Research Article

Morphological and morphometrical analysis of fibula in relation to fibular facet

P. Santhanam, Karthik Ganesh Mohanraj*

ABSTRACT

Introduction: The fibula bone is also known as the calf bone, which was introduced into anatomical nomenclature by Vesalius during the 16th century. Fibula is a slender lateral bone of the leg, the fibula is identified by a proximal head, with a twisted shaft and a distal lateral malleolus. The lower ends of the bone fibula and tibia form an anatomic and functional unit. In view of the widespread clinical relevance, the purpose of this study was to investigate the morphology and morphometric analysis of the human fibula bone in relation to fibular incisura within South Indian population group. **Materials and Methods:** In the present study, a total of 30 dry human fibula bones of unknown sex and without any gross abnormality will be collected from the Department of Anatomy, Saveetha Dental College, Chennai, for evaluation. With the help of Vernier caliper and ruler, the measurements such as the length, breadth, and diameter of the orbital cavity will be measured. The maximum orbital length and the maximal orbital breadth are measured to calculate the orbital index. The results obtained were analyzed, tabulated, and represented graphically. **Results:** After analyzing the data we come to know that diameter from upper and lower articulating facet seems to lie between 2 cm and 2.5 cm and height of lateral malleolus tend to be between 2.5 cm and 3 cm in the analyzed dry bone. About 50% of the bone sample contains nutrient foramen at inferior one-third, 40% contain at superior one-third, and only 10% contain nutrient foramen at the middle one-third. **Conclusion:** Because this study documented several locations of the nutrient foramen within the fibular shaft, along with the diameter of superior articulating facet, diameter of inferior articulating facet, and height of lateral malleolus it may lead to the development of a simple classification scheme providing appropriate sites for the harvesting of grafts.

KEY WORDS: Bone, Fibula, Insura, Morphology, Osteometry

INTRODUCTION

The fibula bone is also known as the calf bone, which was introduced into anatomical nomenclature by Vesalius during the 16th century.[1-3] Fibula is a slender lateral bone of the leg, the fibula is identified by a proximal head, with a twisted shaft and a distal lateral malleolus.[4,5] The lower ends of the bone fibula and tibia form an anatomic and functional unit. The distal tibiofibular joint takes on a shape in between the medial convex surface on the distal end of the fibula and the lateral concave surface of the fibular incisura of the tibia. This joint is a syndesmosis type of the fibrous joint. The syndesmosis type of joint is a true joint, with articular cartilage which covers the lateral aspect of the tibia and the medial aspect of the distal fibula and also known as the fibular incisura. The ligaments of the syndesmosis type of joint keep the fibula closely approximated in the fibular notch, and thus form an articulation.[6-9] The lateral surface of the distal tibia is the triangular fibular notch: its posterior and anterior edges, which are called the posterior and anterior tubercles, which project and converge proximally to the interosseous border. The floor of the fibular notch is roughened proximally by a substantial interosseous ligament, but it is smooth distally. The fibular incisura of the tibia is called the incisura notch, peroneal groove of the tibia, fibular notch of the tibia, or syndesmotic notch.[10,11]

The growing popularity of the advent of microvascular surgery and fibula flap transfer has specified the fibula flap as the workhorse flap in mandibular reconstruction.[12,13] Because the fibula group of bone is considered to present with fewer complications such as nutrient foramen and articulating facets at the

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respective donor and recipient sites than any other bone group and the distant location of the fibula from the head allows for a concurrent two-team approach, the fibula bone is widely used in orthopedic, plastic surgery, and cosmetic surgeries.[14,15]

One of the major anthropometric components in the nutritional assessment of an individual is height, newly developed linear regression models have incorporated the fibula length as a measure of stature in convalescent homes and hospitals. Fibula bone is mostly affected by osteoporotic fractures in old age.[16] The inconsistency in lengths of the leg is especially important in the management of cases (patients) presenting with a deficiency of the fibula, because the absence of the fibula bone is often accompanied by other leg malformations.[17]

