Research Article

Size, shape, and prominence of vascular foramina in dry calcaneal bone and its clinical implications

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ABSTRACT

Introduction: Among the tarsal bone of hindfoot, calcaneus is the largest one and hence the name calcaneum. Calcaneus, the tarsal bone, is roughly box-shaped bone. Calcaneus sit below the talus, in its anterior aspect, it is inclined cranially. Posteriorly, the bone projects, so it forms the core of the heel. Clinically, the calcaneus articulates with the talus superiorly and anteriorly it articulates with the cuboid and the talonavicular joint shares the joint space with it, hence, the name talocalcaneonavicular joint. **Materials and Methods:** The study was carried out using 20 calcaneal bones (10 right and 10 left) collected from the Department of Anatomy, Saveetha Dental College, Chennai. The bones were macroscopically studied for vascular foramina with respect to its location, number, size, and shape using Vernier caliper. The data collected were categorized, tabulated, and statistically analyzed. **Results:** The experiment was done from the 20 calcaneal bone (10 right and 10 left) collected from the department of anatomy; it is observed that based on size among 100%. About 31% were found as large foramina and 23% were medium in size and 26% small in size. Based on the shape, it is observed that 46% foramina were round in shape, 39% were oval in shape, and 15% were double in shape. **Conclusion:** Vascular foramina were observed that on the posterior, anterior, inferior, superior, lateral, and medial surfaces of the calcaneus. It had been observed that the maximum number of the vascular foramina is present in the lateral and medial surface of the calcaneal bone and the anterior, superior surface. The minimum number of vascular foramina is seen in the posterior surface of both the sides.

KEY WORDS: Calcaneal bone, Morphometry, Shape, Size, Vascular foramina

INTRODUCTION

Among the tarsal bone of hindfoot, calcaneus is the largest one and hence the name calcaneum. Calcaneus, the tarsal bone, is roughly box-shaped bone. Calcaneus sit below the talus, in its anterior aspect, it is inclined cranially.[1] Posteriorly, the bone projects, so it forms the core of the heel. Clinically, the calcaneus articulates with the talus superiorly and anteriorly it articulates with the cuboid, and the talonavicular joint shares the joint space with it, hence, the name talocalcaneonavicular joint.[2] The tarsal bone calcaneus transmits most of the body weight form the lower limb to the ground.[3] Fracture in the calcaneal bone has been recognized as a way of significant disorder and it had been recognized as one of the most critical articular fractures to treat.[4]

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Historically, there is a strong discussion on the best way for the treatment of these kinds of fractures.[5]

The tarsal bone calcaneus is mainly supplied by the medial calcaneal and lateral calcaneal arteries branch of the posterior tibial artery. Of which, only 10% of blood supply to calcaneus bone is from sinus tarsi artery.[6,7] Calcaneus fractures contribute for only 2% of all fractures; however, they contribute nearly 60% of fractures in the mid-foot bones.[8] Mainly, the calcaneal bone fractures are found in 80–90% of middle-aged male industrial workers out of that 60%.[9]

Many authors have noted that the fractures in the calcaneal bone can be actually severe. Treatment mainly involves surgery made to reframe the normal anatomy of the calcaneal bone and its mobility.[10] However, apart from the appropriate treatment, some fractures will cause long-term complications, mainly such as pain, swelling, loss of motion, and the arthritis.[11] The rebuilding to these kinds of

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fractures can take approximately 9 months to several years, which enforces a great economic burden on society.[12] The big or small foramina present on bones for the passage of blood vessels is called as a nutrient foramina otherwise vascular foramina.

MATERIALS AND METHODS

The study was carried out using 20 calcaneal bones (10 right and 10 left) collected from the Department of Anatomy, Saveetha Dental College, Chennai. The bones were macroscopically studied for vascular foramina with respect to its location, number, size, and shape using Vernier caliper. The data collected were categorized, tabulated, and statistically analyzed.

RESULTS

Vascular foramen was observed that on the posterior, anterior, inferior, superior, lateral, and medial surfaces of the calcaneus. The whole number and percentage distribution of the vascular foramina are observed. It had been observed that the maximum numbers of the vascular foramina are present in the lateral and medial surface of the calcaneal bone and the anterior, superior surface. The minimum number of vascular foramina is seen in the posterior surface of both the sides.

