ORIGINAL ARTICLE

Age Estimation from Medial End of Clavicle by X- Ray Examination

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ABSTRACT

One of the paramount important steps in Forensic Medical Examination or medicolegal examination is the establishment of the individuality of a person, i.e., personal identity and determination of age is a significant feature to establish or confirm identity of a person. In the present study 100 individuals are studied between the age group of 18 to 27 years in male and female (separately), whose X- ray examination is done at Accident and Emergency Department of Rawalpindi General Hospital, Rawalpindi. Male and female individuals were studied with age interval of two years and ten cases from each age interval were taken. The study is carried out to know the fusion of epiphysis at medial end of clavicle. For that purpose, every individual's X-ray chest AP view is taken.

Keywords: Epiphyseal Fusion, X-ray, Medial end of clavicle.

INTRODUCTION

The establishment or confirmation of personal identity is primarily the job of investigating agency but these investigating agencies or courts require the help of a medical man for that purpose[1]. The medical man by ascertaining age, sex, race and stature etc. assists the investigating agencies or courts to establish or confirm identity of an individual in certain criminal and civil cases[2].

For all long bones the fusion of epiphysis takes place at 20 years of age except clavicle[3] and presence and eruption of all the four wisdom teeth almost confirm that an individual is not less than 25 years[4], so to determine the period of age between 20–25 years the epiphysis union at medial end of clavicle is studied in this part of the world as several studies indicate that medial end of clavicle unites at about the age of 22 years[5]. Age of each individual studied was confirmed from birth certificate, service record, driving license and National identity card etc.

MATERIAL AND METHODS

In present study, 100 cases were studied including Male and female differently. The cases studied were between age group of 18-27 years that were exposed to X-ray examination at Accident and Emergency Department of Rawalpindi General Hospital, Rawalpindi. The study design was cross sectional and patients were selected by adopting consecutive sampling technique who were apparently healthy and both parents of these patients being Punjabi. Male and Female individuals were studied with age interval of two years and ten cases from each age interval were taken. The cases were studied with the help of X-ray Chest- antero-posterior view for medial end of clavicle. Status of epiphyseal union was divided into following four stages:

Stage	Appearance and fusion	Grade
I	Centre not appeared	A
II	Centre appeared but no union	+
III	Union started but incomplete	++
IV	Complete union	+++

Method for X- Ray examination: Study was carried out by Roentgenographic technique. The technique included standardization of time of exposure, positioning of the part, distance of film from X- Ray tube and processing and time of developing the films.
Positioning of the Epiphysis during X- Ray: Clark's radiographic technique has been followed in this study[6].

Positioning of Patient and film: The patient was asked to lye supine on the X- Ray table with the centre of the clavicle being examined over the midline of the table. A small sand-bag is placed under the opposite shoulder to rotate the patient slightly towards the affected side to make sure that the medial end of the clavicle is not superimposed on the vertebral column. The arm of the side being examined is in a relaxed position by the side of the trunk. The film is placed transversely in the Bucky tray centered to the clavicle and should be large enough to include the whole of the clavicle and its medial and lateral articulations.
Direction and Centering of the X- ray Beam: The vertical central ray is directed to the middle of the clavicle. Exposure taken on arrested respiration. The percentages calculated and p value determined to

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calculate significant difference between male and female subjects.

RESULTS

It is evident from Table No. 1 that in male subjects in eight cases (80%) centre of ossification for medial end of clavicle did not appear & in two cases (20%) centre appeared but no union occurred in age group 18-19 years. While in contrary to that, in age group 26-27 years, in eight cases (80 %) complete union has occurred and in two cases (20%) union started but incomplete. In age group 19-20 years, in eight cases (80%) centre did not appear & in one case (10%) centre appeared but no union occurred whereas in another case center of ossification appeared, union started but incomplete.

In age group 22-23 years, in two cases (20%) centre did not appear, in three cases (20%) centre appeared but no union occurred, in three cases (30%) union started but incomplete & in two cases (20%) complete union occurred. In age group 24-25 years, in one case (10%) centre not appeared, in one cases 10%) centre appeared but no union occurred, in two cases (20%) union started but incomplete & in six cases (60%) complete union occurred.

