Research Article

# Radiological study of hand and wrist in the age groups 11-20 years in persons of North Karnataka

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## Abstract

**Introduction: Ossification** is the process of laying down new bone material by cells called osteoblasts. It is synonymous with bone tissue formation. **Material and Methods:** The subjects of the present study consists of total number of 200 healthy students which 100 were boys and 100 girls, collected over a period of two years (2000 – 2002) from Revan siddheswar Primary School, Ambedkar high school and other neighboring areas in and around Bijapur city. **Observation:** Lower end of radius: In males the mean age of fusion was 17.48 ± 1.345 years with an earliest age of 15.34 years and latest age of 18 years. **Discussion:** The present study was undertaken to assess the age of fusion of primary and secondary ossification centres of various bones of the wrist and hand viz. lower end of radius lower end of ulna, carpal bones, metacarpal bones, phalangeal bones of the fingers in the age group 11-20 years in Bijapur (North Karnataka) region and to compare the findings with that of other workers. **Conclusion:** If there is no legal justification for a radiographic examination, the range of possible methods is limited to a physical and a dental examination.
**Keywords:** ossification centres, pisiform bone, fusion.

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## INTRODUCTION

Ossification is the process of laying down new bone material by cells called osteoblasts. It is synonymous with bone tissue formation. There are two processes resulting in the formation of normal, healthy bone tissue: Intr-amembranous ossification is the direct laying down of bone into the primitive connective tissue (mesenchyme), while endochondral ossification involves cartilage as a precursor. In fracture healing, endochondral osteogenesis is the most commonly occurring process, for example in fractures of long bones treated by plaster of Paris, whereas fractures treated by open reduction and stabilization by metal plate and screws may heal by intramembranous osteogenesis. Heterotopic ossification is a process resulting in the formation of bone tissue that is often atypical, at an extra-skeletal location. Calcification is often confused with ossification. Calcification is synonymous with the formation of calcium-based salts and crystals within cells and tissue. It is a process that occurs during ossification, but not *vice versa*. The exact mechanisms by which bone development is triggered remains unclear, but it involves growth factors and cytokines in some way. In many countries the age thresholds of relevance to criminal prosecution lie between 16 and 22 years. In line with the recommendations of the Study Group on Forensic Age Diagnostics, age estimates should consist of a physical examination which also records anthropometric data,

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signs of sexual maturation and potential age-relevant developmental disorders, an X-ray of the left hand and a dental examination which records dentition status and evaluates an orthopantomogram. To assess the age of persons who are assumed to be at least 18 years old, an additional radiographic or CT examination of the clavicles is recommended. With a view to increasing the accuracy of age estimates and improving the identification of age-relevant developmental disorders, a combination of all methods mentioned above should be used, and each examination should be carried out by an expert with forensic experience. The expert in charge of coordinating all contributions should compile the results in a final age diagnosis.[1,2,3]

## MATERIAL AND METHODS

The subjects of the present study consists of total number of 200 healthy students which 100 were boys and 100 girls, collected over a period of two years (2000 – 2002) from Revan siddheswar Primary School, Ambedkar high school and other neighboring areas in and around Bijapur city. The age of the students was ranging between 11-20 years and the same was confirmed from their school records and birth certificates. Both hands and wrists of all the students were radio graphed from radiology department BLDEA'S Sri B.M. Patil Medical college hospital and research center Bijapur and their radiological findings of carpal bones, meta carpal bones, phalangeal bones, lower end of radius and lower end of ulna of both hands and wrist were recorded to assess the time of appearance of ossification centres.

## OBSERVATION

### Lower end of radius

- In males the mean age of fusion was 17.48 ± 1.345 years with an earliest age of 15.34 years and latest age of 18 years.
- In females the mean age of fusion was 16.14 ±0.75 years with an earliest age of 18.0 years and latest age of 18.666 years.

### Lower end of ulna

- In males the mean age of fusion was 17.52 ± 1.299 years with an earliest and latest age of fusion 15.32 and 18.0 years respectively.
- In females the mean age of fusion was 16.061± 0.725 years with an earliest and latest age of fusion 14.4 and 20 years respectively.

### Capitate and Hamate

- In males all the subjects showed the appearance from 0.833 to 18.936 years. In males all the subjects showed the appearance from 1 year to 20 years, in females.

### Pisiform

- In males the mean age of appearance was 13.74 ± 1.10 years with an earliest and latest age of appearance 12 and 15 years respectively.
- In females the mean age of appearance was 12.27 ± 2.35 years with an earliest and latest age of appearance 6.16 and 15 years respectively.

### Metacarpal I - V

- In males the mean age of fusion was 16.79 ± 1.43 years with an earliest and latest age of fusion 14.56 and 18.8 years respectively.
- In females the mean age of fusion was 16.102 ± 1.687 years with an earliest and latest age of fusion 14.24 and 20.0 years respectively.

### Thumb finger

- In males the mean age of fusion in all, proximal, middle and distal phalanges were 16.85 ± 1.315 years with an earliest 14.56 years and latest of 18.88 years.
- In females the mean age of fusion in all, proximal, middle and distal phalanges were 16.119 ± 1.69 years with an earliest 14.24 years and latest of 19 years.

