How to Cite:
Kumar, V., & Gajbhiye, V. M. (2022). A comparative study of neck shaft angle of femur in Madhya Pradesh. *International Journal of Health Sciences*, *6*(S2), 1–7.
https://doi.org/10.53730/ijhs.v6nS2.4983

A Comparative Study of Neck Shaft Angle of Femur in Madhya Pradesh

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***Abstract*---**Background: Prevalence of hip osteoarthritis, femoral neck fracture and other hip joint ailments are increasing day by day. Total hip arthroplasty is a commonly performed surgery now a day. There are regional and racial variations in the stature of the population of India. So there is always need of specific data for best fit prosthesis. Objective: The present study was conducted to compare the NSA disparity between femurs on both sides and to compare the NSA with the Western and Indian population sizes of different regions. This research therefore leads to Indian data on these parameters. Materials and Methods: A total of 200 (100 right and 100 left) dried femur bones were used for measuring the neck shaft angle. For comparing the right and left femora, unpaired t-test was used. Results: The total mean value and standard deviation of neck shaft angle was 126.71°±5.12°. It ranges between 113° to 136°. The mean value of right side was 126.04±4.93° and left side was measured 127.40±5.20°. There was no significant correlation between right and left neck shaft angle. Conclusion: The mean left femoral NSA was higher than the right femoral shaft in the present study, but the values were not statistically important. The angle of the neck shaft was lower than most studies in the Western population, but it was similar to most other studies in India. In the Indian population, geographical variations in the angle of the neck shaft also occur. In the field of orthopaedic surgery and implant manufacturing unit, this research will be of benefit.

***Keywords*---**arthroplasty, femur bone, femoral shaft, neck shaft angle.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
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Manuscript submitted: 27 Nov 2021, Manuscript revised: 09 Feb 2022, Accepted for publication: 18 March 2022

Introduction

The prevalence of hip osteoarthritis, femoral neck fracture and other hip joint diseases are increasing gradually. Arthroplasty is the appropriate options for the treatment of these patients. The femur is the bone of the thigh, bearing body weight, provides attachment to the muscles, and supports the movements of lower limb [1]. After achieving human erect bipedal stance, the femoral neck undergoes the most significant functional change. Many authors have investigated the angle of the neck shaft, including Hasimoto [2], Humphrey [3], Kate [4], Parson [5], Singh [6] and Siwach [7]. In the diagnosis and follow-up of femoral neck fractures, trochanteric fractures, and hip developmental abnormalities, the NSA of the femur is clinically significant. The angle between the neck and the shaft affects joint mobility because it keeps the neck and head perpendicular to the acetabulum in the neutral position.The longer the femoral neck or the greater the angle, the bending movement on the femoral neck, leads to the greater risk of femoral fracture [8].

Sex, race, environmental variables, and lifestyle all have an impact on bone morphology. According to one study, lifestyle factors have an impact on geometric values of bone strength in the proximal portion of the femur [9]. Western data is used to create commercially viable hip joint prostheses [10]. As a result, an ill-fitting hip prosthesis in total hip arthroplasty can have an impact on these functions. To develop a stronger bone plate structure, a better contour fit bone and plate is required [11]. Popular implants for surgical treatment of proximal femoral fractures are those designed for western patients, whose biomechanical and constitutional variables differ from those of Indian patients [12].

The design and proportions of the femoral portion of a full hip arthroplasty should conform to the anatomy of the femur, according to Siwach and Noble PC [7, 13]. The femoral parameters were compared to those of Western areas by Siwach et al. They claimed that the implants were overweight, and that their angles and orientations were not up to par, potentially resulting in splintering and fractures [7].

Objective

The purpose of this study was to compare the NSA discrepancy between femora on both sides, as well as the NSA with population sizes in Western and Indian regions. As a result of this research, Indian data on these parameters is available.

Materials and Methods

The present study performed on total of 200 (100 left and 100 right) dried femora without any gross deformities or damage obtained from the anatomy department of different colleges of Madhya Pradesh and the analysis was performed at RKDF Medical College Hospital & Research Center, Bhopal (M.P.). For measuring the NSA: the neck axis of femur was lined by a thread dividing the anterior aspect of the neck into upper and lower, two equal halves. After that the axis of the shaft was lined with the same thread in the vertical plane over the anterior surface of the shaft and the angle was taken by a Goniometer.

