



Study of pattern of fusion of coronal suture using skull radiography and its association with documented age in males.

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Citation this Article: Dr Ishita Manral , Dr Rashid Nehal Khan, Dr Abhijit Rudra , “Study of pattern of fusion of coronal suture using skull radiography and its association with documented age in males.”, IJMSIR- April - 2020, Vol – 5, Issue - 2, P. No. 07 – 14.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Paleodemography is a usual case faced by Forensic Practitioners in any set-up. Identification is the establishment of the individuality of a person. No age is irrelevant in its potential for an aging dispute from a medico-legal point of view. Age estimation is needed to apply for government posts or pension or in cases of amnesia. Examples of legal issues are fixing the age for employment, superannuation, pension settlements and benefits. Cranial sutures when used with other factors are reliable for age estimation. In the present study we studied skull roentgenogram of patients who have been advised roentgenogram for diagnostic and therapeutic purpose from other departments. We studied the fusion of coronal sutures in those roentgenograms where age was known. The suture was dividing into upper half and lower half and stage of fusion was documented. We followed the Key et al stage of fusion of sutures. We found the earliest beginning of fusion occurred in coronal suture at 34 years and 30 years in its upper half and lower half

respectively. The earliest complete fusion occurred at 56 years in upper half and 50 years at lower half.

Keywords: Coronal Suture; Roentgenogram; Skull; Male; Fusion; stage

Introduction

Paleodemography is a usual case faced by Forensic Practitioners ^{1,2}. Identification is the establishment of the individuality of a person. It maybe: Complete-absolute or Partial / Incomplete- in which certain facts are ascertained and others are unknown ^{3,4,5}. Race, age, sex and stature are considered the four parameters in forensic identification ^{4,5}. Age of an individual is determined from teeth, bones, secondary sexual characters, general development and other features ^{2,4,5}. The present study is an attempt to correlate the documented age of an individual with the skull radiographs using coronal suture of the skull in male population.

The aim of the study is to study the pattern of fusion of coronal suture using skull radiographs and its association with documented age. The objectives are to study the stages of progression of closure of coronal

sutures and compare with the available standards in male.

Materials and Methods

The present study was conducted in Department of Forensic Medicine and Toxicology at Armed Forces Medical College, Pune from November 2015 to November 2017. Cases included for the study are those who have been advised a radiograph of the skull (AP view or PA view or Lateral view) for diagnosis.

Such roentgenograms were studied and interpreted in terms of closure of suture with the documented age in correlation with the Birth certificate/ Aadhaar card/ Driver's license/Voter's ID/ Ration card.

The study was approved by the institutional ethics committee.

Methodology

The roentgenogram of the patient and his documented age in a Government identity card, after collection were tabulated. Coronal suture was divided into upper and lower half. Sample was then grouped in age groups of 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70 and stage of fusion was documented.

Stage of fusion of the three sutures was as 1- not commenced 2- in process of fusion and 3 fused (Examples in Figure 1, 2, 3 respectively).

Results

A total of 221 male individuals were included in the study for fusion of coronal suture in males. Age distribution of the the subjects is depicted in table 1.

Table 1 shows the distribution of the stage of fusion in coronal suture in males in our study.



Figure 1:years/ Male(stage 1)

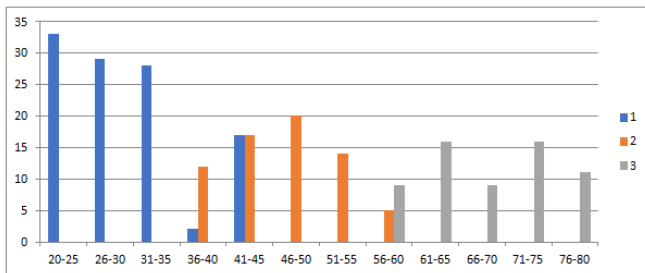


Figure 2: 48/ Male showing coronal suture in the process of fusion in male.

