

A study of age estimation from digital X-ray of shoulder joint in south Gujarat region

Shivnath Parkhe^{1*}, Jignesh Patel², Kalpesh Zanzrukiya³, Umang Patel⁴, Ganesh Govekar⁵

¹Assistant Professor, Department of Forensic Medicine, D.V.P.P.F's Medical College, Ahmednagar, Maharashtra, INDIA.

²Assistant Professor, ⁵Professor and Head, Department of Forensic Medicine Govt. Medical College, Surat, INDIA.

³Assistant Professor, Department of Forensic Medicine, Smt. B.K. Shah Medical Institute and Research Centre. Badoda. INDIA.

⁴Assistant Professor, Department of Forensic Medicine Vedantaa Institute of Medical Sciences, Palghar, INDIA.

Email: dr.shivnathparkhe@gmail.com, dr.jignesh69@gmail.com, kalpeshzrk1987@gmail.com, umang272@gmail.com, ggovekar@yahoo.com

Abstract

Background: Different studies conducted in different states have concluded that the age of union of epiphysis in Indians is about 2-3 years earlier than in Europeans. In addition, it occurs somewhat earlier in females by 1-2 years than in males. Considering these variations, we have made an effort to give the status of ossification which would be helpful for age determination of subjects between 14-20 years' age group in south Gujarat region. **Aim:** To study the progress of fusion bony centres in relation to sex, religion, diet, socioeconomic status, and Geographical condition in the age group between 14 years to 20 years in living human beings. **Material Method:** The present study was conducted in the Department of Forensic Medicine and Toxicology at Government Medical College and New Civil Hospital, Surat. This study was carried out on total 200 subjects between the age group of 14 years to 20 years. **Observations:** A of complete fusion of Head of Humerus in Males 18-19 years and in Females 17-18 years. In females, the ossification centre of shoulder joint occurs earlier than males by one year as seen above. The complete fusion of centres of shoulder joint occurs one to two years later than the subject of England and America. The complete fusion of centres of shoulder joint occurs one to two years later in the population of south-Gujarat than south Indian population and most of the remaining parts of India, centres of shoulder joint fuse at approximately the same as other parts of INDIA.

Keywords: Age estimation, Ossification centres, Shoulder joint, X-ray.

*Address for Correspondence:

Dr Shivnath Parkhe, Assistant Professor, Department of Forensic Medicine, D.V.P.P.F's Medical College, Ahmednagar, Maharashtra, INDIA..

Email: dr.shivnathparkhe@gmail.com

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INTRODUCTION

The scientific estimation of age is not an easy task, but still it is easier to determine the age of the person with a certain degree of accuracy from birth to 25 years, however these data to some extent are influenced by heredity, climate, race, diet, hormone level, disease process, socioeconomic

status, working styles, Geographical condition etc. We have made an effort to give the status of ossification which would be helpful for age determination of subjects between 14-20 years' age group in south Gujarat region.^{1,2,3}

Aim and Objectives:

To study the progress of fusion in relation to sex, religion, diet, socioeconomic status, and Geographical condition in the age group between 14 years to 20 years in living human beings. To study the fusion of bony centres in the shoulder joint in South Gujarat region. To find out whether the present study would help to standardize the age estimation from radiological study of shoulder joint in south Gujarat region. To detect the relationship between various influencing factor and fusion of bony centres in the shoulder region.

MATERIAL METHOD

The present study was conducted in the Department of Forensic Medicine and Toxicology at Government Medical College and New Civil Hospital, Surat. This study was carried out on total 200 subjects between the age group of 14 years to 20 years. Ethical committee permission were obtained. Permission from Radiology department, New civil Hospital, Surat for Digital X- ray has been taken. Written and informed consent for X-ray were taken from all subjects. Performa and Information sheet used in English and Gujarati language. Information of address, education, disease, any habit, age, sex, physical development, nutritional status, work, handedness, diet, family size, socio-economic condition was taken from the subjects. Documentary proof of birth certificate, school leaving certificate, Ration card, election ID, Aadhar card, school ID, hospital record and Driving licence verified.

Sampling method: Simple random sampling.

Inclusion criteria

Subject from South Gujarat Region coming to Forensic Medicine Department for age estimation, MLC and cases referred by CMO from Casualty. Date of birth proof for age. Age group between 14 years to 20 years. Persons free from any physical disability. No any bone and cartilage disease and fracture of shoulder joint. Persons willing to join this study.

Exclusion criteria

Pregnancy. Persons suffering from previous or current H/O bone and cartilage disease and fracture of Shoulder joint. Persons who have previous or current H/O any disease, physical disability. Subject from out of South Gujarat Region. Persons not understand Gujarati Language.

