

Original Research Paper

Radiological Study of Union of Lower End of Humerus and Femur for Estimation of 16 and 18 Years Age in Agra Region

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Abstract

The bony age is determined from the study of growing ends of long bones i.e. the appearance and fusion of epiphysis with the diaphysis. The bony age is considered nearest to accuracy in estimating the clinical age. The actual bony age can't be determined in living, therefore the law enforcing agencies has to rely upon radiological estimation of bony age that too with many limitations and conditions. The present series of work was conducted at Forensic Medicine and Radiology Department of Sarojini Naidu Medical College, Agra. The study was based on 200 cases of males and females 10-20 years of different school and colleges running in the Agra city. In male all epiphysis of lower end of humerus are fused except medial epicondyle at age of 16 years. Lower end of femur not fused in both males and females at age of 16 years. In both males and females lower end of femur fused at age of 16 years.

Key Words: Skeletal age, Radiological examination, union, Femur, Humerus

Introduction:

While most researches determine union visually, some scholars advocate the use of radiographs to determine the degree of union. [1] Skeletal age, dental age, morphological age, secondary sex character age are other method in use for asserting age of individual. In medico-legal practice a combined view is taken and opinion is expressed after considering all methods. However radiological examination is a must and the court of law did not believe any conclusion without it. [2]

The complexity of overall ossification problem may be gleaned by the estimation that at the 11th prenatal week in humans there are some 806 centers of bone growth, at birth about 450, while the adult skeleton has only 206 bones. [3]

It is an established fact that the sequence of appearance and ultimate ossification of epiphysis varies in both sexes in different part of the world to the extent that there are wide variation even in the population of the different states of a country.

In case of alleged rape when the sexual intercourse has taken place with the consent of the girl, to made it a cognizable criminal offence it has to be proved that the girl was < 16 years of age. The medical experts are not in a position to certify the age of the girl due to the lack of relevant data with the result that the accused get the benefit of doubt and is set free. [4]

Material and Methods:

The present study was carried out in the Forensic Medicine and Radiology Department of Sarojini Naidu Medical College, Agra. A total of 200 (100 males, 100 females) in the age group of 10-20 years were selected randomly from various schools of Agra Region.

Criteria for Selecting Subjects:

- They should be living in Agra for more than 5years.
- They should be free from any physical disability or endocrine anomaly.
- Only those cases were taken for the study whose date of birth is verified by their school or college authorities by birth certificate.
- Informed expressed verbal consent of the subject was taken before proceeding to their, physical, dental and radiological examinations.

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The persons selected for study were grouped as per their stated age, 10-11 years, 11-12 years, 12-13 years, 13-14 years, 14-15 years, 15-16 years, 16-17 years, 17-18 years, 18-19 years, and 19-20 years.

The age group 10-11 years is considered as those of who have completed 10 years of age but yet to complete 11 years of age and similarly other age groups. Age as stated by them is further confirmed by birth certificate or entry in their school record.

After obtaining informed expressed verbal consent for their radiological and clinical examination each person is x-rayed for Right side elbow and knee joint. AP and Lateral view is taken and the skiagrams are studied in detail in reference to fusion of epiphysis at lower end of humerus and lower end of femur.

Radiologically the union is taken as complete when:

- Diphysio-epiphyseal space is completely obliterated and become bony in architecture and density. [5]
- There is continuity of the periosteum between epiphysis and diaphysis with no notching at the periphery of epiphyseal line.
- Presence or absence of epiphyseal scar

For generalization fusion in more than 75% cases is relied upon as complete fusion. For the study X-ray films were divided into two groups for each epiphysis:-

- Those showing complete union.
- Those showing non-union.

Observations and Results:

In present work 100 females and 100 males of various authentically known age groups were selected. These cases were distributed between 10 to 20 years of age. (Table 1) In (Fig. 2) there is a male of 11 years showing appearance of ossification centre of trochlea, capitulum and medial epicondyle.

