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

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Abstract

Assessment of age is required in litigation cases of a person. It is usually estimated by physical appearance and radiological appearance. In instances of the estimation of age of an individual, it may be asked by the employer to fix his age for the benefits of pension or age disputes over retirement and the like. Cranial sutures are like epiphyseo-diaphysis plane. The edges are the growth points and they close at an age range. In this study we have used this principle to study the stages of fusion of sagittal sutures in roentgenogram of males where the age is known. We have divided our samples in the age group of 20- 25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80 years. We have used the documented age to study the stage of fusion the suture.

Keywords: Age estimation, cranial sutures, identity, sagittal suture.

Introduction

Identification is the establishment of the individuality of a person. It maybe: Complete- absolute ascertainment of identity or Partial / Incomplete- in which certain facts of identity are ascertained and others are unknown. Age, Sex, Stature and Race are considered the primary parameters in forensic identification[1,2].

Sutures are like epiphysio-diaphysis plane. The edges are the focus of growth. They fuse with time depending on the age, sex, genetic determinants[3-6]. For the study of sutures, in skull roentgenogram, the skull sutures can be divided into upper half and lower half[5].

Previously, serrations on radiographs have been reported as None-flight-Medium-Complex[7]. With the advent of technology, the stages are now classified as open, partial union and fused[2-5]. Antero-posterior view, lateral views of the skull are preferable for viewing the sutures[2-4]. Plain film radiography is a cost-effective method in evaluating skull fractures, vascular grooves and sutures[8].

Methodology

We studied 126 digital films of radiography (roentgenogram) of skull advised from clinical department for investigation and management after the patients consented to the study. The digital skull was studied for stage of fusion of sagittal suture by dividing the suture into upper and lower half and studying the staging in males of 20-80 years age group.

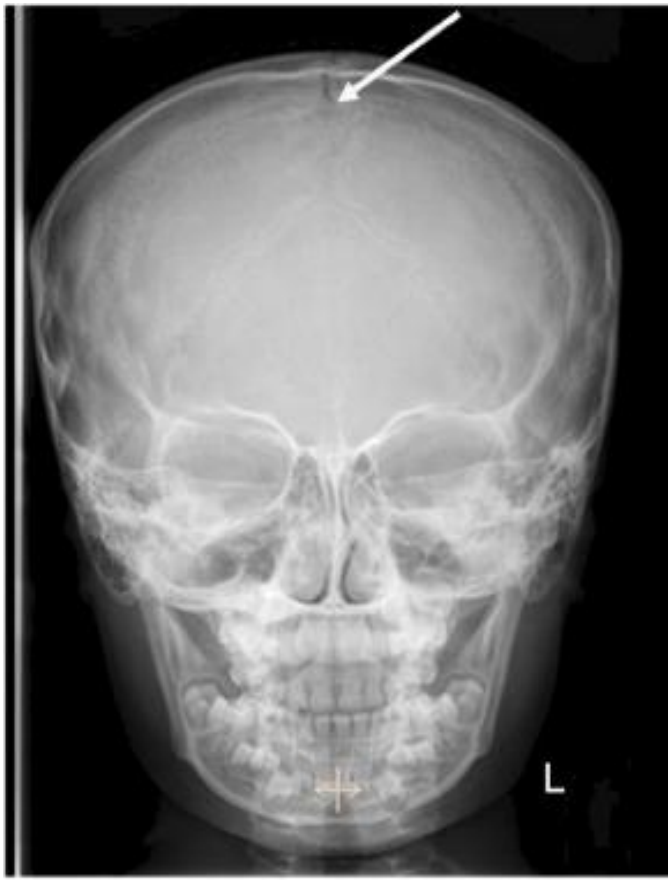

Figure-1: 21 years/ Male Antero-Posterior view of the skull showing sagittal suture of the skull.

Figure-2: 45 years male Antero-posterior view of the skull.

Figure-3: 73 years, male Antero-posterior view of the skull.

