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Normative Cervical Cobbs' angle in Sudanese: CT Based Study

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Abstract: *The purpose of this descriptive study was to establish the normal values of cervical* Cobbs' *angle in Sudanese subjects using Computerized Tomography (CT).This study was done at Al-Zytouna specialized hospital and Royal Care hospital. A sample of 90 patients in different ages and different genders were involved and* Cobbs' *method was used in the evaluation of superior and inferior end plates.*
The lateral scouts for cervical spine were obtained. Traumatic cases, any disease of the vertebral column, spinal canal, para vertebral muscles diseases were excluded. Toshiba CT scanner was used. The exposure factors were 120 KVp, 10-50 MA. End plates angle from C3 to C5 was measured using Cobbs' *method for both genders and the data were correlated to their ages, weight, and vertebral height. The mean* Cobbs' *angle of cervical vertebra in males were found to be (5.42^0), (5.08^0), (5.01^0), and in females (4.45^0), (4.27^0), (4.09^0) for C3, C4, and C5 respectively. There is significant difference in* Cobbs' *angle of cervical spine between the two genders at p=0.000. The mean weight in males were found to be (75.83 kg) and in females (69.63 kg), the end plates angles increase when the subject body weight increase.*
The study concluded that the mean Cobbs' *angle of cervical vertebra differs significantly from males and females Sudanese.*

Keywords - *Cobb Angle, end Plates, cervical, CT*

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I. Introduction

Seven cervical vertebrae form the cervical region of the vertebral column, which encloses the spinal cord and meninges. The stacked, centrally placed vertebral bodies support the head, and the intervertebral articulations, especially the craniovertebral joints at its superior end, provide the flexibility necessary to allow positioning of the head. [1]

The typical cervical vertebrae have the vertebral body is small and longer from side to side than anteroposteriorly; the superior surface is concave, and the inferior surface is convex, the vertebral foramen is large and triangular, the transverse processes of all cervical vertebrae (typical or atypical) include foramina transversaria for the vertebral vessels, the superior facets of the articular processes are directed superoposteriorly, the inferior facets are directed inferoposteriorly, and their spinous processes are short. [1]In the fetus, the vertebral column has one continuous anterior concavity. After birth, when the child is able to raise his or her head and keep it poised on the vertebral column by muscular activity, the cervical part of the vertebral column becomes concave posteriorly .Toward the end of the first year, when the child begins to stand upright, the lumbar part of the vertebral column becomes concave posteriorly. The development of these secondary curves results in a modification in the shape of the vertebral bodies and the intervertebral discs. In the adult in the standing position, the vertebral column therefore exhibits in the sagittal plane the following regional curves: cervical, posterior concavity, thoracic, posterior convexity; lumbar, posterior concavity; and sacral, posterior convexity. [2]In the Cervical Spine CT procedure, the patient is positioned in supine and head is inserted first using headrest, arms are parallel to the body, shoulders are positioned down, the scan is obtained after removal of dental prostheses, necklaces. Orthogonal positioning of the patient's head simplifies the image interpretation. [3]The Cobbs' angle is measured on plane radiographs by drawing a line through the superior endplate of the superior end vertebra of spinal curve, and another line through the inferior endplate of the inferior-most vertebra of the same spinal curve, and then measuring the angle between these lines. Clinically, many Cobbs' measurements are still performed manually using pencil and ruler on hardcopy X-ray films, but PACs systems are increasingly used which allow manual Cobbs' measurements to be performed digitally by clinicians on the computer screen. [4] This paper answers the question of what is a normal value for vertebral endplate from C3 to C5 in normal Sudanese population in order to standardize the norms of Cobbs' angle as well to establish new equations for prediction of angle when the age and weight are known

II. Material and method

This study was done at Al-Zytouna specialized hospital and Royal Care Hospital. A sample of 90 patients in different ages and genders were included and the Cobb method was used in the measurement. The lateral scouts for cervical spine were obtained. Traumatic cases, any disease of the vertebral column, spinal canal, Para vertebral muscles diseases were excluded. Toshiba CT scanner was used. The exposure factors were 120 KVp, 10-50 MA. End plates angle from C3 to C5 were measured using Cobbs' method for both genders and the data were correlated to their ages and weight. The ages and weight for both genders were classified to different groups; the measurements were presented as mean values for C3 to C5 Cobbs' angle endplate for each group. The data were analyzed using SPSS program.

