

■ ORIGINAL ARTICLE

## Age Determination from Coracoid Process of Shoulder Joint in Males of Central India

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### ABSTRACT

There is no statistical data to establish variation in coracoids process fusion of shoulder joint in males in central India population. This significant oversight can lead to exclusion of persons of interest in a forensic investigation. Coracoid process fusions in males were analyzed on radiological basis to assess the range of variation of coracoids process fusion at each age. In this study the X ray films of the subjects were divided into three groups on the basis of degree of fusion. Firstly, those which were showing No Fusion (N), secondly those showing Partial Union (PC), and thirdly those showing Complete Fusion (C). Observations made were compared with the previous studies.

Keywords | Coracoid Process; Shoulder Joint; Radiological basis.

### INTRODUCTION

Epiphysis of the bones unites at the particular ages which are remarkably constant for a particular epiphysis and this is helpful in age determination. In law the crime and punishment is entirely based on criminal responsibility and this in turn depend on the age of a person. Age is helpful in identification of an individual which in turn is helpful in both civil and criminal cases. It has been also stated that the study of epiphyseal union of bones is considered a reasonably accurate and accepted method for age determination by the

law courts all over the world. As per Modi's textbook, owing to variation in climatic, dietetic, hereditary and other factors affecting the people of the different states of India, it cannot be reasonably expected to formulate a uniform standard for the determination of the age of the union of epiphyses for the whole of India.<sup>1</sup> Union of epiphysis in cartilaginous bones takes place earlier in the females by about 2 years than in males except in case of skull sutures where obliteration sets in little later and proceeds more slowly in females than in males

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#### How to cite this article

Vishal Babulal Surwade, Sachin Kumar Meena, B H Tirpude, P N Murkey/Age Determination from Coracoid Process of Shoulder Joint In Males of Central India/Indian Journal of Forensic Medicine and Pathology/2021;14(3):355-360

and under tropical conditions ossification is observed earlier than in temperate areas. Reddy KSN (2009) stated that the bones of human skeleton develop from a number of ossification centers.<sup>2</sup> At eleventh to twelfth week of intrauterine life, there are 806 centers of ossification, at birth there are about 450. The adult human skeleton carries only 206 bones. Mehta Homi S (1963) observed that it has been approved by research in our country that the epiphysio- diaphysial union in Indian occurs about a year or two in advance of the age at which that occurs in Europeans.<sup>3</sup> Jit and Kulkarni revealed that Precocity of epiphyseal union has been attributed to racial and climatic factors.<sup>4</sup> This difference could possibly be due to inadequate material or recording of incorrect ages of the subjects. By taking into consideration the radiological assessment in central India the study will be of help in further understanding the details of precise assessment of age in central Indian population.

#### AIMS AND OBJECTIVES

- To estimate age from coracoids fusions at shoulder joint in male subjects.
- To asses age specific difference in coracoids fusion at shoulder Joint in all subjects.
- To assess and evaluate the difference in the coracoid fusion at shoulder Joint in Central part of the India with other parts of India on the basis of previous studies.

#### MATERIAL AND METHODS

The study was carried out with the objective to assess the general skeletal maturity of subjects in Central India. Total eighty (80) females were taken in this study from age ranging from thirteen to twenty one years (13-21).

The individuals were selected from the following sources:

- Individuals admitted in Hospital for treatment purpose.
- Patients coming to the hospital for routine check-ups.

- Student coming to the hospital for medical check-ups.

The individual chosen for the study were evaluated and confirmed for the following:

- They were born to parent native of Central India and lived here since birth.
- They have authentic documentation of their date of birth. (Birth certificate, School leaving certificate, Hospital records, School records).
- Individuals involved in study were predominately right-handed.

#### Exclusion Criteria

- The subjects should not have any bony deformity or pathology, congenital malformation, nutritional deficiency, endocrinal disorders, history of chronic drug intake (e.g.) anti-epileptic drugs, steroids and chronic illness thus affecting the skeletal growth and development of the individual.
- Those who have no valid Date of Birth certificates.