Results and discussion

In the Table-1 in age group 20-25 years, total numbers of cases were 25 (20%). In the upper half of the suture, 25 cases (100%) fusion had not commenced. In the lower half of the suture, 25 cases (100%) fusion had not commenced. In the age group 26-30 years, total numbers of cases were 14 (11%). In the upper half of the suture, 14 numbers of cases (100%) where fusion had not commenced. In the lower half of the suture, 2 cases (14%) fusion had not commenced, 12 cases (86%) fusion was in the process. In the age group 31-35 years, total numbers of cases were 16 (12%). In the upper half of the suture, 5 numbers of cases (31%) where fusion had not commenced, 11 numbers of cases (69%) fusion was in the process. In the lower half of the suture, 16 cases (100%) fusion had not commenced. In the age group 36-40 years, total numbers of cases were 7 (6%). In the upper half of the suture, 7 numbers of cases (100%) were in the process of fusion. In the lower half of the suture, in 01 case (14%) fusion had not commenced, in 6 cases (86%) fusion was in the process as depicted in Figure-4, 5.

In the Table-1, in age group 41-45 years, total numbers of cases were 6 (5%). In the upper half of the suture, 6 numbers of cases (100%) were in the process of fusion. In the lower half of the suture, in 6 cases (100%) fusion was complete. In the age group 46-50 years, total numbers of cases were 10 (8%). In the upper half of the suture, 1 case (10%) was in the process of fusion, 9 number of cases (90%) were fusion occurred. In the lower half of the suture, in 10 cases (100%) fusion was complete. In the age group 51-55 years, total numbers of cases were 9(7%). In the upper half of the suture, 9 number of cases (100%) fusion had occurred. In the lower half of the suture, in 9 cases (100%) fusion was complete. In the age group 56-60 years, total number of cases were 9 (7 %). In the upper half of the suture, 9number of cases (100%) fusion had occurred. In the lower half of the suture, in 9 cases (100%) fusion was complete. In the age group 61-65 years, total numbers of cases were 6 (5%). In the upper half of the suture, 6 number of cases (100%) fusion had occurred. In the lower half of the suture, in 6 cases (100%) fusion was complete. In the age group 66-70 years, total numbers of cases were 9 (7%). In the upper half of the suture, 9 number of cases (100%) fusion had occurred. In the lower half of the suture, in 9 cases (100%) fusion was complete. In the age group 71-75 years, total numbers of cases were 9(7%). In the upper half of the suture, 9 number of cases (100%) fusion had occurred. In the lower half of the suture, in 9 cases (100%) fusion was complete. In the age group 76-80 years, total numbers of cases were 6 (5%). In the upper half of the suture, 6 number of cases (100%) fusion had occurred. In the lower half of the suture, in 6 cases (100%) fusion was complete as depicted in Figure-4,5.

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

P value for age versus lower half of Sagittal suture in male is < 0.001as the age increases the trend is not commenced to fused. Test used is Fisher's Exact test.

Discussion: It was observed that the order of obliteration of sutures is (1) Sagittal, (2) Coronal, (3) Lambdoid[8-11].

Sutures which are not fused have a characteristic serrated appearance in outer table with progression of fusion of sutures, the radiolucent appearance of fusion and margin decreases[12]. Indian literature on stage of fusion reveals suture closure by 40-50 years in upper half and lower half by 30- 40 years. Table No 2 shows a comparative account of different studies on sagittal suture and its age of starting and completion of fusion.

Table-1: Sagittal Suture in Male.

AGE	No. of Cases		Upper Half						Lower Half					
(YRS)	No	%	Not commenced		In process		Fused		Not commenced		In process		Fused	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
20-25	25	20	25	100	0	-	0	-	25	100	0	-	0	-
26-30	14	11	14	100	0	-	0	-	2	14	12	86	0	-
31-35	16	12	5	31	11	69	0	-	0	-	16	-	0	-
36-40	7	6	0	-	7	100	0	-	1	14	6	86	0	-
41-45	6	5	0	-	6	100	0	-	0	-	0	-	6	100
46-50	10	8	0	-	1	10	9	90	0	-	0	-	10	100
51-55	9	7	0	-	0	-	9	100	0	-	0	-	9	100
56-60	9	7	0	-	0	-	9	100	0	-	0	-	9	100
61-65	6	5	0	-	0	-	6	100	0	-	0	-	6	100
66-70	9	7	0	-	0	-	9	100	0	-	0	-	9	100
71-75	9	7	0	-	0	-	9	100	0	-	0	-	9	100
76-80	6	5	0	-	0	-	6	100	0	-	0	-	6	100
TOTAL	126	100	-	-	-	-	-	-	-	-	-	-	-	-

