

Isolated “Nutcracker” Fracture of the Anterior Calcaneal Process: do we need a more Comprehensive Classification for this Injury Spectrum? A Case Report

Pasquale Sessa^{1*} and Marzia Mascarello²

¹P.O. Ospedale Nuovo San Giovanni di Dio, USL Toscana Centro-Via di Torregalli 1, Firenze (Italy)

²Dipartimento di Scienze Anatomiche, Istologiche, Medico-Legali e dell'Apparato Locomotore-Sapienza Università di Roma, Piazzale A. Moro 3-5, 00100 Roma (Italy)

*Corresponding author

Pasquale Sessa, P.O. Ospedale Nuovo San Giovanni di Dio, USL Toscana Centro-Via di Torregalli 1, Firenze, Italy, E-mail: p.sessa@hotmail.it

Submitted: 29 Sep 2018; Accepted: 10 Oct 2018; Published: 31 Oct 2018

Abstract

Fractures of the anterior calcaneal process are relatively rare accounting for 3-15% of all calcaneal fractures and can occur due to high or low energy trauma. Avulsion fractures are generally due to forced inversion and plantar flexion of the foot and are associated with ligament tears. More are impaction fractures, i.e. nutcracker fractures, are commonly described as due to a forced eversion and abduction of the foot with compression forcing the anterior process of the calcaneus against the cuboid. Clinical features are subtle and X-ray examination for the diagnosis of anterior calcaneal process fracture is challenging. A CT examination can reveal the fracture and should be performed whenever a doubt exists for correct diagnosis. Here we present the unique clinical case of a 44ys old female patient who suffered an isolated compression fracture of the anterior calcaneal process due to a fall from a stair with forced foot eversion and low energy trauma mechanism. The patient healed uneventfully with a conservative treatment. A more comprehensive classification of this spectrum injury is sought as many different fracture or combined bone-ligamentous lesions exist requiring different surgical or non surgical management. Actually, no clear guidelines exist in literature assisting the treating physician in the management of such challenging lesions.

Keywords: isolated anterior calcaneal process fracture; nutcracker fracture; midtarsal sprain; Chopart fracture-dislocation

Introduction

Anterior calcaneal process fractures are rare, accounting for 15% of all calcaneal fractures [1-3]. Compression, i.e. “nutcracker” fractures of the anterior calcaneal process are described as caused by a forceful eversion of the foot and are often associated with other fractures or dislocations of the midfoot [1-3]. They can be due to low energy midtarsal sprain or high energy trauma mechanism and involve the calcaneo-cuboid articular surface differently from inversion mechanism, where an intact articular surface is left [4-6]. Isolated nutcracker fractures of the anterior calcaneal process due to low energy mechanism are exceedingly rare [7-8]. Subtle clinical presentation and difficult X-ray interpretation due to bone overlap make a high suspicion index necessary for a correct diagnosis and appropriate management as such fractures are often misdiagnosed in the emergency setting as ankle sprain [7-9].

Here we present the unique clinical case of a 44ys old female patient who suffered an isolated compression fracture of the anterior calcaneal process due to a fall from a stair with forced foot eversion and low energy trauma mechanism.

Case Report

A 44 ys old female nurse with no sensitive medical history presented to the Emergency Ward of Our Department due to a fall from stairs at home. The patient referred she had suffered few hours earlier an ankle sprain; she described an eversion/abduction trauma mechanism

of the foot. The patient revealed that she heard at the moment of the trauma a sudden “clunk” along her lateral foot side, followed by impossibility to walk. The physical exam revealed ankle swelling and ecchymosis along the lateral calcaneal side. An elective pain was present over the calcaneo-cuboid joint and along the course of the fibulotalar ligament. Stress tests did not reveal instability of the subtalar or midtarsal joint.

The X-ray examination in the lateral view and AP view was unremarkable for fractures (Fig.1). However the lateral 20° view of the foot revealed a fracture rim along the anterior calcaneal process (Fig.2). A CT scan was performed and confirmed the diagnosis of compressive anterior calcaneal process fracture (Fig.3 and Fig. 4) No further bony lesions were assessed at the CT examination.



Figure 1: a) Antero-posterior and b) lateral X-ray imaging of the left foot. Fracture rim is not visible in conventional views



Figure 2: a) Dorso-ventral and b) 20° oblique X-ray imaging of the left foot demonstrate fracture rim involving the anterior process of the calcaneus