### Index finger

- In males the mean age of fusion in all, proximal, middle and distal phalanges were 16.85 ± 1.315 years with an earliest 14.56 years and latest of 18.88 years.
- In females the mean age of fusion in all, proximal, middle and distal phalanges were 16.119 ± 1.69 years with an earliest 14.24 years and latest of 19 years.

### Middle finger

- In males the mean age of fusion in all, proximal, middle and distal phalanges were 16.85±1.315 years with an earliest 14.56 years and latest of 18.88 years.
- In females the mean age of fusion in all, proximal, middle and distal phalanges were 16.119 ± 1.69 years with an earliest 14.24 years and latest of 19 years.

### Ring finger

- In males the mean age of fusion in all, proximal, middle and distal phalanges were 16.85 ± 1.315 years with an earliest 14.56 years and latest of 18.88 years. In females the mean age of fusion in all, proximal, middle and distal phalanges were 16.119 ±1.69 years with an earliest 14.24 years and latest of 19 years.

### Little finger

- In males the mean age of fusion in all, proximal, middle and distal phalanges were 16.85 ± 1.315

years with an earliest 14.56 years and latest of 18.88 years.

- In females the mean age of fusion in all, proximal, middle and distal phalanges were 16.119 ± 1.69 years with an earliest 14.24 years and latest of 19 years.

## DISCUSSION

The present study was undertaken to assess the age of fusion of primary and secondary ossification centres of various bones of the wrist and hand viz. lower end of radius lower end of ulna, carpal bones, metacarpal bones, phalangeal bones of the fingers in the age group 11-20 years in Bijapur (North Karnataka) region and to compare the findings with that of other workers.

### Fusion of secondary ossification centre of lower end of radius

It was observed that the fusion of secondary ossification centre of lower end of radius was 17.48 ± 1.345 years in males 16.14 ± 0.75 years in females. The center fused later in males by 1.34 years. Flecker HMB (Australia) 1942[4] studied roentgen- logically and found the fusion age of the secondary ossification centre of lower end of radius 19.0 years in males, 18 years in females. The centre fused later in males by 1.0 year. The present findings are lower by 1.52 years in male, 1.86 years in females than the Flecker HMB.

### Carpal Bones

Appearance of primary ossification centres:

It was observed from the present finding that the age of appearance of primary ossification centres of pisiform bone was 13.74 ±1.10 years in males, 12.27 ± 2.35 years in females. The centres appeared earlier in males by 1.47 years in pisiform bone.

### Fusion of secondary ossification centres of metacarpal bones

It was observed from the present findings that the fusion of secondary ossification centres of metacarpal bones I to V 16.79 ± 1.280 years in males, 16.102 ± 1.687 years in females. The secondary centres fused later in males by 0.688 years than females. Flecker HMB. (Australia) 1942[4] found out the age in years of fusion of secondary ossification centres 18 year in males for metacarpals I to IV, 15 years in females in metacarpal I and 16 years in females for metacarpals II to IV. The secondary centre fused later by 3 year in males for metacarpal I; by 2 year in males for metacarpals II to IV. The present findings are lower by 1.21 years in males for metacarpals I to IV, higher by 1.102 years in females for metacarpal I, by 0.102 years in females for metacarpals II to IV than that of Flecker HMB. Fusion of secondary ossification centers of phalangeal bones:- From the present findings it was found that the fusion age in years of secondary ossification centre of all phalangeal bones 16.85 ± 1.315 years in males, 16.119 ± 1.69 years in males. The fusion of secondary ossification centre of phalangeal bones is later in males by 0.731 years. Flecker HMB. (Australia) 1942 found out the fusion age in year of the secondary ossification centres of phalangeal bones. Proximal row - thumb, 17 years in male, 15 years in female's index finger. 18 years in males, 16 years in females, middle, ring and little fingers 18 years in males, 14 years in females. Middle row - index finger, middle finger, ring finger little finger 17 years in male, 16 years in female distal row- Thumb and Index ring and little finger 17 years in male and for middle finger 15 years in males. Thumb 13 years, Index, Middle ring and little finger 15 years in females. The secondary centres of ossification of phalanges fused later in males. Proximal row thumb by 2 year, Index finger by 2 year middle ring and little fingers by 3 years. Middle row Index middle, ring and little finger by 1 year; distal row thumb by 4 year, index 2 years, middle at the same time ring and little fingers by 2 years. The present findings are lower in males proximal row thumb by 0.15 years, Index finger 1.15 years; middle finger, ring finger and little fingers and little fingers by 4 years, middle row index, middle ring and little finger by 1 year, distal row by 0.15 years thumb and index finger by 0.15 year. Middle finger at the same time, ring and little fingers lower by 0.15 years. The secondary centres of ossification fused later in males by 0.731 years in all the rows in all the fingers.

## DISCUSSION

If there is no legal justification for a radiographic examination, the range of possible methods is limited to a physical and a dental examination. Age estimates carried out properly help enhance legal certainty by ensuring equal treatment of persons with or without valid identity documents. On the one hand, they help prevent perpetrators from wrongfully benefiting from false claims to be younger than they really are. On the other hand, they supply exonerating evidence for persons who are erroneously suspected of making false statements about their age.

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