#### Procedure of Radiography

After taking the written consent the thorough physical examination and radiological evaluation was done. X-Rays were taken with the help of X-Ray machine in the Department. Minimum shots were taken to expose the joints involved in study and minimum and appropriate voltage settings of X-Ray machine were applied so as to avoid unnecessary radiation exposure of the subjects to get the desired qualities of X-Rays. All the radiological procedure was undertaken according to the prescribed standards. Skeletal maturity was evaluated according to the Jits and Kulkarni's classification of four stages, Appearance, Non fusion, Partial fusion, and complete fusion ("NF", "PF", "CF" respectively).<sup>4</sup>

X-Rays showing clear gap between the epiphyseal and diaphysial, showing saw tooth like appearance end were designated as "Non-fusion" (NF) X-rays. The X-rays

showing a line replacing the hiatus between the epiphyseal and diaphyseal ends and not showing saw tooth like appearance were designated as “Partial Fusion” (PF) X-rays. X-Rays showing the same bony architecture in the diaphysis and epiphysis and showing scar of the previous stage were designated as “Complete Fusion” (CF).

The master chart was prepared and tabulated as per code number given above. It was classified, analyzed and compared with known standards. Data analysis was done EPI Info software. At the end conclusions were drawn.

### OBSERVATION AND RESULTS

Total 170 individuals were included in this study. The numbers of males were 90 and numbers of females were 80. In this study radiological examination of right side shoulder joint was studied.

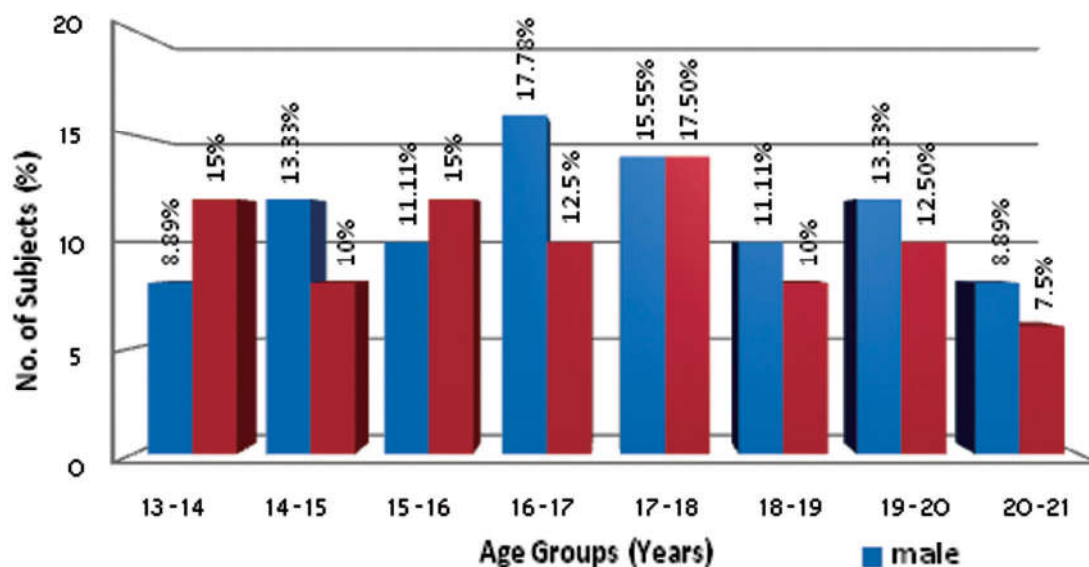
**Table 1:** Age and Gender Wise Distribution of Subjects.

Age (in years)	Males		Females	
	No	Percentage (%)	No	Percentage (%)
13-14	8	8.89	12	15.00
14-15	12	13.33	8	10.00
15-16	10	11.11	12	15.00
16-17	16	17.78	10	12.50
17-18	14	15.55	14	17.50
18-19	10	11.11	8	10.00
19-20	12	13.33	10	12.50
20-21	8	8.89	6	7.50
Total	90	100.00	80	100.00

