DOI Number: 10.5958/0974-1283.2019.00148.8

Study of Correlation between Age and Closure of Cranial Sutures – A Post-Mortem Observational Study

B. B. Oza[1], J. A. Tanna[2], A. K. Pathak[3]

[1]Tutor, GMERS Medical College, Dharpur, Patan, [2]Assistant Professor, GMERS Medical College, Junagadh, [3]Professor & Head, P.D.U Medical College, Rajkot

Abstract

Introduction – There is tremendous need for Indian data regarding the age of closure of cranial sutures. So, current study was undertaken at S.S.G. Hospital, Vadodara for a period of 1 year.

Material & Method - All cases of known age coming for the postmortem examination in which the victim is between 21-40 years of age were taken for the study. Both ectocranial and endocranial state were taken into consideration.

Results - In female subjects, significant correlation was found in sagittal, coronal and lambdoid suture closure in both ectocranially and endocranially in 21-30 age group (Table 2). In 31-40 age group significant correlation was found in coronal suture right and left side ectocranially.

Statistical Analysis - Spearman rank correlation coefficients, Levene's test for equality of variances, Student's t test for equality of means, STATAIC-13 software was used.

Conclusion – Many of the findings of current study were correlated with earlier studies, while others were found contradictory. Further detailed study with larger sample size is required.

Key-words – *Age-estimation, Cranial sutures*

Introduction

Age estimation forms the integral part of identification of the individual. In cases where we receive badly decomposed and skeletonized dead-bodies Identification forms the main examination point from the post-mortem examination. One of the main criteria in such cases would be to estimate the age from the state of fusion of sutures. The studies and data that are available in India are old and mostly from foreign studies. So, there is a dire need to conduct methodical research in the field of age estimations. So, the current study was undertaken at P.M. room of S.S.G. Hospital, Vadodara to study the correlation between age and state of fusion of sutures in 21-40 years age group. Out of total cases coming from post-mortem examination total 150 cases were selected based on inclusion, exclusion criteria.

Corresponding Author –
Dr. Jitendra A. Tanna
Assistant Professor, Forensic Medicine Dept,
GMERS Medical College, Junagadh
E-mail – jitu_tanna1@yahoo.com

Material & Method

The study was conducted on cases coming for medico-legal postmortem examination to the Department of Forensic medicine, Govt. Medical College and SSG Hospital, Baroda during a period of April 2016 to December 2016.

Inclusion Criteria: All cases of known age coming for the postmortem examination in which the victim is between 21-40 years of age.

Exclusion criteria: Unknown, unclaimed bodies where exact age cannot be confirmed.

Cases showing deformed or diseased or fractured skull, which may hamper the study of suture closure.

Method

This Cross-Sectional autopsy-based study was conducted in the Department of Forensic Medicine, S.S.G. Hospital & Medical College Baroda after taking the permission from the Institutional Ethics Committee. 150 cases of postmortem examination in which the victims are between 21-40 years of age were taken into the consideration for this study. Informed consent was taken from the relatives of the deceased before taking various body measurements.

Skull sutures were examined during the process of medico legal autopsies. After putting coronal incision over the head, scalp was reflected in anterior and posterior half to expose the skull completely to examine the coronal, sagittal and lambdoid sutures applying ***Acsadi-Nemeskeri Scale (ANS)***[1] ectocranially. For endocranial examination same score system was applied after removing the calvaria taking due care to include complete coronal and sagittal suture. Lambdoid suture was studied in-situ. The calvarium was cleaned of soft tissues on both sides and was dried, which made the sutures more prominent. The obliteration of the sutures was ascertained endocranially as well as ectocranially. In both cases degree of closure was scored in 16 parts of the main cranial sutures as has been done by Acsardi-Nemeskeri method. The coronal suture was studied in three parts on right side and left side each; sagittal suture in four parts and lambdoid suture in three parts each on right and left side. Ectocranially the different sections were distinguished by differences in the character of the suture. Endocranially the sutures do not show these differences in character. Consequently, the endocranial sutures were simply divided in sections of equal length.

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

4 = Closed. Even location cannot be recognized.

