



Assessment of Femoral Neck-shaft Angle on Plain X-rays and its Clinical Implications

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Femoral neck-shaft angle is an important parameter for evaluating the biomechanics of the hip joint. It plays a pivotal role in surgeries for developmental dysplasia of the hip, neuromuscular disorders of the lower limb, proximal femoral fractures, Total Hip Arthroplasty, Perthes disease etc., It is also considered to hold an extensive bearing while designing orthopaedic implants.

Aim: This study aimed to evaluate the femoral neck-shaft angle of proximal femur on plain radiographs of our local population

Study Design: Retrospective study

Methods: This cross-sectional study was done at Saveetha medical college hospital, a tertiary care institute in Chennai. 50 pelvic X-rays of patients aged between 30 to 70 who presented to the outpatient or emergency care department were used in the study. Using a goniometer the femoral neck shaft angle was measured in the plain X - ray.

Results: The mean age of the population in our study was 47.12. And the mean femoral neck shaft was 132.6 in males and 124.9 in females.

Keywords: Neck shaft angle; femoral neck; orthopaedic implants; radiology; biomechanics of hip; neck shaft angle in indian population; THR implants for Indian population.

1. INTRODUCTION

The femoral neck-shaft angle (FNSA) is one of the most frequently applied anatomical measurement for the evaluation of hip biomechanics [1]. During mobility; this angle is essential for the femoral shaft to swing clear further from the pelvis [2]. Also; the neck shaft angle differs and it tends to be smaller in females because of broad pelvis leading to a greater inclination of the femoral shaft. It is usually set at 125°; but it can range from 120° in females to 140° in males. When it is less than 120°; it is known as coxa vara; and when greater than 140°; it is coxa valga [3]

This angle plays a pivotal role in the diagnostic and restorative planning of patients with various hip and femur pathologies including developmental dysplasia of the hip; neuromuscular disorders of the lower limb; proximal femoral fractures; total Hip arthroplasty; Perthes disease etc. [4]. Moreover; these angle values have an extensive bearing on designing orthopaedic implants; devising hip osteotomies and designing and positioning femoral stem in total hip replacement [5].

This study is aimed at evaluating the femoral neck-shaft angle of proximal femur on plain radiographs which would provide anthropological and biomechanical data beneficial for designing implants and other orthopaedical equipment.

2. MATERIALS AND METHODS

This cross-sectional study was done at Saveetha medical college hospital; a tertiary care institute in Chennai. 50 pelvic X-rays of patients aged between 30 to 70 who presented to the outpatient or emergency care department were used in the study. The inclusion criteria were adults; whose X-Ray film indicated the absence of both hip and femur pathology. Cases like Slipped upper femoral epiphysis; dislocations; Perthes disease; Osteoarthritis and fractures were the exclusion criteria.

The study protocol was clearly explained to the patients and those who signed the consent form and met the inclusion criteria were taken up for the study. Their name; age; height and weight were noted. Then with the help of a goniometer the femoral neck shaft angle was measured in

the plain X - ray. It is the angle subtended by the intersection of the mid-diaphyseal line of shaft and the neck of femur mid axial line. The data was written in a proforma which contained columns for age; sex; right and left neck shaft angle. The mean of neck shaft angle were calculated separately for both males and females. Inter observer variation in minimized by measuring the SA by two surgeons & the mean value is used in the study.

3. RESULTS

In this current study; we examined the x-rays of 50 patients consisting of both males and females. The mean age of the male and female population was 48.7 years and 44.75 years respectively. The mean age of the overall study population was 47.12 years (30 to 70 years) as shown in the Table 1.

The mean neck-shaft angle of males was 132.6 degrees (range = 128 to 139 degrees) and that of females was 124.9 degrees (range = 117 to 130 degrees). The mean neck-shaft angle for the total population as presented in the Table 2 & Fig. 1 was 129.5.

