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AGE DETERMINATION FROM EPIPHYSEAL UNION OF BONES AT ANKLE JOINT IN GIRLS OF VALSAD DISTRICT

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Abstract:

INTRODUCTION: There is an increasing demand or challenge for age estimations for both forensic and bioarchaeological contexts. Exact age of individuals can be obtained from only certified documents. The principal methods used for age determination are those of carban dating, radiology, tooth morphology, physical, biochemistry and knowledge of ossification. All over the world it has been proved that the study of epiphyseal union of bones is considered a reasonably accurate and accepted method for age determination. Owing to variation in climatic, dietetic, hereditary and other factors like hormones 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. **AIM AND OBJECTIVES**: To procure radiology films of ankle joint of both sides of girls aged between 13 to 20 years from Valsad and to assess whether the data correlate or contradict the findings of different authors in other parts of India. **MATERIAL AND METHODS:** A total of 72 girls participated in this study. The subjects included students of schools, College from Valsad district aged between 13 to 20 years. X ray was taken after physicians' evaluation in the department of Radiology. Skeletal maturity was evaluated as Appearance, Non fusion (NF), Partial fusion (PF), and complete fusion (CF). **RESULTS AND DISCUSSION:** In 16- 20 age group 3 (4.17%) girls shows partial fusion at distal end of fibula while 41 (56.90%) shows complete fusion at distal end of fibula. In 16-20 age group at distal end of tibia complete fusion was observed in 42 (58.33%) while partial fusion was observed in 3 (4.17%).In 15-20 age group at distal end of tibia complete fusion was observed in 55 (76.39%).**CONCLUSION:** The ossification at the ankle joint in females of Valsad is completed in all instances (100%)at the age of 15-20 year. To evaluate life style changes, studies are recommended in different regions of India at regular interval for academic and judicial interest.

INTRODUCTION

Today there is an increasing demand or challenge for age estimations in living individuals for both forensic and bioarchaeological contexts in developing and underdeveloped countries where the documentation is not proper or standard. Exact age of individuals can be obtained from only certified documents; when not mentioned, there is a need to verify whether an individual should be accepted as an adult. The principal methods used for age determination are those of radiology, tooth morphology, physical, biochemistry and knowledge of ossification [1-3]. Epiphysis of the bones unites at the particular ages which are remarkably constant for a particular epiphysis and this is helpful in age determination [4]. In law the crime and punishment is entirely based on criminal responsibility and depend on the age of a person. All over the world it has been proved that the study of epiphyseal union of bones is considered

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a reasonably accurate and accepted method for age determination [5]. According to Parikh CK et. al. [6] the Union of epiphysis in bones cartilaginous takes place near about 2 years earlier in the females than in males except in case of skull sutures where obliteration sets in little later and proceeds more slowly in females than in males and under tropical conditions ossification is observed earlier than in temperate areas. As per Modi's textbook [7] it is quoted that owing to variation in climatic, dietetic, hereditary and other factors like hormones 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. There are hundreds of ossification centers in the bones of the body but for assessment of age the long bones of upper and lower limbs play an important role. The knee is an ideal anatomical locus for assessment of epiphyseal union, as the patient's knee joint often presents for investigation of trauma. [8]As a result, large data banks of knee radiographs exist. The anterior posterior radiographs of the knee shows three epiphyses – distal femur, proximal tibia and proximal fibula. According to previous studies, differences exist in the timing of epiphyseal union between individuals from different populations [1]. The bone grows by length at epiphysial plate. This plate is layer of cartilage which separate primary ossification center (diaphysis) from the secondary ossification center (epiphysis). This plate grows away from the shaft and replaced by bone, when the cells in this plate stop dividing, the epiphysis fuses with the shaft. Primary center is diaphysis and secondary center is epiphysis. Secondary center progressively ossified where the cartilage is replaced by bone until thin epiphysis plate separates diaphysis. These are the events marks the end of longitudinal bone growth (9).

So, the present study was carried out to investigate the ages of epiphyseal union around the ankle joint and its correlation with chronological age.

AIMS AND OBJECTIVES

- To procure radiology films of ankle joint of both sides of girls aged between 13 to 20 years of female subjects of Valsad, Gujarat.
- To examine the status of epiphyseal lines of bones.
- To assess whether the data correlate or contradict the findings of different authors in other parts of India and data of other countries on the basis of previous studies..

MATERIAL AND METHODS

The present study was carried out in Department of Anatomy at GMERS Medical College, Valsad. A total of 72 girls participated in this study. The subjects included students of schools, College from Valsad. Girls aged between 13 to 20 years were included in the study. An informed consent was taken from all subjects regarding study & prior to each investigation.

Inclusion criteria

- Girls aged 13 to 20 years
- Born to the parents living in Valsad and lived in Valsad since birth

Exclusion criteria

- Any defect in the bones
- Any deformity or injury to the bone
- Suffering from chronic disease which affects the general health.

Radiography

After obtaining written consent thorough physical examination was done from the physician and Antero-poststerior & lateral X ray of Ankle joints were taken after physicians evaluation in the department of Radiology. Voltage settings of X-Ray machine to avoid unnecessary radiation exposure of the subjects. Skeletal maturity was evaluated according to the Jits and Kulkarnis[10] classification of four stages, Appearance, Non fusion (NF), Partial fusion (PF), and complete fusion (CF)

The part X rayed was ankle for distal end of tibia and fibula.

