

## ORIGINAL RESEARCH

### **Age Estimation by Epiphyseal Union of Medial Epicondyle, Lateral Epicondyle, Capitulum & Trochlea in the Age Group of 15 To 19 Years**

**Kishore Kumar G<sup>1</sup>, Nikhil K<sup>1</sup>, R.Jenifer Jacqueline<sup>2</sup>**

<sup>1</sup>Assistant Professor, Department of Forensic Medicine and Toxicology, Government medical College, Suryapet, Telangana, India.

<sup>2</sup>Final year Post Graduate, Department of Forensic Medicine and Toxicology, Government medical College, Suryapet, Telangana, India.

#### **ABSTRACT**

**Background:** Age determination in both living and dead plays an important role in medicolegal cases. There are various methods to assess the age by physical characteristics, odontological development but the most valuable method seems to be the osteological changes observed by radiological examination i.e., the appearance and fusion of secondary ossification centers like medial epicondyle, lateral epicondyle, capitulum & trochlea. The present study was conducted on 131 subjects out of which 110 were males and 21 were females. The main aim of the study was to find the age of fusion of secondary ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea and to compare the distribution of fusion of ossification centers between males and females.

**Materials and Methods:** Firstly, informed consent was taken. Preliminary details of each individual were noted that included general examination, physical examination, dental examination followed by taking X-ray AP view of elbow for radiological examination. The results were noted based on the degree of fusion as No Union (O), Beginning union (B), Recent union (R), Complete union (C).

**Results:** The present study showed among males, the fusion for each ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea started by 15-16 years and was completed by 18-19 years whereas in females it started fusion by 15-16 years but complete fusion occurred around 16-17 years itself.

**Conclusion:** Based on the analysis of fusion of ossification centers it shows that the ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea fuses earlier in females by 1-2 years than in males.

**Keywords:** Age, X-rays, ossification, fusion.

**Corresponding Author:** Dr. Kishore Kumar, Assistant Professor, Department of Forensic Medicine and Toxicology, Government medical College, Suryapet, Telangana, India. Mail id: dr.gkishorekumar@gmail.com

#### **INTRODUCTION**

Age estimation in the living is one of the most important tasks especially in developing countries where both birth records are often not available or not well maintained. Despite the fact that there are a number of laws requiring registrations of births (Eg: Registration of Births and Deaths Act 1969) most births are not properly recorded. Though there are many general developmental factors in assessing the age, changes in bones specially time related appearance and fusion of different ossification centres in growing period are valuable indices

for assessing the age.<sup>[1-4]</sup> The variation in the appearance and the fusion of ossification centres is mainly attributed to various factors like climate, hereditary, race, nutrition, dietary habits and gender, socioeconomic status of the population.<sup>[5-8]</sup> Scientific estimation of age of an individual whether living or dead or from human remains is a vexing problem for medical jurist in both civil and criminal matters, Age estimation cases are often referred to forensic experts as it plays an important role in deciding upon the quantum of punishment given to the accused and where to execute the same in a Reformation or juvenile court school or jail. As the age between 15 to 17 years is very important medicolegally especially in the females, it is important to differentiate between 14-15 years in employment and 17-18 years in connection with Hindu Marriage Act. Amongst all the parameters of age determination, radiological examination of bones ends has shown accuracy and reliability acceptable to medical profession and legal fraternity. So the objective of this study is to find out the age of an individual from the fusion of secondary ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea and to compare the age of fusion of ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea between males and females.<sup>[9,10]</sup>

## **MATERIALS & METHODS**

The present study was conducted in Government Junior College, Suryapet, Telangana. The study was carried on a total of 131 subjects out of which 110 were males and 21 were females. Subjects with deformities of medial epicondyle, lateral epicondyle, capitulum & trochlea, signs of malnutrition, congenital anomalies, infections and metabolic disorders were excluded. We obtained written consent for every individual subject for their radiological examination. The X-rays of AP view were taken in an outside lab. The persons selected for the study were grouped as per their stated age viz, 15-16 years, 16-17 years, 17-18 years & 18-19 years. Age as stated by them was further confirmed by birth certificate or entry in their school record. The Xerox copy of proof of birth certificate was collected. The persons belonging to the age group selected for either gender was included in the study irrespective of their socio-economic, religion. We prepared a proforma with particulars containing Name, sex, date of birth, address, height, weight and Identification marks. In males the colour and growth of scalp hair, beard, moustache, axillary and pubic hair were examined and noted. In females, development of breast was noted and complete menstrual history was taken. Dental examination was done by noting the number of temporary and permanent teeth and a dental chart was prepared. Radiological assessment of various ossification centres, their appearance, process of fusion were noted. The observations were based on the following grades of stages of fusion.