Table 1. Mean distribution of age

Gender	Number	Mean age
Male	30	48.7
Female	20	44.75
Total	50	47.12

Table 2. Mean neck-shaft angle distribution

Gender	Mean NSA	Maximum	Minimum
Male	132.6	139	128
Female	124.9	130	117
Total	129.5	139	117

4. DISCUSSION

Femoral neck-shaft angle measurement is very significant as it has a greater importance in diagnosing numerous disease conditions like Paget's disease; femoral fracture; etc.; [5]. This is the foremost reason why it is of high clinical relevance to surgeons. Assessment of neck-shaft angle in our community gives an insight into several related disease conditions and also contributes in the manufacturing of several orthopaedic implants specific for our

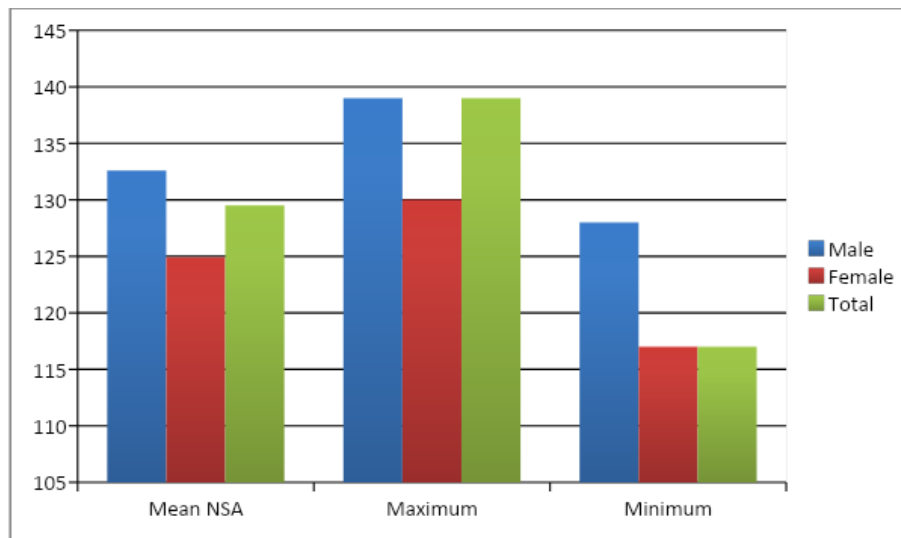


Fig. 1. Depicting the NSA between males and females

population [5]. Various methods for measurement such as MRI; CT; dry bone measurements; etc can be used but among them radiology is the most preferred because of its easy availability and practicality. Thus it is a potent tool to measure the femoral neck-shaft angle.

In our study when we measured the neck-shaft angle of our population; the mean neck-shaft angle in males turned out to be 132.6 and in females; it was 124.9. The results seemed nearly indistinguishable compared to other studies. Like in the study of Too good et al; the mean NSA was measured to be 129 degrees [6]. The mean neck-shaft angle by Hoaglund and Low was also 129 degrees [7]. Only amongst the westerners and mongoloids maximum neck shaft variation is noticed. In Vipin Sharma and Krishna Kumar et al; a study on evaluation of sub-Himalayan population of North West India was done [5] and NSA was noted to be 127.45 ± 2.50 .

Moreover in our study; we also noted that the NSA is lesser in females compared to males. In a study by chuick et al; it was also recognized that the NSA of females was lesser than that of males [8]. The slight dissimilarities of NSA seen around the globe is influenced due to many factors like gender; race; ethnicity; lifestyle changes; side as well as the method of assessment [9]. In the early diagnosis and treatment of several orthopaedic conditions like epiphysiolysis capitis femoris; arthritis of hip; etc.; the femoral neck shaft angle has been extremely helpful in designing orthopaedic implants in the recent years. But only continuous studies in this field will

lead to innovative and modernized manufacture of implants.

5. CONCLUSION

Our study conducted in tertiary care hospital gives a proposition about the femur neck shaft angle among our community people. It was also recognised that the inter observer variation appeared to be negligible. We hereby highlight the importance of taking into consideration the neck shaft angles in orthopaedic surgery which might be of substantial significance in designing implants that might bestow surgeons with more angle possibilities; revamping the patient's overall prognosis [4] and longevity of implants along with less difficulty in fixing fracture of proximal femur.

CONSENT & ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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