Statistical Methods:

To estimate the possible relation between suture closure and age at death, appropriate statistical tools were used (Spearman rank correlation coefficients, Levene's test for equality of variances, Student's t test for equality of means, STATAIC-13 software). $p<0.05$ was considered as significant.

Results

Out of total 170 cases selected as per inclusion, exclusion criteria. 70 were female and 100 cases

Table 1 – Comparison between Ectocranial & endocranial sutures

		Ectocranial					Endocranial				
Age	**No.**	**S_ Ecto**	**CR_ Ecto**	**CL_ Ecto**	**LR_ Ecto**	**LL_ Ecto**	**S_ Endo**	**CR_ Endo**	**CL_ Endo**	**LR_ Endo**	**LL_ Endo**
21-30	43	.842**	.788**	.790**	.887**	.887**	.770**	.822**	.822**	.823**	.803**
		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
31-40	42	.525**	.591**	.528**	.493**	.536**	.496**	.459**	.434**	.543**	.501**
		.000	.000	.000	.001	.000	.001	.002	.004	.000	.001

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Ectocranial sutures were compared with endocranial sutures through sagittal, right and left coronal and lambdoid (Table 1). To estimate the possible relation between suture closure and age at death, Spearman rank correlation coefficients (2 tailed) were calculated. Because of the considerably skewed age distribution of the sample, Pearson correlation coefficients are less appropriate. Significant correlation was found in earlier age group till 40 years of age.

Table 2 – In Females, Comparison between Ectocranial & endocranial sutures

		Ectocranial					Endocranial				
Age Groups	**No.**	**S_Ecto**	**CR_Ecto**	**CL_Ecto**	**LR_Ecto**	**LL_Ecto**	**S_Endo**	**CR_ Endo**	**CL_ Endo**	**LR_ Endo**	**LL_Endo**
21-30	13	.811**	.752**	.752**	.791**	.791**	.632*	.815**	.815**	.741**	.741**
		.001	.003	.003	.001	.001	.021	.001	.001	.004	.004
31-40	22	.484*	.593**	.589**	.471*	.430*	.338	.318	.276	.518*	.520*
		.023	.004	.004	.027	.046	.123	.150	.214	.014	.013

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

In female subjects significant correlation was found in sagittal, coronal and lambdoid suture closure in both ectocranially and endocranially in 21-30 age group (Table 2). In 31-40 age group significant correlation was found in coronal suture right and left side ectocranially.

Table 3 – In Males, Comparison between Ectocranial & endocranial sutures

Age Groups	**No.**	**S_Ecto**	**CR_Ecto**	**CL_Ecto**	**LR_Ecto**	**LL_Ecto**	**S_Endo**	**CR_ Endo**	**CL_ Endo**	**LR_ Endo**	**LL_Endo**
21-30	30	.881**	.798**	.794**	.917**	.917**	.836**	.848**	.848**	.881**	.833**
		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
31-40	20	.644**	.641**	.488*	.545*	.664**	.661**	.583**	.581**	.573**	.474*
		.002	.002	.029	.013	.001	.002	.007	.007	.008	.035

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

In male subjects ectocranial and endocranial suture closure were found to be correlated up to 40 years (Table 3).

Discussion

In later years of life all the teeth have erupted, practically all the epiphyses have united with the diaphysis, the height and weight are of no significance to determine the age.

Gustafson has done the work in which he has given the idea to determine the age on the basis of changes that occur in teeth. Literature is full of certain changes such as lipping of the bones, graying of the hair, appearance of arcus senilis in the cornea, opacity in lens, atherosclerotic changes in the arteries, wrinkling of the skin especially

of the face. They are too vague to be considered for determination of age in Medico-legal work.

Obliteration of skull sutures in late age, practically when all the teeth have erupted and epiphysis have fused i.e. after 21 years of age, gives a fairly accurate idea but here also we find that the determination of age can only be in decades, based on sole criterion of suture obliteration.

