Role of different imaging modalities in the evaluation of painful heel

Essay

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By

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Lists of abbreviations

a : inclination angle
ab : abductor hallucis
adm : abductor digiti minimi
AP : anteroposterior
ATT : Achilles tendon thickness
B : posterior angle of calcaneus
Calc : calcaneum
cc : convex contour
cl angle : chauveaux – liet angle
cp angle : calcaneal pitch angle
CT : computed tomography
FDB : flexor digitorum brevis
FDL : flexor digitorum longus
FHL : flexor hallocis longus
FP angle : fowler and Philips angle
fr : flexor retinaculum
IF : insufficient fracture
LN : lateral planter nerve
LVb : lateral vascular bundle
MHZ : mega hertz
MN : medial planter nerve
MRI : magnetic resonance imaging
Mvb : medial vascular bundle
Pcs : posterior calcaneal spur
PcsT : posterior calcaneal step
ppl : parallel pitch lines
ps : planter spur
pt : posterior tibial
PTA : posterior tibial artery
PTV : posterior tibial vien
qp : quadratus plantae muscle
RCR : retrocalcaneal recess
S : sustentaculur fragment
S1 : 1st sacral nerve
S & E angle: steffensen and evensen angle
ST : sustentaculum tali
STIR : short time inversion recovery
TA angle : total angle of ruch
tis : transverse interfascicular septum
UBC : unicameral bone cyst
US : ultrasonography

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ABSTRACT

Heel pain is a generalized term used to describe a range of undifferentiated conditions affecting the heel. Diagnostic imaging has been used by many researchers and practitioner to investigate the involvement of specific anatomical structures in heel. These observations help to explain the underlying pathology of the disorder, and are of benefit in torming an accurate disgnosis and targeted treatment plan . The purpose of this systematic review was to investigate the diagnostic imaging Features associatedwith heel pain.

Key words: painful heel,

INTRODUCTION

Heel pain, or calcaneodynia, is a frequent symptom in patients with foot and ankle disorders. This complaint may cause significant disability and interfere with routine activities. Clinical diagnosis of the cause of pain is often difficult due to the broad spectrum of potential causes ***(Hedrick, 1996).***

Heel pain may arise from six major anatomic structures:

(a)The plantar fascia, (b) various tendons (Achilles tendon, flexor digitorum longus [FDL] tendon, flexor hallucis longus [FHL] tendon), (c) the calcaneus, (d) bursae (retrocalcaneal bursa, retroachilleal bursa), (e) the tarsal tunnel and its nerve content, and (f) the heel plantar fat pad ***(Hedrick, 1996).***

Heel pain is a common condition in adults that may cause significant discomfort and disability. A variety of soft tissue, osseous, and systemic disorders can cause heel pain. Narrowing the differential diagnosis begins with a history and physical examination of the lower extremity to pinpoint the anatomic origin of the heel pain. The most common cause of heel pain in adults is plantar fasciitis. Patients with plantar fasciitis report increased heel pain with their first steps in the morning or when they stand up after prolonged sitting. Tenderness at the calcaneal tuberosity usually is apparent on examination and is increased with passive dorsiflexion of the toes. Tendonitis also may cause heel pain. Achilles tendonitis is associated with posterior heel pain. Bursae adjacent to the Achilles tendon insertion may become inflamed and cause pain. Calcaneal stress fractures are more likely to occur in athletes who participate in sports that require running and jumping. Patients with plantar heel pain accompanied by tingling, burning, or numbness may have tarsal tunnel syndrome. Heel pad atrophy may present with diffuse plantar heel pain, especially in patients who are older and obese. Less common causes of heel pain, which should be considered when symptoms are prolonged or unexplained, include osteomyelitis, bony

abnormalities (such as calcaneal stress fracture), or tumor. Heel pain rarely is a presenting symptom in patients with systemic illnesses, but the latter may be a factor in persons with bilateral heel pain, pain in other joints, or known inflammatory arthritis conditions ***(Aldridge, 2004).***

Aim of work:

The purpose of study is to analyze the value of radiological imaging studies in patients with heel pain. We aim to recognize the normal and abnormal appearance of heel, and to describe the advantages and limitations of various radiological techniques.

CHAPTER I

Anatomy of The Heel

The heel is the Back part of the human foot, below the ankle and behind the arch.

