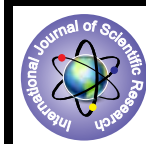


Certain Forensic Aspects of Midline Vault Sutures in South Indian Population.



Forensic Medicine

KEYWORDS: Sagittal suture, Age, Frontal suture, Double Y suture.

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Introduction:

The word suture is derived from Sutura (*Latin*) – seem like or series of stitches. Skull sutures are inter woven pattern of bone attachments and sites of bone growth. Cranial sutures are useful in finding out age of an individual, his stature, origin and ancestry. Some researchers used skull suture patterns as a tool of absolute identification even in identical twins. Sagittal suture and Frontal suture (an anatomical variant) in some cases are included in this study. Forensic implication of those sutures in finding out age at death of an individual, radiological artefact and as an identification tool are dealt in this paper.

Keywords: Sagittal suture, Age, Frontal suture, Double Y suture.

Materials and Methods:

After approval from Institutional Ethical Committees, this study on cranial vault sutures is started. 500 bodies with known age at death (between 30 to 80 years) subjected to medico legal autopsy over time at our center are included in this study. Bodies with congenital anomalies or deformed skull (injured) are carefully excluded from the case sample.

Brunt of this study is concentrated on Sagittal suture. Methodology followed for this study is making a mastoid to mastoid incision in the scalp, and reflecting it to the level of super ciliary arches and fronto nasal suture anteriorly, and to the external occipital protuberance posteriorly. Adherent periosteal layer is scrapped off with knife tip. Naked eye examination of Anterior 1/3rd, Middle 1/3rd and Posterior 1/3rd of sagittal suture is done. Closure status is assessed according to Modified Perizonius scale system. The results are tabled and analyzed using Epi info 7 software. In certain number of cases, metopic sutures (or persistent frontal sutures) that unite two halves of the frontal bone is also noted for its incidence and types. Double Y suture⁽¹⁾ (a condition of open Coronal and Lambdoid sutures but complete fusion of Sagittal suture) is noted for its incidence and cause of death for those individuals.

Discussion:

Sutures are membranous sites of bone growth (Membranous ossification) comparable to epiphyseal activity (Enchondral ossification) in long bones. Suture fusion is influenced by many factors like age, sex, geographic location, climate variations and ancestry. Later views suggest tissue interactions, mechanical influences and biochemical signaling at suture sites⁽²⁾. Sutures does not reduce the total strain within the skull, but act in certain ways to allow the skull to manage the strain by distributing the strain around the skull⁽³⁾. Tensile forces across the sutures, growing brain and active muscle requirements, also affect the sutures and its closure^(4,5).

For age estimation, Sagittal suture closure is more relied upon than that of Coronal or Lambdoid Suture's closure pattern⁽⁶⁾. Sagittal and Coronal sutures are least or not affected by muscular attachments when compared to Lambdoid suture (which is affected by frontalis, temporalis and occipitalis muscle pulls)⁽⁷⁾.

Table 1: Case distribution (in age groups)

Age in years	No. of cases	% in total
21 to 30 y	26 (13 M, 13 F)	5.2
31 to 40 y	156 (119 M, 37 F)	31.2
41 to 50 y	123 (85 M, 38 F)	24.6
51 to 60 y	100 (72 M, 28 F)	20.0
61 to 70 y	60 (46 M, 14 F)	12.0
71 to 80 y	35 (23 M, 12 F)	7.0
Total	500 (358 M, 142 F)	100

In this Table – 1; the age groups are divided into decades (31 to 40 years, 41 to 50 years, 51 to 60 years etc.). To obtain symmetrical distribution, age 30 is assigned to the first age group 21 to 30 years, even though individuals with age 30 years are only in that group. This is done to get statistical convenience and correction. Sex related frequency distribution of cases in each decade is also available from the Table (M – Male, F – Female cases).

Ecto cranial Suture closure status after naked eye examination is recorded using **Modified Perizonius phases (0 to 4) after Ascadi and Nemeskeri** system of sutural closure pattern staging⁽¹⁾ which reads: Stage 0 - Open suture (A clear space between adjoining bones Picture 1); Stage 1- Incipient suture (Suture is closed, but visible as continuous, zigzagging line); Stage 2 - Closure in process (Suture line becomes thinner, less zigzags, interrupted by areas of complete fusion - Picture 2); Stage 3 - Advanced suture (Only scattered pits remain on location of suture - Picture 2); Stage 4 - Closed suture (Suture completely obliterated; even its location cannot be recognized - Picture 3).

