Determination of Age by Studying Radiological Fusion of Shoulder Joint in Relation to Birth Certificates in 16-20 Years Age Group

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Abstract— *Age estimation of an individual is of medicolegal importance. Age becomes an important criteria for voting, driving licence, marriage, in civilcases e.g. to get government jobs and pensions. In criminal cases, the judgmentis based on the opinion about age given by the forensic experts. Ossification centres appear in a fairly definite sequence at a particular age group and fuses at a particular age group from which an age of the individual can be determined. Materials and methods: 60 subjects were randomly selected from various schools, from neighbourhood as well as the cases attending the OPD of General Medicine Department of Madras Medical College, Chennai – 3. Conclusion :None of the cases in the age group of 16 – 17 yrs among males showed fusion of the secondary ossification centre of the shoulder joint. 30.76% and 28.57% of the cases showed fusion of the secondary ossification centre of the shoulder joint among males in the age group of 17 – 18yrs and 18 – 19 yrs respectively. 30%, 40%, 50% of the cases showed fusion of the secondary ossification centre of the shoulder joint among females in the age group of 16 – 17 yrs, 17 – 18 yrs, 18 – 19 yrs respectively. In the present study, it is observed that the mean age at which the secondary ossification centre of the shoulder joint fuses is 18 – 19 yrs in both boys and girls. In the present study, the fusion of the secondary ossification centre of the shoulder joint occurred one year later among females in comparison to ages mentioned in various standard literatures.It is due to the racial, economic, hereditary and hormonal factors.*

Keywords— ***Age estimation, Secondary centre, Shoulder joint, Radiographs***

I.   INTRODUCTION

Identification may be of two types: complete and partial. Complete identification refers to the perfect fixation of the individuality of the person and also called as absolute identification. Partial identification or incomplete identification implies ascertainment of only some traits or facts about the identity while the others remain unknown.

For establishment of the corpus delicti after homicide, accurate identification is necessary since portions of a dead body or bones or unclaimed bodies are sometimes brought forward to support a false charge. The term corpus delicti is the establishment of identificationof the

dead body.

Age, Sex and Stature constitutes the three primary characteristics of identification. Identification of the individuals would be difficult based on visually who died in mass disasters, air crash accidents, explosions, fires, advanced decomposition, earthquakes, exhumation and terrorist act.

Skeletal age of an individual can be determined based on the characteristic changes that occur during epiphyseal union. This skeletal age which when compared with age -based standards provides an estimation of chronological age of an individual. In forensic age diagnosis

of living adolescents and young adults, radiological assessment of the degree of ossification of the medial clavicular epiphysis plays a vital role.

II.   AIM AND OBJECTIVES

AIM

To study the age determination by radiological examination of fusion of epiphyseal centres of shoulder joint in relation to birth certificates in subjects between 16-20 years of age.

OBJECTIVES

1. To assess the age determination from fusion of epiphyseal centres of shoulder joint in subjects between 16-20 years of age using digital X-rays in Ajmer region.

2. To assess and compare radiological age to the documented age as per the birth certificate.

3. Suggestions for authenticity of age estimation from ossification centres, physical and dental examination.

III.   MATERIAL & METHOD

This study will be carried out at the Department of Forensic Medicine, JLN Medical college,Ajmer with assistance from Department of Radiology, for radiological examination after obtaining due clearance from research and review board of JLN Medical College and Hospital, Ajmer.

Study design: Community based Descriptive Observational Study.

Study period: 1st April, 2021 to 31st March, 2022 or Until the Sample Size is achieved; whichever is earlier.

Study universe: Students and staff of Medical, nursing & other paramedical college as well as students from academic institutions of Ajmer between the age group of 16-20 years with reliable document of date of birth.

Inclusion criteria:

- Should belong to Rajasthan by origin or staying for last 10 years in the Ajmer region.
- Only Subjects who have documentary evidence of age in the form of birth certificate issued by Nagar Nigam & competent authority and matriculation certificate.
- Age group: 16-20 years.
- Subjects who give their consent for participation in the study.