(Fig -1)

Results

The measurements were obtained and NSA calculations were tabulated. A statistical analysis was done by using SPSS (version 20.0). The unpaired t-test was used for comparison of right and left femora. For NSA, the mean value and SD of total femur was 126.71±5.12° obtained. The mean value of NSA in the right femur was 126.04° and 127.40° on the left side with a standard deviation of 4.93° and 5.20°, respectively. The NSA range lies between 113° and 136°. The side differences of both side femora were insignificant. There was no substantial difference between the right and left side of the unpaired t-test in both NSA (P>0.05) findings.

Table 1
Showing the results of parameters (n=150 femurs)

Parameter		Total (n=200)	Right side	Left side	P-value
NSA in degrees	Mean±SD	126.71±5.12°	126.04±4.93°	127.40±5.20°	P>0.05
	Range	113°-136°	113°-135°	119°-136°	

Discussion

In the present analysis, the mean and standard deviation of neck shaft angle is 126.71±5.12°. Our findings among western workers were comparable to the results of authors who studied the British population, i.e. Parsons et al (126.3°), Reikeras O et al (127.7°) for the population of Norway, and Otsianyi et al (127.56°) for Nairobi population. whereas authors Da Silva et al (122.55°) on Brazil [14],

Rubin et al (122.9°) the French population [21], and Noble (124.7°) on American population [13] reported lower values from the current study. The mean NSA of the current study was lower than most studies in the West. Authors Hoaglund et al [19] (England 136° and Chinese population 135°), Bulandra et al [22] (Poland 140.48°), Toogood PA et al [23] (American 129.2°), and Otsianyi et al [8] (Nairobi 127.56°) reported higher values from the current studies.

In the Madhya Pradesh region (Table: 2), the current research was conducted and the mean and SD of NSA 126.71°±5.12° is comparable to most other Indian studies. Whereas KC Saikia et al[15] reported an average neck shaft angle of 139.5° from the population of the north-east, Shakil M khan et al [16] reported 137.1° from the region of southern India, and Subhash Gurjar et al [17] reported 136.3° from the region of western India, higher values were all reported from the present analysis. In the Punjab area, author Kaur P et al [18] recorded a lower NSA value of 121.39° on the right side and 121° on the left side, which is comparatively less than the current analysis.

Table 2
Comparison of NSA with Indian studies (T-Total, M-male, F-female, R-right, L-left)

S. No	Authors	NSA & D	Year	Population
1	Isaac et al [24]	126.7°	1997	Vellore
2	Siwach et al[7]	123°±4.3°	2003	Rohtak
3	Saikia et all [15]	139.5°±7.5°	2008	Guwahati
4	Deshmukh et al [25]	131.5°	2010	Vidarbha
5	Ravichandran et al [12]	126.55°	2011	Chennai
6	Rawal et al [26]	124.42°±5.49°	2012	Indian
7	Kaur et al [18]	L-121°±2.44° R-121.39°±2.46°	2013	Ludhiana
8	Subhash et al[17]	T-136.3±6° L-136.6±5.45° R-136±6.68°	2013	Gujarat
9	Santanu et al [27]	R-125.12±2.22° L-124.96±1.93°	2014	Kolkata
10	Shakil et al[16]	T-137.1°, R-137.3 L-136.9°	2014	Karnataka
11	Roy et al [28]	T-130.57±3.0° M-131.0 (L-130.99±3.77°; R-130.89±3.61°) F-130.37°, (L:130.2±2.56°; R-129.93°±3.82°)	2014	Eastern Indian
12	Lakshmi et al [29]	124.95°±6.09°	2016	Rajasthan
13	Rajendran et al [30]	T-146.25° ± 4.18° R-145.46° ± 4.62° L-147.06° ± 3.54°	2020	Chennai
14	Present Study	Total-126.71°±5.12° Right -126.04°±4.93° Left- 127.40°±5.20°	2022	Madhya Pradesh

Conclusion

In this study, the left femora's mean neck shaft angle was higher than the right femora's, although the differences were not statistically significant. Although the NSA was smaller than most Western studies, it was comparable to most Indian research. In a few Indian investigations, the NSA was comparable to our findings. There are also NSA disparities in the Indian population by area. Hip prosthesis based on Western data are mismatched in Indians. The best-fitting prosthesis for the Indian population can be created using published proximal femur data. This research will be beneficial to orthopaedic surgery and the implant production unit.

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