Table II depicted that among female subjects, in age group 18-19 years, in one case (10%) centre of ossification for medial end of clavicle did not appear, in four cases (40%) centre appeared but no union occurred and in five cases (50%) union started but incomplete. But in age group 26–27 years, in all 10 cases (100%) medial end of clavicle completely fused whereas In age group 20–21 years, in six cases (60%), centre appeared but no union, in three cases (30%) union started but incomplete & in one case (10%) complete union occurred. In age group 22 - 23 years, in three cases (30%), centre appeared but no union, in five cases (50%) union started but incomplete & in two cases (20%) complete union occurred. In age group 24-25 years, in four cases (40%) union started but incomplete & in six cases (60%) complete union occurred.

The table III showed that in female subjects in 10% cases medial end of clavicle was completely fused with the shaft up till the age of 21 years while it was completely united in 100% cases up till the age of 27 years. On the contrary, in male subjects, complete union of medial end of clavicle occurred in 80% cases up till the age of 27 years while center did not appear in any case up till the age of 21 years. Though the medial end of clavicle united earlier in female subjects but the difference is not statistically significant.

Table 1: Incidence and extent of fusion of the medial end of clavicle in different age groups for Males

Extent of fusion	Age Group 18-19 years	Age Group 20-21 years	Age Group 22-23 years	Age Group 24-25 years	Age Group 26-27 years
Centre not appeared	8 (80)	8 (80)	2 (20)	1 (10)	0 (0)
Centre appeared but no union	2 (20)	1(10)	3 (30)	1 (10)	0(0)
Union started but incomplete	0 (0)	1(10)	3 (30)	2 (20)	2(20)
Complete union	0 (0)	0(0)	2 (20)	6 (60)	8(80)

Table II: Incidence and extent of fusion of the medial end of clavicle in different age groups for Females

Extent of fusion	Age Group 18 - 19 years	Age Group 20 - 21 years	Age Group 22 - 23 years	Age Group 24 - 25 years	Age Group 26 - 27 years
Centre not appeared	1(10)	0 (0)	0 (0)	0 (0)	0 (0)
Centre appeared but no union	4 (49)	6 (60)	3(30)	0 (0)	0 (0)
Union started but incomplete	5 (50)	3(30)	5(50)	4 (40)	0 (0)
Complete union	0 (0)	1 (10)	2 (20)	6 (60)	10 (100)

Table III: Age of incidence of complete union in all subjects

Age Group (Years)	No. of cases examined	For Males No. of cases with complete union	For Females No. of cases with complete union	P value
18 - 19	20	0 (0)	0 (0)	>0.05
20 - 21	20	0 (0)	1(10%)	>0.05
22 - 23	20	2 (20%)	2(20%)	>0.05
24 - 25	20	6(60%)	6(60%)	>0.05
26 - 27	20	8 (80%)	10(100%)	>0.05

DISCUSSION

Medial clavicular epiphysis is the long bone epiphysis to fuse last and therefore, is useful for estimating age in the post-pubertal period[7]. In the present study, in majority of cases, both males and females showed complete epiphysis union between 24-27 years of age and earliest union occurred at the age of 22 years in males and 20 years in females. These findings are close to Kreitner KF et al, Stevenson, Galstaun[1,2,3]. On the contrary Singh J and Chavali KH[5] observed commencement of fusion at the medial end of clavicle as early as 18 years of age in both male and female subjects whereas complete fusion of the medial end of the clavicle was seen latest at 32 years in the male clavicles while the same was observed at 31 years in the female bones, i.e., the medial epiphysis of female clavicles fused one year earlier than their male counterparts.

In another study, conducted in Australia[7], it is concluded that with the complete fusion of clavicle in males the age will be at least 18 years of age, with a 99% certainty of being at least 21, and in females they will be at least 20 years old. If union of medial end of clavicle is at stage three then an individual of either sex will be at least 17 years of age. These findings are in contrast to the present study and this revealed that the Punjabis of Rawalpindi district reached maturity at later stage of age as compared to the Australian population and gained maturity earlier as compared to Indian population[5]. These findings showed that the difference in complete fusion of medial end of clavicle in different studies is due to the fact that these studies carried out in different races.

CONCLUSIONS

It is concluded from the present study that complete epiphyseal union at medial end of clavicle in Punjabis of Rawalpindi district occurred at the age of 26-27 years, hence, epiphyseal union of medial end of clavicle can be used as a parameter to ascertain age between 22-30 years along with other bony parameters. However, these figures cannot be applied to the other races in criminal investigations as different races have different age of union of sterna end of clavicle. Furthermore, different technique used to assess epiphyseal union at medial end of clavicle can give different results[8].

Suggestions: A more elaborative study should be carried out to determine age from medial end of clavicle by comparing different races and by using different techniques like Naked eye examination, plain X-Ray Chest AP view and by CT tomography.

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