



Original Research Article

Sexual Variation in Cranial Suture Closure - A Cross Sectional Post Mortem Study Done in Tertiary Care Hospital

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ABSTRACT

Objective: To find out the sexual variations in cranial suture closure.

Materials and methods: After reflecting the scalp, coronal, sagittal and lambdoid sutures were studied applying five point scale ectocranially. For endocranial suture closure, same score system was applied after removing the calvaria by craniotome. Lambdoid suture was studied in-situ. Photographs were taken in all cases.

Results: When comparison between males and female subjects were made, closure was earlier in females (Mean 6.97 vs. 4.94 in case of endocranial suture closure & 5.42 vs. 2.66 in case of ectocranial suture closure).

Conclusion: In the present study we conclude that suture closure contributes to sex determination. Our analyses strengthen that there is a very close association between suture closure and sex.

Key words: Cranial sutures, age, sex

INTRODUCTION

Data on sex differences, based on the morphology of the skull, have been widely published and utilized in most forensic and archaeological contexts by physical anthropologists. [1]

Though the cranial sutures and their degree of closure and morphology have primarily drawn interest in age estimation studies, several authors have looked at variations in sex. [2] This information is necessary, since differences in suture closure and morphology based on sex would require

the creation of unique standards for males and females.

Todd and Lyon (1924), however, suggested that sex differences were insignificant to suture closure, despite the fact that only males were observed. As Todd and Lyon's method was long accepted as the standard, many authors assumed that sex could be ignored. [3]

Brooks (1955), that female cranial sutures tend to remain open much more frequently than in males; cranial suture closure is somewhat sexually dimorphic, and

it should not be used as any more than “a secondary confirmation, with caution” in males and never in females. [4]

On the contrary, Acsadi and Nemeskeri (1970) calculated total scores for each suture on 208 male and 144 female crania. The authors found no significant differences in mean suture closure stages, either ectocranially or endocranially, based on sex. [5]

Perizonius (1984) confirmed this using the same method. [6]

The same year Baker (1984), using a different method, concluded that sex differences were significant. The males from a Los Angeles sample exhibited suture obliteration at a younger age than the females. He suggested that ectocranial suture closure is not useful for males but can be applied limitedly for females (the opposite of Brooks’ suggestion) and that age estimates should not be made without first identifying the sex of the individual. [7] Though these findings may have been significant, Meindl and Lovejoy (1985) reported no statistically significant differences in patterns of cranial suture closure based on sex using their method. [8]

Due to the large amount of conflicting data up to 1985 and the rise of Meindl and Lovejoy’s method as a new standard, it became generally accepted that sex did not need to be addressed before applying age estimates. However, more recent authors disagree.

Key et.al (1994) found, in a comparison of three popular scoring methods and two populations that sexual dimorphism was significant and females demonstrated a greater correlation with age. [9]

Hauser et.al (1991) observed the patterns, both size and shape, of the cranial sutures. Suture segments of the coronal, lambdoid and sagittal sutures were scored on 35 male and 35 female crania according to

their degree of maximal shape extension, basic configuration and secondary protrusions. Results showed heterogeneity for all three criteria of all three sutures, but differences in sex were minimal. [2]

Hershkovitz et.al (1997) reported that the sagittal suture of females more frequently remained patent, until age 65, than in males. Zambrano (2005) also established a clear relationship between sex and suture closure. Females were better correlated with age from the vault and endocranial sutures whereas males had the strongest correlation in the lateral-anterior system. Sex was determined, therefore, to influence the pattern and rate of suture closure. [10]

MATERIALS AND METHODS

In this study, all the cases brought for post-mortem examination at mortuary of KLEs Prabhakar Kore Hospital And Mrc, Belgaum between 1ST Jan 2008 to 31st Dec 2009 have been studied. All autopsies performed on deceased belonging to 3rd, 4th and 5th decades of life were included in this study. It was a Cross-sectional study & sample size was 70.

Preliminary data has been recorded as per the proforma. After reflecting the scalp, coronal, sagittal, lambdoid sutures were studied applying five point scale ectocranially. For endocranial suture closure, same score system was applied after removing the calvaria by craniotome taking due care to include complete coronal and sagittal suture. Lambdoid suture was studied in-situ. The calvarium was cleaned from soft tissues on both sides and was dried, which made the sutures look more prominent. Photographs were taken in all cases. 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 five point scale. The coronal

suture was studied in two parts on right side and left side each; sagittal suture in three parts and lambdoid sutures in two parts each on right and left side. Ectocranially the different sections are distinguished by differences in the character of the suture. Endocranially the sutures did not show these differences in character. Consequently the endocranial sutures were simply divided in sections of equal length. Examination is done under 5 point scale of 0 to 4 (0- Open, 1- Less than one half closed, 2- Half closed, 3- More than one half closed and 4- Totally closed (for inner and outer table separately).

After completion of data collection, it has been analyzed to find out pattern of skull vault suture closure in relation to various sex. Any notable difference in suture closure patterns with regards to sex of the individual and sides of skull was also analysed.

Inclusion criteria:

Deceased between 21-50 years of age.

Exclusion criteria:

- 1) All other age groups, 2) Cases with skull vault fractures and 3) Cases involving of pathological conditions.

RESULTS

The study consisted of 70 cases brought to the mortuary of KLEs Prabhakar Kore Hospital and MRC, Belgaum. from Jan 2009 to Dec 2009.

In our study, out of 70 cases there were 16 females and 54 males. (TABLE-1).

