Injury, Int. J. Care Injured 43 (2012) 1640–1650

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Review

Management of calcaneal fractures
What have we learnt over the years?

Enrique Guerado *, María Luisa Bertrand, Juan Ramón Cano

Department of Orthopaedic Surgery and Traumatology, Hospital Costa del Sol, University of Malaga, Marbella, Malaga, Spain

ARTICLE INFO

Article history:
Accepted 7 May 2012

Keywords:
Calcaneus fracture
ORIF
Arthroscopy
Arthrodesis
Less invasive surgery
Systematic review

ABSTRACT

Calcaneal fractures result, in many cases, in, subtalar joint stiffness and severe disability. Diagnosis is usually made by X-ray, but more accurately by a computed tomography (CT) scan. In the last years, much has been known regarding its physiopathology and osteosynthesis. Although new developments in osteosynthesis materials have been made, calcaneus fractures still remains in dispute of those advocating non-operative treatment and those defending open reduction and internal fixation. Less invasive surgery, arthroscopy and three-dimensional (3D) fluoroscopy are very important for reduction accuracy and soft-tissue damage avoidance. In this article, the physiopathology, diagnosis, classification and treatment of calcaneus fractures are updated. Nevertheless, systematic reviews have shown no evidence about what treatment is better.

Contents

Introduction

Much has been known about the physiopathology of calcaneus fractures in the last years, thanks to the important contribution of digital X-rays and, particularly, computed tomography (CT) scan. However, although new developments in osteosynthesis materials have been made, calcaneus fractures still remain in dispute in terms of those advocating non-operative treatment and those defending open reduction and internal fixation (ORIF). Although new knowledge and implant developments have made ORIF, together with less invasive surgery, achieve better results than before, subtalar joint stiffness still will result in the majority of the cases.

The anatomy of the calcaneus is very complex, as it has many different joint axes in three-dimensional orientations (Fig. 1).

* Corresponding author at: Department of Orthopaedic Surgery and Traumatology, Hospital Costa del Sol, Autovía A-7 Km.187, 29603 Marbella, Malaga, Spain. Tel.: +34 951976224; fax: +34 951976222.
E-mail address: eguerado@hcs.es (E. Guerado).

0020–1383/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.injury.2012.05.011

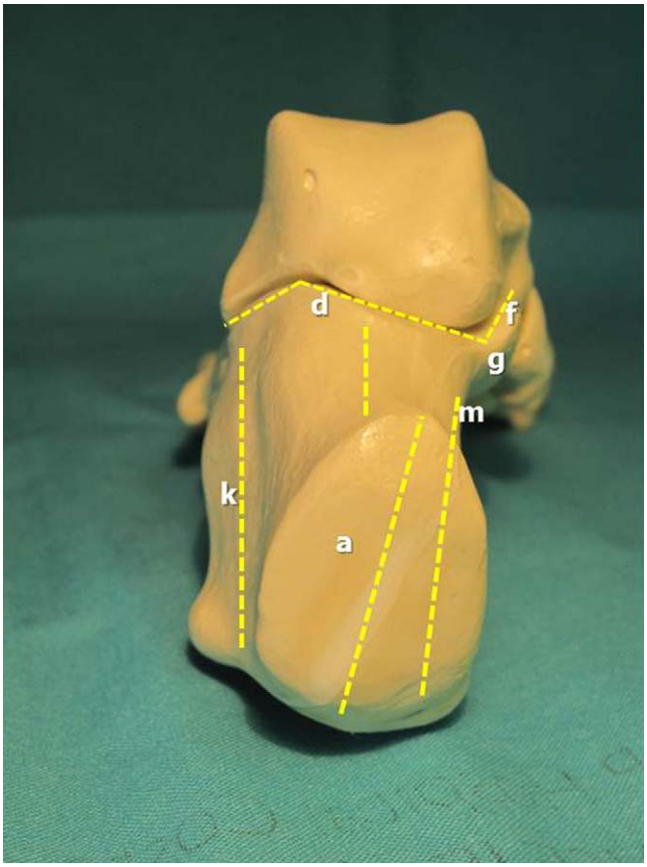

Fig. 1. Posterior view of the calcaneus. The 3D anatomy can be seen with the axes of the tuberosity, the anterior process, and the lateral and medial cortex in different directions. The subtalar joint has itself also different orientations. Although the calcaneocuboid facet cannot be seen in this view, it also has a different orientation. **a**: tuberosity. **d**: posterior subtalar joint. **f**: middle facet for calcaneus–talus neck joint. **g**: sustentaculum tali. **k**: lateral cortex. **m**: medial cortex.

The posterior joint facet is convex, sloping posteromedially in its support of the talar body. The anterior and middle facets support the talar head and neck, and are flattened. The medial facet is supported by the sustentaculum tali, a hard bone process very interesting to be considered for screw purchase in case of osteosynthesis (Figs. 2 and 3).