Exclusion criteria:

- Subjects without proof of birth record.
- Subjects below 16 years and above 20 years.
- Subjects with Severe malnutrition.
- Subjects with Chronic illness.
- Subjects with Endocrinal disorders.
- Subjects with deformities of limbs and pelvis.

Method of collection of data:

After obtaining consent from the subjects satisfying the inclusion criteria and obtaining valid informed written consent, the general physical examination will be conducted to know the health status and rule out any deformities to select the subjects after applying exclusion criteria.

Materials:

- Printer black ink
- Data collecting instrument, X-ray film
- Lead marker, lead apron
- 8 x 10 inches rigid cassette
- Film hanger (8" x 10")
- Developer Solution
- View box
- Magnifying lens
- Weighing machine and height measuring scale
- Proforma

- **Sampling method**:
- Stratified Random Sampling based on age.
- Sample size – 87(39 Boys + 48 girls)

Computing sample size for Females

- Previous studies tell us that 80 % cases of epiphysial union occurs in specified 16-18 year period.

  Precision=we'd like the result to be within 10% of true value.

  Confidence level: convention=95%=1-α

  α = 0.05 ; Z(1- α /2) one tailed test=1.65 in practice of forensic medicine   research is going on over fusion of epiphysis so upper end is taken for consideration

  Corresponding to significance level of 0.05

  p= 0.80 whereas q =1-p=0.20; Plugging all values in formula

  $n=z^2pq/ d^2 = (1.65)^2(.80)(.20)/(0.1)^2 = 43.56 = 44$ sample

  10% extra sample for Geographical variation (previous studies not being   conducted in Ajmer) =48 sample

Computing sample size for Males

- Previous studies tell us that 85 % cases of epiphysial union occurs in specified 18-20 year period.

Precision=we'd like the result to be within 10% of true value.

Confidence level: convention=95%=1-α

α = 0.05 ; Z(1- α /2) one tailed test=1.65 in practice of forensic medicine research is going on over fusion of epiphysis so upper end is taken for consideration

Corresponding to significance level of 0.05

p= 0.85 whereas q =1-p=0.15

Plugging all values in formula

$n = z^2 pq/ d^2$

$=(1.65)^2(.85)(.15)/(0.1)^2 = 34.71 = 35$ sample

10% extra sample for Geographical variation (previous studies not being conducted in Ajmer) =39 sample

be subjected to Digital X-ray examination of shoulder joint. The Radiographs will then be studied for appearance and fusion of ossification centres and age determination will be done on basis of the table of Galustan in Modi's textbook of Medical Jurisprudence. The documented age of the subject will also be noted and the determined age will be analysed in relation to the documented age (as per birth certificates).

Statistical analysis

The finally analysed data would then be tabulated in Microsoft Excel Worksheet and statistically analysed using appropriate statistical software to determine its significance at 95% confidence limits.The collected qualitative data will be expressed in groups, diagrams, proportion and percentages and analysed using appropriate statistical tests. The quantitative data will be expressed in linear and standard deviation and analysed by appropriate statistical tests as per the data obtained. Continuous data would be expressed in form of proportion and percentages differences in proportion would be analysed using chi square test. $P < 0.05$ will be considered significant.

IV.   METHOD

After selection of cases, the personal details will be recorded and after taking informed written consent clinical and dental examination will be carried out and details recorded in pre-proposed Performa. The subjects will then

