RESEARCH ARTICLE

Estimation of age from the head of the femur of male Sudanese Population

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ABSTRACT:

Objective: To estimate age from the upper end the femur in Sudanese population. **Methods:** This was a cross-sectional study conducted on femur radiographs approximately upper and lower ends. The study recruited 109 males of deferent ages from birth to 22 years. The population were from all social classes, with variable socioeconomic status and healthy at the time of radiograph. The neonatal and any patient having a disease affecting the bone growth were excluded from the study. The x-ray films were taken by Siemens X-ray system and Toshiba & Shimadzu. The X-ray films were photographed and preserved for documentation as well as for atlas construction. **Results:** Out of the total patients, there were 65.7% males and 34.3% were females. Ossification center of upper end of the femur appeared in all the patients of age 3 years & above and in 76.5% of age below 3 years. Ossification centre was present in 40.4% of the females. The presence of ossification centre was higher in the age group 16-20 years females (46.2%) followed by 3-8 years (44.4%), <3 years (35.7%) and 8-16 years (33.3%). The thickness of epiphyseal plat was absent in 9.2% of the male patients and in 15.8% females. Non-union was in 68.8% males and in 28.1% females. The complete union was observed in 24.6%. The age was significantly (p=0.0001) different among different thickness of epiphyseal plate. **Conclusion:** The results suggest that the Sudanese population have the same pattern of skeletal maturation similar to Irish population.

Key words: Head, Femur, Ossification center, epiphyseal plate

INTRODUCTION

Bone age is a way of describing the degree of maturation of child's bones. As a person grows from fetal life through childhood, puberty, and finishes growth as a young adult, the bones of the skeleton change in size and shape. These changes can be seen by X-ray. The "bone age" of a child is the average age at which children reach this stage of bone maturation. A child's current height and bone age can be used to predict adult height & age.

The calculation of bone age is also employed for estimation of chronological age in conditions were accurate birth records are not available. The absent birth data is a big problem in our part of the world. In South Asia, it was estimated that 65% of all births are not registered by the age of 5 years[1]. Thus, need for accurate estimation of age arises in conditions where the age of a child needs to be accurate, such as during immigration[2], in law suits[3] and in competitive sports[4]. In these cases, bone age is used to provide the closest estimate of chronological age.

Many methods are available for the skeletal age assessment. An alternative method for skeletal age assessment can be by assessing the depth of the epiphysial cartilage of femoral

head which is continuously being ossified, in contrast to visualizing the bony ephiphysial end of femur. When ossification is complete, most of the cartilage is replaced by bone and the remaining cartilage is called as the "hyaline articular cartilage". There are very limited studies on the ultrasonographic measurement of the thickness of anterior femoral head cartilage with relatively small number of subjects and lack of racial heterogeneity[5]. Acheson[6] has developed the "Oxford method" for assessing skeletal age from X-rays but is of limited value for identification purposes until the majority of epiphysis should be found.

In Sudan there is no standard or reference in bone age estimation, there is gap between law and medicine to estimate the age of people. The bone age study can help to evaluate how fast or slowly a child's skeleton is maturing, which can help doctors to diagnose conditions that delay or accelerate growth. Thus, the present study was planned to estimate age from the upper end of femur in Sudanese population.

MATERIAL AND METHODS

This was a cross-sectional study conducted on femur radiographs approximately upper ends. The study recruited 109 males and 57 females of deferent ages from birth to 22 years. The population were from all social classes, with variable socioeconomic status and healthy at the time of radiograph. The neonatal and any patient having a disease affecting the bone growth were excluded from the study. The x-ray films were taken by Siemens X-ray system and Toshiba & Shimadzu. The X-ray films were photographed and preserved for documentation as well as for atlas construction.

Analysis

The results are presented in mean±SD and percentages. The one way analysis of variance followed by Tukey's comparison test was used to compare the age among different age groups and epiphysial appearances. The p-value<0.05 was considered significant. All the analysis was carried out by using SPSS 16.0 version (Chicago, Inc. USA).

RESULTS

Out of the total patients, there were 65.7% males and 34.3% were females. About one fourth (28.9%) were <3 and 3-8 years. However, 26.5% and 15.7% were between 8-16 years and 16-20 years respectively. The percentage of males was higher in all the age groups (Table-1).