The heel consists of:

1. The calcaneus (largest of the tarsal bones), inserted at posterior end tendon Achilles, and cushioned below by a bursal sac.
2. Planter fascia and fat pad.
3. Thickened skin ***(Buchbinder, 2004).***

Calcaneus:

It is called os calcis.

The calcaneus develops from two centers of ossification:

One begins at birth, the other usually after age 8. Ossification is usually complete by age 15 ***(Michael* et al, 2006).**

In the calcaneus, an ossification center is developed during the 4^{th} – 7^{th} intrauterine month ***(*Platzer and Werner, 2004).**

The calcaneus is roughly rectangular, articulating above with the talus bone of the ankle joint and in front with the cuboid, another tarsal bone. Posterior, a roughened area the tuber calcanei, takes much of the weight in standing. On, one side of this is a small protuberance, the lateral process ***(*Platzer and Werner, 2004).**

On its lower edge on either side are its lateral and medial processes (serving as the origins of the abductor hallucis and abductor digit minimi). The achillus tendon is inserted into a roughened area on its superior side, the cuboid bone articulates with its anterior side, and on its superior side are three articular surfaces for the articulation with the talus bone. Between these superior articulations and the equivalents on the talus is the tarsal sinus (a canal occupied by the interosseouss talocalcaneal ligament). On the medial side of the bone, below the

middle talar facet is the sustentaculum tali (which serves for the attachment of several other ligaments). On the lateral side is commonly a tubercle called the peroneal trochlea, under which is a groove for the tendon of the peroneus longus ***(Gray et* al, 2000).**

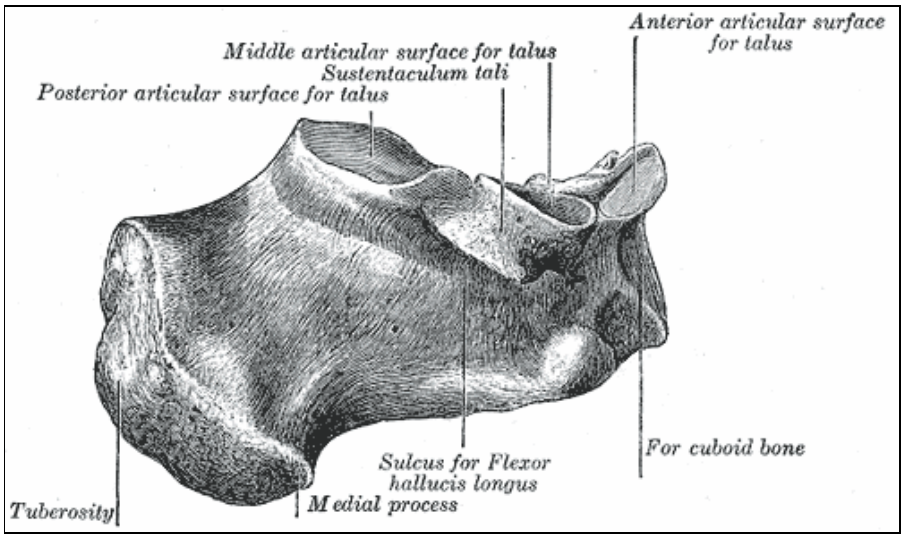

Figure1: Showing medial aspect of left calcaneus ***(*Platzer and Werner, 2004).**

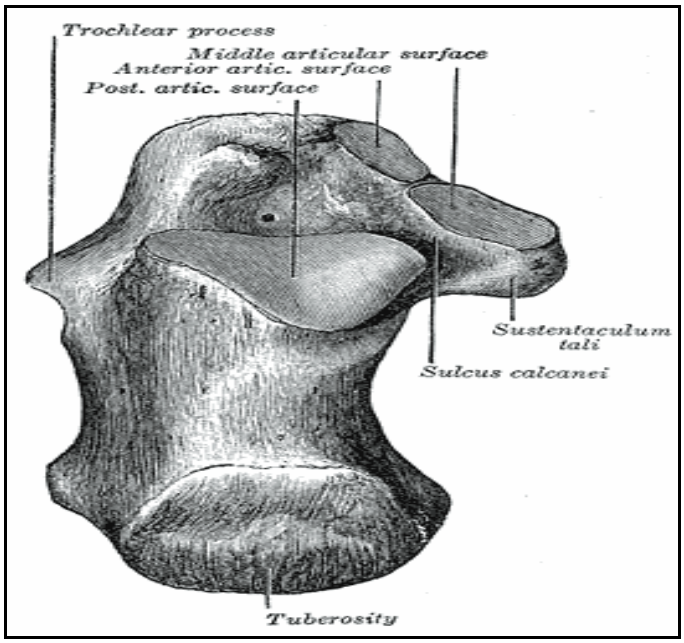

Figure2: Showing superior aspect of left calcaneus ***(*Platzer and Werner, 2004).**

