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An autopsy based study on cranial vault sutural fusion for estimation of age of Jaipur region at S.M.S. medical college Jaipur, during 2020-21

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Abstract

This study conducted during one year of period from 1st Aug. 2020 to 31st July. 2021 at Mortuary, the Department of Forensic Medicine & Toxicology, S.M.S. Medical College & Attached Hospital, Jaipur. The study was Hospital Based Prospective Observational and cross-sectional study, conducted on Medico-Legal autopsies done in the department. The aim of this study was To observe the fusion of cranial vault sutures in deaths autopsied at SMS hospital Jaipur during the study period. The objectives of the study to observe sagittal, lambdoid, coronal sutures fusions in respect to age and variations in both sexes, outer & inner tables. Total autopsies conducted during this period was 4096, out of which 100 cases were included for study on the basis of random selection. In our study 100 cases were divided into five groups were 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70 years and each groups had 20-20 cases (10 males and 10 females). In our study, complete fusion of ectocranial sagittal suture was observed at the age of 52-60 yrs in female, in 46-49 yrs in male. The endocranial sagittal suture fusion was observed at 31-39 yrs in male, 40-50 yrs in female. Age of complete fusion of right coronal suture was 66 -69 years in male in ectocranium & 36-39 years in endocranium and was 65-69 years in female in ectocranium & 41-49 years in endocranium. While in left coronal suture age of complete fusion was 60 -69 years in male in ectocranium & 34-39 years in endocranium.

Keywords: Coronal, Ectocranium, Endocranium, Lambdoid, Sagittal.

Introduction

Identification is the determination of personality of an individual by means of various physical features and biological parameters, which are unique for each individual i.e. exact fixation of individuality of a person. Some of them are as external features (such as birth marks, scar, tattoo marks, occupational marks, malformations), personal features (such as clothes, speech, habits, handwriting), age and sex, race and stature and anthropometric measurements, finger prints and foot prints, DNA finger printing [1,2,3]. Usually, the age estimation up to 25 years is involve physical examination, appearance of secondary sexual characters, data from dental eruption, and maturity of bones, appearance and fusion of various ossification centers. Sometimes even when the age of person is known by the horoscope, hospital records and birth certificate, but still its scientific confirmation is required by court of law and certain administrative departments. In India and many other countries, the task of scientific confirmation of disputed age issues of civil and criminal nature is the domain of forensic expert [3]. However cranial sutural fusion is influenced by heredity, climate, race, diet, hormone level, disease process etc. Only handful of studies has been conducted in India, and data on heterogeneous population of Jaipur region is virtually non-existent. So, this study on the cranial vault suture is conducted to develop the statistical data in relation with the age of an individual of Jaipur region. In our study ectocranial Ly sagittal suture complete fusion was observed earlier in males as compared to females. Earliest age at which complete union of lambdoid suture was seen at 45 years ectocranial Ly and 40 years endocranially found in this study.

Material & Methods

This study was conducted in all cases of deaths autopsied at the Department of Forensic Medicine, S.M.S. Medical College & Attached Hospital, Jaipur after taking permission from research review board and institutional ethical committee and completing all due formalities. It is Hospital Based Prospective Observational and cross-sectional study on Medico-Legal autopsies conducted at Mortuary S.M.S. Hospital Jaipur from 1st August, 2020 to 31st July, 2021. Randomly Cases were selected for the study. After obtaining written informed consent for participation in the study from available near relative of the deceased, relevant details of deceased. Age was confirmed by documentary evidences like birth certificate, identification cards; ration card, Indoor papers etc. Deceased under exclusion criteria were excluded from study. After reflecting the scalp, coronal, sagittal, lambdoid and temporoparietal sutures will be studied by applying Acsadi-Nemeskeri scale[21]ectocranially. For endocranial suture same scoring system was applied after removing the calvaria by craniotome taking due care to include complete coronal, sagittal suture & temporoparietal suture. Lambdoid suture was studied in situ. The calvarium was cleaned of soft tissues which made the sutures more prominent. The obliteration of the sutures were ascertained endocranially as well as ectocranial Ly. The coronal suture was studied in three parts, sagittal suture in three parts, lambdoid sutures in three parts. Details were filled as per pre designed Proforma by interviewing of available legal heirs and attendants for Demographic profile like sex, socio economic status, dietary habit, built and height data was also collected. All the details were filled in the Microsoft Excel data sheet to create a master chart of the data. The

data was then tabulated and analysed statistically. Results and conclusion were derived.