Sagittal suture

In our present study we have found that the sagittal suture, endocranially, starts fusing at the end of 21-30 years and completion is perfected at the age of 51-60 years, and this observation confirms with that reported by Shetty U(2009)[2], Modi K(2015)[3], Todd & Lyon (1924)[4], while it is in contrast to the observation reported by Zanzrukiya et al[5] , who indicated endocranial commencement of sagittal suture at a much later age at about 40 years.

Ectocranially sagittal suture closure was never complete. Youngest age at which sagittal suture union was seen in 35 years ectocranially and 32 years endocranially.

Coronal Suture

While in the present study endocranial fusion of coronal suture was observed as early as 21-30 years and completion by the late age other workers like Maish W et al[6] reported in males the minimal age of fusion in endocranium were 40 years for both sagittal suture (SS) and coronal suture (CS). Their study does not indicate whether it was ectocranial or endocranial or it was commencement or termination. In coronal suture youngest age at which complete union was seen at 50 years ectocranially and 35 years endocranially.

Lambdoid Suture

Lambdoid suture endocranially, starts fusing at the age of 21-30 years in our study which shows that it is a year earlier than that reported by Shetty U (2009)[2], Modi K (2015)[3], Todd and Lyon (1924)[4], while completion in our study is 51-60 years. Earliest age at which complete union of lambdoid suture was seen at 39 years ectocranially and 32 years endocranially.

Our Indian data compare well with those of the male whites (Todd & Lyon 1925)[7]. Negro skulls however show an earlier date of commencement and closure.

Form the present study (see graphs and tables) it is clearly evident that endocranial union is a far better parameter for age determination than is the ectocranial union as also has been established by A. Hardlicka[8], Meindl RS[9], Kumar V[10].

Statement of Conflict of Interest – NONE

Statement of Informed consent – Informed consent of relatives taken

Statement of Human and animal ethics – No ethical issues involved.

References

1. Krogman WM, Iscan MY.Skeletal age:cranium.In: The Human skeleton in Forensic Medicine.Charles C Thomas Publishers 1986; 2nd edn : p.103-132.
2. Shetty U. Macroscopic study of cranial suture closure at autopsy for estimation of age. Anil Aggrawal's Internet J of Foren Med and Toxicol, 2009; 10(2). 22-26.
3. Modi k,Solanki U,Parikh U,Algotar G,Mehta T and Patel P. ASCADI Nemeskeri scale based study on closure of skull sutures and its relation with Age. INT J Int Med Res.2015;2(2):40-44.
4. T.W. Todd, D.W.Lyon jr. Endocranial suture closure. Its progress and age relationship part1.Adult males of white stock. Am. J.Phys.Anthropol.1924; 7:325-384.
5. Zanzrukiya K, Prajapati P, Govekar G, Patel G, Chandegara P, Gajera C. A cross sectional study of cranial suture closure by CT scan with reference to age, IRPMS, 2015;1(3):57-63.
6. Masih W, Gupta S, Jaiswal P, Chand A and Saraswat P. Morphological Study of Vault Suture & Its Correlation with Age in Central Rajasthan. Natl J Med Res. 2014; 4(1): 19-22
7. T.W. Todd, D.W.Lyon jr. Suture closure-Its progress and age relationship part4. Ectocranial closure in Adult males of Negro stock. Am. J.Phys. Anthropol.1925; 8:149-168.
8. A.Hardlicka. Estimation of age in;T.D.Stewart (Ed). Hardlicka's Practical Anthropometry, 4th ed. Wistar Institute of Anatomy and Biology. Philadelphia.1952:54.

9. Meindl RS, Lovejoy CO. Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral anterior sutures. Am J Phys Anthropol. 1985 Sep; 68(1):57-66.
10. Kumar V., Agrawal SS., Bastia BK., Shivaramu MG., Honnungar RS. Fusion of skull vault sutures in relation with Age – A cross sectional post mortem study done in 3rd, 4th & 5th Decades of life. J Forensic Res 2012.Vol.3, Issue 10:1000173.
11. S – sagittal suture, CR – coronal right-side suture, CL - coronal left side suture
12. LR- Lambdoid Right side, LL - Lambdoid left side, Ecto – Ectocranial, Endo-Endocranial