V.   ANALYSIS OF RESULTS

1.   ANALYSIS OF RESULTS

60 Radiographs in the age group of 16-19 yrs were analyzed, ofwhich were male and were female

Table 1: Sample distribution among male and female

Age Group	Male	Female	Total
16-17	11	10	21
17-18	13	10	23
18-19	06	10	16
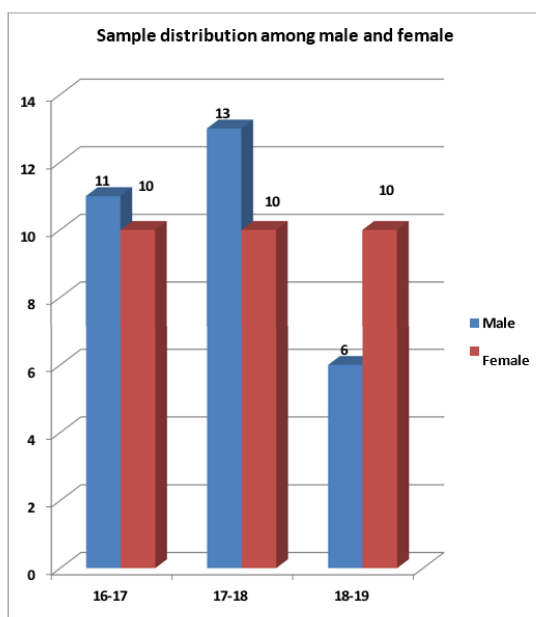
Table 2. Stage of fusion of epiphysis of Shoulder joint

Stage	I	II	III	IV
16-17	06	06	06	03
17-18	04	05	06	08
18-19	01	03	05	07
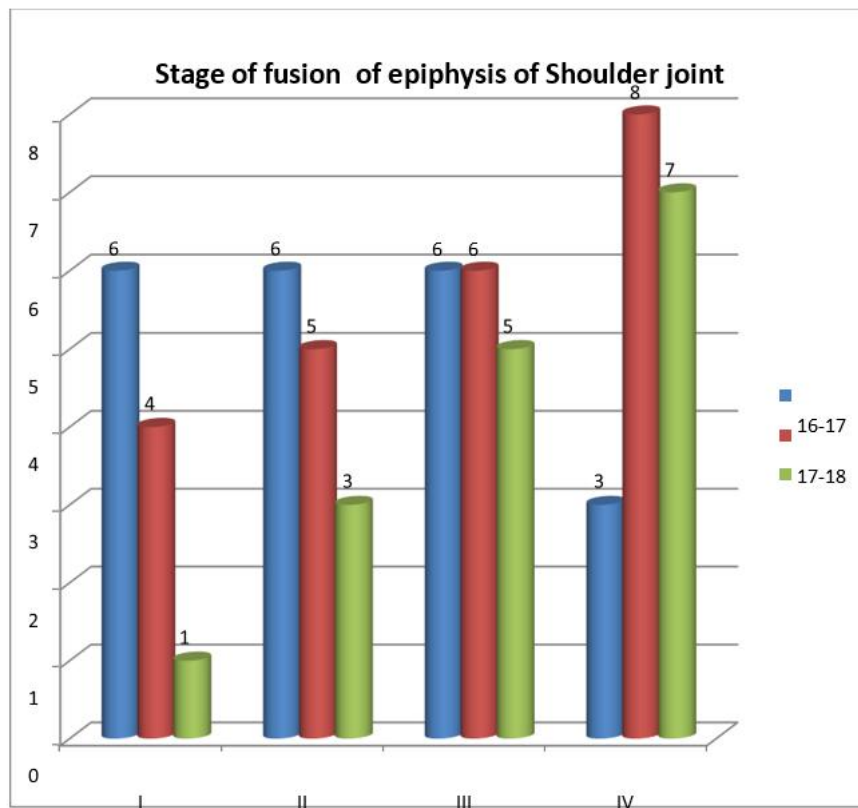
Table 3: Stage of fusion of the epiphysis ofshoulder joint among females.

