

**CONGENITAL VERTICAL
TALUS**

An Essay

Submitted in partial Fulfillment

for the master degree in

ORTHOPAEDIC SURGERY

By

M . Awad
M.B., B.CH.

under the Supervision of

Prof . Dr .

M . El Ghawaby

Prof . of Orthopaedic Surgery

Faculty of Medicine

Ain Shams University

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TO MY MOTHER

.....

IF THERE WAS EVER LOVE IN THE WORLD

I LOVE HER



ACKNOWLEDGEMENT

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ANATOMY

The foot is well adapted to perform a variety of functions. Its accommodation to any surface irregularity, its versatility & speed of movements during running, jumping, & walking make this structure a biomechanical marvel. There are seven tarsal bones, two of which, the talus & the calcaneus form the hind part of the foot (Fig. 1) The navicular, cuboid & the three cuneiforms form the mid part of the foot. The joints between the hind part & the mid part of the foot, are called the midtarsal joints or Chopart's joint. The fore part of the foot consists of the five metatarsals & the two phalanges of the great toe & the three phalanges for each of the lateral four digits of the foot. The five tarsometatarsal articulations are collectively named Lisfranc's joint.

Looking first at the dorsal surface of the foot (Fig. 2) one perceives that the general contour of the tarsal portion of the foot is markedly convex from medial to lateral. The structures underlying the skin from superficial to deep, (Fig. 3) are the inferior extensor retinaculum & under it traversing from medial to lateral the tibialis anterior, extensor hallucis longus, extensor digitorum longus & peroneus tertius tendons. At a slightly deeper level are located the deep branch of the peroneal nerve, the extensor hallucis brevis & the extensor digitorum brevis muscles. On the medial side of the foot (Fig. 4) underlying the skin and subcutaneous fat one finds the abductor hallucis originating from the plantar medial aspects of the calcaneus & inserting into the medial aspect of the base of the proximal phalanx of the great toe. The tibialis posterior tendon inserts at the plantar medial aspect of the navicular tubercle & the proximal edge of the first

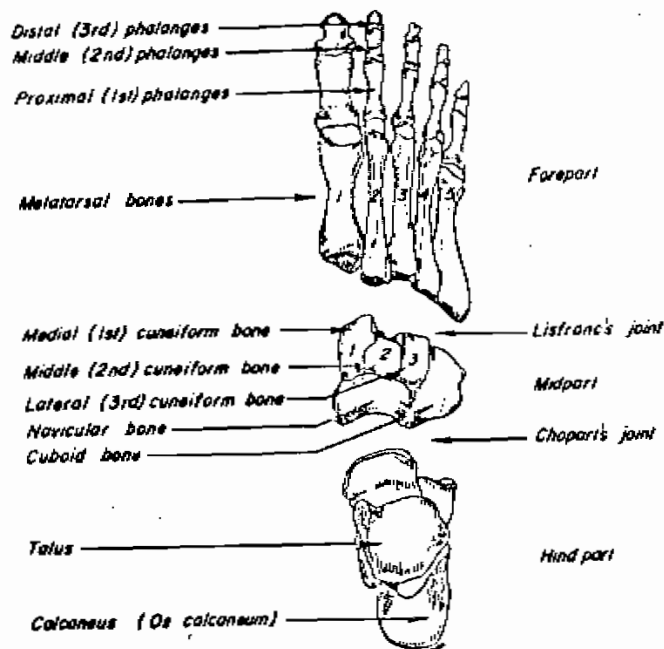


Fig. 1 Bones of the foot.

(After Rockwood 1975)