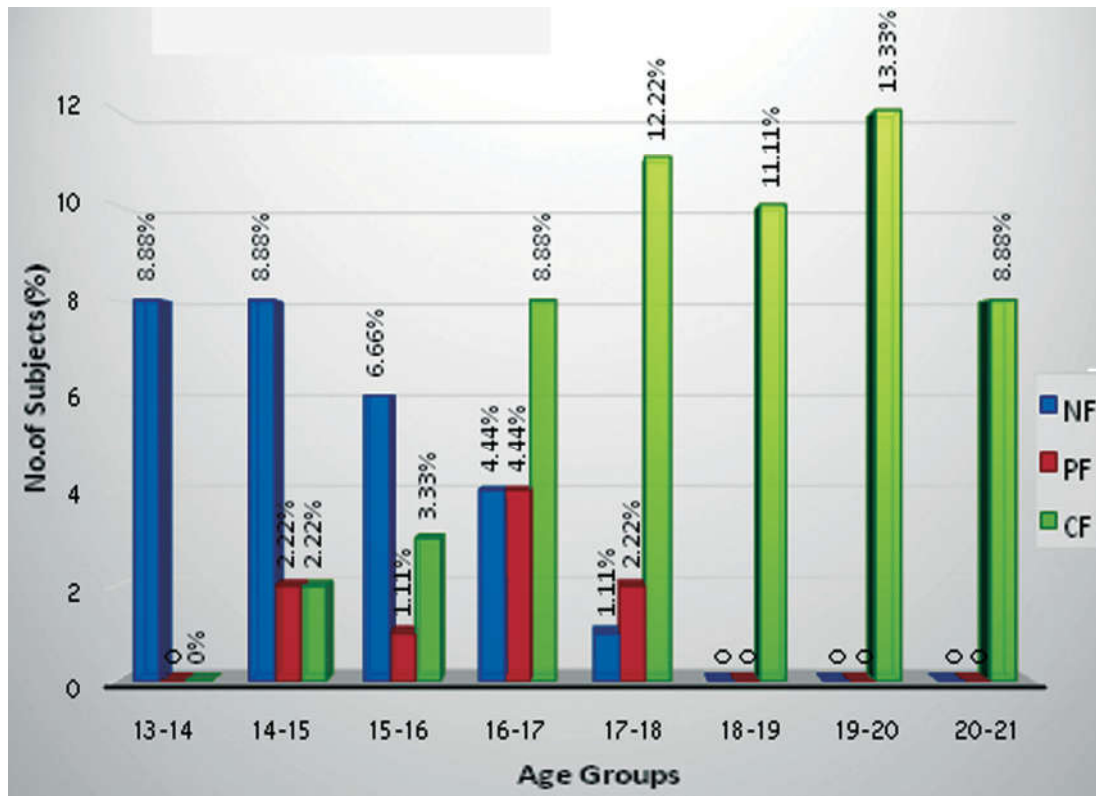
**Table 2:** Coracoid Process in Males.

Age in years	NF	PF	CF	Total
13-14	8(8.88%)	0(0%)	0(0%)	8(8.88%)
14-15	8(8.88%)	2(2.22%)	2(2.22%)	12(13.33%)
15-16	6(6.66%)	1(1.11%)	3(3.33%)	10(11.11%)
16-17	4(4.44%)	4(4.44%)	8(8.88%)	16(17.77%)
17-18	1(1.11%)	2(2.22%)	11(12.22%)	14(15.55%)
18-19	0(0%)	0(0%)	10(11.11%)	10(11.11%)
19-20	0(0%)	0(0%)	12(13.33%)	12(13.33%)
20-21	0(0%)	0(0%)	8(8.88%)	8(8.88%)
Total	27(30%)	9(10%)	54(60%)	90(100%)

**Graph 1:** Age and gender wise distribution of subjects.



**Graph 2:** Coracoid Process in Male.



$\chi^2$ -value 60.3333  
 p-value 0.000, S, p<0.05

Note: Figures in parenthesis indicates percentage.

Coracoid Process in males shows partial fusion in 12 (14.63%) cases in 14-15 year of age group. 2 (2.22%) cases in 14-15 years of age group. 1 (1.11%) case, 4 (4.44%) cases and 2 (2.22%) cases in 15-16 years, 16-17 years and 17-18 years of age groups respectively.

Similarly it Show complete fusion in 2 (2.22%), 3 (3.33%) and 8 (8.88%) cases in age group of 14-15 years, 15-16 years and 16-17 years respectively. Whereas it is in 11 (12.22%) cases in 17-18 years of Age group. As the person grows and matures it shows complete fusion in all 30 (33.33%) cases between 18-21 years of age group.

