Amit Kumar Nayak, Kapil Malviya, Anand Mishra, Mayank Gupta and Chhandamayee Mohanty

Abstract

Introduction: Femur is the longest and strongest bone of the human body & has a very important role in mechanism of weight bearing and locomotion. The upper end has a head, which is connected to shaft by neck. The neck shaft angle is the angle between the long axis of femoral shaft & axis of the femoral neck. A detailed study on the neck-shaft angle, the femoral neck length and the relation between them is essential for clinical procedures in the hip region.

Material & Method: 90 intact dry femur without any deformity were studied. Femoral neck length was measured using a slide caliper. This angle was measured with help of goniometer. Data was charted and statistical analysis was done using SPSS version 16.0.

Result: The overall mean NL was found to be 2.93± 0.12cm (right side was 3.02±0.07cm & left side was 2.85± 0.09cm). The mean NL of the right side was more as compared to left side, the difference was not significant. The overall mean NSA was found to be 129.00° ± 1.54(right side was 129.87° ±1.42, left side was 128.13°±1.09). The NSA of right side was greater than the NSA on left side but the difference was not significant. The correlation between the NL & NSA was found to be significant.

Conclusion: There is significant positive correlation between the femur NL and NSA of the corresponding bone. This study will be helpful while performing various clinical procedures in this region.

Keywords: Femur, neck length, neck shaft angle

Introduction

Femur, the longest and strongest bone of the human body has a very important role in mechanism of weight bearing and locomotion. Femur consists of upper end, lower end and shaft. The upper end has a head, which is connected to shaft by neck. Femoral neck is approximately 5cm long [1].

Neck is narrowest in its mid part & widest laterally. Neck provides a lever for action of muscles around hip joint. The neck shaft angle (NSA) is the angle between the long axis of femoral shaft & axis of the femoral neck (figure 1). This angle ranges between 125° to 140° [2]. Elongated neck and neck-shaft angle (NSA) allows the lower limb to swing clearly away from the pelvis and increases the range of movement at the hip joint [3]. Variations in this neck-shaft angle (NSA) and femoral neck length (NL) have been widely documented in various research papers and textbooks. Normally, neck shaft angle (NSA) is widest at birth & diminishes gradually until adolescence [1]. Neck- shaft angle (NSA) is smaller in case of female [4].

The neck shaft angle is increased in congenital subluxation and dislocation of the hip, poliomyelitis, cerebral palsy and idiopathic scoliosis. The neck shaft angle is decreased in congenital coxavara, perthe’s disease, softening of the neck due to rickets and delayed formation of the diaphyseal spur [3]. Various other causative factors like metabolic diseases, osteoporosis and genetic influence have also been documented [1].

A detailed study on the neck-shaft angle (NSA), the femoral neck length (NL) and the relation between them is essential for clinical procedures in the hip region.
Material and Method
The present study was conducted in the department of Anatomy, Institute Of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India. 90 intact dry femur (45 right side femur and 45 left femur) without any deformity were collected from the department and were numbered. Age and sex were not known. Femoral neck length (NL) was measured using a slide caliper. For measuring NSA, axis of the shaft and axis of the neck were taken. The axis of the neck was obtained by a line through the midpoint of narrowest part. Axis of the shaft was obtained by a line through the narrowest part of the shaft. The NSA was the angle formed between the axis of shaft and axis of the neck. This angle was measured with help of goniometer.

Data was charted and statistical analysis was done using SPSS version 16.0

Result
Neck length
The overall mean NL was found to be 2.93± 0.12cm. The mean NL of right side was found to be 3.02±0.07cm & the mean NL of left side was found to be 2.85± 0.09cm. Although the mean NL of the right side was more as compared to left side, the difference was not significant (P value > 0.01).

Neck shaft angle
The overall mean NSA was found to be 129.00± 1.54. The mean NSA on right side was observed to be 129.87±1.42 &mean NSA on left side was found to be 128.13±1.09. Similar to NL, the NSA of right side was greater than the NSA on left side but the difference was not significant (P value > 0.01)

The correlation between the NL & NSA was found to be significant at p value 0.01.

Table 1: Depicting the mean, SD and correlation between femur neck-length and neck-shaft of the corresponding bone

<table>
<thead>
<tr>
<th></th>
<th>Mean (N=90)</th>
<th>Standard Deviation</th>
<th>r (significance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femur neck-length (NL)</td>
<td>2.93cm</td>
<td>0.12</td>
<td>0.821**</td>
</tr>
<tr>
<td>Neck-shaft angle of the corresponding bone (NSA)</td>
<td>129.00°</td>
<td>1.54</td>
<td>**Correlation is significant at the 0.01 level</td>
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</tbody>
</table>

Table 2: Depicting the mean, SD and t value for right and left femur neck length and neck-shaft angle

<table>
<thead>
<tr>
<th></th>
<th>Mean (Standard Deviation)</th>
<th>t (df = 88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck-length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right femur bone</td>
<td>3.02cm (0.07)</td>
<td>9.936</td>
</tr>
<tr>
<td>Left femur bone</td>
<td>2.85cm (0.09)</td>
<td></td>
</tr>
<tr>
<td>Neck-shaft angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right femur bone</td>
<td>129.87° (1.42)</td>
<td>6.463</td>
</tr>
<tr>
<td>Left femur bone</td>
<td>128.13° (1.09)</td>
<td></td>
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Discussion
There is abundance of studies on femoral NL& femoral NSA, but any substantial data related to eastern part of uttar-Pradesh was missing. As the NSA & NL varies from region to region & is dependent on various parameters like climate, clothing, lifestyle, sex, age & side it was necessary to have the parameters in particular region for clinical use. Our study was carried out to note the following points:
1. Observe the femoral NL of each side & to look for any significant difference between the two sides.
2. Observe the NSA of each side & to look for any significant difference between the two sides.
3. To observe any relationship between femoral NL& femoral NSA.

Neck length
The values obtained in our study were similar to that found by Rakeshadhikari et al. (2.93± 0.24cm) in Nepal. Our data was slightly higher than that observed by Smriti et al. (2.91cm r& 2.93cm left) in Jharkhand region.

Although our findings were less as compared to studies in south Indian population (3.63cm) &western Indian region (3.44cm).

Neck shaft angle
Our data was less than that observed by Shakil Mohamad Khan et al. (137.1°) in south Indian population & subashgujar (136.3°) in western Indian region, but was more than observed by Khaleel N. et al. (125.3° ± 6.5°) in south Indian population.

Conclusion
The overall mean femoral NL was 2.93± 0.12. The mean NL of right side (3.02±0.07) was higher than the mean NL of left side (2.85± 0.09). The difference was not significant (p value > 0.01).Mean NSA was found to be 129.0° ± 1.54. NSA of right side (129.87° (1.42)) was higher than that of left side (128.13° (1.09)). The difference was not significant. There is significant positive correlation between the femur NL (Mean = 2.93, SD = 0.12) and NSA of the corresponding bone. Variations between different age groups & sex couldn’t be established as age & sex of the dry bone was not known. This study will be helpful to orthopedists, radiologists & prosthetists while performing various clinical procedures in this region.

References:
3. DattaA K. Essentials OfHuman Anatomy (part – iii,