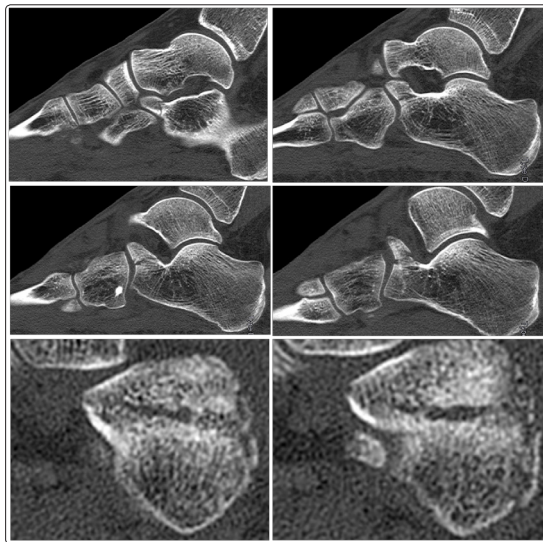


Figure 3: CT scans show the involvement of the articular surface with joint depression



Figure 4: Axial and 3D reconstruction showing depression of the articular surface of the calcaneocuboideal joint

Due to the preserved length of the lateral column of the foot and the absence of marked instability or displacement, the patient was managed with a conservative treatment consisting of below the knee paraisplast without weight bearing for 6 weeks and then progressive

weight bearing assisted with cans for further 4 weeks and range of motion exercises of the ankle. The patient healed uneventfully without complaining of foot instability or chronic pain.

Discussion

The anterior portion of the calcaneus body is a distinct, well recognized and clinically important part of this bone; despite the lack of an official anatomic term, it is reported in literature as the anterior process of the calcaneus [10]. It is a saddle shaped osseous process that participates to the calcaneo-cuboid joint and forms the anterior subtalar joint superiorly. A ligamentous network consisting of the bifurcate ligament and interosseous ligament joins the anterior calcaneal process with both the navicular and cuboid. Fractures of the anterior calcaneal process are relatively rare accounting for 3-15% of all calcaneal fractures and can occur due to high or low energy trauma [1-3]. Avulsion fractures are generally due to forced inversion and plantarflexion of the foot and are associated with ligamentous tear of dorsal talonavicular, dorsal calcaneocuboid and bifurcate ligaments [1-3,7-9]. More are impaction fractures, i.e. nutcracker fractures, are commonly described as due to a forced eversion and abduction of the foot with concomitant axial compression forcing the anterior process of the calcaneus against the cuboid [7]. The impaction force propagates through the medial side of the foot generally involving the navicular bone or other bones and midtarsal ligaments, presenting mainly as an associated fracture [11-12]. Degan et al. classified the anterior calcaneal process into three types according to the fragment extension and dislocation and this classification is often cited to decide whether a conservative (type I and II) or surgical (type III) management has to be considered [13].

Due to similar causative mechanisms and comparable clinical symptoms with ankle sprain, anterior calcaneus process fracture with midtarsal sprains are often missed at diagnosis in the emergency setting. Besides, anterior calcaneal fractures are particularly challenging to diagnose on plain radiographs due to bone overlap obscuring the midfoot bones [14-15]. The reported incidence of missed fractures at the Chopart joint on radiographs ranges from 6% to 41% in the literature [16-18]. However, the distinction between the two conditions is of paramount importance because of the different biomechanics of the joints and an improper management of midtarsal sprain with associated anterior calcaneal process fractures could lead to persistent pain and chronic instability with the development of the cuboid syndrome [19-21].

Clue elements for an appropriate diagnosis, apart a high suspicious index due to injury pattern, are an elective tenderness over the calcaneocuboid joint located 1 cm inferior and 3 to 4 cm anterior to the lateral malleolus and a plantar or lateral ecchymosis.

X-ray examination for the diagnosis of anterior calcaneal process fracture is challenging: oblique X-ray of the foot or a lateral foot view can reveal the fracture although directing the beam 20 degrees superior and posterior to the mid portion of the foot can project the APC away from the talar neck, thus improving fracture visualization [1-3,7,19-21]. A CT examination can reveal the fracture and should be performed whenever a doubt exists for correct diagnosis [1-3,7,19-21].

The unicity of our case is that a “nutcracker” fracture of the anterior process of the calcaneus occurred with no associated lesions of other midtarsal bones and with a low energy mechanism, differently

from other cases reported in literature [8]. The lack of the navicular avulsion fracture, described as a fracture pattern associated with calcaneal “nutcracker” fractures, reveals a wide spectrum of different patterns of lesions involving the anterior calcaneal process during forced abduction and eversion of the foot according to the magnitude of involved forces. A more comprehensive classification of such lesions should be sought as a deeper knowledge of the different existing fracture pattern may affect the clinical management and final outcome of such lesions.

The low energy trauma (fall from stairs), supports the hypothesis that an insufficient trauma force is unable to cause additional fractures or ligament fracture avulsions through a medial propagation towards the navicular bone. Medial or capsular lesions could be expected. According to Hirschmann et al, a MRI in the acute setting seems to be inappropriate when an accurate diagnosis based on X-ray and CT is done [7]. Such exam should be performed when unclear clinical symptoms or non conclusive previous imaging are present.