**DISCUSSION**

Researcher	Region	Male
Galstaun (1937)	Bengal	17-18
Krogman (1960)	USA	18-19
Reddy KSN (1973)	Andhra Pradesh	15-16
Sahana S.N (1986)	Bengal	17
Saini et al (2005)	Rajasthan	18-19
Agrawal Anil (2006)	Delhi	16
Cardoso Hugo (2008)	Spain	17
Schaefer M.C.(2008)	Bosnia	15-18
Pimple et al (2013)	Mumbai	18-19
Present Study	Central India	18-19

Out of 170 subjects 90 males and 80 females from age group 13-21 years, were studied radiologically for epiphyseal fusion of coracoid process of scapula.

In the age group of 13-14 years males shows non fusion in 8 (8.88%) cases. In 14-15

years of age group partial fusion was seen in 2 (2.22%) cases and complete fusion was seen in 2 (2.22%) case. Similarly 15-16 years and 16-17 years age group shows complete fusion in 3 (3.33%) and 8 (8.88%) cases respectively. The coracoid process shows complete fusion in all 41 (45.55%) cases between 17-21 years of age group of males.

Average age of complete fusion of coracoid process with scapula in male subjects was 18-19 years in present study.

The observation of present study exactly matched with the work of Pimple et al (2013)<sup>5</sup>, Saini et al (2005)<sup>6</sup> and Krogman (1960)<sup>7</sup> in the population of Western Maharashtra, Rajasthan and the United States of America respectively.

Disparity was observed with the work of Galstaun (1937)<sup>8</sup> and Hugo Cardoso (2008).<sup>9</sup> They observed fusion of coracoid process in males 1 year earlier than present study i.e. 17-18 years. A Delhi based study done by Agarwal A (2006)<sup>10</sup> observed early fusion of coracoid process at 16 years which was 2 years earlier than present study.

This means, the observations of present study done in Central India, is slightly different than the observations done in North and Eastern India and so also with some Western countries. The reason may be change in climate, dietary and hereditary factors.

The coracoid process showed complete fusion in 8 (10%) cases in 18-19 years age group, in 10 (12.5%) cases in 19-20 years age group and in 6 (7.5%) cases in 20-21 years of age group.

This means, the observations of present study done in Central India, is slightly different than the observations done in North and Eastern India and so also with some Western countries. The reason may be change in climate, dietary and hereditary factors.

The present study confirms that, the worldwide trend of early fusion of epiphysis in females as compared to their male counterparts is uniform throughout the world. The present study also observed that, female epiphyseal fusion is early than male subjects.

#### Limitations of Study

- Population in Central India is mixed type comprising of various religions and castes so this study is not applicable to specific caste or religion.
- Dietary, religious, economic, environmental factors are not studied in the present context.
- As the number of subjects were less, for confirmation of various variations, more studies are required.
- This study was conducted exclusively on the young indigenous population of Central India keeping in mind that very less literature about the age estimation from ossification of shoulder joint is available involving this particular region of India.
- By comparing the available literature about ossification of long bones, fusion was delayed one to three years in this study with population of Central India than those parts of Eastern India in the population of Bengal.
- By comparing the available literature the age of skeletal maturity in males in this region are nearly similar to those in population of Western Maharashtra and Rajasthan were compared with available results of various previous studies.
- As this study is done in Central India region the application of standards of this study may be considered ideal for application in the region of Central India.
- Population in Central India is mixed type

comprising of various religions and castes, so this study is not applicable to specific caste or religion for estimation of age.

- Due to changing life style pattern, dietary, climatic, behavioral factors; age of ossification is changing as mentioned in the available literature. So as to evaluate these changes, studies are recommended in every region of India at regular time period for academic and judicial interest.

- Due to very narrow borderline range of differentiation between various stages of fusion, it is difficult to consider stage of

fusion as age indicator.

- The opinion about age should always be given in the range. From this study, range of 1-2 years of margin of error can be concluded.
- With similar findings we have observed, there is enhancement of belief in the theory that the similarities in geographic-climatic condition, ethnicity, socioeconomic status, dietary habits have the common influence on the fusion of epiphysis with the age.

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