A Study of the Collo-Diaphyseal Angle in an Adult Population in Southern Nigeria

*A.I. Udoaka¹ and C.E. Agi²

¹Department of Anatomy, College of Health Sciences, University of Port Harcourt, Port Harcourt, Nigeria
²Department of Radiology, College of Health Sciences, University of Port Harcourt, Port Harcourt, Nigeria

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The collo-diaphyseal angle which is also called the neck-shaft angle is the angle formed between the axis of the shaft of the femur and the neck. This study was aimed at finding out the variations in the different adult age groups in the Southern Nigeria population. A total of 232 anterior posterior radiographs of the pelvis showing both hip joints of normal adult males and females age ranging from 20-79 years were utilized for this study. Results showed a decline in the values of the collo-diaphyseal angles as age progresses, the least was recorded for the old age group of 70-79 years. The males in all the age groups had larger collo-diaphyseal angles though only significant at the age range of 20-29 years and 40-49 years (p<0.05). The least recorded angles was 127° for the elderly females. This study has shown a tendency towards coxa vara in the elderly population and it is imperative to emphasize the possibility of applying this finding in orthopaedic practice in relation to the risk of fracture of the neck of the femur.

Keywords: Collo-diaphyseal angle, Femur, Radiographs, Coxa Vara, Orthopaedic Practice

1. Introduction

The role of the skeleton in estimating attributes such as age, sex, race, stature etc has been studied extensively and more using radiographs. Early works on the neck-shaft angle also called the collo-diaphyseal angle like that of Pearson and Bell [1] and Singh and Bhasin [2] were carried out by direct measurement from the skeleton. More recent studies are based mostly on the use of radiographs which was first adopted by Keats and Lusted [3]. Our interest in this study stems from the fact that the femur possesses an anatomical variation which is also dependent on the age and has been found to greater in children(150 degrees) and reduces as age advances to adulthood to about 126 degrees [4]. Regional variations also exist even within the same age group. Cheng et al [5] who studied the angle in the American skeleton through x-ray discovered an average value of 125° ± 8.5. Other workers in Sao Paulo, Brazil got 128.23±2.56 as the mean value [6].

In Africa, studies by Igbigbi et al also showed regional variation. Tahir et al [8] who studied the Hausa people of North Eastern Nigeria and Singh et al [9] who worked on the people of the south eastern Nigeria all had different values of the mean collo-diaphyseal angles in the different regions of Nigeria. Odukuma et al [10] in 2004 also studied the collo-diaphyseal angle in the Southern Nigeria population and also noted differences in the mean adult values. The collo-diaphyseal angle has also been used to identify sex in several studies and males have been found to have significantly greater angles than the females [8,9,10,11,12].

There has been reported association between this angle and localised femur fractures of the neck [14]. An increase or reduction of this angle can imply a pathology. An increase is termed Coxa valga and a reduction of the collo-diaphyseal angle is termed Coxa vara. The aged population is more prone to fracture of the neck of the femur due to osteoporosis, however with an addiction of pathological collo-diaphyseal angle, the risks of the neck fracture is even greater [13,14,15].

The aim of this study therefore is to find out if there are significant differences of the collo-
diaphyseal angles of the people of the southern Nigeria in the different age groups. This is because the documented values for the region are only for a mean adult population. No study has been carried out in the different adult age groups and especially localising to the elderly to the best of our knowledge.

2. Materials and Methods

The study was carried out using 232 randomly selected radiographs of the anterior-posterior view of the pelvis showing its articulation with the proximal position of both femur bones. The radiographs were of adult southern Nigerians residing in Port-Harcourt comprising 110 males and 122 females. The age range was from 20 years to 79 years.

The radiographs were from the archives of the Radiology departments of the University of Port Harcourt, Teaching Hospital, Port Harcourt. The inclusion criteria was that only radiographs that had no visible pathologies and reported normal were accepted to the study. The neck-shaft angle (Collo-diaphyseal angle) is the angle made by the intersection of the longitudinal axis of the neck with that of the longitudinal axis of the shaft. This was measured from each radiograph with the help of a viewing box.

From Figure 1, the axis of the neck(ab) was drawn by joining the mid points of the maximum diameters of the neck(b’) and the head of the femur (a’) while the axis of the shaft of the femur was drawn by joining the midpoints of the shaft of the femur just below the lesser trochanter(c’) and at its distal end (d’). The collodiaphyseal angle was taken as the intersection of the two axes (aod).

The mean value of the left and the right collodiaphyseal angles was then taken, there was actually no significant difference between the two, this has also been documented by earlier authors [8,11].

3. Results

The age range of 20-29 in the males had the highest Collo-diaphyseal angle of 133.7° while the least of 130.3° was for the 70-79 years age group. The females however had the highest value of 131.94° in the 50-59 years age group and also had the least of 127° in the 70-79 years age group. In all the age groups, the males had greater Collo-diaphyseal angle than the females, though it was only in the age group of 20-29 years and 40-49 years that the differences were significant. The rest of the other age groups the differences were not significant (P>0.05).

4. Discussion

The collo-diaphyseal angle was studied in this research to assess the effect of old age on its values. The angle has been studied in several populations and findings have all shown mean female values to
be significantly less than that of the males, our values also corroborated such findings though only in the age groups of 20-29 and 40-49 years. For the rest of the age groups as shown in the result, the male values though greater than that the females but was not statistically significant(p>0.05).

A gradual decrease in the collo-diaphyseal angles is noted amongst the males as age advances, the highest being in the 20-29 year group and the least at the 70-79 year age group. For the females, there is not much difference in the age groups except the 70-79 age group that had significantly lower values. This goes to show that there is indeed a decrease in the value of the collo-diaphyseal angle as age advances into old age. There is therefore a tendency towards coxa vara at old age.

The mean reduction in the angle of elderly age of 70 and above was 3.4° in the males while that of the females the drop in value was 4.9°. This study in conclusion has for the first time reported a significant drop in the value of the collo-diaphyseal angle in the elderly in our population. This finding of a tendency towards coxa vara in old age may be one of the contributing factors in the incidence of increased fractures of the neck of femur in this age group.

### References


### Table 1: Mean values of the collo-diaphyseal angles of the various age groups in the study population.

<table>
<thead>
<tr>
<th>Age Range (Years)</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (°)</td>
<td>Freq.</td>
<td>SD</td>
<td>Mean (°)</td>
<td>Freq.</td>
</tr>
<tr>
<td>20-29</td>
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<td>50-59</td>
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<tr>
<td>60-69</td>
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</tr>
<tr>
<td>70-79</td>
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<td>12</td>
<td>6.48</td>
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