Original Article

Morphological and Morphometrical Study of Dry Fibula at Medical college of Western Nepal

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ABSTRACT

Background: The fibula bone that lies lateral to the tibia is important for talocrural joint stabilization. The morphology and morphometry of fibula are important in the design and preparation of fibula flap transfer in mandibular reconstruction. The nutrient foramina location is important for fibular shaft vascularization. Hence, the present study aims to investigate the morphology and morphometry of fibula bone in the Nepalese population.

Methods: This study was done on 50 dry fibulas in the Anatomy Department, Manipal College of Medical Sciences, Nepal. With the help of a thread, measuring scale, and vernier caliper the maximum length of fibula, length, and breadth of superior and inferior articulating facets were measured for right and left fibula. The nutrient foramina location on the fibula of both sides was noted. Data collection was analyzed by Microsoft Excel Software 2007 version and reported as mean ± SD.

Results: The mean length of right fibula was 33.21±1.42 cm and left fibula was 33.06±1.52 cm. The mean length and breadth of superior and inferior articulating facet was found to be between 1.25 cm to 1.75 cm for the right and left fibula. In middle 1/3rd of the fibula, 77% of nutrient foramina were located, 12.5% were located in upper 1/3rd and 10.41% were located in lower 1/3rd of the fibula. The posterior surface of fibula shows the majority of the nutrient foramina.

Conclusion: The Fibula morphology and morphometry is of clinical importance because it will be helpful to surgeons during bone repair, bone grafting, and microvascular bone surgery in Nepalese population.

Keywords: Fibula; Morphology; Morphometry; Nutrient foramina; Location

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INTRODUCTION

Vesalius introduced fibula into the anatomical nomenclature during the 16th century.[1] The fibula also known as the calf bone is a slender long bone and located lateral to the tibia. The fibula can be recognised by its head placed proximally, twisted shaft and lateral malleolus placed distally.[2] The upper end or head is expanded and presents an oval facet which articulates with lateral tibial condyle and styloid process for the attachments of ligaments. The neck of fibula is a constriction connecting the head with the shaft. The shaft of fibula presents three borders and three surfaces. The fibula lower end is expanded antero-posteriorly to form the lateral malleous.[3] Functionality the fibula is considered as lack of a weight bearing and doesn't take part in the knee joint, but it plays an important role for the talocrural joint stabilization.[4] Pre- and postoperative evaluations of talocrural fracture patterns are dependent on the distal fibular anatomy.[5] The morphology and morphometry of fibula is an important parameter in the design of microvascular surgery and preparation of fibula flap transfer in mandibular reconstruction. Inappropriate design and transfer could affect outcome of the surgery with reported complications.[6] Normally long bones have one or two nutrient foramina. The nutrient foramina location is especially important for the fibular shaft vascularization as the survival of osteophytes in pathological cases is dependent on an ample nutrient blood flow.[7] The fibula bone is considered to have fewer complications than any other bone such as nutrient foramina and articulating facets at the respective donor and recipient sites. Hence, fibula bone is widely used in orthopedic, plastic surgery, and cosmetic surgeries.[8]

There have been very few studies on the morphology and morphometry of fibula in the Nepalese population. Thus, we aimed to investigate the morphology and morphometry of fibula bone in Nepalese population.

MATERIALS AND METHODS

The cross sectional study was done on the availability of 50 adult fibula bones of both limbs (25 right and 25 left) in the Anatomy Department, Manipal College of Medical Sciences, Pokhara, from January 2020 to May 2021. Normal dry fibula used in this study was taken from the Osteology Department. The fibula belongs from Nepalese cadavers with unknown sex and race aged between 30 to 60 years. Fracture fibula and tumours like abnormalities and deformities of fibula was not taken for the study. Ethical clearance was taken from IRC of Manipal College of Medical Sciences, Pokhara, Nepal. With the help of measuring scale, thread and vernier caliper, the measurements (maximum length of fibula, maximum length and breadth of superior articulating facet, maximum length and breadth of inferior articulating facet) were measured for right and left fibula separately (Figure 1).

The measurements were taken thrice, and an average of the three readings was calculated. The morphology of the nutrient foramina and its location were observed with surface and zone and noted. All morphometric data were processed with MS Excel 2007 software and represented as mean ± SD. The Student's t-test was used in the assessment of side differences. P value was considered as statistically significant <0.05.