Methodology

The X- ray AP view of Shoulder joint taken by using digital X-ray method for appearance and fusion of ossification centres of acromion process, coracoids process

and head of humerus. The X- ray of the Shoulder joint were taken in antero-posterior (AP) view using a factor 55 KVP and 9 MAS. Care was taken for the centring of X-ray tube over the epiphyses as it is quite easy to give un-united epiphyses the appearance of union by directing the cone of rays obliquely.

Adequate precautions were taken to avoid unnecessary X-ray exposure of subjects by providing them lead gown.

Radiological Findings:

Skeletal maturity was evaluated according to the Jits and Kulkarni's classification of four stages, Appearance, Non fusion, Partial fusion, complete fusion.⁴

Stage 0: When the epiphyseal cartilage did not begin to decrease in thickness designated as "Not appeared".

Stage 1: X-ray showing clear gap between the epiphyseal and diaphyseal, showing saw tooth like appearance end were designated as "Non fusion".

Stage 2: X-ray showing a line replacing the hiatus between the epiphyseal and diaphyseal end and not showing saw tooth like appearance were designated as "Partial fusion".

Stage 3: X-ray showing the same bony architecture in the diaphysis and epiphysis and showing scar of the previous stage were designated as "Complete fusion".

OBSERVATIONS

This study was conducted at Department of forensic medicine and Toxicology at Government Medical College and New Civil Hospital, Surat. This study was carried out on 200 participants who belong to the age group of 14-20 years attending the Forensic Medicine and Toxicology Department and outpatient department of New Civil Hospital, Surat.

Thus in our study, of the total 200 participants, 100, i.e. 50% were males and 100, i.e. 50% were

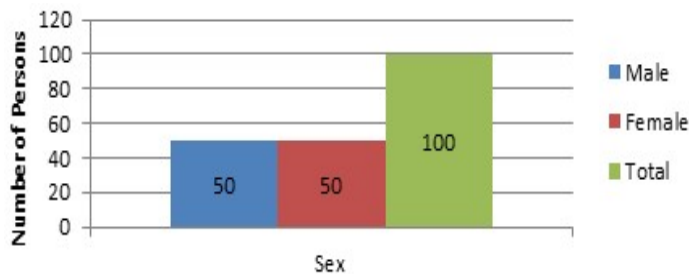


Figure 1: Sex Wise Distribution

Table 1: Comparison of ossification of proximal end of humerus with Age, Sex and other studies

Sr. No	Study	Age of ossification of proximal end of humerus in years	
		Male	Female
Indian studies			
1	Hepworth (Punjabi-1929)		17-18
2	Pillai (Madras – 1936)		14-17
3	Galstaun (Bengal – 1937)	14-18	14-16
4	Reddy KSN (Andhra Pradesh - 1973)	18-19	17-18
5	Sahana S N(Bengal - 1986)	-	18
6	Saini O P (Jaipur - 2005)	18-19	17-18
7	Agarwal Anil (Delhi - 2006)	18	17
8	Pimple D H (Mumbai - 2013)	18-19	17-18
9	Tirpude B H (Maharashtra - 2014)	-	17-18
10	Present Study (South Gujarat 2015)	18-19	17-18
Foreign Studies			
1	Paterson (Manchester - 1926)	20	18
2	Davies and Parson (England -1927)		19-21
3	Flecker (Melbourne - 1932)	19	17
4	Krogman (USA-1960)	-	18-19
5	Knight B (UK - 1961)	16-23	-
6	Cardoso Hugo (Spain - 2008)	-	20
7	Memon <i>et al.</i> (Pakistan - 2008)	-	16-17

As evident from the above table, in our study, we have found that in statistically significant number cases, the age of fusion of head of humerus in male 18 – 19 years and 17 – 18 years in females, which is in accordance with the findings of Reddy K S N (Andhra Pradesh 1973)⁵, Saini O P (Jaipur - 2005)⁶, Agarwal Anil (Delhi - 2006)¹, Pimple D H (Mumbai - 2013)⁷, Tirpude B.H (Maharashtra- 2014)⁸ but not with Galstaun (Bengal – 1937)⁹, his study suggest that fusion occurs at lower age. Davies and Parson (England - 1927)³, study suggest that fusion occurs at 20 years in male and 18 years in female and Flecker (Melbourne - 1932)¹⁰ study suggest that fusion occurs at 19 years in male and 17 years in female.



