

# Age of Fusion of Epiphysis at the Lower End of Radius

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## Abstract:

**Context:** Age has to be determined not only for identification purpose but also for various civil and criminal purposes. Timing of epiphyseal fusion is an important means to estimate the age of adolescents and young adults. The present study was conducted to determine age of fusion of lower end of radius.

**Materials and Methods:** This cross sectional descriptive type of study was carried out in the Department of Anatomy, Rajshahi Medical College from July 2018 to June 2019. Total number of subjects was 88 age ranging from less than one year to twenty one years. Radiographs (A-P view) of both hands including wrist joint were studied.

**Result:** In this study complete fusion of lower end of radius was found to occur at 17-18 years. There was no appreciable difference in the age of fusion between right and left side.

**Key words:** Age, epiphyseal fusion, wrist joint, radius

## Introduction:

Estimation of age is an important task for forensic medicine experts especially in developing countries where birth records are often not well maintained. Forensic medicine experts have to evaluate age in different medico legal situations when the identity is not known or when the liability and punishment are related to the maturity, age of the individuals as in cases of criminal cases, rape, kidnapping, nullity of marriage, child labour, disposal of properties etc.

And changes in bones specially time related appearance and fusion of different ossification centers in growing periods are valuable indices for assessing the age, but that is quite reliable only up to 25 years of age; beyond that it becomes more uncertain.<sup>1</sup>

The study of epiphyseal fusion of bones is considered a reasonable scientific and accepted method for estimation of age by the courts of law all over the world.<sup>2</sup> There are many factors which affect the appearance and fusion of various bony centers like environmental, nutritional etc.

Changes in human skeletal development are basically similar, as the development process of each bone has continuity and runs through the same stages. At each stage, bones have specific characteristics. Therefore, comparing with Chronological age (CA), Skeletal age assessment (SAA) is a more accurate way to reflect the level of individual growth development and the degree of maturation.<sup>3,4,5</sup>

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So it is necessary to gather and follow the latest data available for a particular population for estimation of the age. This study might provide clinically an important role to the forensic medicine, pediatrics, endocrinology and radiology for age determination.

**Materials and Methods:**

This cross sectional type of descriptive study was carried out in the Department of Anatomy, Rajshahi Medical College in collaboration with Department of Radiology and Imaging, Rajshahi Medical College Hospital from July 2018 to June 2019. Radiographs (A-P view) of both hands including wrist joint of 88 subjects of age ranging from less than one year to twenty one years were studied. Subjects having musculo-skeletal, nutritional and endocrine disorders, previous history of trauma or injury at the wrist joint and bones were excluded.

After obtaining the written consent, X-rays of both hands including wrist joint (A-P view) of each case was taken. Joints involved in the study were subjected to minimum exposures and appropriate voltage settings of x-ray machine was applied so as to avoid unnecessary radiation exposure of the

subjects and to get the desired qualities of X-rays. The developed X-ray films were studied with assistance from an experienced radiologist.

**Ethical clearance**

The study was approved by the Ethical Review Committee of Rajshahi Medical College.

**Criteria for union**

Skeletal maturity was evaluated according to the Jits and Kulkarnis<sup>6</sup> classification of four stages, Appearance, Non fusion, Partial fusion, and Complete fusion (abbreviated as “AP”, “NF”, “PF”, “CF” respectively).

- a) **Nonfusion:** X-Ray showing clear gap between the epiphyseal and diaphyseal end. It was showing tooth like appearance.
- b) **Partial fusion:** X-Ray showing a line replacing the hiatus between the epiphyseal and diaphyseal ends and not showing tooth like appearance.
- c) **Complete fusion:** X-Ray showing the same bony architecture in the diaphysis and epiphysis of previous stage with presence of scar.

**Results:**

**Table I**

*Frequency distribution of subjects by status of epiphyseal fusion at the lower ends of radius (n = 84)*

Status of fusion of lower end radius	Right		Left	
	Frequency	Percentage	Frequency	Percentage
Non fusion	44	50.0	44	50.0
Partial fusion	20	22.7	20	22.7
Complete fusion	24	27.3	24	27.3

Partial fusion at the lower end of the radius with its shaft was found started at the age of 12- 13 years and complete fusion was found at the age of 17 – 18 years (Table II)

**Table-II**  
*Epiphyseal fusion at the lower end of radius with its shaft*

Age (years)	Fusion of the lower end of radius					
	Right			Left		
	Non(n = 44)	Partial(n = 20)	Complete(n = 24)	Non(n = 44)	Partial(n = 20)	Complete(n = 24)
< 1	2	-	-	2	-	-
1-2	4	-	-	4	-	-
2-3	-	-	-	-	-	-
3-4	3	-	-	3	-	-
4-5	4	-	-	4	-	-
5-6	6	-	-	6	-	-
6-7	3	-	-	3	-	-
7-8	5	-	-	5	-	-
8-9	4	-	-	4	-	-
9-10	2	-	-	2	-	-
10-11	4	-	-	4	-	-
11-12	4	-	-	4	-	-
12-13	3	<b>1</b>	-	3	<b>1</b>	-
13-14	-	3	-	-	3	-
14-15	-	4	-	-	4	-
15-16	-	4	-	-	4	-
16-17	-	5	-	-	5	-
17-18	-	3	<b>4</b>	-	3	<b>4</b>
18-19	-	-	10	-	-	10
19-20	-	-	6	-	-	6
20-21	-	-	4	-	-	4



**Fig.-1:** Radiograph of wrist joint of 10 years old female showing non fusion at the lower end of radius



**Fig.-2:** Radiograph of wrist joint of 13 years old female showing partial fusion at the lower end of radius



**Fig.-3:** Radiograph of wrist joint of 17 years old female showing complete fusion at the lower end of radius

#### **Discussion:**

An extensive work for determination of age of epiphyseal union in different states of India was done which revealed the difference in the age of epiphyseal union.<sup>7</sup> They stated that the difference might be on account of varying sexual dimorphism, dietetic, geographic, hereditary and other factors.

From the present study it was observed that fusion at the lower end of radius occur at 17-18 years in both sides (Table II). That result was supported by six studies; Bhise<sup>8</sup>, Sangma<sup>9</sup>, Krishnamoorthy<sup>10</sup>, Hassan<sup>11</sup>, Kumar<sup>12</sup>, Leena<sup>13</sup>.

Al-Qtaital<sup>14</sup> found fusion at the lower end of radius occurred 1-2 years earlier than that of the present study. Furthermore, fusion at the lower end of radius was found to be 2-3 years earlier in the study conducted by Memon<sup>15</sup> and 2-3 years later in the study done by Nemade.<sup>16</sup>

#### **Conclusion:**

The completion of epiphyseal fusion in the present study for the lower end of radius is found at the age of 17-18 years. Though the general development including height, weight, secondary sexual characteristics are helpful, eruption and maturity of teeth are quite reliable data for estimation of age. The ages of epiphyseal fusion are found to vary greatly all over the world indicating the need for separate standards of ages of epiphyseal union for separate regions.

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