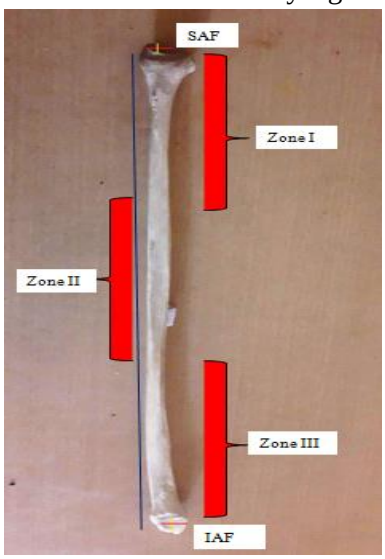

Figure 1: Different zones in fibula bone and measurement of maximum length of fibula (indicated by blue line) length and breadth of superior articulating facet (SAF) and inferior

articulating facet (IAF) indicated by red and yellow line respectively.

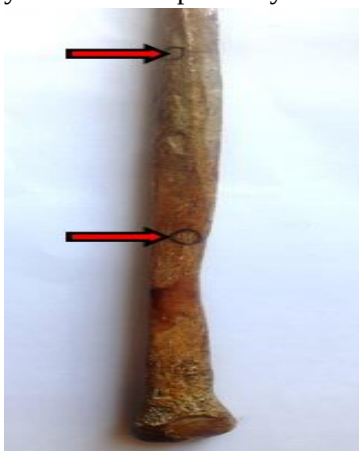

Figure 2:Two nutrient foramina (red arrow) in left fibula bone.

RESULTS

The following observations were found in the present study. The mean and standard deviation (SD) of various parameters of both sides fibula is shown in table 1. Nutrient foramen was not seen in 6 fibulas (3 of right side and 3 of left side). However, 3 fibula of right side showed double nutrient foramina and 1 fibula of left side showed double nutrient foramina (Figure 2). The maximum nutrient foramina were observed in zone II (middle 1/3rd) of both right and left fibula. The position and numbers of nutrient foramina in different zones for right and left fibula is shown in table 2. The majority of nutrient foramina were present in posterior surface of both right and left fibula. Nutrient foramina in 93.75% cases were directed away from growing end (proximal epiphysis), while nutrient foramina in 6.25% cases were directed towards the growing end. The nutrient foramina numbers in different surfaces of both sides fibula is shown in table 3 (Figure 3).

Table 1: Different parameters of right and left fibula in centimeter (cm).

S.N	Parameters	Right side	Left side	p-value
		Mean ± SD	Mean ± SD	
1	Maximum length of fibula	33.21±1.42	33.06±1.52	0.38
2	Length of superior articulating oval facet	1.46±0.23	1.45±0.24	0.41
3	Breadth of superior articulating oval facet	1.52±0.13	1.53±0.14	0.10
4	Length of inferior articulating triangular facet	1.75±0.24	1.69±0.14	0.11
5	Breadth of inferior articulating triangular facet	1.36±0.15	1.34±0.10	0.33

P value <0.05 was considered as statistically significant.

Table 2: Position and numbers of nutrient foramina of right and left fibula.

Position of nutrient foramen	Number of foramen in right fibula	Number of foramen in left fibula	Total number of foramen
Zone I	3	3	6
Zone II	19	18	37
Zone III	3	2	5
Total	25	23	48

Table 3: Numbers of nutrient foramina in different surfaces of right and left fibula.

Parameters	Location of nutrient foramina		Total number of foramen
	Right fibula	Left fibula	
Medial surface	3	2	5
Lateral surface	6	7	13
Posterior surface	16	14	30
Total	25	23	48

