ORIGINAL PROF-537

AGE OF FUSION FOR EPIPHYSIS ;
ELBOW AND WRIST IN NORMAL CHILDREN

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ABSTRACT

The age of fusion of the epiphysis at elbow and wrist has been studied radio logically at department of Forensic Medicine and Toxicology, Chandka Medical College, Larkana, during 1999-2000. One hundred eighty normal children (75 females and 105 males) of average middle class aged 12 to 19 years were examined. The females were 1 to 2 years advanced as compared to the males in their fusion time. All the epiphysis at elbow (excluding medical epicondyle) showed complete fusion at the age of 15 years in females and 17 years in males, while fusion time at wrist was found 17 years in females and 19 years in males. It was found that the time of fusion in present study was 1-3 years earlier than English but was nearly correlating to Australian or even 1-2 years late to Indian and Bengali children.

KEYWORDS: Age fusion of Epiphysis – Elbow – Wrist – Radiograph.

INTRODUCTION

Where chronological age is uncertain, then it is the bone age which becomes very important and more reliable; though skeletal age by radiographic method is not absolute, it is relative.

As the age of ossification is important for medio legal as well as clinical point of view, hence the work in this field has been carried out all over the world. It was Pryor[2] who first published that the bones of the females ossify earlier than the males. The work of Indian authors[3,4,5] in various provinces of their country showed some regional variation in ossification time, but even then they all found that Indian subjects mature earlier than those of western. On the contrary, Mackay[6] found that African subjects are 1-2 years behind then those of

American subjects.

As regards the age of ossification, the most complete set of data to be found is that of Flecker[7], Greulich-Pyle[8] and Tanner-White house[9]. On the basis of their work, others[6,10,11] have made standards of skeletal age for their own countries. Unfortunately in Pakistan expect Rikhasor[12], no such work has been done so far.

This cross-sectional study was carried out at Larkana City during 1999-2000, and the purpose of this study was to establish an average time of fusion of epiphysis at elbow and wrist in this region.

MATERIAL & METHOD

The material consisted an anteroposterior radiograph of the left elbow and wrist joints of one hundred and eighty children (105 males and 75 females) having age range from 12 to 19 years. The subjects were the students of local schools and colleges of Larkana City, having no apparent musculo skeletal, nutritional or endocrine disorders.

The chronological age was based on birth certificate of Hospital & Municipal Corporation obtained from parents on special request. All the subjects were distributed in various age group as shown in table-1.

The age of the subject was not recorded in fraction, six months or more than six months were recorded as one year. As the process of fusion is completed within months, the stages of fusion were not graded, only fusion and Non – fusion were noted.

For each epiphysis average of Fusion was taken as the earliest age as which more than 50% of the children examined in that particular age group showed complete fusion. Complete fusion was assumed when the epiphyseal space has been filled with bone of equal density to the epiphysis and diaphysis, and was therefore invisible on the radiograph. An exception was made of the Line – like mark which some time persists in adult life, the so called "epiphyseal scar"

Table – 1 **Distribution of children examined in different age groups in the present study.**

Age Groups (in years)	No of Females	No of Males
12	10	12
13	10	11
14	12	12
15	13	14
16	15	12
17	10	16
18	05	17
19	–	11
TOTAL	75	105

OBSERVATIONS & RESULTS

The results are shown in table-2. Each epiphysis was studied for its average (mean) time of the fusion in females and males separately.

The earliest fusion of the distal composite epiphysis (capitulum and trochlea) of the humerus with its diaphysis was found in one girl at the age of 13 years and in one boy at the age of 15 years. Majority of subjects (more than 50%) showed union of distal epiphysis (excluding medial epicondyle) at the age of 15 years in females and 17 years in males. While the epiphysis of medical epicondyle showed its union with diaphysis at the age of 16 years in females and 18 years in males in most of the cases.

Table 2 **Average age of fusion for epiphyses with**

their diaphyses at the elbow and wrist as observed in the present study.

Epiphysis	Fusion (in years)	
	Females	**Males**
Humerus:		
Composit (conjoint) epiphysis.	15	17
Medial epicondyle	16	18
Radius:		
Proximal epiphysis (head)	15	17
Distal epiphysis	17	19
Ulna:		
Proximal epiphysis	15	17
Distal epiphysis (head)	17	19

The earliest fusion of the proximal epiphysis of radius and ulna was found in 2 out of 12 girls at the age of 13.6 years and in 1 out of 12 boys at the age of 15.5 years. Majority of the cases showed the proximal epiphyseal fusion at the age of 15 years in females and 17 years in males.

The earliest fusion of the distal epiphysis of the radius and ulna was noted in one girl and one boy at the age of 14 and 16 years respectively. In most of the cases the distal epiphyseal fusion was found at the age of 17 years in females and 19 years in males.