The vascular supply to long bones, especially the fibula bone, is a central factor in ensuring the success of orthopedic procedures, plastic surgeries, and cosmetic surgeries.[18] Despite the classical description of the situation of nutrient foramina, it appears to be much variable regarding their location from the recent studies. Location of nutrient foramen appears to be at different levels when compared with the left and right leg bone in a single individual.[15] Because there are much uncertainty and irregularities in the exact location of the nutrient foramina within the relative fibular surfaces, an understanding of the regional distribution of nutrient foramina is necessary to avoid injury to such regions during surgery to stimulate healing of the fracture.[19,20]

In spite of lack of a weight-bearing function and the non-participation in the knee joint, the fibula bone plays a pivotal role in the tibiofibular syndesmosis for the stabilization of the talocrural joint. Pre- and post-operative evaluation of fracture in talocrural joint patterns is dependent on the distal fibular anatomy. Tibia is the stronger and larger of the two bones in the leg present on the medial aspect to the fibula.[21,22] Thus, in view of the widespread clinical relevance, the purpose of this study was to investigate the morphology and morphometric analysis of the human fibula bone in relation to fibular incisura within South Indian population group.

MATERIALS AND METHODS

In the present study, a total of 30 dry human fibula bones of unknown sex and without any gross abnormality were collected from the Department of Anatomy, Saveetha Dental College, Chennai, Tamil Nadu, India, for evaluation. With the help of Vernier caliper and ruler, the measurements such as the length, breadth, and diameter were measured. The maximum length of superior articulating facet, inferior articulating facet, and the maximal breadth of superior articulating facet, inferior articulating facet is measured. Parameters such as diameter of superior articulating facet, diameter of inferior articulating facet, height of lateral malleolus, and location of nutrient foramen were taken into study. The results obtained were analyzed, tabulated, and represented graphically.

RESULTS

The morphological aspects of fibula showing its

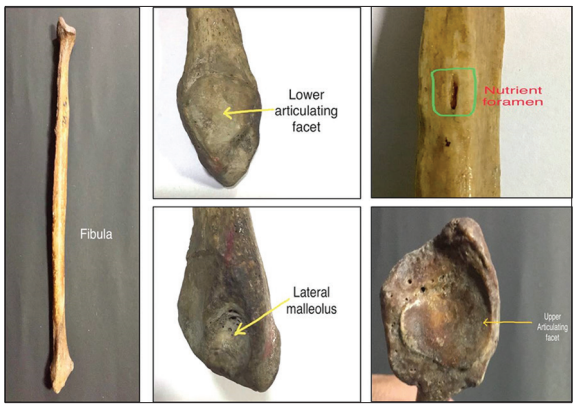

Figure 1: Morphological aspects of fibula showing inferior and superior articulating facet, lateral malleolus, and nutrient foramen in the shaft

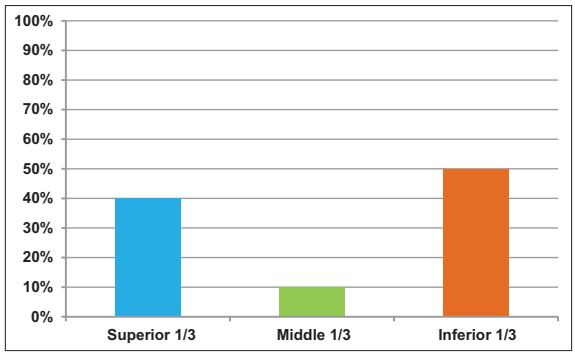

Figure 2: Location of nutrient foramina in the superior, middle, and inferior one-third of shaft of fibula

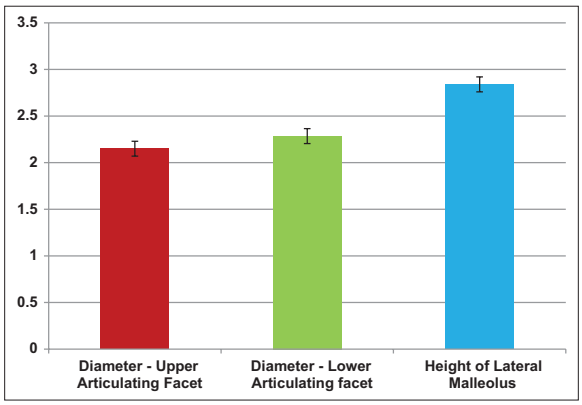

Figure 3: Morphometric analysis of diameter of the upper and lower articulating facet of fibula and height of lateral malleolus of the fibula

