

## A RADIOLOGICAL STUDY OF APPEARANCE OF OSSIFICATION CENTRES IN THE CARPAL BONES IN BOYS AND GIRLS (AGE GROUP 2 to 12 YEARS) OF THE JODHPUR REGION

Dr. Shailendra Khichi<sup>1</sup>, Dr. P.C. Vyas<sup>2</sup>, Dr. Manish Tak<sup>3</sup>

Senior Professor & Head Department of Forensic Medicine & Toxicology

**Article Info:** Received 07 May 2021; Accepted 08 July 2021

**DOI:** <https://doi.org/10.32553/ijmbs.v5i7.2015>

**Corresponding author:** Dr. P C Vyas

**Conflict of interest:** No conflict of interest.

### Abstract

**Background:** To study the appearance of ossification centres of carpal bones in both sexes in age group 2 to 12 years.

**Methods:** This study was conducted to find out age from ossification of carpal bones on 200 children (2 years to 12 years of age) at Dr. S.N. Medical College and Associated Group of Hospitals, Jodhpur. Minimum age of the child was 2 years and maximum 12 years. The cases were randomly selected, but priority was given to only those children whose parents could give the exact date of birth of their children.

**Results:** Triquetral and lunate carpals appear after capitate and hamate. Triquetral appeared at the age of 3-4 years and lunate at the age of 4-5 years. So below the age of 3 years a child may have 2 carpals which may increase to 3 at the age of 3 years and 4 at the age of 4 years in both sexes. Trapezium, trapezoid and scaphoid carpals appeared between the age of 5 to 9 years. Their appearance was slightly earlier in females than in males. These three carpals may appear simultaneously or at different times. The pisiform was last to ossify in both the sexes. In the female it appeared between 10 to 11 years of age. In male it appeared between 11 to 12 year of age.

**Conclusion:** The sequence of appearance of carpal bones in the Jodhpur population is similar to what is described in the literature.

**Keywords:** Carpal bone, Age, Sex

### Introduction

The Determination of age of an individual by radiological observation of the time of appearance and fusion of ossification centers is a matter of great medicolegal and academic interest. Verification or determination of age is prerequisite for personal identification in living as well as dead. Age estimation in living as well as dead is one of the most important task for a Forensic practitioner. In developing countries like India because of illiteracy the birth are not registered or records of birth are not properly maintained. It is increasing important in criminal and civil matters. Infact, if doubt arises regarding the age of person in any legal inquiry, Forensic age estimation is promptly requested by authorities to ascertain whether the person concerned has reached the age of imputability<sup>1-3</sup>. Age estimation becomes a valuable tool to assist in administration of many civil and criminal procedure codes such as.

- Identification
- Consent
- Criminal responsibility
- Clinical examination
- Validity of will

- Attainment of majority
- Kidnapping or Abduction
- Rape
- Criminal abortion
- Judicial punishment
- Marriage contract
- Infanticide.
- Eligibility for employment professional and other courses
- Senior citizen concession, old age pension
- Age of retirement disputes etc.

### Materials and Methods

The radiological study of "appearances of ossification centres in the carpal bones in boys and girls of age group 2 years to 12 years in Jodhpur region." was carried out in Jodhpur region studying in various schools of Jodhpur district. The children selected for the study was in the age group of 2 to 12 years and are from both the sexes boys and girls. The study was done as shown below in table:-

Age group	Male	Female
2 - 3 years	–	–
3 - 4 years	–	–
4 - 5 years	–	–
5 - 6 years	–	–
6 - 7 years	–	–
7 - 8 years	–	–
8 - 9 years	–	–
9 - 10 years	–	–
10 - 11 years	–	–
11 - 12 years	–	–

- Children of age group 2 to 12 year both male and female are included in study. The Children were selected from either sex and were from different socio economic religious and educational status.

- The study was carried out in minimum of 200 cases from both the sexes of various OPD/IPD of Dr. S.N.M.C. associated group hospital, Jodhpur.

- The study was conducted after taking consent from parents or guardians.

➤ **Place of study:-** Dr. S.N. Medical College, Jodhpur an associated group of Hospitals.

➤ **Study design:-** cross-sectional study.

#### Sample size:

Sample size was calculated at 95% confidence interval to verify an assumed 50% proportion of presence of ossification centers in carpal bones among age group 2–12 years at absolute allowable error of 10%. Sample size was calculated using the formula for sample size for estimation of proportion –

$$N = \frac{Z_a^2 P(1-P)}{E^2}$$

Where,

$Z_a$  = Standard normal deviate for 95% confidence interval  
(taken as 1.96)

P = assumed proportion of appearance of ossification centers in carpal bones among age group 2-12 years

E = allowable error (taken as 10% absolute)

Sample size was calculated to be to be minimum 100 subjects. So for study purpose 100 samples has been taken of each gender distributed equally among different age groups of range 2-12 years.