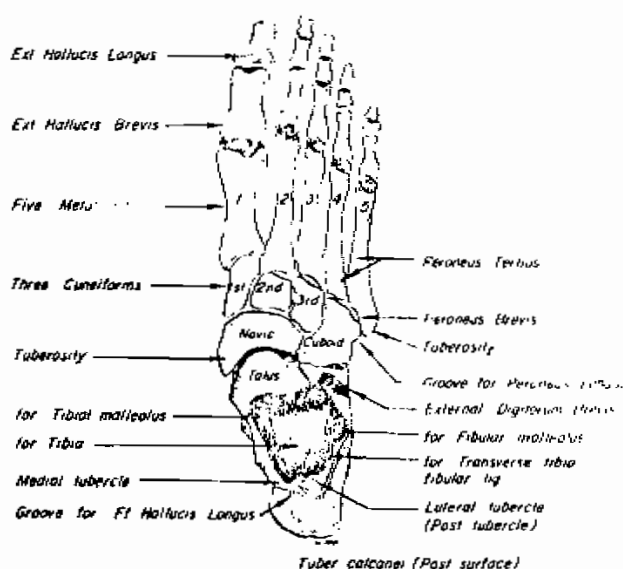
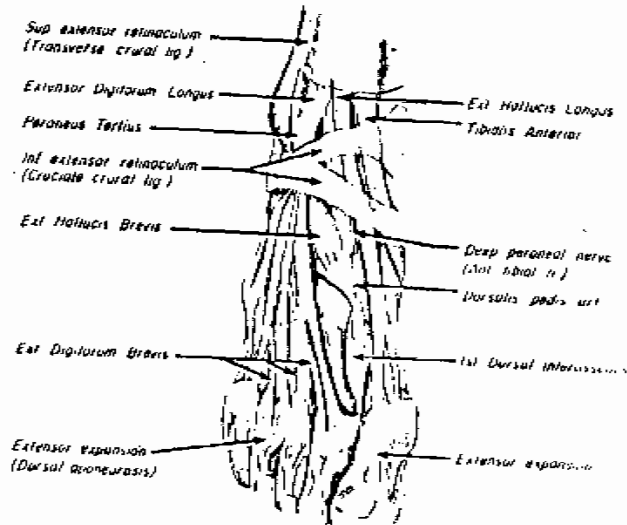


Fig. 2 Dorsal view of the foot.

(After Rockwood 1975)



Fig(3) Structures underlying the skin.

(After Rockwood, 1975)

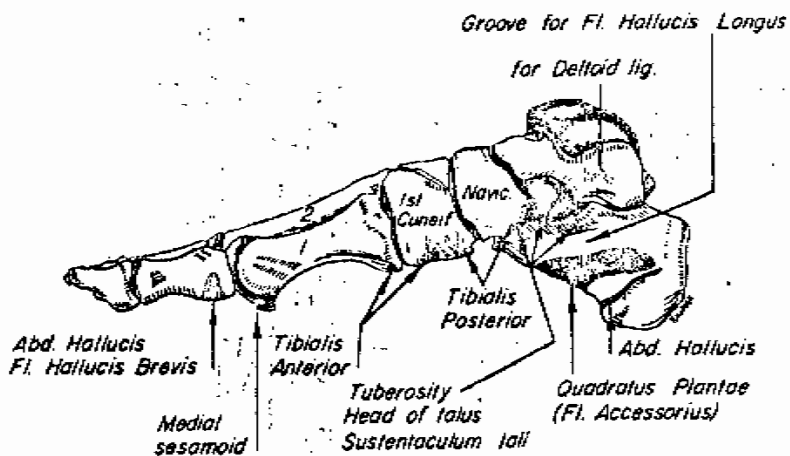


Fig. (4) Medial view of the foot.

(After Rockwood, 1975)

cuneiform before progressing plantarward to its ultimate insertion. The tibialis anterior tendon inserts at the plantar medial surface of the distal portion of the first cuneiform & the base of the first metatarsal & then progresses plantarward. The sustentaculum tali is seen to have a broad groove on its lower aspect. This is continuous with a groove on the medial & posteromedial surface of the talus for the flexor hallucis longus tendon. The dorsolateral aspect of the foot in addition to the extensor digitorum longus, the peroneus tertius tendon & the extensor digitorum brevis muscle bellies, presents (Fig. 5) the peroneus brevis tendon, which inserts into the base of the fifth metatarsal & the peroneus longus tendon which dips into the plantar aspect of the foot in the groove between the cuboid & the fifth metatarsal. (Fig. 6) The sinus tarsi is the depression found on the lateral side of the tarsus, and is distal to & on the same level as the lateral malleolus. The plantar fascia is a strong layer of white fibrous tissue whose thick central part is bound by thinner lateral portions. The central portion is attached to the medial calcaneal tubercle. As it progresses distally divides into five sections each extending into a toe & straddling the flexor tendons. The plantar muscles in the sole of the foot are divided into four layers. The first two layers originate from the calcaneal tuberosity & the other two from the metatarsal shafts. The first subfascial layer (Fig. 7) consists from lateral to medial of the abductor digiti minimi, the flexor digitorum brevis and the abductor hallucis. The muscles of the second layer are (Fig. 8) from medial to lateral the tendon of the flexor hallucis longus, the tendon of the flexor digitorum longus, the quadratus plantae & the lumbrical muscles. In the third subfascial layer one finds (Fig. 9) the flexor digiti minimi, the adductor hallucis & the flexor hallucis. The muscles of the fourth layer (Fig. 10) are the unipennate plantar & the bipennate dorsal interossei as well as the

