

CASE REPORT

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Cuboid dislocation following low-energy injury in a college athlete: A case report

Raja Ullah, Conner Patrick, Raja Jamal, W Bentley Edmonds

ABSTRACT

Introduction: Cuboid dislocations in isolation are rare injuries often associated with high energy mechanisms, but here we present a case of a college football player with a low energy mechanism that underwent surgical treatment.

Case Report: We report a case of an 18-year-old college football player who injured his left foot after tripping over his dog and falling down the stairs. His injury was initially missed, but he was later found to have a left cuboid dislocation. He underwent an open reduction in the operating room and his midfoot was stabilized with Kirschner wires.

Conclusion: Cuboid dislocations are rare due to the soft tissue constraints around it. As in this patient, this is often a missed injury with delayed time to diagnosis and treatment. Imaging should be scrutinized, particularly with an inversion/plantarflexion force to cause injury. Due to the soft tissue restraints, this injury usually requires an open reduction, and adequate timely reduction can lead to improved outcomes and function.

Keywords: Cuboid, Fracture dislocation, Midfoot, Open reduction

Raja Ullah¹, MD, Conner Patrick¹, MD, Raja Jamal², BS, W. Bentley Edmonds³, MD

Affiliations: ¹Program Year 3 Resident, Department of Orthopedic Surgery, University of Oklahoma, Oklahoma City, OK, USA; ²Medical Student Year 2, University of Oklahoma, Oklahoma City, OK, USA; ³Orthopedic Foot and Ankle Surgeon, Clinical Instructor, Department of Orthopedic Surgery, University of Oklahoma, Oklahoma City, OK, USA.

Corresponding Author: Raja Ullah, MD, Department of Orthopedic Surgery and Rehabilitation, University of Oklahoma Health Sciences Center, 800 Stanton L Young Blvd, Suite 3400, Oklahoma City, OK, USA; Email: raja-ullah@ouhsc.edu

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INTRODUCTION

Isolated cuboid dislocations are exceedingly rare injuries due to the structure of the midfoot and its robust ligamentous support. Injury to the midfoot is predominantly seen following high-energy trauma such as motor vehicle collisions and to our knowledge, dislocation of the cuboid as a result of a low-energy mechanism has infrequently been reported in the literature [1, 2]. The rarity of such cases can pose difficulties in both recognition of injury pattern and treatment. Regarding surgical treatment of a cuboid dislocation, whether isolated or associated with a fracture, various methods of fixation must be considered with respect to the surrounding bony architecture. In this article, we report a case of cuboid dislocation following a low-energy mechanism and describe our approach to surgical fixation in order to bring more awareness to this rare injury pattern and provide a surgical technique for definitive treatment.

CASE REPORT

Patient information

An otherwise healthy 18-year-old male college football athlete presented to a local emergency room after tripping over his dog and falling down a short flight of stairs. The patient described an inversion and plantar flexion

mechanism to his left foot. He had immediate pain over the lateral aspect of his left foot and inability to bear weight. Initial interpretation of his radiographs in the emergency room did not reveal an apparent fracture or dislocation. He was diagnosed with an ankle sprain and placed into a walking boot and allowed to weight bear as tolerated. He presented to our clinic nearly three weeks after the injury due to continued pain during ambulation.

Clinical findings

Physical examination demonstrated diffuse swelling in the midfoot with a small palpable step-off over the plantar aspect of the lateral midfoot. Tenderness was elicited over the lateral aspect of the midfoot and pain was elicited with inversion stress of the foot. The motor function and sensation of the extremity were intact, and the patient's vascular exam was unremarkable.

Diagnostic assessment

Radiographic examination of the injured foot (Figure 1) was performed. The anterior-posterior (AP) radiograph demonstrated an abnormal shift of the fifth metatarsal (MT) base off the cuboid. The lateral radiograph demonstrated increased overlay of the cuboid and the fifth MT when compared to the uninjured side. Computed tomography (CT) imaging (Figure 2) was obtained for pre-operative planning and to better characterize the dislocation pattern. This revealed a fourth MT fracture dislocation off the dorsal aspect of the lateral cuneiform, a fifth tarsometatarsal (TMT) dislocation, and dislocation of the cuboid, which was incarcerated under the lateral cuneiform. There was no associated cuboid fracture.

