ISSN 2563-7142

MINI REVIEW

Talus Bone: Unique Anatomy

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Hegazy AA, Hegazy MA. Talus Bone: Unique Anatomy. Int J Cadaver Stud Ant Var. 2022;3(2):52-55.

Abstract

The talus, also called astragalus bone, is a small, irregular bone that sits on top of the other bones of the foot. It is the only bony connection between the tibia, fibula, and the other tarsal bones. Despite its small size, it is a dense and strong bone. It transfers the weight of the human body through the tibia to the foot. Reviewing the anatomy of talus is essential for physicians and orthopedic surgeons for proper diagnosis and management of any disorder involving the ankle. This is because the talus is involved in many joints that can affect human movements in walking, running and even standing properly. In this short review, we will focus on some of the unique anatomical features of talus that may assist clinicians in their clinical practice. The unique feature of the ankle is that most of its surface is covered with articular cartilage. In addition, there are no muscles attached to the bone. This may be a cause of poor blood flow to the talus and may lead to poor healing after a fracture.

Key Words: *Talus; Anatomy; Orthopedics; Tarsus; Talocrural joint; Subtalar joints*

Human anatomical knowledge is vital to any clinical practice [1,2]. This includes the anatomy of the talus. This irregular bone is unique in its detail and needs to be reviewed and understood prior to any surgical intervention. Despite its small size, it represents the inlet of the movements of the foot. The talus, also known as the astragalus bone, is a small, irregular bone located on top of the tarsal bones. Unlike the carpal bones, the talus and calcaneus begin to ossify before birth [3].

The talus is unique in its shape. It is shaped like an irregular saddle. It consists of the head, neck, and body. The body is the largest posteriorly directed part and rests on the sustentaculum tali of calcaneus. The head of talus is pointing forward and medially. It articulates anteriorly with the navicular and inferiorly with the calcaneus (Figure 1). The neck, connecting the head and body, bears a groove on its lower surface called the sulcus tali. In the articulated foot, it joins the sulcus below it, on the upper surface of the calcaneus, to form a tunnel called the sinus tali [3]. The sinus contains strong ligaments that connect the talus firmly with calcaneus, called the interosseous and cervical talocalcaneal ligaments [4].

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Received: November 16, 2022, Accepted: November 23, 2022, Published: December 10, 2022

Figure 1) *An X-ray of the ankle and foot showing the skeleton and location and parts of the talus.*

The talus is also distinctive in that it is involved in several different joints that attribute to an array of movements. At its lower end, it forms a separation of two functional units. It forms a part of talotibiofibular unit. This unit is inferiorly separated from the foot unit, which includes all the bones of the foot except the talus, by the subtalar joints [5]. Superiorly, it shares information of talocrural or ankle joint. The upper articular surface of the body of the talus is wide in the anterior side and narrower as it is directed backward. It articulates with the inferior surface of the tibia. The body forms a wedge between the medial malleolus of tibia and lateral malleolus of fibula. Through this joint, plantar flexion and dorsiflexion movements of the foot are allowed [6].

The subtalar joints can generally be divided into two main joints, anterior and posterior. Each joint has its own ligamentous capsule and is separated from the other by the sinus tarsi [7]. The type of anterior subtalar joint is a ball and socket joint. The ball is represented by the head of the talus, while the socket consists of the following structures articulated with the head of the talus including the "anterior" navicular, "inferior" calcaneus, and the "medial" spring ligament [8]. Despite the ball and socket type, the talocalcaneonavicular joint differs from other joints of the same type in that it has sliding motions and the movable end is the socket, not the ball. On the other hand, the posterior joint is formed between the lower posterior facet on the body of the talus and the upper posterior facet of the calcaneus [9,10]. This is a plane synovial joint allowing gliding movements. However, the main movements allowed through the subtalar joints are inversion and eversion of the foot [10].

