

Original Research Paper

Study of Ossification Centres Fusion of Elbow Joint in 15 to 17 Years Garhwali Females of Dehradun Region

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Abstract

Age estimation in the living is one of the most important tasks of a Forensic practitioner especially in developing countries where birth records are often not well-maintained. The age between 15 to 17 years is very important medico-legally especially in the females, it is important to differentiate between 14-15 yrs in employment and 17 to 18 in connection with Hindu marriage Act. X-ray study of epiphysis of bones has traditionally been used for age estimation by observing the ossification centers. On the other hand, Ultrasonography is a much safer, effective and non invasive procedure. The study was carried out between 2011 and 2014 on 100 female patients of Garhwali origin. The age of the subjects was from 15 to 17 years which was verified from date of birth certificate. The main focus of the present study was to find out the age of fusion of ossification centers in the upper ends of radius & ulna, and lower end of humerus. In order to narrow down the range of age an attempt has been made to undertake this study by means of Ultrasonography. During the study, encouraging results were discovered.

Key Words: Age Estimation, Garhwali Females, Ultrasonography

Introduction:

Age estimation in the living is one of the most important tasks especially in developing countries where birth records are often not well-maintained. Despite the fact that there are a number of laws requiring registration of births (e.g. Registration of Births and Deaths Act 1969) most births are not properly recorded. There is a variation in the timing of appearance and fusion of the epiphyses of the bones.

Ossification center are seen earlier in the tropical countries and in females. The variation in the appearance and the union of ossification centers is mainly attributed to various factors like climate, heredity, race, nutrition, dietary habits, gender and socio-economic status of population.

Scientific estimation of age of an individual whether living, dead or from human remains is a vexing problem for medical jurist in both civil and criminal matters. Age estimation cases are often referred to Forensic experts as it is a very important issue to the court of law and to common man.

As the age between 15 to 17 years is very important medico-legally especially in the females, it is important to differentiate between 14-15 yrs in employment & 17 to 18 in connection with Hindu marriage Act.

X-ray study of epiphysis of bones has traditionally been used for age estimation by observing the ossification centers. On the other hand, Ultrasonography is a much safer and non invasive procedure.

Moreover, ultrasonographically, we can see the appearance and fusion of various centers dynamically and in a better way by placing the probe on a desired area. Amongst all the parameters of age determination, radiological examination of bone ends has shown accuracy and reliability acceptable to medical profession and the legal fraternity.

But X-ray examination for age estimation is fraught with ionization risks. Also, the informed consent had to be obtained from their guardians who were as expected not forthcoming, it was decided to embark upon the examination of these ossification centres by means of ultrasound study. In the past too age determination by means of ultrasonography has been documented.

Therefore, it was decided in conjunction with the department of radiology to undertake this study through non-invasive means.

This study aims to find out the age of fusion of ossification centers in upper ends of radius & ulna, and lower end of humerus in Garhwali

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DOR: 25.09.2014 DOA: 28.10.2014

females between 15 to 17 years of age. In order to narrow down the range of age an attempt has been made to undertake this study by means of Ultrasonography.

Material Methods:

This study was carried out on 100 Garhwali females of 15 to 17 years during 2011 to 2014 in the Department of Forensic Medicine and Toxicology, SGRR Medical College and Hospital, Dehradun.

All subjects were Garhwali since birth which was confirmed from date of birth certificate issued by the Municipal authority. They should be free from any physical disability involving upper limbs. Physical, dental and ultrasonological examinations were done but the more emphasis was placed on ultrasonological examination.

The cases selected for the study were grouped as per their stated age viz. 15-15.5 years, 15.5-16 years, 16-16.5 yrs and 16 – 17 yrs. Informed consent of each subject so chosen on the basis of criteria as mentioned above was evaluated clinically in detail.

After obtaining the informed consent for the ultrasonological and clinical examination, each subject was examined ultrasonologically for elbow joint of right upper limb in the Department of Radiology of SGRR Medical College, Patel Nagar, and Dehradun and subsequently the ultra sonogram was studied in detail by the radiologist with respect to fusion of various ossification centres.

Result & Discussion:

The present study was undertaken to find out the age of fusion of epiphyses at the lower end of humerus and upper end of radius and ulna in females of Garhwali region.

Ultrasonological study was conducted on 100 females in the age group of 15-17 yrs. in Dehradun, Uttarakhand, India. Courts very often refer the cases particularly those falling in border line category for medical opinion before finalizing their verdict. In most of the cases the result was found to be more reliable and precise as compared to radiological examination.

So the basic aim of this study remains the same. This study has been done by ultrasonographical method which is superior to X-Ray. This study would certainly help the medical professionals, law enforcers, bar, bench and even the public at large more effectively.

In our study fusion of medial epicondyle was found between 15 years to 15.5 years in 92% cases and between 15.5 years to 16 yrs in 96% cases but all the cases i.e. 100% showed fusion between 16 to 17 yrs. (Table 1)

In a similar study done by R.S Jnanesh et al, [1] epiphyseal center for medial epicondyle fuses with shaft at the age of 14-15 years in females. In our study we have observed that Medial Epicondyle of Humerus showed fusion in all cases at the age of 16-17 yrs.