Therapeutic intervention

The patient was offered operative intervention after proper diagnosis of his pathology was made. After consent was obtained, the patient was taken to the operating theatre nearly a month after his injury was sustained. The patient was placed in the supine position where he succumbed to general anesthesia with use of a laryngeal mask airway. The left lower extremity (LLE) was prepped and draped in standard sterile fashion and a timeout was performed confirming correct patient, procedure, and laterality. A bump was placed under the left hip and a leg ramp was placed under the LLE, which was exsanguinated prior to inflating a thigh tourniquet to a pressure of 250 mmHg. Sharp dissection was carried down in the interval between the fourth and fifth MT shafts running proximally over the fourth and fifth MT bases and the dorsal aspect of the cuboid. We identified dorsal dislocations in the fourth and fifth TMT joints and the incarcerated dislocation of the cuboid underneath the lateral cuneiform. Extensor digitorum brevis interposition was noted and dissection of this tissue was performed to allow for reduction of the cuboid. Several unsuccessful attempts were made at reduction. The

patient was converted to endotracheal anesthesia to allow for paralysis. This allowed for relaxation of his soft tissues and eventual reduction of the cuboid dislocation by applying axial traction and elevation of the cuboid using Freer elevator. Given the degree of physiologic motion at the calcaneocuboid and TMT joints, we elected to stabilize our reduction using multiple Kirschner wires (K-wires) to allow for preservation of joint motion (Figure 3). We provided fixation by first placing a 2.0-mm K-wire from the plantar lateral aspect of the cuboid, running obliquely to the dorsomedial aspect of the cuboid and across the articulation of the cuboid and lateral cuneiform and running further proximal into the middle cuneiform. This provided provisional stability for additional reductions. We then reduced the fourth TMT joint and this was fixed with a retrograde 2.0-mm K-wire from the fourth MT base into the dorsomedial cuboid. The fifth TMT joint was then reduced and fixed with a retrograde 2.0-mm K-wire into the plantar lateral aspect of the cuboid. We subsequently added two additional 2.0-mm K-wires in order to provide further stability. One of these wires was placed parallel to the first wire from the plantar lateral aspect of the cuboid, again running obliquely to the dorsomedial aspect of the cuboid and across the articulation of the cuboid and lateral cuneiform. The last wire was placed retrograde across the fourth TMT joint. Direct visualization and intra-operative radiographs confirmed anatomic reduction of the cuboid. K-wires were buried under skin according to the surgeon's preference and the foot was placed into a short leg splint.

The patient had his wound inspected and sutures removed at two weeks post-op and was transitioned to a removable short leg splint in which he remained fully non-weightbearing. At eight weeks post-op, the patient returned to the operating theatre to have the buried K-wires removed under general anesthesia. Following removal of the K-wires, he was transitioned to a walking boot and allowed to begin weightbearing as tolerated. The patient also began physical therapy at this time to improve range of motion and conditioning. Four weeks after K-wire removal, he was allowed to begin weaning out of the walking boot. At six months post-op, the patient's



Figure 1: Pre-operative antero-posterior (left image) and lateral (right image) radiographs of the left foot demonstrating the plantar-medial dislocation of the cuboid without fracture.

radiographs were unremarkable and he had returned to participating in football related activities without issue (Figure 4).

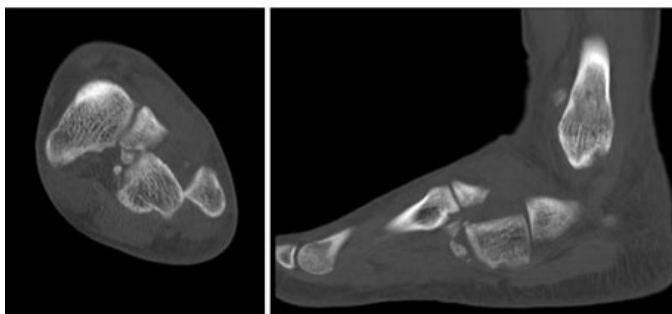


Figure 2: Pre-operative axial (left image) and sagittal (right image) computed tomography scan of the left foot demonstrating a small fracture of the fourth metatarsal base with plantar-medial dislocation of the cuboid.