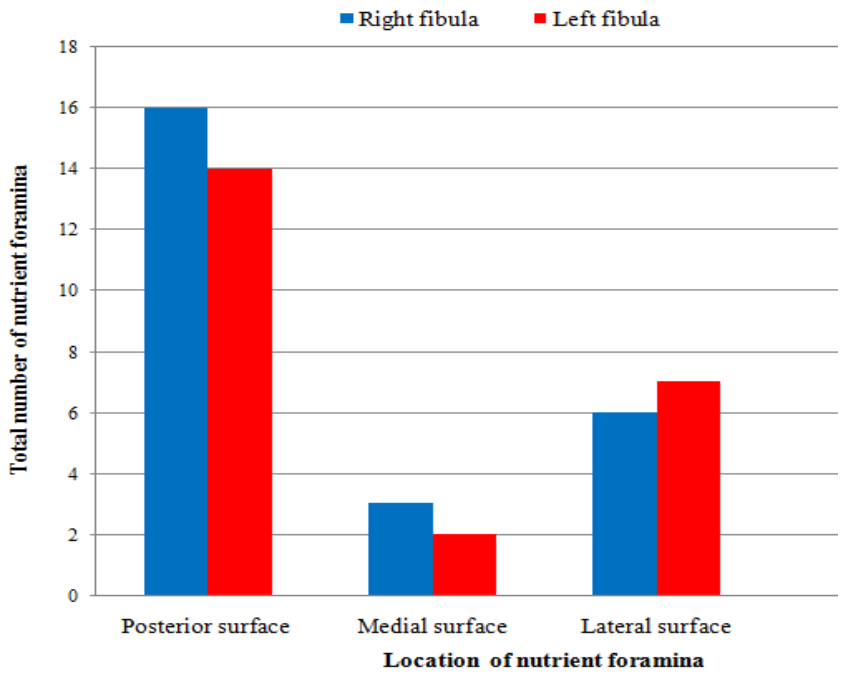

Figure 3: Location and numbers of nutrient foramina of right and left fibula.

DISCUSSION

Few fibula studies using different materials and techniques such as Plain radiographs, Computed Tomography (CT) scans and dry bones have been carried out in different countries. The present morphological and morphometric study was done on dry fibula bones of Nepalese population. Matsuura et al. stated that, beside the morphometric consistency and shape shift ability, the fibula bone appears as an important to any other bone as it allows operative time reduction.[8] According to Nguyen and Lin, for the individual prosthetic restoration, the fibula bone provides an osseous platform following disarticulation and fracture.[9]

The mean length of right fibula was 33.21±1.42 cm and left fibula was 33.06±1.52 cm in the present study. However, the results of the Jayaprakash T.[10] studies were slightly higher 35.8±2.72 cm for right fibula and 35.68±2.2 cm for left fibula than that was reported in our study. Karthik Ganesh Mohanraj in Indian population, measured the length and breadth of superior articulating facet and inferior articulating facet between 2 cm to 2.5 cm for the right and left fibula.[11] The results obtained from these populations are contrary to the data obtained from this study. These differences may be due to racial differences or different measuring technique used.

Jayaprakash T. studied nutrient foramina on fibula in South Indian population and he observed that single nutrient foramina was seen in 90% cases, double nutrient foramina was seen in 2% cases and nutrient foramina was absent in 8% cases. In 95.74% cases nutrient foramina were located away and in 4.54% cases it was located towards the growing end. Nutrient foramina in 82.7% cases were seen in the middle zone of posterior surface.[10] The data coincided with the present data. In this study, 77% cases of nutrient foramina were located in middle 1/3rd, 12.5% were located in upper 1/3rd and 10.41%were located in lower 1/3rd of the fibula. These results of the present study correlate with Gupta R et al. studies which was done in North Indian which states that nutrient foramina in 81.95% cases were located in middle 1/3rd, in 9.02% cases in upper 1/3rd and in 9.02% cases in lower 1/3rd of fibula respectively.[12]Gumusburun et al. studied 60 fibula in Turkish population and found nutrient foramina in middle 1/3rd of fibula in 92.3% cases.[13] McKee et al. in Canadian population found nutrient foramina in middle 1/3rd of fibula in 96% cases.[14] The present study shows the maximum nutrient foramina on the posterior surface and middle 1/3rd of the fibula. This was in accordance with the Shimada and Yoshimura[15] studies conducted in Japanese population and Chen et al.[16] in Chinese population

also observed nutrient foramina were maximum in the middle 1/3rd of the fibula.

This study has attempted to investigate the morphology and morphometry of dry fibula bone of Nepalese population. However, sex differentiation of fibula was not determine and is the limitation of the study. Hence, further large scale study should be done to define the morphometric parameters in broad perspective.

CONCLUSION

The morphology and morphometry of Nepalese fibula are different as compared to Chinese, Japanese, Canadian, Turkish and Indian populations. The number of nutrient foramina was variable, ranging from 0 to 2 on a single fibula. The double nutrient foramina presence was seen more in right fibula as compared to left fibula. The Fibula morphology and morphometry is of clinical importance because it will be helpful to surgeons during bone repair, bone grafting, and microvascular bone surgery in Nepalese population.

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