DISCUSSION

The average age of fusion of the distal epiphysis of the humerus (excluding medial epicondyle) and the proximal epiphysis of the radius & ulna was found 15 years in females and 17 years in males. This age figure was 1-3 years earlier than the findings of Paterson[13]. However, the time of fusion of present study was about 1 year late (behind) than those of Galstaun[14], Flecker, Hansman[15] and Khana & Kirn for the Bengalis, Australian, American and Indian subjects respectively.

The medial epicondyle epiphysis showed its union with diaphysis at the age of 16 years in females and 18 years in males in majority of the cases. This time figure was 1-2 years late (behind) than the findings of all the other authors given in table-3.

The average age of fusion of the distal epiphysis of the radius and the ulna was found 17 years in females and 19 years in males. This time figure was earlier than the findings of Paterson, but was nearly coinciding with work of Flecker. However, fusion time was about 1 to 2 years late (behind) than those of Galstaun, Hansman, Khana & Kirn and Rikhasor & Abdullah[16].

In the present, study the fusion time of all the epiphysis at elbow and wrist was over all about 1-2 years late as compared to the studies of other authors (except Paterson) which might be due to genetic, regional, nutritional or some other factors for which longitudinal study is suggested on large scale (national level).

Table-3 Comparison of present work with other authors

Auhtor (with year)	Subjects	Time of fusion (in years)											
		HUMERUS				RADIUS				ULNA			
		C.E		M.E		P.E		D.E		P.E		D.E	
		F	M	F	M	F	M	F	M	F	M	F	M
Paterson (1929)	English	14-15	18-21	-	-	14	18-19	19	21	14	19	19	21
Galstaun (1937)	Bengalis	14	16	15	17	14	16	16.5	18.5	14	16	16	18
Flecker (1942)	Australians	14	16	14	16	14	16	18	19	14	16	17	19
Hansman (1962)	Americans	13	16	15	17	14	16	16	18	14	16	16	18
Khana & Kirn (1979)	Indians	13	14	14	16	14	16	-	17	13	15	14	17
Rikhasor & Abdullah (1993)	Pakistanis	-	-	-	-	-	-	16	18	-	-	16	17.5
Present Study(2000)	Pakistanis	15	17	16	18	15	17	17	19	15	17	17	19

C.E = Composite Distal Epiphysis M.E = Medial Epicondyle Epiphysis
D.E = Distal Epiphysis P.E = Proximal Epiphysis

REFERENCES

1. Krogman WM. The human skeleton in Forensic Medicine, 3rd Ed. Spring field, Illinois: Charles C Thomas Publisher 1978; 337.

2. Pryor JW. Time of ossification of bones of the hand of male and female and union of epiphysis with idaphysis. Am J Anthropol 1925; 8: 401-10.

3. Loomba SD. Age of epiphyseal union at the wrist. Indian J Med Assoc 1958; 30: 393-6.

4. Saksena JS, Vayas SK. Epiphyseal union at the wrist, Knee and ilian crest in residents of Madhya Paradesh. Indian J Med Assoc 1969; 53: 67-8.

5. Khana KK, Kirns. Radiological study at wrist and elbow epiphyseal fusion with diaphysis. Indian J Med Sci 1979; 33: 121-5.

6. Mackay DH. Skeletal maturation in the a study of development in East African children. Trans R Soc Trop Med Hyg 1952; 46: 135-50.

7. Flecker H. Time of appearance and fusion of ossification centers as observed by roentgenographic method. AJR 1942; 47: 97-159.

8. Greulich WW. Pyle SI. Radiographic atlas os skeletal development of the hand and wrist. 2nd ed, Standford, California: Standford University Press, 1959: 56.

9. Tanner JM, White house RH Marshall WA, Healy MJR, Foldstein H. Assessment of skeletal maturity and prediction of adult height (TW2 method). London: Academic Press, 1975.

10. Sutow WW, Ohwada K. Skeletal standards of healthy Japanese children from age 6-19 years. Clin pediatr (JPN) 1953; 6: 14 – 22.

11. Canals ML, Valenzuela CV, Vergara SP. Skeletal

maturity of children aged 6-19 years wrist and hand. Rev Chil Pediatr 1988; 59: 102-5.

12. Rikhasor RM, Qureshi AM, Rathi SL, Channa NA. Skeletal maturity in Pakistani chlidren. J. Anat 1999; 1995: 305-8.

13. Paterson RS. A radiological investigation of the epiphysis of the long bones. J. Anat 1929; 64: 28-46.

14. Galstaum G. A study of ossification as observed in Indian subjects Indian J. Med Res 1937; 25: 267-324

15. Hansman CF. Appearance and fusion ossificatin centers in the human skeleton. AJR 1962; 88: 476-82.

16. Rikhasor RM, Abdullah S. Time of fusion of the epiphysis of the hand and wrist bones. Pakistan J Med Res 1993; 32: 311-4.