Figure 3: Post-operative radiographs of the left foot demonstrating adequate reduction of the cuboid and fixation with K-wires.



Figure 4: Radiographs of the left foot six months after surgery demonstrating adequate alignment of the cuboid that is maintained following removal of K-wires.

DISCUSSION

Dislocation or subluxation of the cuboid bone is uncommon due to its articulations and soft tissue constraints. The cuboid articulates with the calcaneus proximally, the navicular and third cuneiform medially, and the fourth and fifth metatarsals distally. These articulations are tethered by multiple ligaments and stability is further reinforced by the tendinous and soft tissue attachments of the peroneus longus, peroneus brevis, peroneus tertius, flexor digitorum brevis, tibialis posterior tendon [3]. The isolated cuboid dislocation was first reported on by Penhallow in 1937 and since then there have only been a handful of cases reported in the literature, demonstrating the infrequency of this injury pattern [4]. Although the exact mechanism of

cuboid dislocations is unclear, Drummond and Hastings postulated that a medial and plantar directed force on the forefoot expels the cuboid in the plantar direction, resulting in the interosseous ligaments being torn [5].

The incidence of missed injury leading to incorrect management is a concern with this injury pattern. As this case highlights, radiographic evaluation of the region can be difficult for less experienced physicians due to the overlap and superimposition of the bones. Anterior-posterior, lateral and oblique radiographs of the foot should be closely scrutinized for any abnormal location of the cuboid relative to its surrounding architecture. A CT scan can be helpful to further define the injury pattern and identify associated fractures.

Reduction of the cuboid can pose a challenge due to its surrounding bony and soft tissue architecture. Immediate closed reduction under general anesthesia can be attempted by applying force in the opposite direction; however, this has only been successful in one case [6]. Soft tissue entrapment can pose a hindrance to closed reduction and may necessitate open management [3]. We employed Kirschner wires to provide fixation in order to minimize joint damage and preserve mobility of the lateral column. These should be left in place for a minimum of six weeks to allow for adequate ligamentous healing and to prevent arthrofibrosis [7]. For our patient, we chose to bury the K-wires under skin, doing so primarily based on surgeon preference. Although this necessitated a return to the operating theatre, it decreased any chances of loosening or failure of the K-wires.

CONCLUSION

In conclusion, cuboid dislocations with or without associated fractures are rare injuries. It is important to be aware of this injury pattern when reviewing radiographs in the emergency department, particularly in patients presenting with an inversion and plantarflexion mechanism of injury to the foot and ankle with associated lateral foot pain and inability to bear weight.

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Author Contributions

Raja Ullah – Conception of the work, Design of the work, Acquisition of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Conner Patrick – Acquisition of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Raja Jamal – Acquisition of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

W Bentley Edmonds – Conception of the work, Design of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

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Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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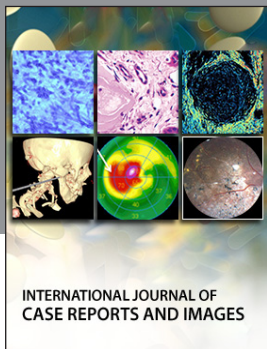
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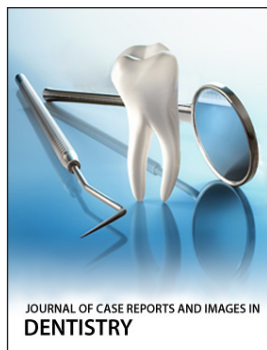
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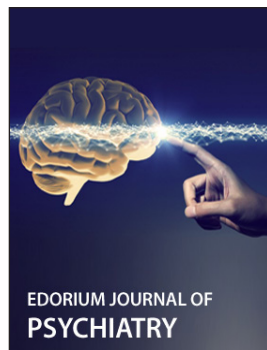
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