The maximum numbers of cases were in 21-30 age groups [39, 56%] followed by 41-50 age group [21, 30%] and lastly 31-40 age group [10, 14%]. Of the total cases, 16 cases were of females [23%], maximum belonging to 21-30 age groups [8 cases, 50% of total]. (TABLE-2)

Table-1. Male & female distribution of cases

	Frequency	Percent
Male	54	77
Female	16	23
Total	70	100

Table-2. Male & female distribution of cases according to age

	Male		Female		Total	
	No.	%	No.	%	No.	%
21-30	31	57	8	50	39	56
31-40	6	11	4	25	10	14
41-50	17	32	4	25	21	30
Total	54	100	16	100	70	100

Table-3. Endocranial suture closure-sexual variation

Age group	N(m/f)		Mean(m/f)	
	21-30	31	8	2.76
31-40	6	4	7.33	7.5
41-50	17	4	6.33	7.28
Total	54	16	4.94	6.97

Table-4. Ectocranial suture closure-sexual variation

Age group	N(m/f)		Mean(m/f)	
	21-30	31	8	2.01
31-40	6	4	3.66	6.62
41-50	17	4	3.51	5.37
Total	54	16	2.66	5.42

When comparison between males and female subjects were made, closure was earlier in females (Mean 6.97 vs. 4.94 in case of endo cranial suture closure & 5.42 vs. 2.66 in case of ecto cranial suture closure). (TABLE-3, 4)

When comparison between male and female ectocranial sagittal suture closure were made, closure was earlier in females compared to male (Mean 1.38 in female vs. 0.86 in male).

When comparison between male and female endocranial sagittal suture closure were made, closure was earlier in females compared to male (Mean 2.35 in female vs. 1.63 in male).

When comparison between male and female ectocranial coronal suture closure

were made, closure was earlier in females compared to male (Mean 2.22 in female vs. 1.04 in male).

When comparison between male and female endocranial coronal suture closure were made, closure was earlier in females compared to male (Mean 2.57 in female vs. 2.02 in male).

When comparison between male and female ectocranial lamdoid suture closure were made, closure was earlier in females compared to male (Mean 1.98 in female vs. 1.14 in male).

When comparison between male and female endocranial lamdoid suture closure were made, closure was earlier in females compared to male (Mean 2.51 in female vs. 1.73 in male).

DISCUSSION

In our study, out of 70 cases there were 16 females and 54 males. The maximum numbers of cases were in 21-30 age groups followed by 41-50 age group and lastly 31-40 age group. Of the total cases, 16 cases were of females [23%], maximum belonging to 21-30 age groups.

When comparison between males and female subjects were made, closure was earlier in females (Mean 6.97 vs. 4.94 in case of endocranial suture closure & 5.42 vs. 2.66 in case of ectocranial suture closure). So, in the present material all the three main sutures of the skull started closing earlier in the females than in the males.

In 1905, Parsons and Box reported that suture closure in females typically commences later than in males.

According to Moondra, in females closure of sagittal, coronal and lamdoid sutures occurs at 46-50, 56-60 and 56-60 respectively. In males closure of sagittal, coronal and lamdoid sutures occurs at 46-50, 46-50 and 56-60 respectively.^[11]

In the present material, in females closure of sagittal, coronal and lamdoid sutures occurs at 31-35, 41-45 and 31-35 respectively. In females closure of sagittal, coronal and lamdoid sutures occurs at 36-40, 46-50 and 36-40 respectively.

CONCLUSION

In the present study we conclude that suture closure contribute to sex determination. Our analyses strengthen that there is a very close association between suture closure and sex determination.

It is evident that, before several sex indicators are combined into complex methods, as much information as possible about the separate sex indicators has to be accumulated. This information can be obtained only by investigating skeletal material of known sex.

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Competing interest- the authors declare that they have no competing interest. Both authors have read and approved the final manuscript.

REFERENCES

1. Keen JA. A study of the differences between male and female skulls. American Journal of Physical Anthropology. 1950; 8(1): 65-80.
2. Hauser, Gertrud, Giorgio M, Alessandro V and Gian FdS. Size and Shape of Human cranial sutures, A new scoring method. American Journal of Anatomy. 1991; 190(3): 231-244.
3. Todd TW and Lyon DW. Endocranial suture closure, its progress and age relationship [part I]

- Adult males of the white stock. American Journal of Physical Anthropology. 1924; 7: 325-384.
4. Baker, Ronald K. The relationship of cranial suture closure and age analyzed in a modern multi-racial sample of males and females, M.A. Thesis, California State University, Fullerton. 1984.
 5. Acsady G, Nemeskeri J. History of human life span and mortality. Akademiai Kiado. 1970.
 6. Perzonius WRK. Closing and non-closing sutures in 256 crania of known age and sex from Amsterdam (AD 1883-1909). J Human Evolution. 1984; 13: 201-216.
 7. Brooks, Sheilagh T. Skeletal age at death: the reliability of cranial and pubic age indicators. American Journal of Physical Anthropology. 1955; 13(4): 567-597.
 8. 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; 68(1): 57-66.
 9. Key CA, Aiello LC and Molleson T. Cranial suture closure and its implications for age estimation. International Journal of Osteoarchaeology 1994; 4: 193-207.
 10. Hershkowitz I, Latimer B, Dutour O, Jellema LM, Wish-Bartaz S, Rothschild C, et al. Why do we fail in aging the skull from the sagittal suture? Am. J. Phys. Anthropol. 1997; 103(3): 393-9.
 11. Moondra AK. Age assessment from vault suture closure in elderly persons (an autopsy study in Haroti Region); Desertation for M.D.: University of Rajasthan; 2000.

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