. Radiographs showing open fracture dislocation of the calcaneocuboid and naviculocuneiform joints: b) ankle x-ray oblique view, c) ankle x-ray AP view, d) foot x-ray AP view, e) foot x-ray oblique view, f) foot x-ray lateral view, and g) CT scan showing fracture of the anterior process of the calcaneus.
examination, his left foot was deformed. He had two open wounds on the medial side; one approximately 10 cm in length just anterior to the medial malleolus, and the other around 15 cm long at the medial aspect of the heel (Fig. 1). Bone was also visible through the wounds. X-rays revealed a fracture dislocation of the CC and CN joints (Fig. 1). The patient underwent a successful closed reduction in the operating room (Fig. 2). The wounds were washed with 9 ML normal saline and approximated by surgical clips, a triple antibiotic was administered. The patient was also put in a below-knee cast, admitted, and scheduled for surgical fixation.

During the hospital stay and prior to surgery, the patient developed an infection after becoming febrile on the 3rd of February 2021; 7th day post admission, and his wounds began to ooze a greenish discharge along with a surge of inflammatory markers; therefore, the patient has been taken to the OR, and I&D was performed, then a wound culture was taken. Antibiotics were given. The wound culture yielded insignificant bacterial growth; after consulting with the Infectious Diseases and Microbiology Department, the patient received a course of antibiotics: Amikin 50 mg/12 h for five days.

Five weeks after injury/admission, on the 2nd of March 2021, and after the infection subsided where the inflammatory markers normalized and wound discharge ceased, the patient underwent open reduction and internal fixation surgery of the naviculocuneiform and calcaneocuboid joints. The surgical approach involved creating a 5 cm dorsomedial incision and exposing the navicular-medial cuneiform (NC-1) and navicular-lateral cuneiform (NC-2) joints via the interval between the tibialis anterior and extensor hallucis longus and lateral aspect of the extensor hallucis longus, respectively. Edema was noted. However, there was a noticeable satisfactory callus formation around the joints. There was also acceptable joint stability. A K-wire was inserted through an inter-cuneiform approach, after which a 32 mm cannulated screw was introduced. A 2.4 mm tarsometatarsal plate was placed over the NC-1 joint, and another was fixed over the NC-2 joint. Finally, a K-wire was inserted through the calcaneocuboid joint. X-ray and CT scan showed a marginal impaction of the calcaneus, about one-third of the joint. Due to the restricted mobility of the CC joint, it has been decided to leave it and place a K-wire to permit midfoot ligamentous tissue healing. Placement of all hardware was confirmed with x-rays at every step, and the final postoperative radiographs revealed ideal fixation (Fig. 3). After skin closure and the application of spray dressing (Opsite), a vacuum dressing was placed over the dorsomedial incision site. The patient's foot was not casted as he had already undergone successful closed reduction previously, and the time elapsed between the injury and the operative intervention was lengthy.

Post-operatively, the patient recovered well and was given strict non-weight bearing orders; full weight-bearing was to be initiated at three weeks post-operation. At the fourth week postoperative follow-up, the patient reported no pain on dorsiflexion or plantar flexion. However, there was noticeable swelling of the foot, and K-wires were in place. He was instructed to start weight-bearing with a walking boot two weeks later and commence physiotherapy. The physiotherapy plan involved increasing his weight-bearing potential in increments of 25% over a period of four weeks, and use of the walking boot would stop at 50% weight-bearing.

At three and a half months postoperatively, on the 5th of May 2021, the patient presented to the clinic with a plantigrade foot. His

Fig. 2. Post closed reduction foot radiographs of open fracture dislocation of the calcaneocuboid and naviculocuneiform joints: a) foot AP view, and b) foot lateral view.
Visual Analogue Scale (VAS) was 2/10, ankle dorsiflexion 0–5°, plantar flexion 0–15°, hindfoot valgus 5°, and no forefoot valgus. The American Orthopedic Foot and Ankle Score (AOFAS) of midfoot was 73, and his EQ-5D score showed a high score of 70. While walking, the patient reported minimal pain in the midfoot area. The foot arch was maintained (no collapse), and his gait pattern was normal; however, the previously mentioned swelling of the foot had yet to subside completely. On the 16 of June 2021, the patient visited the clinic for follow-up, and further improvement was reported. His VAS was 0/10, AOFAS was 83, and EQ-5D was very high at 90 (Fig. 4).