Figure 2: Distribution according to Diet

Diet and Fusion of Head of Humerus:

In the present study total numbers of female candidates are 15 and 66.6 percentage of candidates which show complete fusion; in age groups of 17 to 18 years and total numbers of male candidates are 7 and 85.71 percentage of candidates which completed (i.e. stage 3) fusion in age groups of 18 to 19 years according to their respective diets. As is evident from the above tables, no significant effect of the diet of an individual is seen on the fusion of Head of Humerus

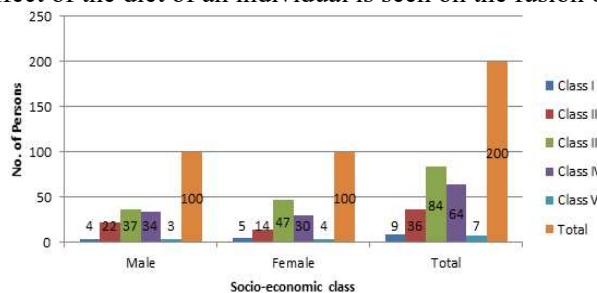


Figure 3: Distribution according to Socio-Economic Classes

Table 2: SE Class and fusion of head of humerus

Age Groups	Sex	Socio- Economic class								
		5 and 4			3 and 2			1		
		No	total	%	No	total	%	No	total	%
14-15 Years	Male	0	3	0	0	11	0	0	0	0
	Female	0	4	0	0	11	0	0	0	0
15-16 Years	Male	0	5	0	0	8	0	0	2	0
	Female	0	1	0	0	9	0	0	0	0
16-17 Years	Male	0	6	0	0	5	0	0	0	0
	Female	0	7	0	0	7	0	0	0	0
17-18 Years	Male	1	7	14.29	1	9	11.11	0	0	0
	Female	3	4	75	6	11	54.55	3	4	75
18-19 Years	Male	5	6	83.33	6	6	100	2	2	100
	Female	6	6	100	8	9	88.89	0	0	0
19-20 Years	Male	5	5	100	9	9	100	0	0	0
	Female	5	5	100	7	7	100	1	1	100
20-21 Years	Male	5	5	100	11	11	100	0	0	0
	Female	7	7	100	7	7	100	0	0	0
Total	Male	16	37		27	59		2	4	
	Female	21	34		28	61		4	5	

As is evident from the above tables, no significant effect of the Socio-Economic class is seen on the fusion of Head of humerus with respective age in both males and females.

DISCUSSION

The digital X-ray of shoulder joint A P view is taken in Radiology Department of New civil hospitals, Surat and to study fusion of head of humerus of shoulder joint in males and females were done. The process of fusion was sub divided in to various stages and study was done to find out its relation to various factors like sex, diet, religion, socioeconomic class were observed:

Sex and Fusion of Centres of Shoulder Joint:

As far as the relation of sex with fusion of centres of shoulder joint concerned, the findings of my study are very much in accordance with the findings of all other studies, both foreign and Indian studies that we have come across, i.e. fusion of these centres occurs earlier in females by one to two years as compared to males.^{11,12,13}

Diet and Fusion of Centres of Shoulder Joint:

Except for us, Kalpesh Shah (Gujarat 1991) and Jain S.^{14,15}, no other researcher has studied the relation of vegetarian or non-vegetarian diet with fusion of epiphyseal centres and as far as we know, all the three studies agree that there is no association of vegetarian and non-vegetarian diet on the fusion of epiphyseal centres, in both male and females.¹⁶

Socio-Economic Class and Fusion Of Shoulder Joint:

This relation was studied to testify the hypothesis that higher SE class leads to better nourishment and better overall growth and thus to earlier / later fusion of epiphysis. However, no significant effect of the Socio-Economic Class of an individual was seen on the fusion of centres of shoulder joint in either males or females, neither in our study, nor in any other study.^{7,13,14}

SUMMARY AND CONCLUSIONS

In the present study from the observations, the following conclusions were drawn: A of complete fusion of Head of Humerus in Males 18-19 years and in Females 17-18 years. In females, the ossification centre of shoulder joint occurs earlier than males by one year as seen above. The complete fusion of centres of shoulder joint occurs one to two years later than the subject of England and America. The complete fusion of centres of shoulder joint occurs one to two years later in the population of south-Gujarat than south Indian population and most of the remaining parts of India, centres of shoulder joint fuse at approximately the same as other parts of INDIA. There is no association of vegetarian and non-vegetarian diet on the fusion of epiphyseal centres, in both male and females. There is no significant effect of the Socio-Economic Class of an individual was seen on the fusion of centres of shoulder joint in either males or females, neither in our study, nor in any other study.

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