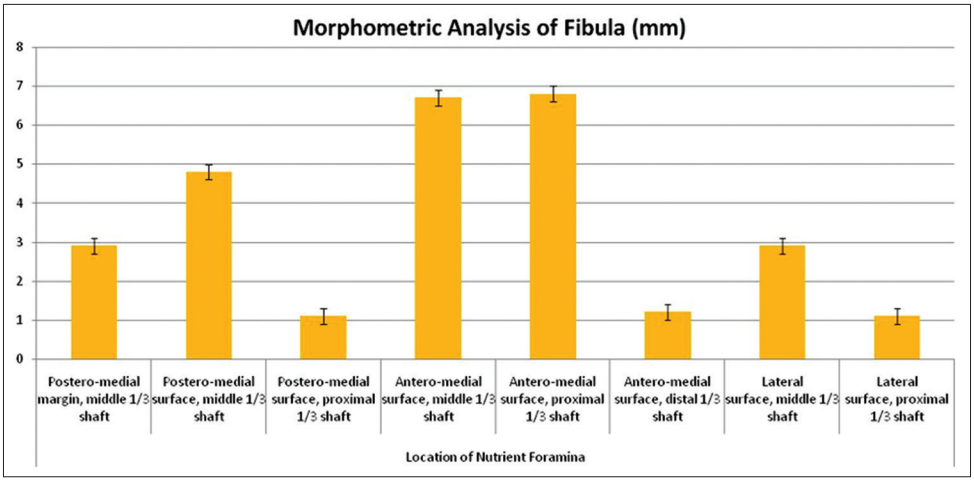

Figure 4: Location of nutrient foramina in different regions of the shaft of fibula

inferior and superior articulating facet, lateral malleolus, and nutrient foramen in the shaft are depicted in Figure 1. After analyzing the data, the diameter from superior articulating facet seems to lie between 2 cm and 2.5 cm, diameter of inferior articulating facet also seems to lie between 2 cm and 2.5 cm, height of lateral malleolus tend to be between 2.5 cm and 3 cm in the analyzed dry bone. Around 50% of the bone sample contains nutrient foramen at inferior one-third, 40% contain at superior one-third, and only 10% contain nutrient foramen at middle one-third [Figure 2]. In fact, three bones which were analyzed contain nutrient foramen at posteromedial margin, middle one-third of the shaft. One bone sample contains nutrient foramen at posteromedial surface, proximal one-third of the shaft. Five bone samples contain nutrient foramen at posteromedial surface, middle one-third of the shaft. Seven bone samples have nutrient foramen at anteromedial surface, middle one-third of the shaft. Seven bone samples contain nutrient foramen at anteromedial surface, proximal one-third of the shaft. One bone samples have nutrient foramen at anteromedial surface, distal one-third of the shaft. Three bone samples have nutrient foramen on the lateral surface, middle one-third of the shaft. One bone samples have nutrient foramen on the lateral surface, proximal one-third of the shaft [Figures 3 and 4].

DISCUSSION

Apart from morphometric consistency and shape shift ability, the fibula appears to be superior to any other bone groups. It allows for a reduction in operative time. Because fibula is considered to provide an osseous platform for the prosthetic restoration of an individual, morphological and osteometric data pertaining to the fibula may prove pivotal for reconstruction following disarticulation and fracture.[23]

As far as the number of nutrient foramen is concerned, the long bones typically bear one or two nutrient foramina. The presence and location of nutrient foramina are most important for the vascularization of the fibular shaft as the survival of osteophytes in pathological cases is dependent on a sufficient nutrient blood flow. Because this study documented several locations of the nutrient foramen within the fibular shaft, along with the diameter of superior articulating facet, diameter of inferior articulating facet, and height of lateral malleolus it may lead to the development of a simple classification scheme providing appropriate sites for the harvesting of grafts.

CONCLUSION

The standard fibular osteometry investigated in this study is novel and unique as previous studies have only reported on the fibular length. As the osseous platform of preference, the fibular osteometry and morphology may assist in the determination of height and other nutritional parameters. In addition, the osteometry of the talar facet may lead to advances in the operative management and design of prosthetics regarding the talocrural joint. The consideration of specific South African demographic factors may represent a potential platform for the introduction of standard norms and fibular models.

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