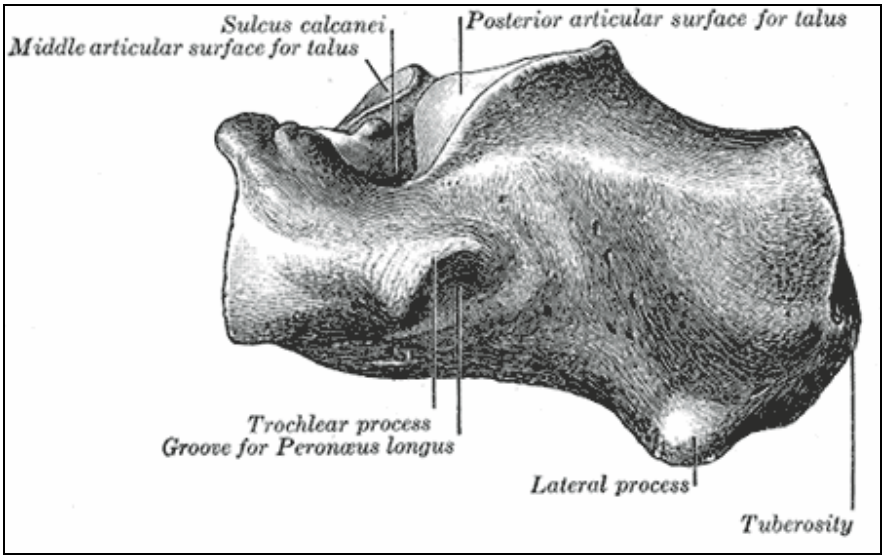

Figure3: Showing lateral aspect of left calcaneus ***(*Platzer and Werner, 2004).**

Radiological anatomy of calcaneus:

Angles and alignment:

In determining the Bohler angle, a line is drawn between the posterior superior aspect of the calcaneus and the highest point of the posterior subtalar articular surface; a second line, which intersects the first, is drawn from the highest point of the anterior process to the posterior margin of the subtalar surface. The angle that results from their intersection measures 20-40°. If the angle is reduced, a calcaneal fracture is present; however,

A normal angle does not exclude a calcaneal fracture ***(Lawrence and Singhal, 2007).***

Figure4: Lateral view ankle x-ray showing bohler angle ***(Lawrence and Singhal, 2007).***

With normal axial alignment in the hind foot, the axes of the tibia and calcaneus lie on a vertical line (pes rectus). If the calcaneal axis is turned medially the foot is in an everted position (pes valgus), and if it is tuned laterally the foot is an inverted position (pes varus) ***(*Platzer and Werner, 2004).**

Investigates the role of calcaneal alignment to the weight bearing axis and assess the shape of the calcaneus in heel pain ***(Perlman et al, 1996).***

The most popular techniques for assessing the calcaneal cause of heel pain are measurement of the prominence of bursal projection as determined by the posterior calcaneal angle of Fowler and Philip and the parallel pitch line of Pavlov as shown in (figs 5, 6, 7). The orientation of the calcaneus was determined relative to the horizontal plane using the Calcaneal pitch angle, posterior calcaneal angle, and parallel pitch line ***(Perlman et al, 1996).***

Calcaneal pitch angle:

Calcaneal pitch angle which is formed by the Intersection of the base line with the horizontal Range: 20.4 - 15.31 degree ***(Perlman et al, 1996).***

Figure5: Showing Calcaneal pitch angle ***(Perlman et al, 1996).***

Philip–Fowler angle (posterior calcaneal angle):

The posterior calcaneal angle of Fowler and Philip is formed by the intersection of the base line tangent to the anterior tubercle and medial tuberosity with the line tangent to the posterior surface of the bursal projection and the posterior tuberosity. Range: 58.1 - 61.7 ***(Perlman et al, 1996).***

Figure6: Showing posterior calcaneal angle of Fowler and Philip ***(Perlman et al, 1996).***

The parallel pitch line:

The parallel pitch line is +ve or -ve depending on whether the postero-superior aspect of the calcaneus projects above the line or below ***(Perlman et al, 1996).***