

## Case Report



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## Avulsion Fracture of the Plantar Calcaneocuboid Ligament in a Skeletally Immature Patient: A Case Report

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### Abstract

**Introduction:** Isolated calcaneocuboid ligament (CCL) avulsion is a rare and often overlooked injury, previously described only in adults. Due to subtle or absent radiographic findings, diagnosis is frequently missed which is evident only on the lateral view radiographs of foot. We report, to our knowledge, the first paediatric case of plantar CCL avulsion, successfully treated with plaster immobilization.

**Case:** A 9-years-old male child presented to us with a dorsiflexion and inversion injury to the foot. While no fracture was evident on dorso-plantar and oblique foot radiographs, fracture was visible on the lateral radiograph as a bony avulsion fracture on the plantar aspect of the cuboid. MRI further delineated the morphology of the fracture pattern. Conservative management in the form of below knee cast was given. Good outcome was obtained at 1 year follow-up.

**Conclusion:** Avulsion fracture of the plantar calcaneocuboid ligament is rare and this is the first reported case of this injury in a child.

**Keywords:** Calcaneocuboid ligament, Lateral foot pain, Paediatric foot

### Introduction

Isolated calcaneocuboid ligament (CCL) avulsion injury has been described and classified for the adults by Andermahr in 2000 [1]. It is a rare and frequently missed injury in the adult population and has not yet been reported in the paediatric age group [2, 3, 4]. The mechanism of injury varies for different anatomic parts of the calcaneocuboid ligament. Plantar flexion or supination position of the foot at the time of impact causes avulsion of dorsal CCL [1]. Conversely, plantar CCL avulsion is caused by dorsiflexion and inversion of the foot. This injury is frequently missed due to the lack of clinical suspicion and its relative subtle appearance or absence on routine dorso-plantar and oblique foot radiographs. Here we present a case of a nine years old boy with a rare type of injury which involves the plantar calcaneocuboid ligament avulsion from the cuboid bone, successfully managed with plaster immobilization.

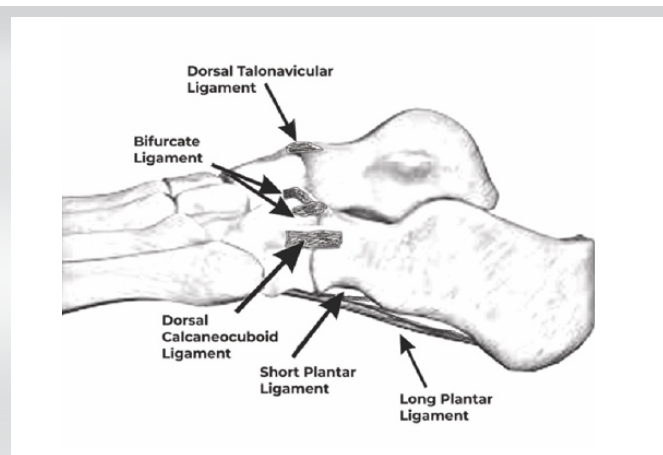
### Case

A nine years old boy presented to the emergency department with a history of fall from stairs and injury to the right foot. He was unable to bear weight on the affected side. On enquiry, he was coming down the stairs and twisted his ankle and sustained a severe impact on the foot on landing. On clinical examination, there was swelling along the lateral aspect of the foot. Tenderness could be elicited along the calcaneocuboid region. There were no open wounds or ecchymosis. Subtalar and ankle movements were painful. Neurovascular examination was normal. Dorso-plantar and oblique radiographs of the foot showed no obvious fracture (Fig. 1A). On the lateral view, a bony chip on the plantar aspect of the cuboid bone was evident (Fig.

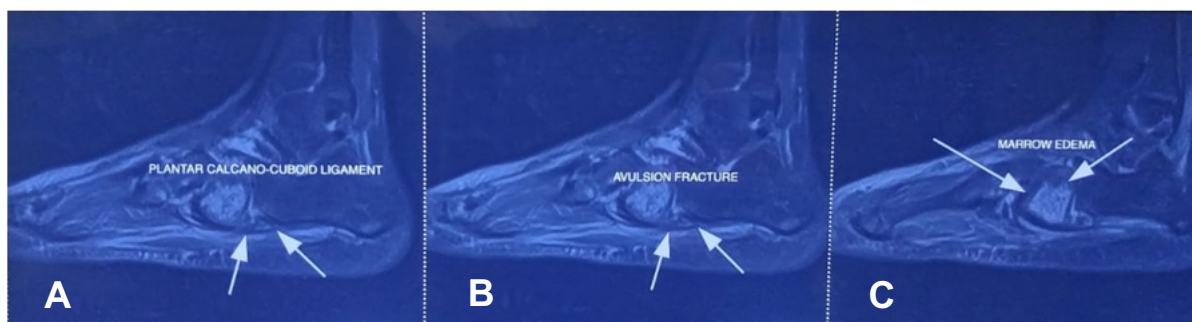
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**Figure 1:** Normal appearing Dorsoplantar radiograph [A] Lateral foot radiograph [B] showing the avulsion fracture on the plantar aspect of the cuboid bone.