Although no clear guidelines exist in literature for the treatment of midtarsal sprain and associated fractures, open reduction and internal fixation (ORIF) is usually reserved for displaced (>2 mm) large fragments (>1 cm) involving the calcaneo-cuboid joint or in cases of associated non reducible midtarsal dislocation [22]. A conservative treatment consisting in a below the knee cast immobilization with no weight bearing for 6 to 8 weeks and then a progressive weight bearing and range of motion exercises seems to afford good clinical results in the treatment of non displaced or minimally displaced fractures [22-23].

Failure to diagnose and properly treat calcaneal fractures caused by lateral column compression in a timely manner can lead to severe chronic disability due to lateral column shortening, valgus deformity, and malalignment of the foot.

References

1. Ochman S, Evers J, Raschke M (2013) Fractures of the anterior process of the calcaneus. Operative Orthopädie und Traumatologie 25: 579-591.
2. DeLee JC (1993) Fractures and dislocations of the foot. In: Mann RA, Coughlin MJ, eds. Surgery of the foot and ankle. 6th ed. St. Louis: Mosby 1465-1703.
3. Hodge JC (1999) Anterior process fracture of calcaneus secundarius: a case report. J Emerg Med 17: 305-9.
4. Thiounn A, Szymanski C, Lalanne C, Soudy K, Demondion X et al., (2016) Prospective observational study of midtarsal joint sprain: epidemiological and ultrasonographic analysis. Orthop Traumatol Surg Res 102: 657-661.
5. Lohrer H, Nauck T (2006) Augmented periosteal flap repair of the chronically unstable calcaneocuboid joint: a series of six cases. J Bone Joint Surg Am 88: 1596-1601.
6. Søndergaard L, Konradsen L, Holmer P, Jørgensen LN, Nielsen PT (1996) Acute midtarsal sprains: frequency and course of recovery. Foot Ankle Int 17: 195-199.
7. Hirschmann A, Walter WR, Alaia EF, Garwood E, Amsler F (2018) Acute Fracture of the Anterior Process of Calcaneus: Does It Herald a More Advanced Injury to Chopart Joint? Am J Radiol 210: 1-8.
8. Gajendran VK, Yoo BJ, Hunter JC (2008) unusual variant of the nutcracker fracture of the calcaneus and tarsal navicular. Radiology Case Reports 3: 208.
9. Judd DB, Kim DH (2002) Foot fractures frequently misdiagnosed as ankle sprains. Am Fam Physician 66: 785-794.
10. Golder WA (2004) Anterior process of the calcaneus: a clinical-radiological contribution to anatomical vocabulary. Surg Radiol Anat 26: 163-166.
11. Hawkins LG (1965) Fracture of the lateral process of the talus. J Bone Joint Surg 47: 1170-5.
12. Bradford CH, Larsen I (1951) Sprain-fractures of the anterior lip of the os calcis. N Engl J Med 244: 970-2.
13. Degan TJ, Morrey BF, Braun DP (1984) Surgical excision for anterior-process fractures of the calcaneus. J Bone Joint Surg Am 64: 519-524.
14. Newton EJ, Love J (2007) Emergency department management of selected orthopedic injuries. Emerg Med Clin North Am 25: 763-93.
15. Trnka HJ, Zettl R, Ritschl P (1998) Fracture of the anterior superior process of the calcaneus: an often misdiagnosed fracture. Arch Orthop Trauma Surg 117: 300-2.
16. Tafur M, Rosenberg ZS, Bencardino JT (2017) MR imaging of the midfoot including Chopart and Lisfranc joint complexes. Magn Reson Imaging Clin N Am 25: 95-125.
17. Baker JC, Hoover EG, Hillen TJ, Smith MV, Wright RW et al., (2016) Subradiographic foot and ankle fractures and bone contusions detected by MRI in elite ice hockey players. Am J Sports Med 44: 1317-1323.
18. Benirschke SK, Meinberg E, Anderson SA, Jones CB, Cole PA (2012) Fractures and dislocations of the midfoot: Lisfranc and Chopart injuries. J Bone Joint Surg Am 94: 1325-1337.
19. Lohrer H, Nauck T, Arentz S, Vogl TJ (2006) Dorsal calcaneocuboid ligament versus lateral ankle ligament repair: a case-control study. Br J Sports Med 40: 839-843.
20. Miller CM, Winter WG, Bucknell AL, Jonassen EA (1998) Injuries to the midtarsal joint and lesser tarsal bones. J Am Acad Orthop Surg 6: 249-258.
21. Kemler E, van de Port I, Backx F, van Dijk CN (2011) A systematic review on the treatment of acute ankle sprain: brace versus other functional treatment types. Sports Med 41: 185-197.
22. Berkowitz MJ, Kim DH (2002) Process and tubercle fractures of the hindfoot. J Am Acad Orthop Surg 13: 492-502.
23. Fadl SA, Ramzan MM, Sandstrom CK (2017) Core curriculum illustration: anterior process fracture of the calcaneus. Emerg Radiol.

Copyright: ©2018 Pasquale Sessa. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.