

## Cervico-diaphyseal angle of Femur in Southern Punjab: Radiographic Study

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### ABSTRACT

**Background:** The cervicodiaphyseal angle of femur varies in different population groups due to genetic and environmental factors and has its clinical implications.

**Aim:** To find the cervicodiaphyseal angle in male and female population of Southern Punjab.

**Study design:** Cross sectional study.

**Methodology:** Two hundred and twelve randomly selected pelvic radiographs of adult males (116) and females (96) of the age 24 to 62 years were included in the study. Cervicodiaphyseal angle was measured on each side and statistical comparisons made. Data analyzed by SPSS 22.0v.

**Results:** The mean value of cervico-diaphyseal angle was found to be  $130.3 \pm 4.9$  in the male and  $127.8 \pm 3.5$  in the female. The angle was larger in the male and significantly larger on the right side in both male and female subjects. Comparison between the two sides of the male ( $p < 0.0158$ ) and female ( $p < 0.0424$ ) subjects was found to be significantly larger on the right side. Statistical difference between overall male and female was very highly significant ( $p < 0.0001$ ).

**Conclusion:** This study provided baseline data on cervicodiaphyseal angle in adult male and female population of Southern Punjab.

**Keywords:** Cervicodiaphyseal angle, collodiaphyseal angle, neck-shaft angle of femur, total hip arthroplasty

### INTRODUCTION

The cervicodiaphyseal (CDA), collodiaphyseal or neck-shaft angle of femur has long been of anthropological and orthopedic interest and the range and pattern of its variations in normal and abnormal conditions have been studied<sup>1,2</sup>. Skeletal morphometric variations in general are pertinent to genetic and environmental factors and are therefore determinants of specific peculiarities of a population<sup>3</sup>. CDA is of paramount importance in total hip arthroplasty where an improper angulation of the implant may lead to long term discomfort for the patient and an ultimate failure of the procedure<sup>4</sup>.

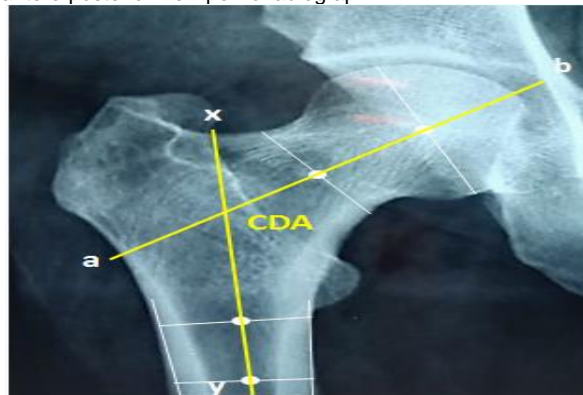
In spite of its importance there has been little interest in the study of this feature in a certain specific group of human population in our country; no published data on CDA is available from Pakistan. Therefore this study was planned to observe and present data on the normal range of CDA on the right and left sides in adult male and female population in Southern Punjab.

The objective of the study was to find the cervicodiaphyseal angle in male and female population of Southern Punjab.

### METHODOLOGY

The prospective random cross sectional population study was carried out over a period of ten months i.e., March to December 2020, at Multan Medical and Dental College (MMDC) and Teaching Hospital, Multan after obtaining approval of the Ethical Committee for Medical Research MMDC and patient consent.

Figure 1: Method of recording cervicodiaphyseal angle on an antero-posterior view pelvic radiograph



Two hundred and twelve randomly selected pelvic radiographs of adult males (116) and females (96) of the

Received on 07-03-2021

Accepted on 29-07-2021

age 24 to 62 years were included in the study. Observations were carried out on antero-posterior view radiographs clearly showing proximal end of femur of the subjects without any bone related affection or apparent deformity. The angle between longitudinal axis of the proximal shaft and neck of femur was measured. A line passing through the center of femoral head and neck defined the femoral neck axis whereas the longitudinal axis of femoral shaft was determined by a line joining two points at least three centimeters apart and bisecting the proximal shaft<sup>1</sup> (Fig.1). Measurements were independently recorded by one person and repeated by another observer. The data was tabulated; significance of comparisons was considered at 95% confidence limit.

**Statistical analysis:** Data analyzed by SPSS 22.0v. The values of cervicodiaphyseal angle in male and female subjects were presented as their means and SD. Results

were tabulated and statistical analysis and comparisons among various groups carried out. Significance was considered at 95% confidence interval having p-value <0.05.