The talus is also unique in that it is not attached to any muscle tendons. Instead, it has many ligaments attached to it and surrounding it to keep it in place and prevent it from dislodging. These ligaments include the lateral and medial ligaments of the ankle joint, as well as the ligaments of the foot that maintain their arches. The lateral ligament of ankle includes three ligaments or bands. They are the anterior and posterior talofibular ligaments that surround another ligament running on the talus from the fibula to the calcaneus called the calcaneofibular ligament. On the other hand, the medial ligament of the ankle, also termed deltoid ligament, consists of many bands that originate from the medial malleolus and reach the talus and extend below it to reach the navicular bone, spring ligament and calcaneus. The spring ligament, also called plantar calcaneonavicular ligament, is one of the most important of these ligaments in maintaining the medial longitudinal arch of the foot and helping to stabilize the ankle by supporting its head. It is a very strong ligament that extends from the sustentaculum tali of calcaneus to the lower aspect of the navicular [11,12]. It is supported inferiorly by the tendon of tibialis posterior muscle (Figure 2).

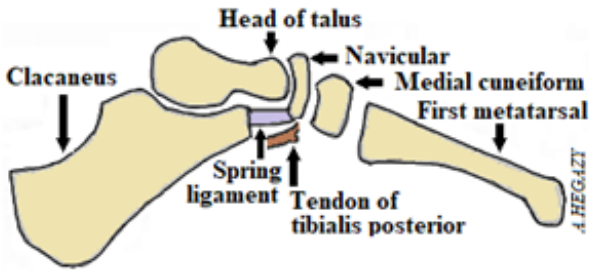

Figure 2) *A diagram showing spring ligament.*

The talus also has relatively poor blood supply [13]. In this respect, it differs from most bones, which have highly vascular tissue [14]. Furthermore, the blood vessels that provide the main blood supply to the talus are incorporated into the sinus tali [15]. Blood supply originates from three blood vessels of lower limb: the anterior tibial artery through branches of its continuation called dorsalis pedis artery, perforating branches of peroneal artery and branches from posterior tibial artery [16].

The blood supply to the talus is mainly extraosseous due to the extensive coverage of its surface by articular cartilage. This makes the bone vulnerable to disruption of the blood supply in fractures [16]. The surface of the talus is covered with articular cartilage over large parts of its surface. This can affect blood flow to the bone, which reaches through the non-articular surfaces. The lack of muscular attachment to the periosteum is another factor in the lack of good blood supply to the talus [13]. Therefore, fracture of the ankle neck with displacement can lead to impaired blood flow to the bone with delayed or non-healing repair and may lead to osteonecrosis.

Although relatively rare, fracture of talus bone can have severe consequences of impairment of blood flow to already poorly vascularized bone, and even lead to its necrosis of neglected or misdiagnosed [17,18]. Therefore, it is essential that doctors are aware of its normal anatomy to visualize any changes before complications occur.

Congenital talus deformities appear in children that lead to abnormal feet. Such abnormalities include congenital vertical talus that is associated with foot having abnormal rocker-bottom appearance. Neglecting this condition can disable the foot, with pain and functional limitations [19]. Furthermore, defects of talus are noticed in all cases of clubfoot (Figure 3) [20]. It has been suggested that surgical resection of the talus can be a single salvage procedure in cases of clubfoot if other conservative methods have failed [21].

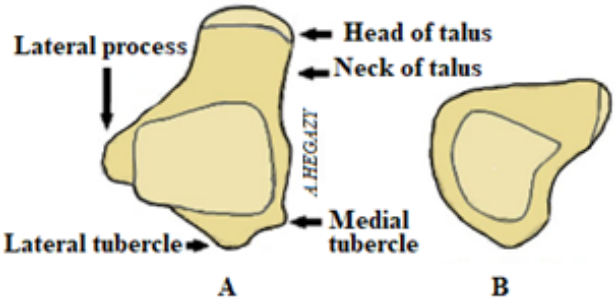

Figure 3) *Diagrams showing talus bone in normal (A) and clubfoot (B).*

It is concluded that the talus is a very important bone in the movement and functional dynamism of the foot. It has complex and unique anatomy that must be taken into account by clinicians to properly diagnose and manage disorders involving the talus. Future studies are recommended to further explore its anatomy in light of new diagnostic methods and modern imaging facilities.

Acknowledgment: All figures are original.

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