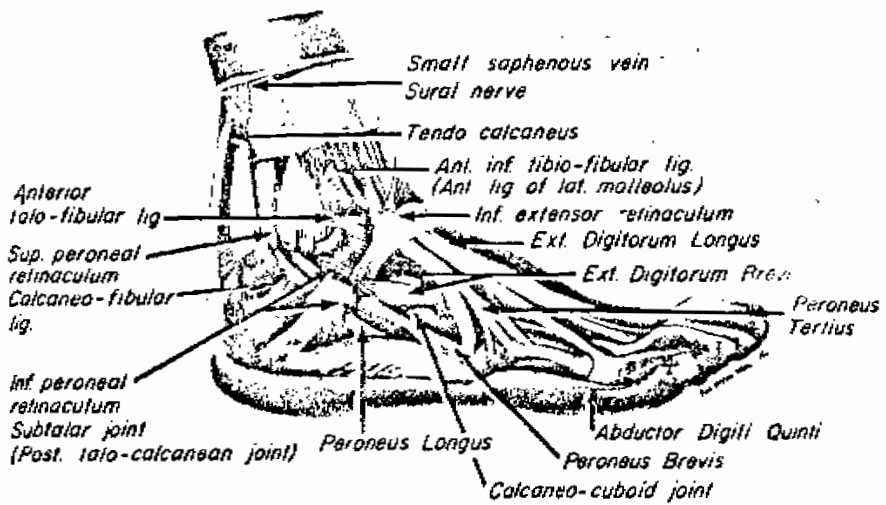


Fig.(5) Dorsolateral view of the foot.

(After Rockwood 1975)

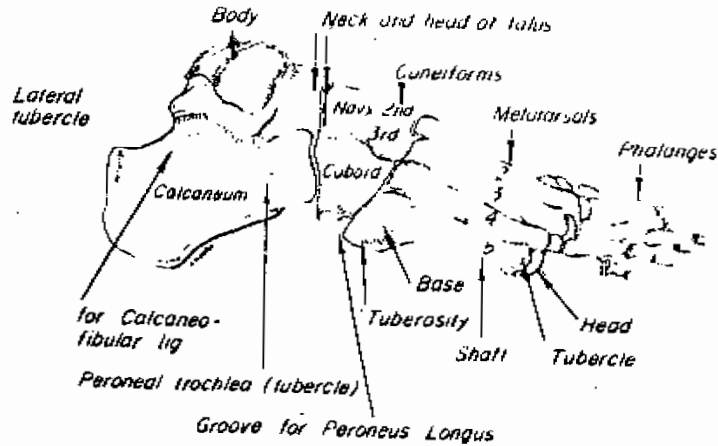
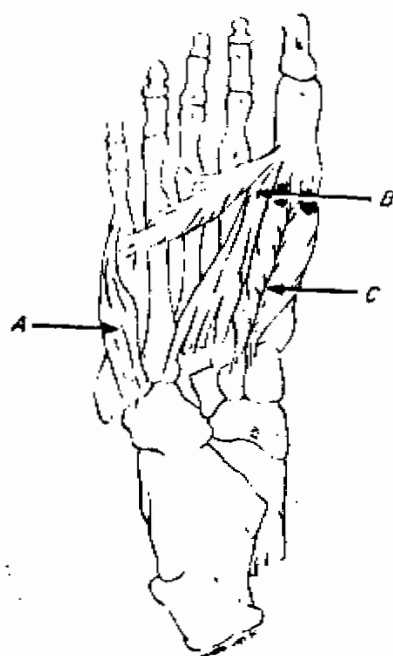


Fig.(6) Lateral view of the foot.

(After Rockwood. 1975)



The third subfascial layer consists of three muscles: (A) flexor digiti minimi, (B) adductor hallucis, oblique and transverse heads, and (C) flexor hallucis brevis. (Adapted from Giannestras, N. J.: *Foot Disorders: Medical and Surgical Management*, ed. 2. Philadelphia, Lea & Febiger, 1973)

Fig.(7)



The composite tendon of the flexor hallucis brevis: (1) medial sesamoid, (2) lateral sesamoid, (A) abductor hallucis, (B) flexor hallucis brevis, (C) oblique head, (D) transverse head of adductor hallucis. (Adapted from Giannestras, N. J.: *Foot Disorders: Medical and Surgical Management*, ed. 2. Philadelphia, Lea & Febiger, 1973)

Fig.(8)

calcaneonavicular (spring) ligament inferomedially. The facets are all in continuity.

Calcaneus is an irregular bone roughly rectangular in shape: (Fig. 14) its posterior part forms the prominence of the heel. The upper surface has posterior, middle and anterior articular facets for the talus.