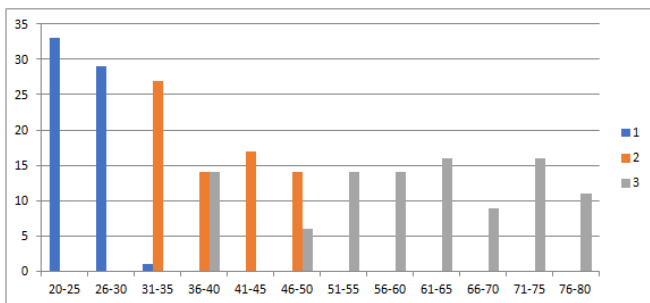
Age	Number Of Cases		Upper Half						Lower Half					
	Number	Percentage	Not Commenced		In Process		Fused		Not Commenced		In Process		Fused	
			NO	%	NO	%	NO	%	NO	%	NO	%	NO	%
20-25	33	16%	33	100%	0	-	0	-	33	100%	0	-	0	-
26-30	29	13%	29	100%	0	-	0	-	29	100%	0	-	0	-
31-35	28	13%	28	100%	0	-	0	-	1	4%	27	96%	0	-
36-40	14	6%	2	12%	12	88%	0	-	0	-	14	100%	-	-
41-45	17	8%	0	-	17	100%	-	-	0	-	17	100%	0	-
46-50	20	9%	0	-	20	-	0	-	0	-	14	70%	6	30%
51-55	14	6%	0	-	14	100%	0	-	0	-	0	-	14	100%
56-60	14	6%	0	-	5	36%	9	64%	0	-	0	-	14	100%
61-65	16	7%	0	-	0	-	16	100%	0	-	0	-	16	100%
66-70	9	4%	0	-	0	-	9	100%	0	-	0	-	9	100%
71-75	16	7%	0	-	0	-	16	100%	0	-	0	-	16	100%
76-80	11	5%	0	-	0	-	11	100%	0	-	0	-	11	100%
TOTAL	221	100	175		31		28		138		56		40	



Figure 3 : 76 years/Male with fused coronal suture
Fusion of Coronal Suture in Male



Graph 1 showing the number of samples in different stages of suture fusion in upper half of coronal suture in male



Graph 2 showing the number of samples in different stages of suture fusion in lower half of coronal suture in male

In the age group of 20-25years, total number of cases were 33 (16%). In upper half of the suture, 33 number of cases(100%) were fusion had not commenced. In

lower half of the suture, 33 number of cases(100%) were fusion had not commenced.

In the age group of 26-30 years, total number of cases were 29(13%). In upper half of the suture, 29 number of cases(100%) were fusion had not commenced. In lower half of the suture, 29 number of cases(100%) were fusion had not commenced.

In the age group of 31-35 years, total number of cases were 28 (13 %). In upper half of the suture, 28 number of cases (100%) were fusion had not commenced. In lower half of the suture,1 number(4%) of cases were fusion had not commenced, 27 cases(98%) fusion were in process of fusion.

In the age group of 36-40 years, total number of cases were 14 (6 %). In upper half of the suture, number of cases were 2 (12%) fusion had not commenced, 12 cases(88%) fusion was in process. In lower half of the suture, number of 14 cases , 14 cases (100%) fusion was in process.

In the age group of 41-45 years, total number of cases were 17 (8 %). In upper half of the suture, number of cases were 17 (100%) fusion had not commenced. In lower half of the suture, 17 cases (100%) fusion was in process.

In the age group of 46-50 years, total number of cases were 20 (9%). In upper half of the suture,20 cases (100%) fusion were in process. In lower half of the suture,14 cases(70%) fusion was in process, 6 cases (30%) were fused.

In the age group of 51-55 years, total number of cases were 14 (6 %). In upper half of the suture, 14 cases(100%) fusion was in process. In lower half of the suture, 14 cases (100%) were fused.

In the age group of 56- 60 years, total number of cases were 14 (6 %). In upper half of the suture, 5 cases(36%) fusion was in process, 9 cases (64%) were

fused. In lower half of the suture, 14 number of cases(100%) were fused.

In the age group of 61-65 years, total number of cases were 16 (7 %). In upper half of the suture, 16 number of cases (100%) were fusion had occurred. In lower half of the suture, 16 number of cases (100%) had fusion.

In the age group of 66-70 years, total number of cases were 9 (4 %). In upper half of the suture, 9 number of cases (100%) were fusion had occurred. In lower half of the suture, 9 number of cases (100%) had fusion.