Discussion

The current case report presents a condition of open fracture dislocation of the CC and NC joints. As this condition is rare, the case study design is the most appropriate and feasible design to assist in deciding possible recommendations and management regimes. Our experience with the case presented was successful, which could help in clinical decision-making and possibly future research. One previous case report presented open fracture and dislocation of the CC and NC joints [6]. The second of Wong, Tang, and Tan, an external fixation procedure was initially performed then K-wiring, plating and hamstring allograft for a 26 years old male; the outcome was satisfactory, with no pain or tenderness, but no functional outcome was reported [6]. However, the current case was complicated by infection, which delayed the surgical intervention; however, the pharmaceutical and surgical management provided led to satisfactory results. At only five months post-injury, the VAS was zero, and the functional outcome scores showed highs of 83 AOFAS and 90 EQ-5D indicating satisfactory functional ability.

Although a unified treatment consensus is unavailable, it is generally agreed that early and accurate diagnosis, timely anatomical reduction, and stable fixation are required for the appropriate management of these types of injuries in order to avoid long-term sequelae, consequent functional impairment, and complications such as avascular necrosis, midfoot collapse, or arthritis [5]. More importantly, it is evident from the review of the previous literature that the surgical fixation using K-wiring has good results, but the approach of ORIF is a biomechanically more rigid and robust method of fixation (Table 1). With regards to our patient, he initially underwent closed reduction and was casted and scheduled for emergent ORIF; however, due to the patient's soft tissue condition and infection, ORIF was delayed by about five weeks. Nevertheless, intra-operatively, there was satisfactory joint congruence and stability in the midfoot. Fixation was applied to prevent the occurrence of any future deformity such as pes planus, which occurred with Genena, Abouelela and Fadel's patient, who also developed midfoot arthritis [10]. For the ORIF stage of treatment, we utilized a hybrid technique by using plates and k-wires; this technique is similar to the one used by Kummer, Crevoisier and Eudier [8]. A plate was used in the midfoot to stabilize the NC joint since this is the highest stress area during gait. Therefore, adequate bone congruence and support are of paramount importance. Plates achieve this because they are stiffer, have a higher failure threshold, and have been shown to provide firm fixation without causing further articular damage in comparison to transarticular screws [6,14]. The rationale

Fig. 3. Foot radiographs post open reduction and internal fixation of open fracture dislocation of the calcaneocuboid and naviculocuneiform joints: a) foot AP view and b) foot lateral view.
behind using a tarsometatarsal (TMT) plate instead of a bridge plate or small locking plate was that a TMT plate would provide a more anatomical fit thereby maximizing joint stability [6,8]. Additionally, adequate anatomical reduction of the NC joint is vital due to the involvement of the medial column in preserving the foot arch [6]. A k-wire was placed through the CC joint given that it is an inherently stable arthrodial joint due to the strong ligamentous attachments to adjacent bones, with close proximity to the peroneus longus and brevis tendons, rigid fibrous capsule, and saddle-shaped joint surface [5]. In general, it is paramount to regain the anatomical alignment of the axes and column of the midfoot post-dislocation, as any shift will cause considerable change in gait biomechanics, thereby increasing the risk of midfoot arthritis in the future [15]. We believe that the combined use of plates and k-wires will maximize stabilization and lead to favorable functional outcome and quality of life scores.

The cause of injury in the case presented is very similar to that of Kummer, Crevoisier, and Eudier [8]. We suspect that the patient's foot was in plantar-abduction while the heavy object was passing over the foot. Valgus force travels from the CC joint and pushes the forefoot in varus position through the NC joint. In terms of evaluation, other than using x-rays, more advanced radiography such as CT scans should be utilized as a vital tool for diagnosis and determining a surgical strategy. In particular, it is evident from the review of the previous literature that the most common associated injury reported is a fracture of the anterior process of the calcaneus (Table 1), which can only be detected using CT scans. Therefore, CT scanning should be mandatory for this type of injury. Through CT, it was possible to identify a comminuted fracture in the anterior calcaneus that was not evident initially. Several other case reports have described this associated injury as well, which is possibly due to the compressive force exerted on the CC joint due to hyperabduction of
Conclusion

Fracture dislocation of the CC and NC joints is a highly unusual injury pattern but can lead to serious complications. Proper diagnosis, holistic evaluation, and appropriate management are integral to avoid long-term life-altering consequences. We believe that early ORIF using a combination of stabilizing hardware is a superior technique that will lead to a satisfactory functional outcome and improved quality of life post-injury. Further studies are needed to establish a classification system and understand the potential mechanism of injury.

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Ethical approval

As this is a case report, no ethical approval is needed.

Consent

Written informed consent was obtained from the case, and personal data and confidentiality were maintained.

Declaration of competing interest

The authors declare no conflict of interest.

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