DEGREE 0: A dark radiolucent line seen throughout the length of the epiphyseal and metaphyseal joining surface (Centre not appeared, union not commenced).

DEGREE 1: Radio opaque area is seen in the middle of or on either side of, but occupies less than half of, the epiphyseal and metaphyseal joining surface (Centre appeared but incomplete, union commenced).

DEGREE 2: Radio opaque area is seen in more than half of epiphyseal and metaphyseal joining surfaces, but the cortical shadow is not continuous (Union started but incomplete).

DEGREE 3: Radio opaque area is seen in the entire length of the epiphyseal and metaphyseal joining surface and the cortical surface is continuous without any notch (Complete union).

For tabulating the findings, the stages of fusion were noted in the form of following abbreviations.

1. No union (O).
2. Beginning union (B).
3. Recent union (R).
4. Complete union (C).

**RESULTS****Table 1: Complete Fusion of Ossification Centres of Medial Epicondyle, Lateral Epicondyle, Capitulum & Trochlea in Males**

Age	Trochlea	Total	Capitulum	Total	Lateral epicondyle	Total	Medial epicondyle	Total
15-16	6(21.4%)	28	10(25.7%)	28	12(42.8%)	28	8(28.5%)	28
16-17	12(37.5%)	32	20(62.5%)	32	22(68.7%)	32	22(68.7%)	32
17-18	30(93.7%)	32	28(87.5%)	32	26(81.2%)	32	28(87.5%)	32
18-19	18(100%)	18	18(100%)	18	18(100%)	18	18(100%)	18

**Table 2: Complete Fusion of Ossification Centres of Medial Epicondyle, Lateral Epicondyle, Capitulum & Trochlea in Females**

Age	Trochlea	Total	Capitulum	Total	Lateral Epicondyle	Total	Medial Epicondyle	Total
15-16	8(80%)	10	2(20%)	10	2(20%)	10	3(30%)	10
16-17	4(100%)	4	4(100%)	4	4(100%)	4	4(100%)	4
17-18	6(100%)	6	6(100%)	6	6(100%)	6	6(100%)	6
18-19	1(100%)	1	1(100%)	1	1(100%)	1	1(100%)	1

[Tables 1 & 2] show that the complete fusion of ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea in males starts at the age of 15 to 16 years followed by individuals of 17 to 18 years showing complete fusion from a range of 80% to 90% and all the 18 subjects between 18 to 19 years show 100% complete fusion. In females in showed that the complete fusion of all ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea started at the age group 15 to 16 years but was not complete and it was followed by appearance of 100% complete fusion in 16 to 19 years age group individuals.

**Table 3: Distribution of Fusion of Ossification Centre of Medial Epicondyle, Lateral Epicondyle, Capitulum & Trochlea in Males**

Age	Trochlea	Capitulum	Lateral Epicondyle	Medial Epicondyle
15-16	6	10	12	8
16-17	12	20	22	22
17-18	30	28	26	28
18-19	18	18	18	18
p value	0.049	0.014	0.007	0.020

**Table 4: Distribution of Fusion of Ossification Centre of Medial Epicondyle, Lateral Epicondyle, Capitulum & Trochlea in Females**

Age	Trochlea	Capitulum	Lateral Epicondyle	Medial Epicondyle
15-16	8	2	2	3
16-17	4	4	4	4
17-18	6	6	6	6

18-19	1	1	1	1
p value	0.050	0.061	0.061	0.044



**Figure 1: depicts X-ray AP view of elbow of 17 years male showing complete fusion of all ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea.**



**Figure.2 depicts X-ray AP view of elbow of 16 years female showing complete fusion of all ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea.**



**Figure 3: depicts X-ray AP view of elbow of 17 years female showing complete fusion of all ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea.**

### **DISCUSSION**

Age determination is important in law of attaining maturity and in criminal case where the disposal of body is done by dismembering the body parts by using various methods or when only skeletal remains is available for examination. Whereas in living it helps in solving medicolegal cases comprising civil cases like those related to employment, education, sports and in criminal cases like robbery, sexual assaults, abduction or kidnapping etc.,