III. the results

Table 1.shows the cervical Cobbs' angles classified according to age and gender

Age classes	Gender	C3 Mean± SD	C4 Mean± SD	C5 Mean± SD
21-30	Male	7.85±1.6	6.81±1.6	6.51±0.9
	Female	5.23±0.3	4.3±1.1	4.83±1.7
31-40	Male	5.53±1.7	5.12±1.3	5.11±1.4
	Female	5.06±0.7	4.9±0.9	4.3±1.1
41-50	Male	4.63±1.1	4.46±1.0	4.57±1.3
	Female	4.37±0.7	4.58±0.9	3.83±1.1
51-60	Male	5.19±2.3	5.00±1.6	4.80±1.6
	Female	3.12±0.5	3.08±0.5	3.26±0.6

Table 2: shows the cervical Cobbs' angles classified according to subjects weight

Weight classes /Kg	***Weight***	***C3***	***C4***	***C5***
	Mean ±SD	*Mean ±SD*	*Mean ±SD*	*Mean ±SD*
51-60	56.1±3.1	3.1±0.4	3.21±0.6	3.33±0.5
61-70	66.4±3.2	5.53±1.6	4.90±1.8	5.08±1.8
71-80	76.13±2.8	5.26±1.9	5.07±1.2	4.85±1.3
81-90	83.84±2.4	5.15±1.5	4.85±1.3	4.66±1.3

Table 3.shows results for both gender including mean and standard deviation of cervical Cobbs' angles

	Gender	N	Mean	STDV	Sig (2tail)
Weight	Male	66	75.83	6.5	
	Female	24	69.63	10.2	0.001
Cobbs' angle of C3	Male	66	5.42	1.9	
	Female	24	4.45	0.9	0.025
Cobbs' angle of C4	Male	66	5.08	1.5	
	Female	24	4.27	1.0	0.019
Cobbs' angle of C5	Male	66	5.01	1.4	
	Female	24	4.09	1.2	0.008

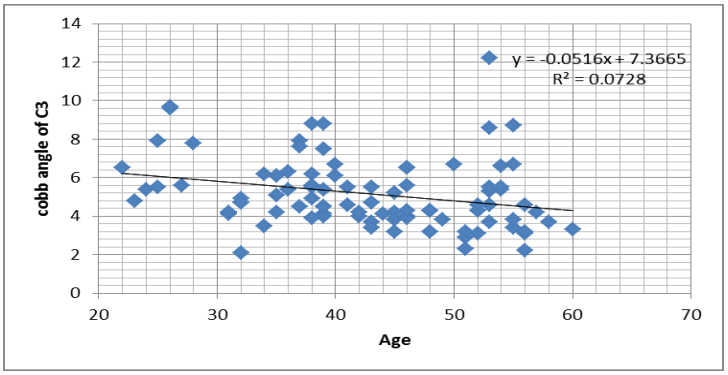

Figure1: Scatter plot diagram shows the linear relationship between Cobb's angle C3 and age.

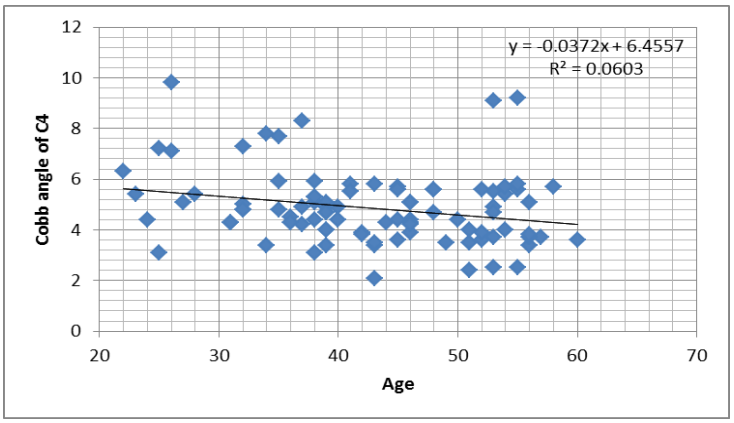

Figure2: Scatter plot diagram shows the linear relationship between Cobb's angle C4 and age.

