The Journal of Emergency Medicine, Vol. 56, No. 2, pp. 224–226, 2019

0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2018.09.054

Visual Diagnosis in Emergency Medicine

THE NUTCRACKER FRACTURE; NOT JUST ANOTHER DANCER'S INJURY

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INTRODUCTION

Axial loading, inversion, and compressive forces can cause a number of different foot fractures, including the Lisfranc fracture, Chopart fracture, and Jones fracture, to name a few. Cuboid fractures, however, are uncommon, often occurring in association with other injuries to the foot (1). It takes a significant amount of compressive kinetic energy to produce this injury. This is a case of a young man who presented to the emergency department (ED) after stepping down hard into a pothole and sustaining an acute "nutcracker fracture."

CASE REPORT

A 25-year-old man presented to the ED with 3 days of left ankle and foot pain after stepping off a curb and landing hard in a pothole and sustaining an axial load and inversion injury to his foot. He was able to ambulate, but he was only able to hobble around on his heel, unable to place weight directly on his mid or forefoot. The pain had worsened over the 2 days before presentation. He described the pain as nonradiating in both the foot and ankle, associated with swelling and ecchymosis. He denied falling to the ground, and did not experience head, neck, back, or other extremity trauma. He also denied prior injury to his foot, and he had not used any medications for the pain.

On physical examination, the vital signs were: temperature 36.4°C (97.6°F), blood pressure 124/80 mm Hg, heart rate 94 beats/min, respirations 16 breaths/min, pain score 7 out of 10, and oxygen saturation 100% on room air. General examination showed the patient was in no apparent distress, alert and oriented, and responding to questions appropriately. His head was without external signs of trauma and there was no midline tenderness or deformity of the cervical, thoracic, or lumbar spine. There was moderate left ankle swelling with ecchymosis over the lateral and medial malleolus. There was no soft tissue crepitus present. He had tenderness to palpation over the lateral malleolus. He also had swelling and tenderness dorsally over the midfoot on the lateral aspect. Perfusion, motor, and sensory examination were within normal limits, dorsalis pedis pulse was not palpable due to swelling, but capillary refill was <2 s, and the foot was warm. There was no proximal tenderness or deformity of the tibia, fibula, knee, or hip.

Initial imaging studies included plain x-ray studies of the ankle and foot (Figure 1). The ankle x-ray studies were negative, but the foot x-ray study showed a subtle lucency projecting over the lateral talar process, seen primarily on the lateral view, with a slight blurring and indistinct cortex of the anterior process of the calcaneus (Figure 1B); these findings raised the possibility of a nondisplaced fracture, which was consistent with his clinical examination. Computed tomography (CT) of the left foot (Figure 2) was obtained to further evaluate for injury. It showed sub-3-mm ossific/calcific fragments at the anterior calcaneal process (Figure 2A), consistent with a minimally

Received: 25 September 2018;
Accepted: 29 September 2018

Figure 1. Plain x-ray studies of the foot. No fractures are evident on the anterior-posterior projection (A), on the lateral view (B) the white arrow points to a very subtle lucency projecting over the lateral talar process, and the black arrow points to an indistinct edge of the anterior process of the cuboid, suggesting a possible fracture.

displaced fracture. There were also punctate ossific/calcific fragments along the proximal dorsal aspect of the cuboid likely reflecting small fractures (Figure 2B). There were nondisplaced irregularities in the cortex of the cuboid dorsally and at the plantodistal aspect (Figures 2C and 2D). There was mild to moderate soft tissue swelling, particularly along the dorsum of the foot. These findings were consistent with the so-called "nutcracker fracture."

Given the rarity of nutcracker fractures, orthopedics was consulted and they agreed that acute treatment with a bulky lower extremity splint, non–weight-bearing on crutches, and outpatient follow-up were appropriate. The patient was discharged with analgesia and orthopedics follow-up within a week.

DISCUSSION

Nutcracker fractures of the cuboid bone are uncommon, as it typically takes a significant mechanism of injury to produce the forces necessary for fracture (1). The rarity of the nutcracker fracture is likely due to the fact that the cuboid is fairly well protected in the midfoot region (2). This injury is important to detect because the cuboid plays a key role in the lateral stability of the foot (3). A fracture of the cuboid may produce long-term changes to the biomechanics of the midfoot (1).

It is more common to see cuboid fractures in connection with other foot fractures, as in our case (2–4). If the cuboid becomes compressed between the bases of the 4th and 5th metatarsals and the calcaneus, this compression is like the forces of a nutcracker and can result in the so-called "nutcracker fracture" (2,5–7). The patient described in this case sustained an axial load and inversion mechanism from stepping off a curb into a pothole and by description most of his weight landed on his foot. Nutcracker fractures have been reported in other activities that involve axial loading and compression, such as ballet dancing and horseback riding (8). There have been case reports of isolated fractures of the cuboid (9).