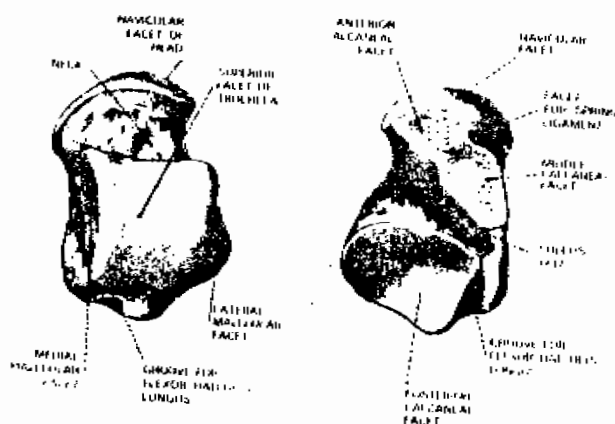
The posterior facet is convex and covers the middle third of the bone it receives the inferior concavity of the body of the talus. The middle and anterior facets articulate with the head of the same bone.

The middle facet lies on a medial extension of the bone, the sustentaculum tali; it is separated from the posterior facet by a deep groove, the sulcus calcanei. The sulcus calcanei and the sulcus tali together form a narrow tunnel, the sinus tarsi, which houses the strong interosseous talocalcaneal ligament. The inferior surface has an anterior tubercle, to which is attached the short plantar ligament and medial and lateral posterior tubercles which give attachment to the long plantar ligament, some short muscles of the sole and the plantar aponeurosis. The inferior surface of the sustentaculum tali is grooved by the flexor hallucis longus tendon.

The lateral surface has a short ridge, the peroneal tubercle, which separates the peroneus longus and brevis tendons. The posterior surface gives attachment to the tendo calcaneus in its middle third, and the smaller anterior surface articulates with the cuboid bone.

Navicular bone lies on the medial side of the foot between the talus and cuneiform bones. Posteriorly it has a concave facet for the head of the talus and anteriorly three facets for the cuneiform bones

Its medial surface is extended downwards and medially to form the prominent navicular tuberosity to which the tendon of tibialis posterior and calcaneonavicular (spring) ligament are attached. (Fig. 15)



Right talus dorsal and plantar aspects

Fig. (13) Talus Bone. (After Hamilton anatomy 1976)

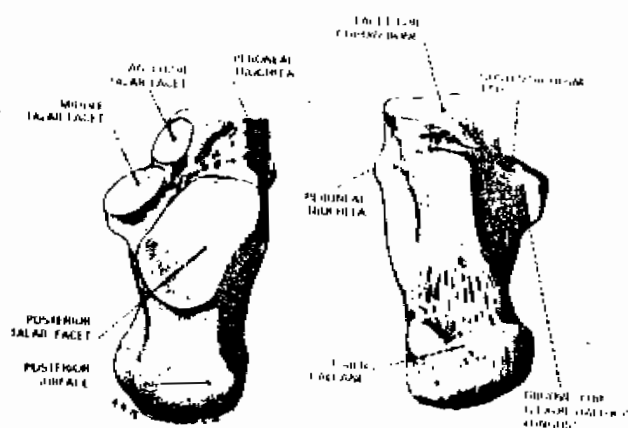


Fig. (14) Calcaneus Bone. (After Hamilton anatomy 1976)

Cuboid bone lies on the lateral side of the foot. It is roughly wedge-shaped and narrower inferiorly. Posteriorly it articulates with the calcaneus, anteriorly with the bases of the fourth and fifth metatarsal bones, and medially the lateral cuneiform and sometimes the navicular. The anterior part of the inferior surface has a prominent groove (for the peroneus longus tendon) situated between anterior and posterior ridges which give attachment to the long plantar ligament. (Fig. 16).

Cuneiforms are three wedged shaped bones. The medial is narrower inferiorly posteriorly they articulate with the navicular and anteriorly with the bases of the medial three metatarsal bones. The medial is the largest and the intermediate the shortest. The base of the 2nd metatarsal is wedged between the medial and the lateral bones.

The lateral cuneiform bone has a lateral articular facet for the cuboid. Parts of the tendons of tibialis anterior, tibialis posterior and peroneus longus are attached to the medial cuneiform, (Anatomy of human skeleton 1973).

THE TALOCALCANEONAVICULAR JOINT

It is a synovial joint of the ball and socket variety. (Fig. 17) Herman described it as a condyloid joint elipsoidal in character. The ball is the head of the talus and the socket comprises two bones and two ligaments. The bones are the navicular and the calcaneus. The posterior surface of the navicular has an articular surface which is concave reciprocally with the anterior convexity of the head of the talus.