The present study was conducted on 131 subjects out of which 110 were males and 21 were females. It shows that fusion of trochlea in age group of 15-16 years the complete fusion is seen only 21% rest population shows recent fusion in males and in age group 17-18 years 93% were completely fused. In females age group of 15-16 years 8% completely fused. Fusion of capitulum in age group 15-16 years the complete fusion is seen only 35% rest population shows recent fusion in males and in age group 17-18 years 87% completely fused whereas in females of the age group 16-17 years 100% was completely fused.<sup>[11]</sup>

The fusion of lateral epicondyle in the age group 15-16 years complete fusion is seen only in 42% and rest of population shows recent fusion in males, in age group 17-18 years, 81%

completely fused whereas in females the age group 16-17 years completely fused. The fusion of medial epicondyle in age group 15-16 years the complete fusion is seen only in 28% rest population shows recent fusion in males and in age group 17-18 years, 87.5% completely fused whereas in females of age group 16-17 years, 100% was completely fused.<sup>[12]</sup>

The fusion of epiphyseal centre of medial epicondyle with the shaft was seen between 15-17 years in males which were concordant with the study conducted by Umesh Choudary et al in march 2017.

It is observed that the ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea in females fuse earlier than males. With reference to the theory of null hypothesis considering  $p=0.05$  as the statistical significant value. The age of fusion of ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea between males and females were observed and it showed that the p value calculated for females was  $>0.05$  when compared to males which were  $<0.05$  (0.013-0.020) and is the probability that the null hypothesis is true.<sup>[13]</sup>

## CONCLUSION

It shows that the complete fusion of ossification centers of medial epicondyle, lateral epicondyle, capitulum & trochlea in females occurs earlier than in males by 1-2 years. 100% complete fusion of medial epicondyle, lateral epicondyle, capitulum & trochlea in females occurs at 16-17 years whereas in males it is seen at 18-19 years.

## REFERENCES

1. Miyazaki CS, Maranhão DA, Agnolitto PM, Nogueira-Barbosa MH. Study of secondary ossification centers of the elbow in the Brazilian population. *Acta ortopedicabrasileira*. 2017 Dec;25(6):279-82.
2. Hassan N, Noor F, Ahmad S, Fazili KM. Age of fusion of the distal radial and ulnar epiphyses from hand radiographs—A study in Kashmiri population. *Science & Justice*. 2016 Dec 1;56(6):431-6.
3. Choudhary U, Kumar S, Singh A, Bharti P. A radiological study of ossification at the lower end of humerus for age estimation among boys in Central Karnataka, India. *International Journal of Research in Medical Sciences*. 2017 Apr;5(4):1204.
4. Rajdev BM, Gajera CN, Rajdev SB, Govekar GP, Tailor CI, Chandegara PV. Age of fusion of epiphysis at distal end of radius and ulna. *Intern J of Intern Med Res*. 2015;1(2):5-11.
5. Cheng JC, Wing-Man K, Shen WY, Yurianto H, Xia G, Lau JT, Cheung AY. A new look at the sequential development of elbow-ossification centers in children. *Journal of Pediatric Orthopaedics*. 1998 Mar 1;18(2):161-7.
6. Patel B, Reed M, Patel S. Gender-specific pattern differences of the ossification centers in the pediatric elbow. *Pediatric radiology*. 2009 Mar;39(3):226-31.
7. Singh OG, Suresh A. Radiological assessment of age from wrist joint in young adolescents. *Journal of Indian Academy of Forensic Medicine*. 2016;38(2):149-51.
8. Jit I, Singh B. A radiological study of the time of fusion of certain epiphyses in Punjabees. *J. Anat. Soc. India*. 1971;20(1):27.
9. Dixit SP, Bansal RK. Study of ossification centres fusion of elbow joint in 15 to 17 years Garhwali females of Dehradun region. *Journal of Indian Academy of Forensic Medicine*. 2014;36(4):396-8.
10. Kripalani G, Banerjee AK, Rao MN. Ossification centres at the elbow joint in Bengali girls. *The Indian Journal of Pediatrics*. 1970 Apr;37(4):127-33.
11. Bajaj ID, Bhardwaj OP, Bhardwaj S. Appearance and fusion of important ossification centres: a study in Delhi population. *Indian journal of medical research*. 1967;55:1064-7.

12. Reddy KS, Murty OP. THE ESSENTIAL OF FORENSIC MEDICINE AND TOXICOLOGY, thirtythird edition New Delhi Jaypee Brothers Medical Publishers 2014.
13. Trotter M. The Human Skeleton in Forensic Medicine. WM Krogman. Thomas, Springfield, Ill., 1961. xxvi+ 337 pp. Illus. \$14.