

## Sexual Variation in Cranial Suture Closure-A Cross Sectional Post Mortem Study Done on 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 is applied after removing the calvaria by craniotome. Lambdoid suture was studied *in-situ*. Photographs are 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 and 5.42 vs. 2.66 in case of ectocranial suture closure).

**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.

**Keywords:** 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 [3], 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.

Brooks [4], reported 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.

On the contrary, Acsádi and Nemeskéri [5] 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. Perizonius [6] confirmed this using the same method.

The same year Baker [7], 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. Though these findings may have been significant, Meindl and Lovejoy [8] reported no statistically significant differences in patterns of cranial suture closure based on sex using their method.

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. [9] 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.

Hauser et al. [2] 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.

Hershkovitz et al. [10] reported that the sagittal suture of females more frequently remained patent, until age 65, than in males. Zambrano, 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.

### 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 1<sup>st</sup> Jan 2008 to 3<sup>rd</sup> Dec 2009 have been studied. All autopsies performed on deceased belonging to 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> decades of life are included in this study. It is a cross-sectional study and sample size is 70.

Preliminary data has been recorded as per the proforma. After

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**Received** October 31, 2012; **Published** January 28, 2013

**Citation:** Vijay Kumar AG, Agarwal SS, Bastia BK, Shivaramu MG (2013) Sexual Variation in Cranial Suture Closure-A Cross Sectional Post Mortem Study Done on Tertiary Care Hospital. 2: 611 doi:[10.4172/scientificreports.611](https://doi.org/10.4172/scientificreports.611)

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reflecting the scalp, coronal, sagittal, lambdoid sutures were studied applying five point scale ectocranially. For endocranial suture closure, same score system is applied after removing the calvaria by craniotomy taking due care to include complete coronal and sagittal suture. Lambdoid suture was studied *in-situ*. The calvarium is cleaned from soft tissues on both sides and is dried, which made the sutures look more prominent. Photographs are taken in all cases. The obliteration of the sutures is ascertained endocranially as well as ectocranially. In both cases degree of closure is scored in 16 parts of the main cranial sutures as has been done by five point scale. The coronal suture is 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 are 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 sexes. Any notable difference in suture closure patterns with regards to sex of the individual and sides of skull is also analyzed.

**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).

When comparison between males and female subjects were made,

	Frequency	Percent
Male	54	77
Female	16	23
Total	70	100

Table 1: Male & female distribution of cases.

	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 2: Male & female distribution of cases according to age.

Age group	N(m/f)		Mean(m/f)	
21-30	31	8	2.76	7.04
31-40	6	4	7.33	7.5
41-50	17	4	6.33	7.28
Total	54	16	4.94	6.97

Table 3: Endocranial suture closure-sexual variation.

closure was earlier in females (Mean 6.97 vs. 4.94 in case of endocranial suture closure and 5.42 vs. 2.66 in case of ectocranial suture closure) (Tables 3 and 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) (Figure 1).

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) (Figure 2).

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) (Figure 3).

Age group	N(m/f)		Mean(m/f)	
21-30	31	8	2.01	4.791
31-40	6	4	3.66	6.62
41-50	17	4	3.51	5.37
Total	54	16	2.66	5.42

Table 4: Ectocranial suture closure-sexual variation.

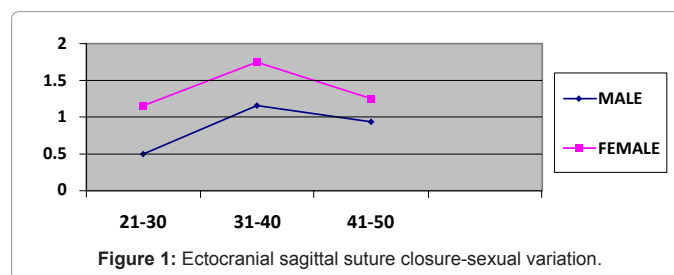


Figure 1: Ectocranial sagittal suture closure-sexual variation.

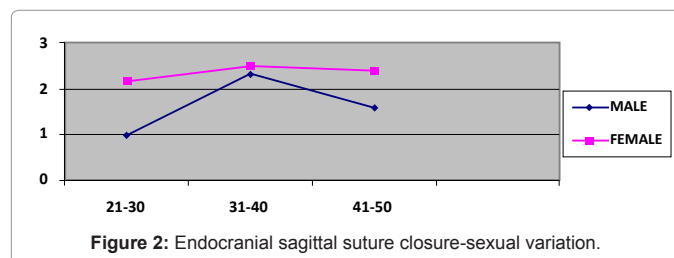


Figure 2: Endocranial sagittal suture closure-sexual variation.

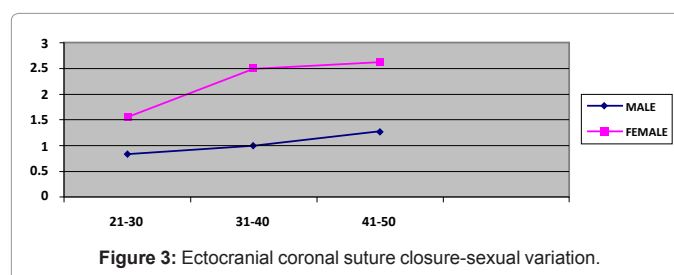


Figure 3: Ectocranial coronal suture closure-sexual variation.

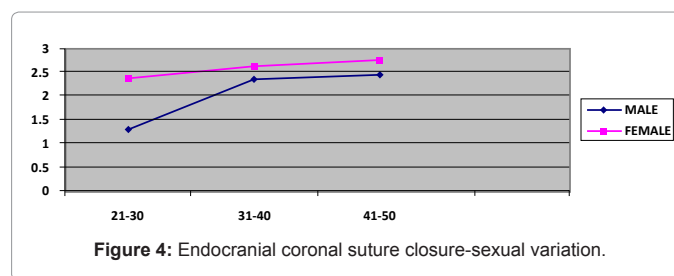


Figure 4: Endocranial coronal suture closure-sexual variation.

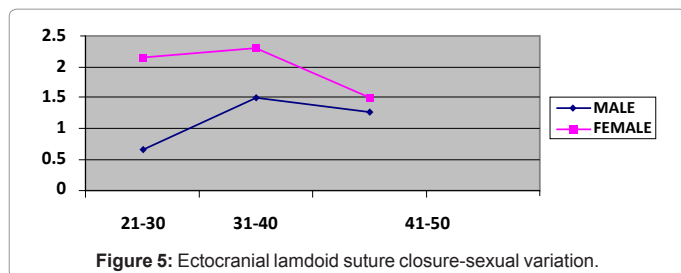


Figure 5: Ectocranial lamdoid suture closure-sexual variation.

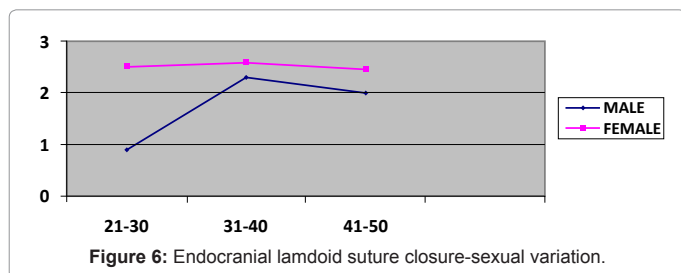


Figure 6: Endocranial lamdoid suture closure-sexual variation.

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) (Figure 4).

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) (Figure 5).

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) (Figure 6).

## Discussion

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

In the present material all the three main sutures of the skull started closing earlier in the females than in the 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 males 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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