Stage	I	II	III	IV
16-17	02	02	02	03
17-18	01	02	03	04
18-19	00	02	03	05
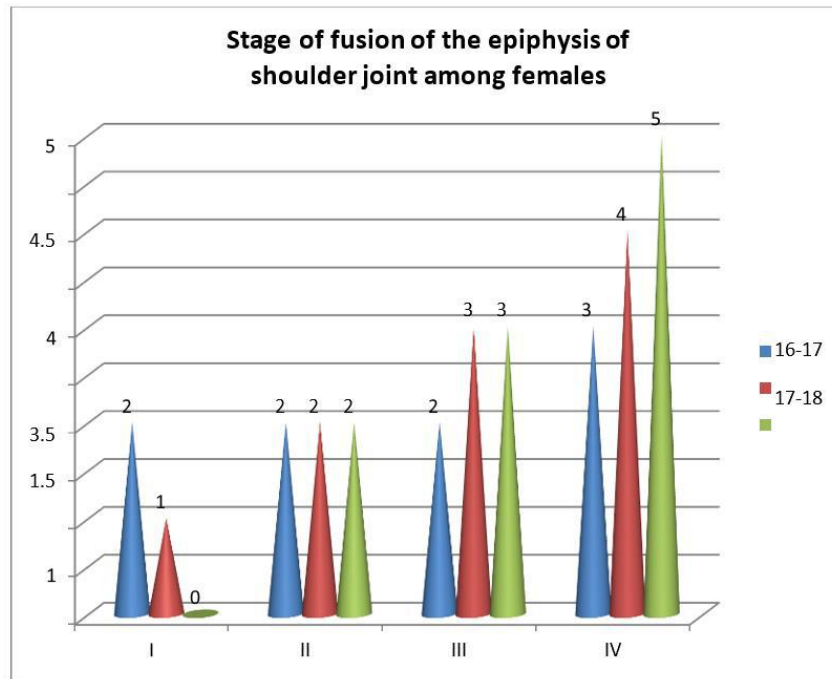
Table 4: Stage of fusion of the epiphysis ofShoulder joint among males.

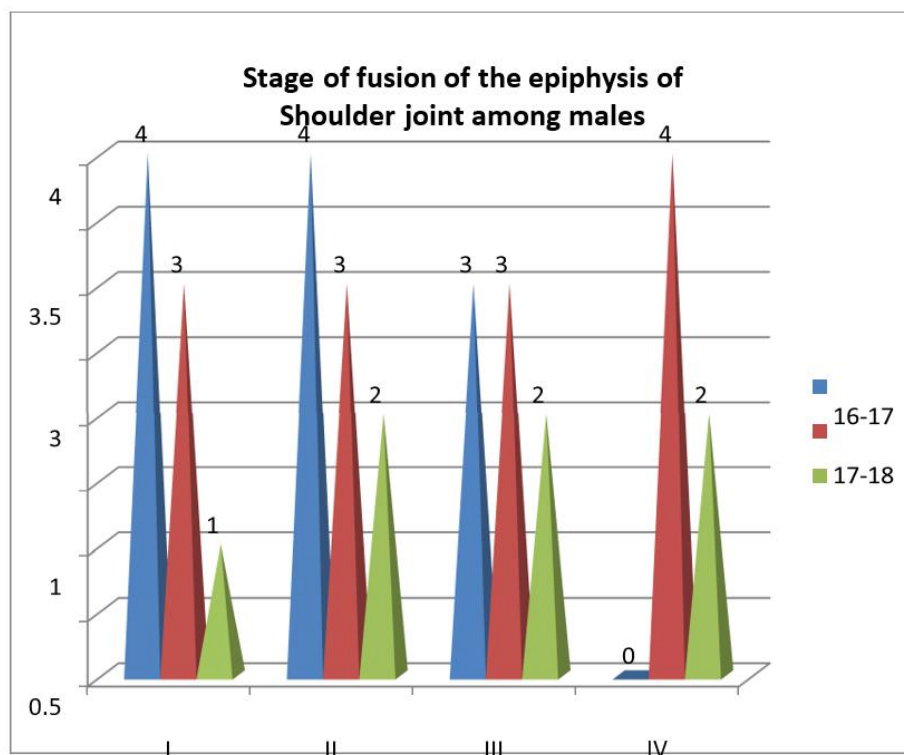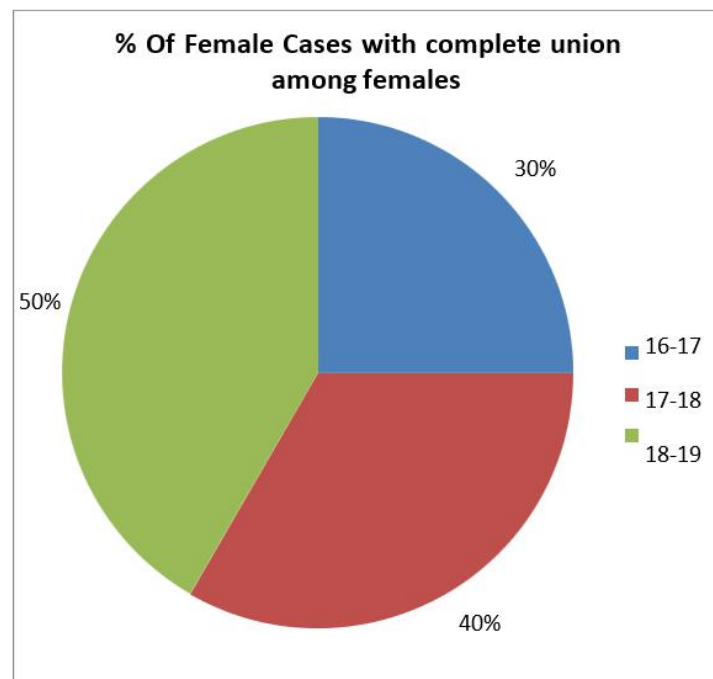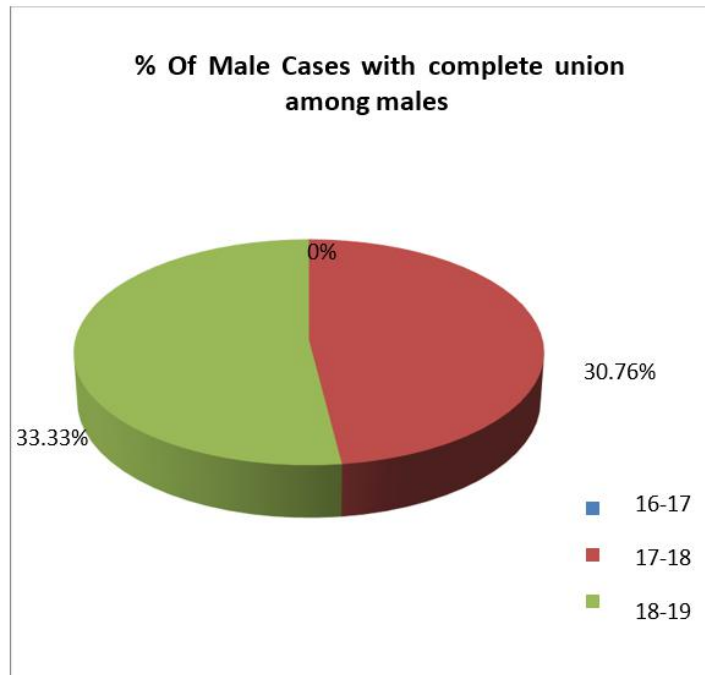| Stage	I	II	III	IV
16-17	04	04	03	00
17-18	03	03	03	04
18-19	01	02	02	02