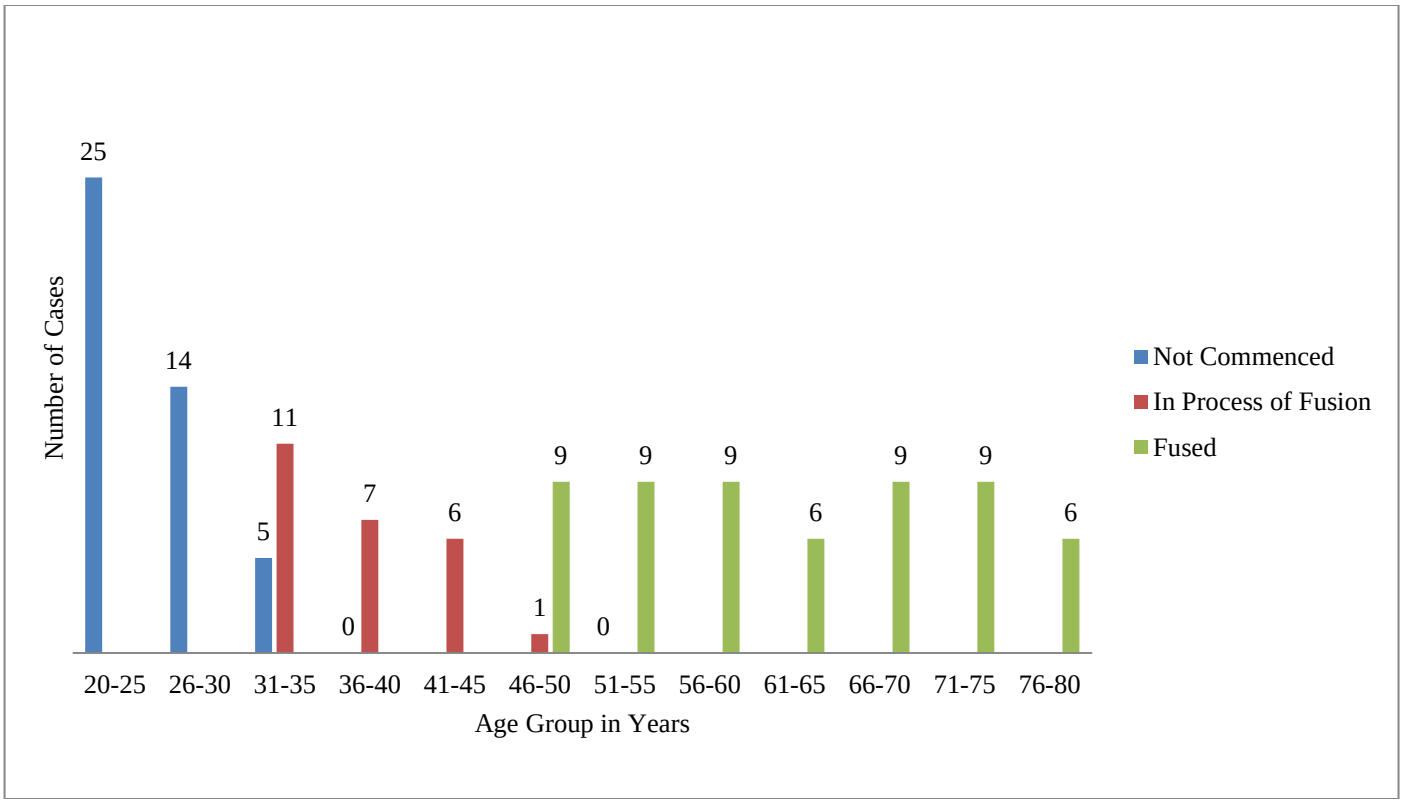

Figure-4: Graph showing stages of fusion in upper half of sagittal suture in males.

