Study on Age Determination by Epiphyseal Fusion of Distal End of Ulna and Radius in Telangana Region

K Srinivasulu[1], Nakkala Supraja Internee[2], Chittireddy Sainithya[3], Jupaka Om Shanti[3]

[1]Prof & Hod Department of Forensic Medicine & Toxicology. Malla Reddy Institute of Medical sciences, Medchal, Telangana, [2]Dept of Forensic Medicine, Mediciti Institute of Medical Sciences, Medchal, Hyderabad, Telangana, [3]3rd MBBS, MallaReddy Institute of Medical sciences, Medchal, Telangana

Abstract

The use of radiographic data for age determination is a widely accepted method and considered scientifically approved. The aim of the present study is to determine the age of epiphyseal union of lower end of ulna and radius among Telangana population. A cross-sectional study was conducted in the region of Telangana, with 100 participants include 50 males and 50 females, we observed that the ossification of lower end of radius completed at 17 to 18 years in females and 19 to 20 years in males, whereas ossification center of lower end of ulna ossified one year earlier than radius, it ossifies at 16 to 17 years in females and 18 to 19 years in males.

Skeletal age is not uniform among all the participants. Ulna ossifies one year earlier than radius in both males and females. We also observed that the ossification completed early in females than in males. We found similar results in several studies conducted in India and abroad.

Key Words: *Age determination, Epiphysis fusion, Ulna, Radius.*

Introduction

Age estimation is an important parameter in dealing with both civil and criminal cases. Skeletal age estimation is based on the appearance and fusion of the ossification center, estimation of age from skeletal study is widely accepted in all medico legal issues. Bone age is an indicator of the skeletal and biological maturity of an individual; this is different from chronological age calculated by date of birth of an individual.

Age determination and issuing of age certificate is always a challenging task to a doctor, multiple factors will influence on appearance and fusion of ossification center. Age estimation becomes a valuable tool in dealing with many civil and criminal procedures such as consent in medical practice, validity of will, attainment of majority, marriage, kidnapping and sexual offences etc.

Age assessment, when done in a living person is always given in the form of a range; the variation in age estimation substantially increases to more than

Corresponding author:
Dr K Srinivasulu,
Professor HOD. Department of Forensic medicine & Toxicology, MRIMS, Hyderabad, Telangana.
Email: drksrinivas1968@gmail.com

a decade in elderly (Rosing et al., 2007[1]). Hence, it must be acknowledged that as age of an individual increases, the chances of assessing a close match to chronological age decreases.

Age determination also plays a great role in identification of an individual especially in mass disasters. A gross difference between skeletal and chronological age indicates a lag in the biological age and points to some underlying genetic, nutritional and endocrinal disorders.[2,3]

Age determination usually done in three steps: physical examination, dental examination and radiological examination. Dental examination by tooth eruption in early ages and physiological changes of tooth by Gustafson's formulae in late ages whereas radiological examination by ossification centers, their appearance and fusion in long bones in early ages and skull suture closure in late ages[2,3].

The aim of this study is to assess the bone age comparing the chronological age of the individual and compare the data with other similar studies.

Materials and Method

A cross- sectional study on age determination from radiological examination of wrist joint, lower end of Radius and Ulna by ossification centers fusion was conducted in Telangana region. The study was conducted with 100 participants in the age group ranging from 16 to 21 years, 50 male and 50 females. Individuals close to normal height, weight and skeletal structure were included in the study.

The following individuals were not included in this study.

- Individuals with bone related problems or deformities.
- Known nutritional, developmental or endocrinal abnormalities.
- Any other systemic diseases.

Informed consent was obtained from all the participants before commencement of the study.

Participants were asked to remove the jewelry and any metal objects that might interfere with the X ray-image. Each participant was subjected to radiological examination of left wrist joint in Antero posterior view. We choose x ray wrist joint, because wrist can be easily isolated from the trunk by extending the hand, thereby minimizing the radiation to the rest of the body.

The distal epiphyses of Radius and Ulna observed for fusion of ossification center. Fusion (union of epiphysis with diaphysis) is graded according to Dr William Sangma, Mckern and Stewart in to 5 stages as follows:

- Stage 1(F1): Nonunion –Epiphyseal cartilage growth plate widen and did not begin to decrease in thickness
- Stage 2(F2): Commence of union – when the thickness of Epiphyseal cartilage was found to be reduced appreciably (1/4th united)
- Stage 3(F3): Incomplete union – when the epiphysis cartilage gap reduced further.
- Stage 4(F4): Complete union – when the epiphyseal cartilage was bony in architecture and its density indistinguishable from the epiphysis and diaphysis in its neighborhood, but an epiphyseal line

called epiphyseal scar could still be distinguished.

 Stage 5 (F5): Complete union – with absence of epiphyseal scar.

Accurate chronological age was obtained in each individual based on their age certificate; bone age was assessed based on the skeletal picture of x ray using established standard practice. We considered stage 4 and 5 is complete union, stage 4 explained as recent fusion.

The findings obtained were tabulated and statistically analysed with the aid of PSPP. The results were compared with similar studies in other parts of India and abroad.

Results

A cross sectional study on age determination by union of ossification centers of lower end of ulna and radius by radiological examination was conducted in a rural medical college of Telangana region, revealed the following results.

Table-1: Age and Sex wise distribution in the study.