Ossification center of upper end of the femur appeared in all the patients of age 3 years & above and in 76.5% of age below 3 years (Table-2).
Ossification centre was present in 40.4% of the females. The presence of ossification centre was higher in the age group 16-20 years females (46.2%) followed by 3-8 years (44.4%), <3 years (35.7%) and 8-16 years (33.3%) (Table-3).
The thickness of epiphyseal plat was absent in 9.2% of the patients with mean (±SD) age of 3.12±4.74. However, non-union was in 68.8% and partial union was in 14.7%. The complete union was observed in 7.3%. The age was significantly (p=0.0001) different among different thickness of epiphyseal plate   (Table-4).

The thickness of epiphyseal plat was absent in 15.8% of the female patients with mean (±SD) age of 2.22±3.14. However, non-union was in 28.1% and partial union was in 31.6%. The complete union was observed in 24.6%. The age was significantly (p=0.0001) different among different thickness of epiphyseal plate   (Table-5).

Table-1: Frequency distribution of age of upper end of the femur of males and females

Age in years	Male		Female		Total	
	No.	%	No.	%	No.	%
< 3	34	70.8	14	29.2	48	28.9
3 – 8	30	62.5	18	37.5	48	28.9
8 – 16	32	72.7	12	27.3	44	26.5
16 – 20	13	50.0	13	50.0	26	15.7
Total	109	65.7	57	34.3	166	100.0

Table-2: Frequency of presence of Ossification centers in males in upper end

Age groups	No. of males	Ossification centers			
		Present		Absent	
		No.	%	No.	%
< 3	34	26	76.5	8	23.5
3 – 8	30	30	100.0	0	0.0
8 – 16	32	32	100.0	0	0.0
16 – 20	13	13	100.0	0	0.0
Total	109	101	92.7	8	7.3

Table-3: Frequency of presence of Ossification centers in females in upper end

Age groups	No. of males	Ossification centers			
		Present		Absent	
		No.	%	No.	%
< 3	14	5	35.7	9	64.3
3 – 8	18	8	44.4	10	55.6
8 – 16	12	4	33.3	8	66.7
16 – 20	13	6	46.2	7	53.8
Total	57	23	40.4	34	59.6

Table-4: Thickness of epiphyseal plate of the upper end of the Femur in male

	No. (n=109)	%	Age in years (Mean±SD)
Absent	10	9.2	3.12±4.74[a]
Non-union	75	68.8	4.77±3.52[a]
Partial union	16	14.7	15.18±1.51[a]
Complete union	8	7.3	19.00±0.92[a]

ANOVA p=0.0001, [a]p=0.0001 (Tukey's post hoc comparison)

Table-5: Thickness of epiphyseal plate of the upper end of the Femur in female

	No. (n=57)	%	Age in years (Mean±SD)
Absent	9	15.8	2.22±3.14[a]
Non-union	16	28.1	5.17±2.12[a]
Partial union	18	31.6	13.28±4.11[a]
Complete union	14	24.6	20.10±3.16[a]

ANOVA p=0.0001, [a]p=0.0001 (Tukey's post hoc comparison)

DISCUSSION

This study was focused in the appearance of secondary ossification centers and stages of union of the epiphyseal plate (shaft –epiphysis) in upper end of femur among male and females patients.The most commonly used method is based on a single X-ray of the femur.In thepresent study, images from bone sample were taken by X-ray films. Sudanese population is comparable to those from previously published studies with epiphyseal union in females occurring earlier than males. Our study is compared with finding of O'Conner et al[7] who estimated the femur in Irish population.

In the present study, ossification center of upper end of the femur appeared in all the male patients of age 3 years & above and in 76.5% of age below 3 years. In females, ossification centre was 46.2% in the age group 16-20 years.   The majority of authors describe only two stages of union: non-union or completed union[7,2]. This study divided in four stages and found that the thickness of epiphyseal plat was absent in 9.2% of the male patients and 15.8% in females. However, non-union was in 68.8% and partial union was in 14.7% in males which was 28.1% and 46.2% in females respectively in this study. The complete union was observed in 7.3% in males and 24.6% in females in the present study. The age was significantly (p=0.0001) different among different thickness of epiphyseal plate in both male and females in this study. This is comparable with finding of O'Connor et al[7] who stated that in males, the youngest subject recorded as having beginning union of the distal femoral epiphysis was aged 12.0 years, and the oldest subject 16.2 years. The mean age of male subjects demonstrating beginning union was 14.0 years, and in the youngest male subjects demonstrating complete union of the femur were aged 18.5.

CONCLUSION

The results suggest that the Sudanese population have the same pattern of skeletal maturation similar to Irish population.

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