X-Rays showing clear gap between the epiphysial and diaphysial end, which shows saw tooth like appearance were called as Non-fusion (NF) X-rays. The X-rays showing a line replacing the hiatus between the epiphyseal and diaphysial ends and saw tooth like appearance has disappeared were designated as Partial Fusion (PF) X-rays. X-Rays which shows the same bony structure in the diaphysis and epiphysis and showing scar of the previous stage were designated as Complete Fusion (CF).

The chart was prepared and tabulated. Data analysis was done in computer using Windows Excel 2013 software.

OBSERVATIONS AND RESULTS

Table 1: Age wise percentage of fusion of distal end of Tibia & Fibula in girls.

Age in years	Distal end of Fibula						Distal end of Tibia					
	NF	%	PF	%	CF	%	NF	%	PF	%	CF	%
13-14	7	9.72	0	0	0	0.00	7	9.72	0	0.00	0	0.00
14-15	0	0.00	0	0	7	9.72	0	0.00	6	8.33	1	1.39
15-16	0	0.00	0	0	14	19.44	0	0.00	0	0.00	13	18.06
16-17	0	0.00	0	0	9	12.50	0	0.00	0	0.00	10	13.89
17-18	0	0.00	2	1.44	13	18.06	0	0.00	1	1.39	15	20.83
18-19	0	0.00	0	0	9	12.50	0	0.00	2	2.78	6	8.33
19-20	0	0.00	1	0.72	10	13.89	0	0.00	0	0.00	11	15.28
Total	7	9.72	3	2.16	62	86.11	7	9.72	9	12.50	56	77.78

Non fusion was seen in 13-14 age group was 7 (9.72%) in both distal end of tibia and fibula. In 14-15 age group 7 (9.72%) girls X ray shows complete fusion at distal end of fibula while 6 (8.33%) and 1 (1.39%) show partial and complete fusion at distal end of tibia respectively. In 15-16 age group at distal end of fibula complete fusion was observed in 14 (19.44%) while at at distal end of tibia complete fusion was observed in 13 (18.06%). In 16- 20 age group 3 (4.17%) girls shows partial fusion at distal end of fibula while 41 (56.90%) shows complete fusion at distal end of fibula. In 16-20 age group at distal end of tibia complete fusion was observed in 42 (58.33%) while partial fusion was observed in 3 (4.17%).

DISCUSSION

Data evaluated from the present study was compared with the similar studies from different part of the country as well as from the different parts of the world.

Distal end of tibia and fibula shows 7 (9.72%) non fusion in 13-14 age group. Similar results were shown by Patond S et al in their study at central India [11]. In 14-15 age group6 (8.33%) and 1 (1.39%) show partial and complete fusion at distal end of tibia.In 16-20 age group at distal end of tibia complete fusion was observed in 42 (58.33%). In 15-20 age group at distal end of tibia complete fusion was observed in 55 (76.39%).

Davies and Parson (1927) in England observed age of fusion distal epiphyseal union of tibia in females was 18[12]. While Hepworth (1929) observed age of fusion in females was 17- 18 in Punjabi [13]. Galstaunin 1937 showed 13-15 age of fusion in girls in Bengali region [14].Bokariya et al (2009) observed age of fusion at distal epiphyseal union of tibia was 14-15. In the study in central India by Patond et al. [11] age of fusion at distal epiphyseal union of tibia was 14-15. In the present study age of fusion at distal epiphyseal union of tibia was 14-15.

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and Basu [15] in 1938 observed age of fusion at distal epiphyseal union of fibula was 15. In the study in central India by Patond et al. age of fusion at distal epiphyseal union of fibula was 15-16. In the present study age of fusion at distal epiphyseal union of tibia was 14-15.Due to very narrow range of differentiation between various stages of fusion, it is difficult to consider stage of fusion as age indicator. The exact opinion about age should always be given in the range. From the present study, range of 1-2 years of margin of error can be concluded.

CONCLUSION

Currently no data is available for assessment of time of fusion of epiphyseal lines for bones of ankle joint from Valsad district. The presence of one more stage (partial fusion) between incomplete and complete stages of fusion provides furthermore defined age range estimations for the process of epiphyseal fusion at ankle.The ossification at the ankle joint in females of Valsad is completed in all instances (100%)at the age of 15-20 year.Due to changes in life style pattern, dietary habits, climatic changes, behavioral factors age of ossification is changing. So as to evaluate these changes, studies are recommended in different regions of India at regular interval for academic and judicial interest. Epiphyseal fusion in female are always earlier than male by 1-1.5 yr. Estrogen facilities bone growth and responsible for the growth spurt during puberty, which promotes deposition of calcium and phosphate in the bone and fasten union of epiphysis with the diaphysis. Thus estrogens show osteoblastic activity and stop the linear growth. Action of estrogen is stronger than testosterone so the growth is arrested before in males that is why females are generally short statured than males. It might be the reason why osteoporosis is commonly seen in females after menopause.

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