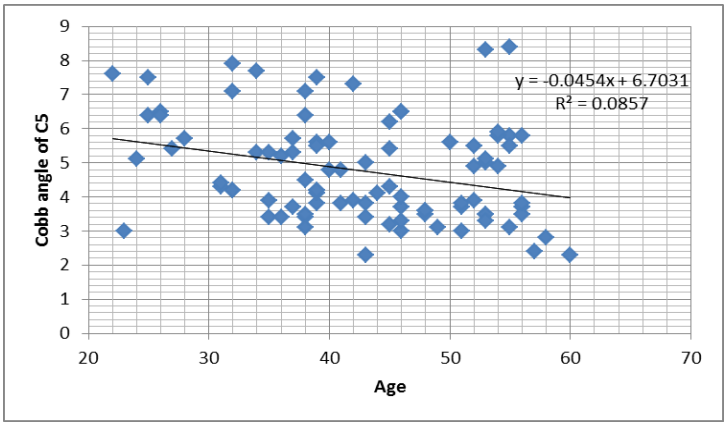

Figure3: Scatter plot diagram shows the linear relationship between Cobb's angle C5 and age.

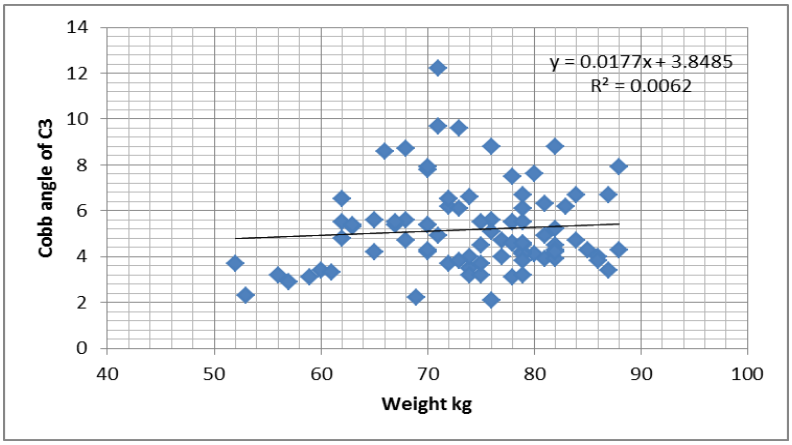

Figure4: Scatter plot diagram shows the linear relationship between Cobb's angle C3 and body weight group.

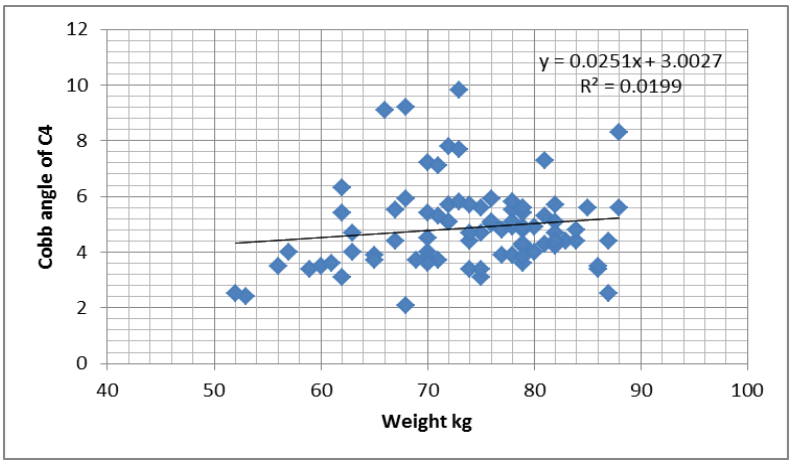

Figure5: Scatter plot diagram shows the linear relationship between Cobb's angle C4 and body weight group.