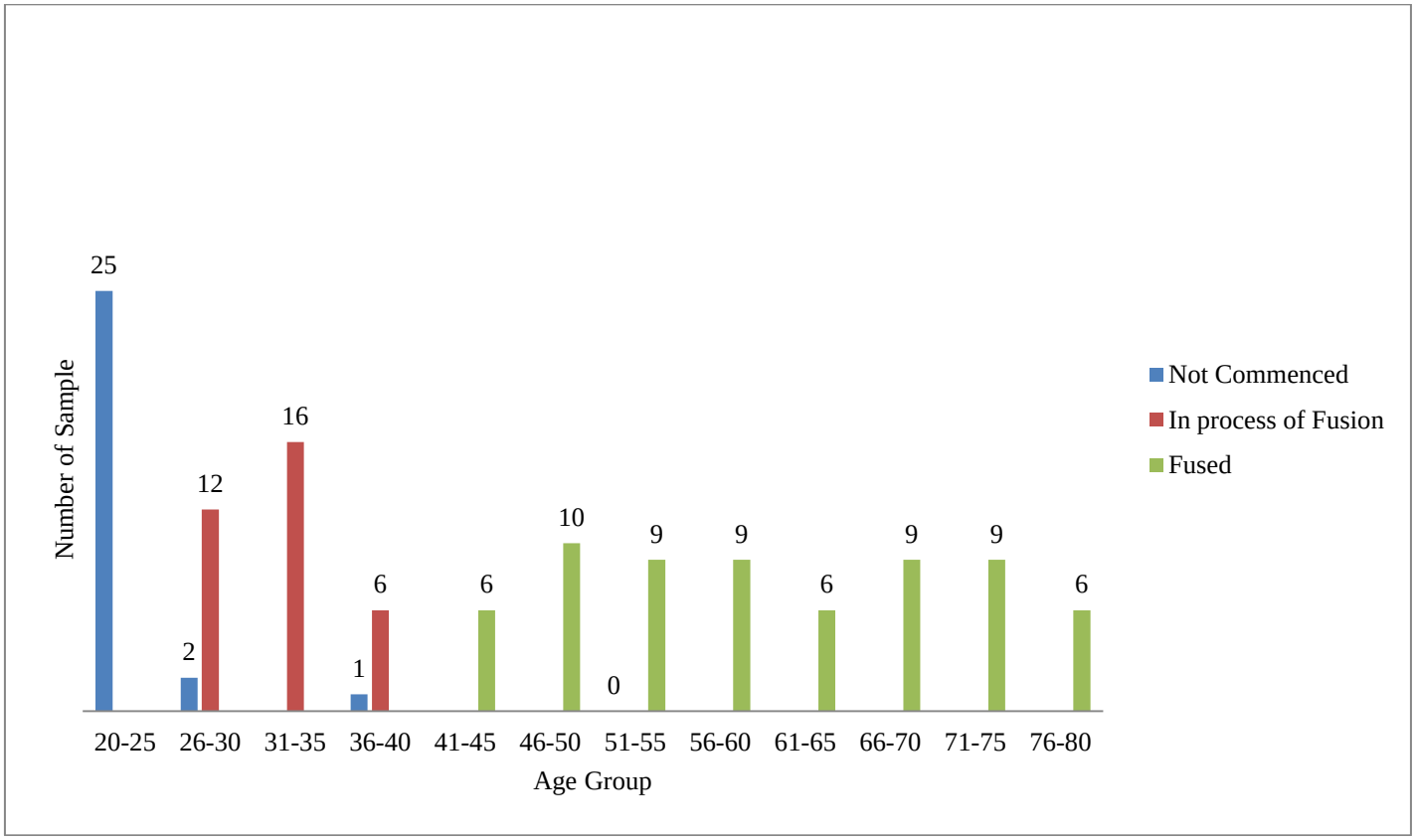

Figure-5: Graph showing stages of fusion in lower half of sagittal suture in males.

Table-2: Comparative account of suture closure.

Age of closure of Sagittal suture	Reference
Fusion: 40-50 years	1
Fusion: 40-50 years	2
Fusion: 50-50 years	9
Fusion: 45-50 years	11
Start -22 years, Fusion: 35 years	13
Start: 22 years	14
Start: 22 years	16
Start: 26-31 years, Fusion: 39-51 years	18
Start: 31 years, Fusion: 40 years	19

The Sagittal suture closes ectocranially at the lower part and is completed by old age. Lynnerup et al.[15] opined that below 40 years of age there is relation between development and age, but that any precise determination of age in seniors is impossible. Many authors have found it this method to be erratic and an unreliable measure of age as fusion depends on many external factors also [16,17]. Gaur et al [19] found that that the first suture to start fusing is the Sagittal suture in the age group of 31-35 years and complete fusion by 40 years. The earliest age of commencement of suture fusion was 31 years in upper half and 26 years in lower half in our sample. The earliest age of completion of fusion was 51 years in upper half and 39 years in lower half.

Conclusion

We studied the radiological stages of fusion of Sagittal suture of the skull in association with the documented age and found a significant correlation between the two using a Scoring method. In our study the earliest age of commencement of suture fusion was 31 years in upper half and 26 years in lower half. The earliest age of completion of fusion was 51 years in upper half and 39 years in lower half. 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.

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