In the age group of 71-75 years, total number of cases were 16 (7%). In upper half of the suture, 16 number of cases (100%) were fusion had occurred. In lower half of the suture, 16 number of cases (100%) had fusion.

In the age group of 76-80 years, total number of cases were 11 (5%). In upper half of the suture, 11 number of cases (100%) were fusion had occurred. In lower half of the suture, 11 number of cases (100%) had fusion.

P value for age versus upper half of coronal suture is < 0.001 as the age increases the trend is not commenced to fused.

P value for age versus lower half of coronal suture is < 0.001 as the age increases the trend is not commenced to fused.

Test used is Fisher's exact test.

Discussion

In Legal Medicine ⁶, Anthropology ⁷, Neurosurgery ⁸ a lot of research has been done in the correlation between the fusion of cranial sutures and age of the individual. The incidence of Roentgenogram or Computed tomography for age correlation has been variable⁹.

The age range of our study is 20 years to 80 years which is similar to other studies. ^{6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18}.

Sutures can be seen in a majority of roentgenograms ²⁰. Antero-posterior view of the skull showed lambdoid sutures and a portion of the sagittal suture, sometimes coronal suture was also seen. The lateral view will showed the lambdoid and coronal sutures^{1,2}

Obliteration of cranial suture on roentgenograms has been studied with greying of hair, wrinkles, arcus senilis and menopause ¹⁵ or with documented age ^{14,17, 18}.

In our study the fusion of sutures started at 32 years and were fused by 60 years in all the cases similar to many studies in India ^{21, 15, 16} and in the west ^{6,18, 22,23,24}. Few studies in the West ^{24, 25} found earliest closure of the suture at years of age and latest by 50 years of age.

In our study in the Coronal sutures (**Table 3**) age of commencement is as follows:

Table 2: Coronal Suture closure in our study

Ectocranial Suture		Earliest age of commencement of fusion as observed
Coronal Suture	Upper half	34 years
	Lower half	31 years

Table 2: Results of our study showing the earliest age of commencement of fusion of sutures in our sample study.

Table 3: Coronal Suture closure in our study

Ectocranial Suture		Earliest age of completion of fusion as observed
Coronal Suture	Upper half	56 years
	Lower half	50 years

Table 3: Results of our study showing the earliest age of completion of fusion of sutures in our sample study. Our study matched with the results of many studies in the Indian scenario^{14,15, 16, 24, 25}. It was observed that the closure of the ectocranial Coronal suture begins between 30 years-40 years and completes by 60 years²⁶. It has been opined if male skull is seen with serration of Coronal suture, age is assumed to be less than thirty years in²³. Similar to our study, fusion was observed to begin in the upper part of the suture¹⁵. A comparative account is given in **Table 5**.

Table 4: Comparative account of Coronal suture fusion

Author	Method	Time of closure of Coronal Suture
Krogman ²⁴	Gross skeleton	24 years to 38 years
Parikh ²⁸	Roentgen ray	35 years to 40 years
Vij ³	Roentgen ray	Lower half – 40 years to 50 years Upper half – 50years to 60 years
Ramachandran ³⁴	Roentgen ray	Lower half – 40 years to 60 years Upper half – 50 years to 60 years
Dikshit ³³	Roentgen ray	Start – 25 years to 30 years Complete – 40 years
Mukherjee ²⁹	Roentgen ray	Lower half – 25 years to 30 years Upper half – 40 years to 45 years
Karmakar ³⁰	Roentgen ray	Start – 25 years to 30 years Complete – 30 years to 40 years

Pillay ³¹	Roentgen ray	40 years to 50 years
Gaur <i>et al.</i> ¹⁶	Roentgen ray	31 years -50 years

Table Number 4: Comparative account of Coronal suture closure

Conclusion

We studied the radiological stages of fusion of Coronal suture of the skull in association with the documented age and found a significant correlation between the two using a Scoring method. Coronal suture was found to start fusion by 31 years and earliest completion was at 50 years. Ectocranial suture closure can be used for age estimation with other associated factors. In our study the trend of correlation is increasing with age which strengthen the view that there is a significant relationship between suture closure and age. It is important to refine the methods of scoring or quantifying these structures to make it an unbiased observation.

Ethical clearance : a prior approval was obtained from the institutional ethical committee

Conflict of interest: none to declare

Source of funding: none to declare

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