Scale for closure: Acsadi-Nemeskeri complex

Method

0 = open. There is still little space left between Edges of adjoining bones.

1 = incipient closure. Clearly visible as a Continuous often zigzagging line.

2 = closure in process. Line thinner, less zigzags, Interrupted by complete

Closure

3 = advanced closure. Only pits indicate where the suture is located (almost complete closure)

4 = closed. Even location cannot be recognised.

Abbreviations

S1: Pars bregmatic a (i.e., first part) of Sagittal suture

S2: Pars verticis (i.e., second part) of Sagittal suture

S3: Pars obelica (i.e., third part) of Sagittal suture

S4: Pars lambdicia (i.e., fourth part) of Sagittal Suture

C1: Pars bregmatic a (i.e., first part) of Coronal Suture

C2: Pars complicate (i.e., second part) of Coronal Suture

C3: Pars pterica (i.e., third part) of Coronal suture

L1: Pars lambdicia (i.e., first part) of Lambdoid Suture

L2: Pars intermedia (i.e second part) of Lambdoid Suture

L3: Pars asterica (i.e third part) of Lambdoid suture

Figures & Tables

Table 1: Minimum Age (in years) of complete Union of Sagittal Sutures

Sagittal Suture	Male		Female	
	Endo-cranium	Ecto-cranium	Endo-cranium	Ecto-cranium
S1	61	60	68	65
S2	46	53	49	61
S3	40	62	50	69
S4	31	46	40	52

Figure 1: Sagittal & Coronal Suture Fusion

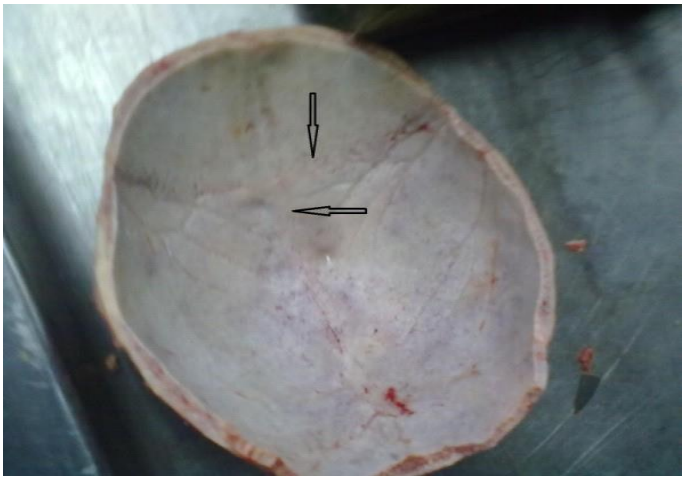

Table 2: Age of complete fusion of right lambdoid sutures

Suture	L1		L2		L3	
	Male	Female	Male	Female	Male	Female
Ectocranially (age group in yrs)	51-59	62 – 69	53-59	59-65	61-69	60-69
Endocranially (age group in yrs)	45-49	49-55	53-59	61-69	67 – 69	67 – 70

Table 3: Age of complete fusion of Right coronal sutures

	C1		C2		C3	
	Male	Female	Male	Female	Male	Female
Ectocranially (Age group in yrs)	66 – 69	65 – 69	-	-	-	-

Endocranially (Age group in yrs)	48 – 49	56 – 59	51 – 60	59 – 65	36 - 39	41 - 49

Table 4: Age of complete fusion of Left coronal sutures

	C1		C2		C3	
	Male	Female	Male	Female	Male	Female
Ectocranial Ly (age group in yrs)	60 – 69	61 – 69	-	-	-	-
Endocranially (Age group in yrs)	48 – 49	51 – 59	51 – 55	57 – 61	34 – 39	38 – 40

Results & Discussion

In our study, out of 100 cases included in the study there were 50 males and 50 females (sex ratio 1:1). Ajay Bhengra et al [2] were observed that the age varied from 20 to 82 years. Maximum (24.00%) were 40-49 Yrs age group followed by 12.00% cases were 30-39 Yrs age group.