A groove divides the posterior and the complex anterior–middle facets. This groove has the insertion of the interosseous ligament. The lateral part of the groove is the floor of the sinus tarsi (Figs. 3 and 4).

As the posterior subtalar joints is responsible for most of the eversion-inversion movement, and during inversion the midfoot joints are locked for gait, three-dimensional reconstruction of the whole calcaneus becomes of overwhelming importance.

Diagnosis

Clinical assessment

Swelling and deformity are the main diagnostic symptoms and signs. Soft-tissue situation must be examined thoroughly to avoid skin complications if surgical treatment is expected to be applied, as skin necrosis has been published to occur in up to 43% of patients.[1,2] Blisters commonly developed in displaced fractures. Clear-fluid blisters indicate that a safe skin incision can be made, whereas blood-filled blisters indicate a major soft-tissue danger.[3,4] Methods to improve oedema and accelerate the 'wrinkle test' of the skin for a safe operation include active exercises and compression devices for intermittent oedema pumping.[5]

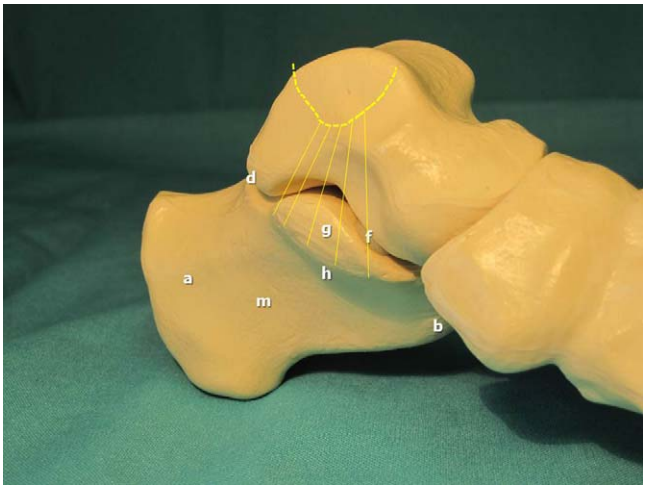

Fig. 2. Medial view of calcaneus. The sustentaculum tali holds the medial facet and is attached to the medial malleolous (dotted line) by the deltoid ligament (continuous lines). Therefore in a calcaneus fracture the sustentaculum, together with the medial facet, is commonly separated from the calcaneus body, remaning connected to the tibia bone by the deltoid ligament. Below the sustentaculum tali, the groove for the flexor hallucis longus can be open and the tendon incarcerate within the fracture. Above the sustentaculum tali the tibialis posterioris neurovascular bundle can be damaged in case of sustentaculum tali fracture. **a**: tuberosity. **b**: anterior process. **d**: posterior subtalar joint. **f**: middle facet for calcaneus–talus neck joint. **g**: sustentaculum tali. **h**: groove for flexor hallucis longus. **m**: medial cortex.

X-rays. Radiological studies are the basis for a proper diagnosis, and therefore a guide for treatment. There are two main radiological projections: lateral and axial views.

1. *Lateral projection*. There are also two important radiographic landmarks on the lateral X-ray (Fig. 5).

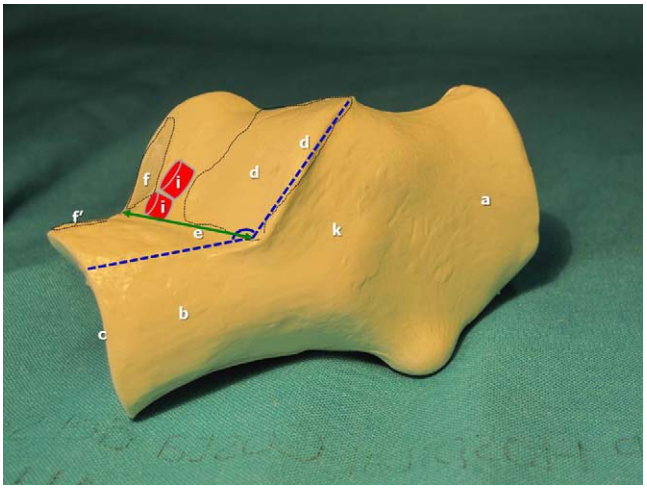

Fig. 3. Anterolateral view of the calcaneus. The interosseous ligament inserts itself in the more medial part of the sinus tarsi. It separates the medial and anterior facets from the sinus tarsi, making difficult to access the sustentaculum tali from a lateral surgical approach. Therefore these facets cannot be seen during a lateral extensile approach unless a part of this ligament is resected. The sinus tarsi are the lateral cavity formed in the lateral area of the tarsi groove (arrow). This groove separates the tuberosity from the anterior process, and the medial from the anterior facet. **a**: tuberosity. **b**: anterior process. **c**: calcaneocuboid joint. **d**: posterior subtalar joint. **e**: sinus tarsi. **f**: middle facet for calcaneus–talus neck joint. **f'**: anterior facet for calcaneus–talus head joint. **i**: interosseous ligament. **k**: lateral cortex.