Age Distribution	Males	Females
16 Years	4	1
17 YEARS	4	2
18 YEARS	13	12
19 YEARS	19	18
20 YEARS	5	15
21 YEARS	5	2
TOTAL	50	50
COMBINED TOTAL		100

Table-1 Age wise distribution of participants of the study. 5 members of 16 years age group, 6 members in 17 years age group, 25 members in 18 years age group, 37 members in 19 years, 20 members in 20 years and 7 members in 21 years age group. A total of 50 participants of male and 50 participants of female were participated.

Table-2: Ossification status at the distal end of radius in females.

FEMALES			
Age	**Ossification status at distal end of radius**		
	stage 3	**stage 4**	**stage 5**
16 Years	1	0	0
17 Years	2	0	0
18 Years	0	10	2
19 Years	0	14	4
20 Years	0	0	15
21 years	0	0	2
TOTAL	3	24	23

Table-2 reveals that none of the participants in stage 2 ossification, very less number in stage 3 was observed in below 17 years age group individuals, 12 members are in stage 4 and 5 are in 18 years age group, 18 members are in stage 4 and 5 in 19 years age, above twenty years age group are in stage 5. In 94% of study population ossification completed at 18 years and above, only 6% in stage 3 are below 17 years age.

Table-3: Ossification status at the distal end of radius in males.

MALES			
Age	**Ossification status at distal end of radius**		
	stage 3	**stage 4**	**stage 5**
16 Years	4		
17 Years	4	0	0
18 Years	11	2	0
19 Years	0	16	3
20 Years	0	1	4
21 YEARS	0	0	5
Sub Total	19	19	12
TOTAL	50		

Table 3 shows 19 participants are in the age group of 16to 18 are in stage 3, remaining 31 participants are above 19 years are in stage 4 and 12 are in stage 5. In 58% of our study population the ossification completed at 19 – 20 years.

TABLE-4: Ossification status at the distal end of ulna in Females.

FEMALES			
Age	**Ossification status at distal end of ulna**		
	stage 3	**stage 4**	**stage 5**
16 Years	0	1	0
17 Years	0	2	0
18 Years	0	4	8
19 Years	0	0	18
20 Years	0	0	15
21 Years	0	0	2
		7	43
TOTAL (50)	0	14	86

Table 4 reveals, all the participants of above 16 years are in stage 4 and 5, Ossification of distal end of ulna in females occur at 16 to17 years in our study population.

Table-5: Ossification status at the distal end of ulna in Males.

MALES			
Age	**Ossification status at distal end of ulna**		
	stage 3	**stage 4**	**stage 5**
16 Years	4	0	0
17 Years	1	3	0
18 Years	0	10	3
19 Years	0	2	17
20 Years	0	0	5
21 years	0	0	5
TOTAL	5	15	30

Table 5 shows 45 participants (90%) above 17 years are completed ossification; only 5 participants of below 17 year's age are in stage3. In 90% of our study population, ossification of lower end of ulna has been completed at 18 to 19 years of age in males.

Discussion

A cross sectional study on ossification of lower end of ulna and radius was conducted in Telangana region, the results of the study compared with other studies in India and abroad.

In our study we found that the complete fusion of lower end of ulna occur at 16-17 years in females and 17-18 years in males, whereas the fusion of radius occurs at 17-18 years in females and 19 -20 years in males. The ossification centers of both radius and ulna fuse one year earlier in females.

Davies and Pearson's[4] (1927) studies on 5000 X-ray plates of patients found that epiphyses of long bones appear and fuse in females earlier than males, similar results were also observed in our study and several other studies.

Melbourne, Flecker H[5] (1932)noticed that the lower end of radius fuses around 18 years in girls and 19 years in boys, while same occurs at ulna around 17 years in girls and 19 years in boys, almost similar results were observed in our study.

A study conducted by Dr Sanjeev Krishnamoorthy and Abhishek Singh[6] on Age Determination from Radiological Investigation of epiphyseal appearance and fusion around wrist Joint at Khammam of Telangana state also revealed similar results. We also observed similar results in a study conducted in Kashmiri population by Nida Hassan and Farida Noor.[7]

A study conducted by Sangita Rajdev[8] in Surat shows different results, the ossification of Lower end of radius observed at 21 years in males and 20 years in females and the lower end of ulna ossified at 21 years in males and 19 years in females, both ulna and radius ossified almost at same age.

In another study conducted in western Rajasthan population by Raichandani Leena,[9] shows different results that the average age for complete epiphyseal fusion of lower end of radius is 18-19 years in males and 17-18 years in females and average age for complete epiphyseal fusion of lower end of ulna is 19-20 years in males and 18-19 years in females.

In most of the studies including in our study ulna ossifies earlier than radius except in a study at western Rajasthan conducted by Raichandani leena, in their study radius ossified one year earlier than ulna.

Conclusion

A cross sectional study on ossification of lower end of ulna and radius was conducted in Telangana population, we observed ossification of lower end of radius completed at 17 to 18 years in females and 19 to 20 years in males, whereas ossification center of lower end of ulna fused one year earlier than radius, it ossify at 16 to 17 years in females and 18 to 19 years in males. Several studies conducted in India and abroad including our study revealed that the ulna ossifies one year earlier than radius. We also observed that the ossification centers of both ulna and radius ossify early in females than in males, a similar kind of results were observed in most of the studies.

Conflict of Interest: Nil

Ethical Clearance: Yes

Source of Fund: Self

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