Lateral epicondyle with capitulum is fused in 100% cases in both males and females at the age of 16 years. Trochlea with capitulum & conjoint epiphysis with diaphysis of Humerus is fused in all cases of females & most cases of males (83.33%) and (75%) respectively at age of 16 years. Lower end of femur is fused 3 times more in females as compared to male. (Table 2)

Lateral epicondyle with capitulum, trochlea with capitulum and conjoint epiphysis is fused in all cases in females and male at the age of 18 years. (Fig. 4)

Medial epicondyle with diaphysis of humerus is fused in all cases in females and in most cases (91.67%) in case of males. (Fig. 3)

Lower end of femur is fused in all cases in females and it is not fused in 17.67% cases in males. (Table 3, Fig.1) In all the epiphysis mean age of fusion is higher in males as compared to females. Difference in age of fusion between males and females is statistically significant. (Table 4)

Discussion:

The epiphyseal union in females occurs earlier than males by few months to 2 years. This is in consonance with various observations, which in long bones females show fusion earlier than male. [6-8]

Considering 75% as age of fusion all the epiphysis of lower end of humerus are fused in females at age of 16 years. These findings were similar with the finding of other workers. [9]

In males all epiphysis of lower end of humerus are fused except medial epicondyle at age of 16 years. This is in consonance with various observations. [10]

Lower end of femur not fused in both males and females at age of 16 years. [11] In both males and females lower end of femur fused at the age of 18 years. These findings are similar with finding of other workers. [11]

Religion, diet, socio-economic status had no effect on epiphyseal union. In assessing the age of candidates, radiological examination is of adequate help but with limitations. We recommend further study of larger geographical area and statistic tests for near scientific opinion in age assessment cases.

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Fig. 1: Rt. Knee Showing Fusion of lower end of Femur (Female 18 Yrs, 2Months)



Fig. 2: Rt. Elbow Joint showing centre for medial epicondyle, capitulum & Trochlea appeared but not fused. Centre for lateral epicondyle not appeared (Male 11yrs, 1 month)



Fig. 3: Rt. Elbow Joint Showing Partial Fusion of Medial Epicondyle. Lateral Epicondyle with Capitulum & Capitulum with Trochlea Fused (Male 16 Yrs, 4 Months)



Fig. 4: Rt. Elbow Showing Complete Fusion of All Epiphysis around Lower End of Humerus (Female 18 Yrs, 2Months)



Table 1: Distribution of Study Subjects According to Sex

Age Grp (Yrs)	Males	Females	Total
10 – 11	5	4	9
11 – 12	5	4	9
12 – 13	6	5	11
13 – 14	8	10	18
14 – 15	18	15	33
15 – 16	12	20	32
16 – 17	12	10	22
17 – 18	12	12	24
18 – 19	10	12	22
19 – 20	12	8	20
Total	100	100	200

Table 2: Epiphyseal Union at Age of 16 Years

EPIPHYSIS	Males (%)	Females (%)
Lateral epicondyle with capitulum	100	100
Trochlea with Capitulum	83.33	100
Conjoint epiphysis with diaphysis of Hur	75	100
Medial epicondyle, with diaphysis of Hur	50	85
Lower end of femur	16.67	50

Table 3: Epiphyseal Union at Age of 18 Years

EPIPHYSIS	Males (%)	Females (%)
Lateral epicondyle with capitulum	100	100
Trochlea with Capitulum	100	100
Conjoint epiphysis with diaphysis of Hur	100	100
Medial epicondyle, with diaphysis of Hur	91.67	100
Lower end of femur	83.33	100

Table 4: Comparison of Mean Age of Fusion between Males and Females

Epiphysis	Mean Age		Mean S.D.		t value	p value
	Male	Female	Male	Female		
Lateral epicondyle with capitulum	16.51	15.87	1.966	2.215	2.024	<0.05
Trochlea with Capitulum	16.83	15.97	1.810	2.118	2.754	<0.05
Conjoint epiphysis with diaphysis of Humerus	17.28	16.17	1.658	1.976	3.554	<0.05
Medial epicondyle with diaphysis of Humerus	17.23	16.54	1.837	1.810	2.160	<0.05
Lower end of femur with shaft	18.01	17.16	1.309	1.618	2.770	< 0.05