Table 5: Age of incidence of complete union

Age Group (years)	No. of Cases	% of Male Cases with complete union among males	% of Female Cases with complete union among females
16-17	21	0%	30%
17-18	23	30.76%	40%
18-19	16	33.33%	50%

Age of incidence of complete union

VI.   DISCUSSION

Radiological examination of the ossification activates of the bones helps to determine the Approximate age of an individual. Age can be determined only in terms of range of two to five years based on the appearance and fusion of the ossification centers. On examination 60 radiographs of the shoulder joint the age of complete fusion of epiphysis of the shoulder joint is 17-18 years for males and 16-17 years for females. Earliest union occurred at the age of 15 years in females and 17 years in males.

In the present study, the age group of complete fusion is higher than the previous studies. The reason for this difference may be the geographical, nutritional and endocrine factors which influence the skeletal maturity. Age estimation from teeth, skull and pelvis has been done conventionally but each method has its own limitation and they are influenced by endocrine, racial, dietary and sex factors.

These methods can be used to categorize age into broad age groups. Estimation of age based on fusion of epiphysis of shoulder joint plays a vital role in forensic age diagnosis of living adolescents and young adults. Sex difference is noted in the age of fusion of epiphysis of shoulder joint by 1-2 years. Females show 2 years earlier onset of fusion than males.

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