The diagnosis of a nutcracker fracture is often subtle and may be missed on initial plain radiographs (10). Oblique views are helpful, but CT is often required in cases where the diagnosis is in question, like this one (6,10).

As there are mostly case reports in the literature regarding nutcracker fractures, the optimal treatment has not been subjected to rigorous study (9). Emergently, it is best to immobilize these fractures in a bulky splint and recommend non–weight-bearing until appropriate follow-up can be obtained with orthopedics. Nutcracker fractures that are nondisplaced may be managed in a short leg non–weight-bearing cast (11). Significantly displaced or comminuted fractures will often require open reduction and internal fixation (ORIF) (11). Ohmori et al. described using an arthroscope to reposition displaced fragments of bone (12). Smith et al., suggest that when a nutcracker fracture causes changes to the lateral stability of the foot, repair via ORIF may be necessary (2). The use of external fixation has been reported, but as yet, no optimal treatment approach has been identified for all cases (7).

SUMMARY

Nutcracker fractures are rare and most commonly occur with other injuries of the foot, such as the calcaneal fracture, which occurred in this case. The mechanism of injury often involves axial loading and requires significant force, as the cuboid is generally protected in the midfoot. The compressive forces on the cuboid between the bases of the fourth and fifth metatarsals and the calcaneus are likened to that of a nutcracker. The diagnosis may be difficult to make on plain films, therefore, when clinical suspicion is high, CT scan is indicated to evaluate for subtle injury. If not recognized, nutcracker fractures may

Figure 2. Lateral reconstructions from the computed tomography scan are shown. (A) Fragments from the anterior process of the calcaneus (white arrow). (B) A small ossific fragment at the posterior dorsal tip of the cuboid and a cortical irregularity of the dorsal surface of the cuboid (white arrows). (C) Lucencies in the cuboid (white arrows) and (D) cortical irregularities (white arrows) of the cuboid both dorsally and at the plantodistal aspect consistent with a non-displaced fracture.

result in loss of the lateral structural integrity of the foot and ankle, as well as chronic pain, stiffness, and some degree of disability. The initial treatment in the ED involves non–weight-bearing in a bulky splint and prompt orthopedic follow-up.

REFERENCES

1. Fenton P, Al-Nammari S, Blundell C, Davies M. The patterns of injury and management of cuboid fractures: a retrospective case series. Bone Joint J 2016;98-B:1003–8.
2. Smith WR, Stahel PF, Suzuki T, Gabrielle P. Musculoskeletal trauma surgery. In: Skinner HB, McMahon PJ, eds. Current Diagnosis & Treatment in Orthopedics, Musculoskeletal Trauma Surgery. 5th ed. McGraw-Hill: New York, NY; 2014:18–87.
3. Jahn H, Freund KG. Isolated fractures of the cuboid bone: two case reports with review of the literature. J Foot Surg 1989;28: 512–5.
4. Sangeorzan B, Swiontkowski M. Displaced fractures of the cuboid. J Bone Joint Surg 1990;72-B:376–8.
5. Hermel MB, Gershon-Cohen J. The nutcracker fracture of the cuboid by indirect violence. Radiology 1953;60:850–4.
6. Abu-Laban RB, Rose NG. Ankle and foot. In: Marx JA, Hockberger RS, Walls RM, eds. Rosen's Emergency Medicine: Concepts and Clinical Practice. 8th ed. Philadelphia, PA: Elsevier Health Sciences; 2014:723–50.
7. Ferris L. Fractures and Dislocations of the Midfoot and Forefoot. In: Chapman MW, Szabo RM, Marder RA, et al., eds. Chapman's Orthopaedic Surgery. 3rd ed. Philadelphia, PA: Lippincott, Williams and Wilkins; 2001:1615–25.
8. Ceroni D, De Rosa V, De Coulon G, Kaelin A. Cuboid nutcracker fracture due to horseback riding in children: case series and review of the literature. J Pediatr Orthop 2007;27:557–61.
9. Lucerna A, Espinosa J, Butler N, et al. Nutcracker cuboid fracture: a case report and review. Case Rep Emerg Med 2018;2018:3804642.
10. Yu G, Yu T, Yang Y, et al. Nutcracker fracture of the cuboid: management and results. Acta Orthop Belg 2012;78:216–9.
11. Gaines S, Handel DA. Foot injuries. In: Tintinalli JE, Stapczynski J, Ma O, et al., eds. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. New York: McGraw-Hill Education; 2016: 1824–37.
12. Ohmori T, Katsuo S, Sunayama C, et al. A case report of isolated cuboid nutcracker fracture. Case Rep Orthop 2016;2016:3264172.