Our findings were consistent with those of Galstaun, [2] Basu & Basu, [3] Hepworth, [4] Lall & Nut, [5] Pillai, [6] Flecker and Franklin. [7]

According to Davies & Parson [8] study fusion occurred at the age of 20 yrs which is at variance with our study, the causes being primarily attributed to geographical position and boys having been included in that study.

Apart from that a host of other factors like state of nutrition, climatic conditions should be taken into consideration. On the other hand, a similar study undertaken by Lal R et al [9] had shown that Medial epicondyle unites by the age of 17 years in 67% cases while the same unites in 90% cases at 18 years of age.

Our study is in stark contrast with this study. The discrepancy again may be attributed to gender selection, exposure time, sample size, geographical location and so on.

In our study we observed that upper end of Radius & Ulna fused at the age of 15 to 16 yrs & 16 to 17 yrs in 96% cases and in 100% cases respectively. (Table 2&3) According to Galstraun [2] study fusion occurred at the age of 14-15 yrs.

Whereas Basu & Basu [3] and Hepworth [4] found fusion at the age of 13-14 yrs. Similar findings were also observed by Flecker, [7] Davies, Parson & Franklin. [8]

The discrepancy could be attributed to a host of factors like ignoring different stages of fusion viz. F3, F4, F5 etc. amid other factors mentioned earlier. If we also take F4 stage as the stage of fusion, our findings become consistent with their findings but we have taken F5 as the complete fusion hence the difference.

Pillai [6] study showed complete fusion around the elbow joint between 14-18 yrs of age. Galstaun G, [2] from his study on Bengalese opined that complete union at the elbow joint occurred at 16 years, Basu SK and Basu [3] recorded fusion at the elbow joint as 17 years.

Lal R and Townsend [9] stated that the fusion around the elbow joint in the north Indian girls was completed by 12-16 years. In this study, at 15 to 16 yrs there is complete union in 96% of the cases. Aggarwal ML and Pathak [10] stated that in Punjabi girls, complete union occurred at the elbow at 16 years, but our study reveals that complete fusion in Garhwali girls can be seen by 17 years which may be due to geographical variation.

Chhokar V et al in their study of 200 female subjects of New Delhi found that complete fusion occurred at 14-16 years, our study further narrows it down to 16-17 years.

Sahni D et al [11] in North West India observed that 100% of the cases in his study showed complete union of the elbow joint epiphyses in the age group of 16-16.9 years and commented that if there is incomplete fusion, the girl is below 16 years of age, even as the present study claims that the age has to be below 16 years in Garhwali females thus further substantiating it helping the law enforcing authorities more effectively.

Conclusion:

We have to some extent been able to show that ultrasound is better than x-ray exposure. It is easy to get subjects because of no risk of radiations. There is no need to take consent from the guardians of these subjects. Rather, the subjects themselves can give consent under sec 89 IPC.

Last but not the least, we can see various ossification centres dynamically by placing the probe on desired orientation. Our study seems to confirm our belief that ultrasound of elbow joint is a potentially promising method to estimate age in persons without exposing them to the undue risk of radiation.

We recommend that this study will help to arrive at a final conclusion regarding the validity of this method in the estimation of age. Since at the outset, our study's focus was x-ray examination of elbow joint between 15-17 years. Later on, we shifted to ultrasonology keeping in view the safety of volunteers and also conducting the examination dynamically unlike invasive and static nature of x-ray examination.

There have been a few studies worldwide involving ultrasound as a means to determining age. So the attempt is to substantiate and compare the findings ultrasonographically.

We have been successful also in bringing out the advantageous role of ultrasonography. It was seen that fusion of ossification centres appeared somewhat earlier on ultrasound than would have been possible radiologically. Moreover, this region of ours being a virgin state wherein no such study was ever undertaken, the present study will be a

benchmark for other researcher in this region to take a cue out of it. Therefore, it is earnestly felt that our study is going to be helpful to solve various medico legal cases connected with ages especially in the Garhwali population. Our successors can endeavor to initiate a similar study taking into its lap more number of cases.

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Table 1: Fusion of Lower End of Elbow

Age In Years	15-15.5	15.5-16	16-16.5	16.5- 17
No. of Children	25	25	25	25
Fusion	23	24	25	25
%	92	96	100	100

Table 2: Fusion of Radius with Shaft of Radius

Age in Years	15- 15.5	15.5-16	16-16.5	16.5- 17
No. of Children	25	25	25	25
Fusion	24	24	25	25
%	96	96	100	100

Table 3: Fusion of Head of Ulna with Shaft

Age in Years	15- 15.5	15.5- 16	16 -16.5	16.5 – 17
No. of Children	25	25	25	25
Fusion	24	24	25	25
%	96	96	100	100