**Figure 4:** Diagram showing the ligaments of the chopart joint



**Figure 2 [A, B, C]:** T2 weighted MRI images showing plantar calcaneocuboid ligament bony avulsion with minimal displacement and marrow edema in the cuboid



**Figure 3:** Radiograph showing evidence of fracture healing.

1B). To ascertain the exact morphology of the fracture pattern and associated ligament injury, Magnetic Resonance Imaging (MRI) was prescribed. It revealed an avulsion fracture of 8 x2.5 x4 mm size, at the insertion of the short plantar CCL along with marrow edema in the cuboid (Fig. 2 A, B, C).The long ligament was found intact.

Due to the presence of local swelling, a below knee slab immobilization was advised for 1 week. At 1 week follow-up, the swelling had subsided and a below knee cast was given for further 3 weeks. At 4 weeks after the injury when plaster was

removed, the pain had disappeared and the swelling had resolved. Radiographs showed signs of fracture healing. Toe touch weight bearing as tolerated was allowed, gradually progressing to full weight bearing at the end of 6 weeks of the injury. At 1 year follow-up the child had normal ankle and subtalar range of movements without any instability. Radiographs at the end of 1 year of injury showed complete healing of the injury (Fig. 3). An informed consent was obtained from the family to report this case for academic purpose.

## Discussion

The calcaneocuboid joint is a part of the Chopart joint complex. Anatomically it is stabilized by strong ligaments dorsally, laterally and plantar-wards. Dorsally lies the bifurcate ligament, laterally the dorsolateral calcaneocuboid ligament and inferiorly the plantar calcaneocuboid ligament. The plantar CCL has two components. The short plantar ligament is deeper and attached on the proximal part of cuboid while the long plantar ligament is superficial and gets inserted on the distal part of cuboid and the base of second, third and fourth metatarsal bones (Fig. 4) [5]. The structural integrity of all of these ligaments, plantar fascia and the spring ligament is imperative for proper function of the calcaneocuboid joint and maintenance of the longitudinal arch of the foot [6]. In our case, the radiological picture was suggestive of involvement of the plantar calcaneocuboid ligament which was confirmed on MRI.

Patho-mechanics of this fracture has been described for the adults by Andermahr et al [1]. Injury to the CCL may occur following an inversion injury, a plantar flexion injury or a nutcracker type of injury to the foot. In their series of tarsometatarsal joint injuries in children, Wiley et al suggested acute abduction and plantar flexion of the forefoot occurring by jumping from a height, leading to a heel-to-toe compression as a possible mechanism of injury [7, 8]. In our case, the child recalled falling on the lateral side of the foot while running down the stairs. This must have caused a dorsiflexion at the midfoot with the impact on the lateral side of foot causing an inversion motion. This mechanism correlates well with the anatomy of the fracture pattern.

Englaro et al studied the scintigraphy of 30 children who presented with a limp but were unable to locate the focal site of pain [9]. In their study, nine cases had high uptake in the cuboid bone region. However, as foot trauma was not initially suspected in the limping child, only four of these nine children had radiographs of the feet, and all were normal. Cuboid fracture was introduced as one of the differential diagnosis of lateral foot pain in children [10, 11]. So, a high clinical suspicion and proper imaging is of paramount importance to diagnose this fracture pattern. In our case, the child presented with a limp and was able to locate the origin of pain to the foot.

H Senaran et al, in their study of cuboid fractures in preschool children observed that patients immobilised had early resolution of pain and limp compared to those in which no treatment was given for cuboid fractures [12]. Andermahr et al

have described the conservative and surgical options for management for CCL injury based on the Calcaneocuboid (CC) angle and the size of the flake [1]. They have recommended non-operative management for cases with a small flake or CC angle <10 degrees. However their observations were limited to dorsal Calcaneocuboid ligament. Elaborating on the natural history of the injury pattern, they have also mentioned the possibility of persistent instability of the Chopart joint and permanent disability which would remain if the fracture is missed or left untreated. We concurred with their observations and immobilized our patient with a belowknee slab.

Missed cuboid fracture may be diagnosed retrospectively by observing sclerosis in the bone suggestive of fracture healing [3, 10]. This is because foot injuries are commonly imaged with a dorso-plantar view and an oblique view of the foot. However, a plantar calcaneocuboid ligament avulsion would be overlapped in these views and the fracture may be missed. In such cases a lateral view of the foot would be very helpful in ruling out these injuries. In cases with significant displacement of the fracture fragment, MRI would be helpful in delineating the fracture morphology, amount of displacement, involvement of the ligament if any. Thereby it would guide the treatment approach. In a recent study of MR imaging of cuboid fractures in children, three out of nineteen patients demonstrated CCL involvement [4]. But, all these fractures were linear and obvious on coronal views. None of the injury of the plantar calcaneocuboid ligament has been reported. Magnetic resonance imaging in our case confirmed the calcaneocuboid ligament avulsion injury with a bony chip from the plantar aspect of the cuboid bone at the insertion of the plantar calcaneocuboid ligament.

## Conclusion

Plantar calcaneocuboid ligament avulsion fracture is a rare injury and an important cause of lateral foot pain in children. If missed, it can become a cause of chronic lateral foot pain. A lateral foot radiograph should be ordered while evaluating foot injuries where a cause cannot be established. MRI can assist in delineating these rare fracture patterns. Non-Operative management in the form of Cast immobilization is adequate management of undisplaced CCL avulsion fracture. To our knowledge this is the first reported case of a plantar calcaneocuboid ligament avulsion in the paediatric age group.

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**Declaration of patient consent :** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil    **Source of support:** None

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