The anterior end of the upper surface of the calcaneus has a concave facet, and the sustentaculum tali similar one (the two are often

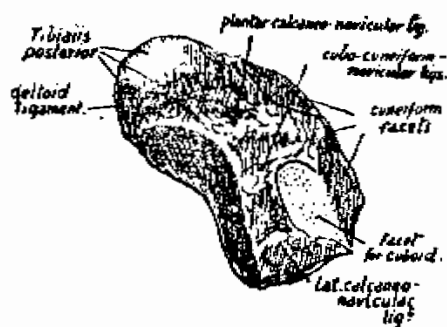


Fig.(15) Navicular bone.

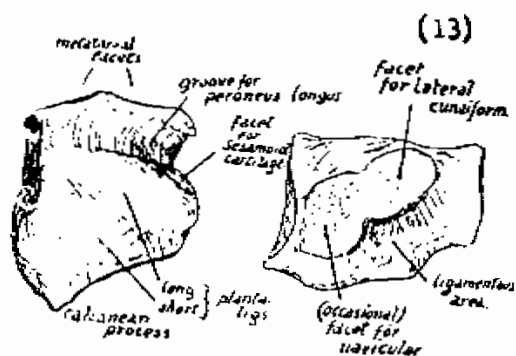


Fig.(16) Cuboid bone.

(After Hamilton anatomy 1976)

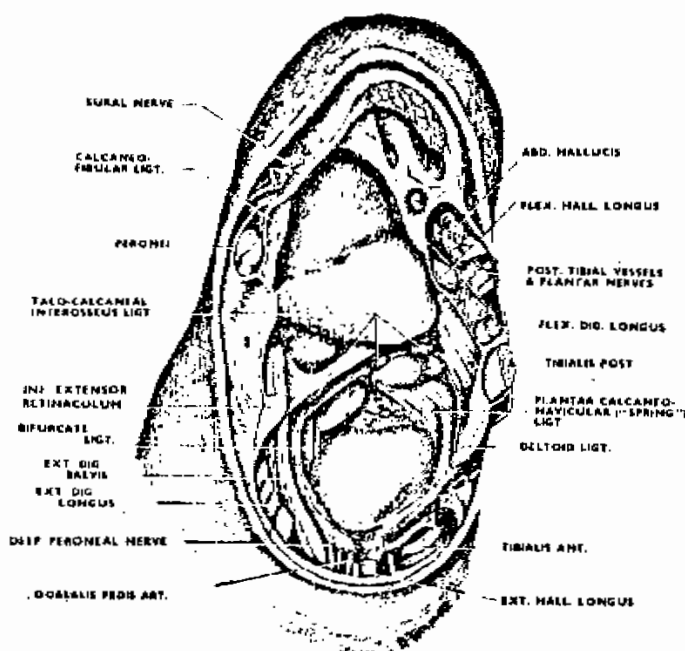


Fig.(17) The Talocalcaneonavicular joint.

(After Last anatomy 1981)

fused into a single cavity) for articulation with the inferior convexity of the head of the talus. On the head of the talus between its navicular and calcaneal surfaces lies cartilage that articulates with neither bone. Here the talus articulates with the spring ligament medially and the calcaneo-navicular limb of the bifurcate ligament laterally. All these structures are enclosed in a single capsule. One end of the capsular sleeve is attached to the neck of the talus around the articular margin on the head. The other end of the sleeve is attached along the upper surface of the navicular the medial edge of the spring ligament, the posterior limits of the articular facets on sustentaculum tali and body of calcaneus, the medial limb of the bifurcate ligament and so back to the upper surface of the navicular. The socket of the joint is closed below by the spring and the bifurcate ligaments. between the two lies a pad of fat covered with synovial membrane, that acts as a swab to spread synovial fluid on the moving head of the talus.

The bifurcate ligament arises from the upper surface of the calcaneus just behind the anterior margin of that bone, under cover of the extensor digitorum brevis muscle at the front of sinus tarsi.

From the single origin two limbs diverge slightly from each other.

The medial limb is attached to the navicular, near the infero-lateral part of its articular margin. It forms part of the socket in which the head of the talus lies and gives attachment to the capsule of the talo calcaneo-navicular joint. It is always present.

The lateral limb of the bifurcate ligament is often absent. It is extra-capsular and is attached to the upper surface of the cuboid, being no more than an accessory ligament of the calcaneo-cuboid joint.

The inferior calcaneo-navicular (spring) ligament is a very strong band that joint the whole thickness of the edge of the sustentaculum tali to the navicular between its tuberosity and the