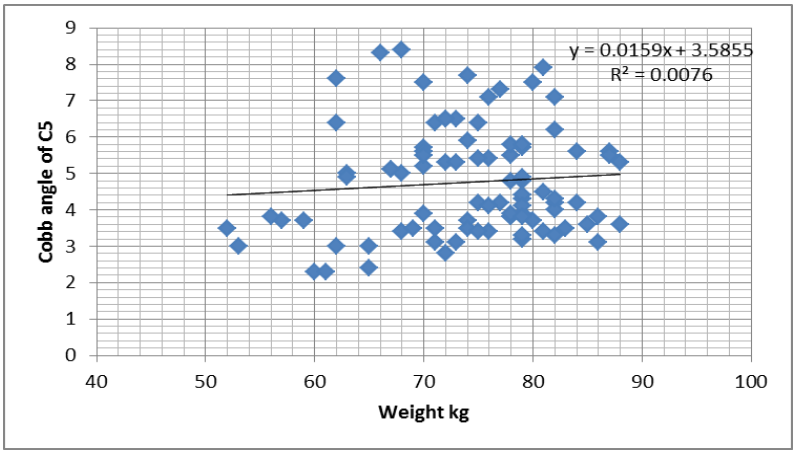

Figure6: Scatter plot diagram shows the linear relationship between Cobb's angle C5 and body weight group

IV. discussion

This study was conducted to establish a reference value for Cobbs' angle measured for superior and inferior end plate in normal cervical vertebrae, using CT scan in Sudanese population.

90 lateral CT scouts were obtained from (66 males, 24females).their ages were ranged from (22 to 60) years old. Toshiba CT scan machine was used with KV=120- MA=10 -50.

The Cobbs' angles were measured from C3 to C5for both gender and correlated to their ages and body weight. The ages, for both gender were classified to different groups, the measurements were presented in (table 1) as mean values for cervical vertebral Cobbs' angles.

The mean Cobbs' angle of cervical vertebral in males were found to be (5.42^0), (5.08^0), (5.01^0), and in females (4.45^0), (4.27^0), (4.09^0) for C3, C4, and C5 respectively. There were significant differences in Cobbs' angle of cervical spine between the two genders at p=0.000. Differences in the cervical lordosis angles might be related to gender differences in skull morphology, larynx, or thorax shape and size. [5][6] The Cobbs' angle related to their ages was found to be decreased by increasing age; the biochemical changes resulting from the increase of age-dependent changes because a decrease in disc height, cause changes in the disc geometry, and affect cervical curvature [7], Yukawa et al. showed that the lordosis angle increased with age [8]. Grob et al. determined that the cervical curvature angle increased with age in females rather than males [9]. Kumagai et al. reported that the cervical lordosis angle increased with age in females exclusively [10]. In our study, there was significant correlation between age and Cobbs' angle measurements. Justification for these results is that imbalance of trunk muscle due to weakness of neck muscles can decrease in cervical Cobbs' angle.

figures (1, 2, and 3): correlate between the age and the cervical vertebral Cobbs' angle. There were linear relationships: as the age increased the angle was decreased. By applying the following equation the Cobb angle can be estimated:

C3 Cobbs' angle = -0.0516Xage+ 7.3665 ***Equation: 1***
C4 Cobbs' angle = -0.0372Xage+ 6.4557 ***Equation: 2***
C5 Cobbs' angle = -0.0454Xage+ 6.7031 ***Equation: 3***

This relationship is for both genders within this sample.

The weight for both genders were classified into different groups, the measurements were presented in (table 2) as mean values for cervical vertebral Cobbs' angles. The mean weight in males were found to be (75.83 kg) and in females(69.63 kg), the end plates angles increase were as the subject body weight increase, where was a linear relationship between Cobbs' angle of the cervical vertebral and weight. There were significant differences in Cobbs' angle of cervical spine between the two genders at p=0.000. The head and it weight were displaced forward of the spinal column and the muscles in back of the spinal column were contracted to maintain the balance, due to muscles contraction the cervical cobb angle is increased.[11]

Figure (4, 5, and 6): correlate between weight and the cervical vertebral Cobbs' angle and there is a linear relationship between Cobbs' angle of the cervical vertebra and weight. By applying the following equations the Cobb angle can be estimated:

C3 Cobbs' angle = 0.0177Xweight + 3.8485 ***Equation: 4***
C4 Cobbs' angle = 0.0251Xweight+ 3.0027 ***Equation: 5***
C5 Cobbs' angle = 0.0159Xweight + 3.5855 ***Equation: 6***

This relationship is for both genders within this sample.

Age and gender play an important role in cervical lordosis change during growth [12], the vertebral height decreased with age [13], As a result of increasing age, the imbalance of trunk muscle due to weakness of the muscles can decrease the cervical Cobbs' angle.

V. Conclusion

The study concluded that the mean Cobbs' angle end plate of the cervical vertebral differs significantly between two genders and it has relation with age, and body weight.

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