**RESULTS**

The cervicodiaphyseal angle was larger in the male and comparatively larger on the right side in both male and female subjects. The values of CDA in male and female subjects on the right and left sides, their means and SD were presented in Table-1.

Comparison between the two sides of the male (*p* < 0.0158) and female (*p* < 0.0424) subjects was found to be significant. Statistical difference between overall male and female was very highly significant having *p*-value < 0.0001 as shown in Table-2.

Table-1: Cervicodiaphyseal Angle of Femur in Male and Female Subjects as Mean ± SD

		Maximum	Minimum	Mean±SD
Male	Right side (n = 52)	136.2	124.7	129.3± 3.4
	Left side (n = 64)	138.4	121.9	131.5±.7
Overall Male: Right and Left sides combined (n=116 )		138.4	121.9	130.3±4.9
Female	Right side (n=49)	129.6	121.1	127.6±3.7
	Left side (n = 47 )	128.7	122.8	126.2±2.9
Overall Female: Right and Left sides combined (n=96)		129.6	121.1	127.8±3.5
Average cervicodiaphyseal angle (n = 212)				128.7± 4.8

Table 2: Comparisons of Means and Significance of CDA Femur among Subjects

Comparison	p value	Significance at 95% confidence limit
Male: right vs left	0.0158*	Highly significant
Female Right vs Left	0.0424*	Significant
Male right vs female right	0.0180*	Highly significant
Male Left vs female left	0.0001**	Very highly significant
Overall: Male vs Female	0.0001**	Very highly significant

\*\*Highly significant \* Significant

**DISCUSSION**

Radiographic assessment of the proximal femur is commonly carried out prior to selecting a suitable implant for total hip arthroplasty. Cervicodiaphyseal angle in this context remains an important parameter. CDA in this study was measured considering the axis of proximal femur because there is a tendency towards varus angulation if the angle is measured considering long axis of the whole femur shaft<sup>5</sup>. Since the THA implant replaces the proximal segment of femur, assessment of CDA using radiographs of proximal femur was an appropriate measure<sup>4,6</sup>.

The cervicodiaphyseal angle on the right side in both male and female subjects was significantly larger with *p* value 0.0158 and 0.0424 respectively. Similarly comparison of each side in the two sexes was also very highly significant; *p* value 0.0180 on right and 0.0001 on left side respectively; the angle being larger in the male than in the female subjects. In overall comparisons of means of male and female subjects the CDA was very highly significantly larger in the male (*p* = 0.0001).

Very few studies of CDA on radiographs are available for comparison. With obvious differences, Rubin et al<sup>6</sup> described average CDA in Swiss population as 122.9±7.6 and Husmann et al<sup>7</sup> in French population as 129.2±7.8. In

our study the overall mean cervicodiaphyseal angle was 128.7±4.8 on the axis of proximal segment of femur. Roy et al<sup>8</sup> in their study on East Indian population described the mean angle values as 131.0 in the males and 130.37 in the females which are much higher than our observations. Mitra et al<sup>9</sup> in their study on Iranian subjects found the value of cervicodiaphyseal angle as 127.6 in the male and 126.6 in the female subjects. Tahir et al<sup>10</sup> in their study on Nigerian population found the mean CDA as 136.7±3.9 in the male and 126.6±3.3 in the female subjects. Our observations are closer to the Iranian population study by Mitra et al<sup>9</sup>.

Nurzenski et al<sup>11</sup> and Igbigbi<sup>12</sup> in their elaborate morphometric studies have propounded that the geometric characteristics of proximal femur are attributed to and defined by not only genetic but also the socio-economic status and geographical conditions of various population groups and are specific morphological determinants for a population.

**Limitations:** Notwithstanding the limitation that observations in our study were carried out on a two-dimensional radiographic image which cannot rule out neck rotational error, the study provided baseline data on cervicodiaphyseal angle in the population of Southern Punjab for further research and better understanding of proximal femur geometry by the engineer for manufacturing of total hip arthroplasty prosthesis and appropriate selection by the orthopedic surgeon.

**CONCLUSION**

This study provided baseline data on cervicodiaphyseal angle in adult male and female population of Southern Punjab.

**Conflict of interest:** None

**Funding:** None

**Author's contribution:** **MSA & MNC:** Conceptualized the study, analyzed the data, and formulated the initial draft. **MK & AQ:** Contributed to the histomorphological evaluation, **MAK & HA:** Contributed to the analysis of data and proofread the draft, **NA & KN:** Contributed to data collection, **TL:** Contributed to the proofreading the manuscript for intellectual content.

**Acknowledgements:** I am thankful to Allah and my colleagues who made it possible for me.

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