Ajay Bhengra et al [2] observed Out of 100 cases 60.00% were male and 40.00% cases were female. In our study, male and female were equally distributed that is 10 male and 10 female in each group.

Naked eye examination of all cases were done with reference to ecto & endocranial closure of sagittal, coronal and lambdoid suture using Acsadi and Nemeskeri scoring and simultaneously radiological confirmation was also done of all cases. Whereas this criterion was not considered by Yadav S.S. and Puri P.R. (1971) Patil T.L. (1981) [4], Bhagwat S.S. (1983) and Chandrashekhar an P. (1985). The fusion process of cranial suture at autopsy has been modified as 0, 1 and 2 by Moondra A.K. (2000) in contrast to Acsadi and Nemeskeri scoring as 1, 2, 3, 4. (TABLE 1-4)

In our study ectocranial Ly coronal suture complete fusion was observed earlier in males as compared to females similar findings were also observed endocranially.

In this study ectocranial Ly lambdoid suture complete fusion of L1, L2 was observed earlier in males in comparison of females but in LR3 early fusion was seen in female than male and endocranially it was observed at same age in male and female. In LL3 early fusion was seen in male than female but endocranially it was observed that in female closure was early. (Table 5)

In present study ectocranial Ly sagittal suture complete fusion was observed earlier in males as compared to females similar findings were observed endocranially where complete fusion of sagittal suture was observed earlier in male as compared to females. Similar observation were also made by Rentoul and Smith H. (1963) [5], Yadav S.S., Puri R.R. (1971), Vyas, P.c. (1996), Moondra A.K. (2000). We too are in agreement with their observation. (TABLE 1)

In our present study we have found that the sagittal suture, endocranially, starts fusing at the start of 30-40 years and completion is perfected at the age of 61-70 years, and this observation conforms with that reported by Todd & Lyon [6], while it is in contrast to the observation reported by Pommerol [7], and Topinard [8], who indicated endocranial commencement of sagittal suture at a much later age at about 40 years. These latter workers have reported on very scanty specimens so it can't by considered as authentic. Youngest age at which sagittal suture union seen was 46 years ectocranial Ly and 31 years endocranially. (TABLE 1) The study showed that fusion of endocranium began first on S4 & last on S1 in both sexes.

Mean age of fusion of Lambdoid suture Lower half (on Right and Left wing) is 67.14 years with SD – 8.355, SE - .769, p = 0.00. This result is contradicted by Guha raj & Chandran [9], Krishnan [10], Mestri [11], Rao NG [12], Nagesh Kumar [13] and Umadethan [14] . Supported by Chandha [15].

Conclusion

The present study we tried the possibilities for suture closure to contribute to age estimation. There is a need for more detailed studies (different age groups, sub samples, individual suture segments etc.) for a subject like suture closure. It is evident that, before several age indicators are combined into complex methods, as much information as possible about the separate age indicators has to be accumulated.

Present studies reveal that obliteration of the various segments of the three main sutures of the skull is so erratic that neither does it help in estimating the age of the deceased nor does it provide any supportive evidence in determining the age of skeletal remain. Our analyses strengthen the view that regardless of scoring method, there is only a very loose association between suture closure and age, and this poses a real problem in terms of practical use for age determination. There is the fundamental problem of using a method based on a structure which as yet is simply poorly understood. But whatever the underlying biological factors are for suture closure, and even if these in the future should be better understood, it is still important to refine the methods of quantifying these structures, in order to render the methods of quantification as unbiased as possible.

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