#### ➤ Inclusion criteria:-

1) Children of age group 2 to 12 year both male and female are included in study. The Children has been selected from either sex and have been from different socio economic religious and educational status.

2) Their age as stated by their parents have been considered along with date of birth certificate.

#### ➤ Exclusion criteria :

1) Subject not consenting for skiagraphy

2) Subject not having valid documentation for proof of age / date of birth

3) All children's below 2 years and above 12 years have been excluded from the study

4) Childers with affecting the growth of bones appearance of fusion centres e.g. congenital deformities fracture cases, chronic illness or on chronic steroid therapy will be excluded from the study.

#### Methodology:

1) Ethical committee permission has been obtained.

2) Individuals of different age group has been taken up for study from 2 to 12 years and both the sexes.

3) Each individual X-ray wrist-AP View from both the hands taken for study.

4) X-ray wrist-AP View from both the hands have been taken with following specification:

- KVp = 40-42
- MAs = 10-13

❖ All observation has noted on a common standard proforma and later the findings were tabulated to draw necessary conclusion.

#### Results

**Table 1: showing comparison in female and male children appearance**

CARPAL BONE	FEMALE CHILDREN	MALE CHILDREN
CAPITATE	BELOW 5 YEARS	BELOW 5 YEARS
HAMATE	BELOW 5 YEARS	BELOW 5 YEARS
TRIQUETRAL	2 to 3 YEARS	3 to 4 YEARS
LUNATE	4 to 5 YEARS	6 to 7 YEARS
TRAPEZIUM	5 to 6 YEARS	6 to 7 YEARS
TRAPEZOID	6 to 7 YEARS	6 to 7 YEARS
SCAPHOID	6 to 7 YEARS	7 to 8 YEARS
PISIFORM	10 to 11 YEARS	11 to 12 YEARS

### Discussion

The interest in investigating the ossification of carpal bones started a long time ago, from the start of the last century.<sup>4</sup> Many studies from different populations published data pertaining to time of ossification of carpal bones.

The main finding in this study is that carpal bones start to ossify in the first year of life, starting approximately at the age of 6 months. This ossification of carpal bones starts with the capitate and hamate. Following this, other bones appear at variable intervals starting from triquetral followed by lunate, then scaphoid, trapezium and trapezoid (but in males, trapezoid arises after scaphoid and trapezium), and lastly the pisiform.

The comparison with other studies will be based on the population type. Compared to Indian children, Saudis have a similar pattern of ossification time in terms of the capitate and hamate.<sup>6-9</sup> However, all other carpal bones, except the pisiform, appear at an earlier time in Saudi children. The pisiform in Saudi males has a similar starting appearance time as in Indians but may not appear until the 14th year of age in Saudis, whereas this bone is ossified in Indians by 12 years. The pisiform bone in Saudi females starts to ossify at 7 years, which is earlier than the pisiform in Indian females, where this bone starts to ossify only at 10 years. With regard to Pakistani children, the Saudis showed a later time of appearance of capitate and hamate, which occur at the age of one month in the Pakistanis.<sup>10</sup>

### Conclusion

The sequence of appearance of carpal bones in the Jodhpur population is similar to what is described in the literature

### References

1. Bjork, A. (1955): Facial growth in man, studied with the aid of metallic implants. *Scandinavica*, 13: 9-34.
2. Chakrabarty, N. and Chakrabarty, O. (1995): *Fundamentals of Human Anatomy*; 1 Ed. Vol. I, Calcutta, New Central Book Agency, 126:12.7.
3. Clark, D. H. (1992): *Practical Forensic Odontology*. 1st Ed. Wright, Oxford, London, Boston, pg. 22, 24, 25, 26.
4. Cobb, W.M. (1952): *Skeleton In: Lansings, A.L. Cowdry's problem of ageing; Bailimare Williams and Wilkins, 1952.*
5. Davies, D.A. and Parson (1927): *F.H.: JI. Anatomy* 62: 58.
6. Flecker, H. Jr. (1932) : *Anatomical Society of India. Vol. 67, Oct.*
7. Franklin, C.A. (1988): *Modi's Text book of Medical Jurisprudence and Toxicology: 21st Ed. Bombay N.M. Tripathi (P) Ltd. pg. 37-46.*
8. Goel and Saraswat (1996): *Manual of medicolegal practice, 1 st Ed. pg. 112-117. Gray Henry (1996): Gray's Anatomy 37th Ed. Churchill Livingstone Edinburgh London Melbourne and New York 341-342.*
9. Grenhich, W.W. and Pyle, S.I. (1959): *Radiographic atlas of skeletal development of the hand and wrist Ed. 2, Stanford University Press, Stanford, Calif.*
10. Memon N, Memon M, Junejo A, Memonn . Age determination by employing radiological technique in pediatric age groups. *J Liaquat Uni Med Health Sci, 2011; 10:53-58.*