MORPHOMETRIC STUDY OF FEMORAL NECK SHAFT ANGLE AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Background: Exact knowledge of femoral neck – shaft angle (NSA) is important in recognizing, understanding and treating pathology conditions in the hip Joint. The purpose of this study is to evaluate neck shaft angle of femur correlated with number of clinical aspects.

Materials and Methods: The NSA was determined in 110 femur in the department of anatomy; NRI medical college; Guntur Dt. and in department of anatomy, KIMS Amalapuram, Andhra Pradesh, India.

Results: Out of 110 specimens; 70% shows normal angle and remaining 40% showed difference that is more (or) less than normal angle.

Conclusion: This study is very important orthopedic surgeons & also to neurology, anthropological practice.

KEY WORDS: Femur, neck axis, shaft axis, neck shaft angle (NSA).

INTRODUCTION

The femur is largest & strangest bone in human body. It consists of proximal end, shaft & distal end. The proximal end of femur has much attention. The knowledge of its anatomy is important in treatment of pathology conditions of the hip & femur.

The NSA is the angle formed by shaft axis & weak axis of the femur. The angle is also named as caput collum diaphysis (or) cervico diaphyscal angle (CCD) [1]. The neck axis is the line drawn from the centre of the femoral head to the centre of the femoral neck at the narrowest part of the neck. The shaft axis is line drawn from the middle of the femoral condyles to the middle of the greater trochantar in two planes. This corresponds to “Ideal Axis” by Billing & long axis by Norman [2,3]. Reikras O etal modified Dunlap/Rippstein method [4-6]. The accuracy of the method was within +/- 7 degrees for the anteversion angle and within -5 to +9 degrees for the head-neck-shaft angle.

Chevrot’s method was described by Chevrot [7] in 11 dissected specimens using a Philip diagnost N to obtain angulations of the central ray. This method had a precision that was significantly poorer than the Dunlap/ Rippstein

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method (p-value less than 0.01 by the F-test) 

According to Ian Gilliam et al [8], did work on NSA in humans: variation relating to climate, clothing, sex, lifestyle, age, side. According to him, the NSA of modern human between 120 to 140 degrees. The averages NSA among modern humans of 127 degrees markedly lower than the average angle 135 degrees quoted in Gray anatomy (standing 2008)[9]. 

Rickles, T; et.al [10] compared young and old adult patient’s FNS angles and determine if a statistically significant difference exists between both age groups and additional focus will be given to look at male and female groups within each age category to see if age related changes affect the two gender groups differently. 

The range of normal femoral neck ante version in adult population and to draw the relationship between the preoperative, biplane X-rays and clinical methods were carried out by Maheshwari, AV et.al. [11] 

The FNA is result of fetal development, heredity, mechanical forces, and intra uterine position [12]. 

In the normal hips, the NSA should cause the longitudinal axes of the femoral necks to cross at the point of body weight. 

The enlargement & maturation of the hip joint increase at 20th wk. of gestation and the NSA ravages from 135°-140° at birth [13]. 

The life time risk of osteoporosis related fractures in the hip, spine and wrist is considered to be 30-40% in women and 13-20% in men[14]. 

The angle increase with cerebral palsy when compared to angles of healthy children (15). 

MATERIALS AND METHODS 

A total of 110 dry femora collected from department of anatomy of NRI medical college, chinnakakani, Guntur and KMIS Amalapuram, Andhra Pradesh, India. 

The study of NSA of femur started with the following methods – (Fig. 1 and 2). 

1. Collection of 110 adult dry femora. 

2. White drawing sheets, sketch pen, pencil, scale. 

3. Goniometer 

Table 1: Showing left and right femurs NSA and their standard deviations. 

<table>
<thead>
<tr>
<th>Neck shaft angle</th>
<th>No. of samples</th>
<th>Method</th>
<th>NSA</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Left side</td>
<td>60</td>
<td>Dry bones</td>
<td>1230</td>
<td>10.8</td>
</tr>
<tr>
<td>On Right side</td>
<td>50</td>
<td>Dry bones</td>
<td>1190</td>
<td>17.15</td>
</tr>
</tbody>
</table>

Average of left & Right 121°
DISCUSSION
The angle of inclination is NSA was approximately 125 degrees. This angle is essential in the diagnosis of various pathological conditions of hip and femur including developmental dysplasia of the hip (DDH) [17, 18], cerebral palsy in children.

According to Christoph kolja boese, [19] the mNSA on rt. 163.50 and on lt. 162.20. The NSA in children and in early fetal life is 160 degrees (Humphery and Friend langer) [20].

The angle in newborn is equal to adult. The average is 126.5° & range is 106°-151° according to Kate BR [21].

If the angle of inclination is greater than 125° is termed as coxa valga or Alsberg’s angle. (Hamill; Spencer) [22,23]. If the angle is decreased termed as coxa vara.

According to Laville, [24] the angle is greater in females than males.

According to I Gilligan et.al, the NSA shows significant differences between ethnic groups, sexes & ages.

Toogood PA [25] studied NSA among dry bone using digital method among American population & observed NSA to be 129.2° which is higher than the present study which may be due to racial variations among the two different populations.

The NSA is very high in neonatal age, and then gradually it decreases during development and reaches adult values [26].

Table 2: Values in the present study are compared with foreign and Indian studies.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Author</th>
<th>Method</th>
<th>NSA</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amith R et al 2016 [27]</td>
<td>Dry bones</td>
<td>121.2</td>
<td>6.2</td>
</tr>
<tr>
<td>2</td>
<td>Christoph kolja boese et al 2016 [9]</td>
<td>Dry bones</td>
<td>163</td>
<td>0.9192</td>
</tr>
<tr>
<td>3</td>
<td>Radha Pujari 2015 [16]</td>
<td>Dry bones</td>
<td>127.5</td>
<td>5.874</td>
</tr>
<tr>
<td>4</td>
<td>P.F. Umebese 2005 [28]</td>
<td>x-ray</td>
<td>1210</td>
<td>6</td>
</tr>
</tbody>
</table>

The present study, the mean neck shaft angle of dry femur was observed on left 123°, on right side 119° and these results are correlation with Amith R (27) and P.F. Umebese (28).

CONCLUSION
The knowledge of Anatomy of proximal end of femur is very important for clinical and pathological states of hip joint and to design pros thesis for hip replacement. The clinical importance of neck shaft angle of femur lies in the diagnosis, treatment and follow up of fractures of the neck of femur, trochanteric fractures, slipped upper femoral epiphysis, development dysplasia of the hip and neuromuscular disorders of the lower extremity.

In children Genu varum is a deformity of the knee concerned with coxa valga causing bow legs and genu valgum is related with coxa vara causing knock knees and pesplanus (flat foot). The NSA is less than 140° in cerebral palsy cases. Osteoporosis and fractures of femoral neck changes NSA.

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ABBREVIATIONS
NSA - Femoral Neck Shaft Angle.

Conflicts of Interests: None

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