The experiment was done from the 20 calcaneal bone (10 right and 10 left) collected from the department; it is observed that based on size among 100%. About 31% were found as large foramina and 23% were medium in size and 26% small in size. Based on the shape, it is observed that 46% foramina were round in shape, 39% were oval in shape, and 15% were double in shape. The various observations of calcaneal measurements are shown in Figure 1-3.

DISCUSSION

The tarsal calcaneus bone forms a part of medial and lateral longitudinal arch. The flexor retinaculum, plantar aponeurosis, and medial root of the inferior extensor retinaculum are attached to the calcaneal sulcus. Both short plantar ligament and long plantar ligament are the main ligamentous support of the longitudinal arch of the foot. Hence, calcaneus plays an integral role in the hindfoot motion and gait.[13,14] The integrity of calcaneal anatomic morphology is of important clinical value to maintain normal function of the hindfoot and supporting modality of the arch and to ensure stress conduction for weight-bearing.

To assess the reduction for calcaneal fractures, comparing pre-operative and post-operative radiographs were a common method. The calcaneal

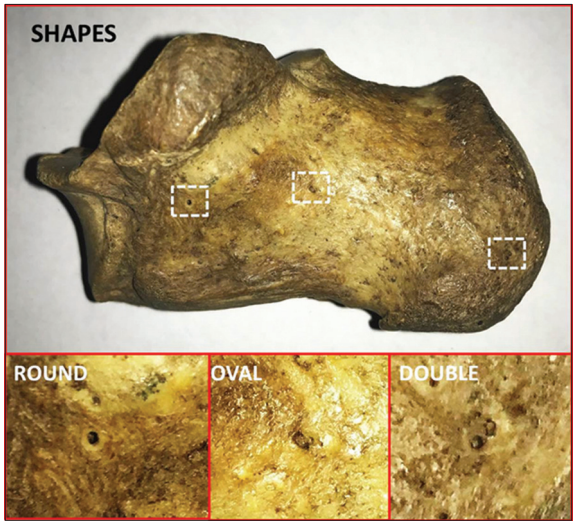

Figure 1: The various shapes observed in calcaneal bone

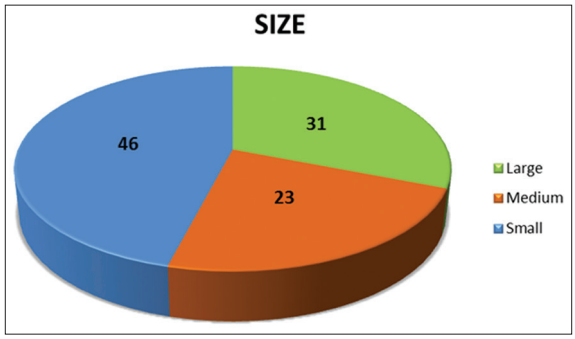

Figure 2: The categorization of calcaneal bone based on morphometric measurements

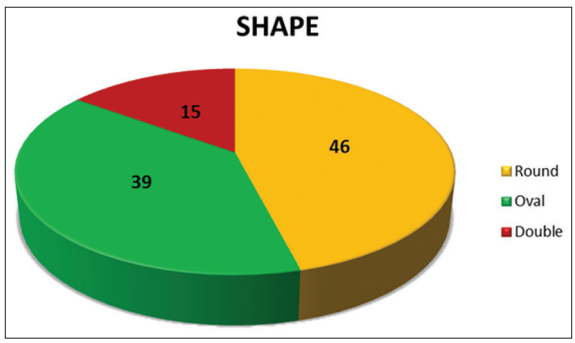

Figure 3: The number of various shapes of calcaneal bone

morphological parameters included relevant angles, distances, and areas.[15,16] To correct deformations of the calcaneus, spare the soft tissue, and lower the complication rate, indirect and less invasive reduction and fixation techniques to treat calcaneal fractures have been developed.[17,18]

CONCLUSION

This study confirms that the function of the calcaneus and subtalar joint can be restored by percutaneous reduction and fixation in patients with a displaced intra-articular calcaneal fracture.[19,20]

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