Picture:1 – Open Sagittal Suture (Stage 0)



Picture:2 – Stage 2 in Anterior & Middle 1/3rd; Stage 3 in Posterior 1/3rd of Sagittal



Picture:3 – Stage 4, Complete fusion of Sagittal Suture.



Values are analyzed using Epi Info 7 software which came as: Mean age of non-fusion of Ecto cranial Sagittal Anterior 1/3rd is 37.34 y with Standard Deviation (SD) – 6.530, Standard Error (SE) - .475, Probability significance (p) = 0.00. Mean age of fusion of Ecto cranial Sagittal Anterior 1/3rd is 55.72 y with SD – 11.713, SE - .664, p = 0.00. Mean age of non-fusion of Ecto Sagittal Middle 1/3rd is 40.45 y with SD – 7.268, SE - .421, p = 0.00. Mean age of fusion of Ecto Sagittal Middle 1/3rd is 61.06 y with SD – 10.796, SE - .760, p = 0.00. Mean age of non-fusion of Ecto Sagittal Posterior 1/3rd is 33.92 y with SD – 6.267, SE - 1.045, p = 0.00. Mean age of fusion of Ecto Sagittal Posterior 1/3rd is 49.93 years with SD – 13.171, SE - .611, p = 0.00.

Picture: 4 – Left dominant Metopic Suture



Picture: 5 – Right dominant Metopic Suture



Metopic suture: Metopic suture can be due to abnormal cranial bone growth, growth interruption, heredity, sexual & hormonal influence, atavism, cranial malformations, and hydrocephalus⁽⁸⁾ or “metopica syndrome” (persistent metopic suture, cranial & finger anomalies)⁽⁹⁾. Metopism can be Complete or Incomplete; Right to Bregma (Picture 5) or Left to Bregma (Picture 4)⁽¹⁰⁾.

Double Y suture: Condition of complete fusion of Sagittal suture with open Coronal (Picture 6A) and Lambdoid suture (Picture 6B). All the 5 positive cases are Hanging death cases.

Picture: 6A – Double Y suture (Patent Coronal Suture with Stage 4 Sagittal Suture Fusion)



Picture: 6B – Double Y suture (Patent Lambdoid Suture with Stage 4 Sagittal Suture Fusion in the same case in Pict. 3)

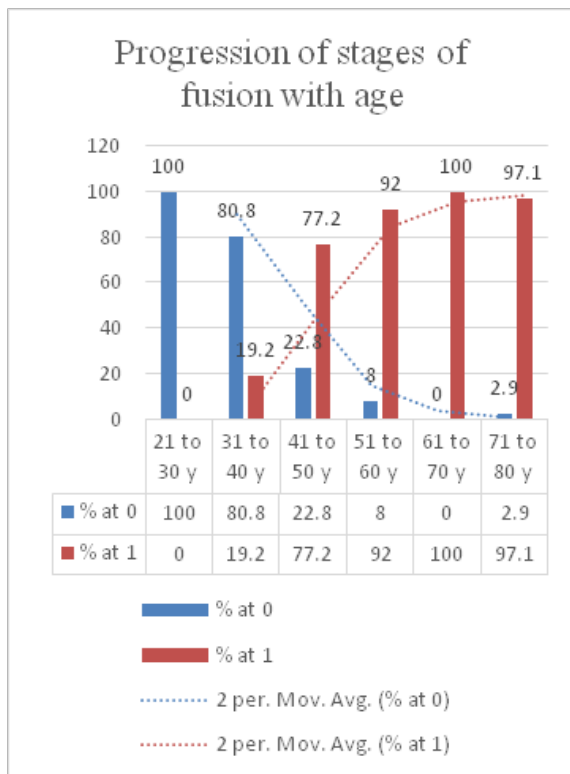


Results:

Ecto Sagittal suture Anterior 1/3rd fuses - 55.72 y (SD – 11.71 y), Middle 1/3rd fuses - 61.06 y (SD – 10.79 y), Posterior 1/3rd fuses - 49.93 y (SD – 13.17 y), No sex difference in suture fusion (no statistical significance between male and female).

Incidence of Metopic suture is 2.2 % (11 out of 500 individuals); more common in female; Complete Metopic suture are 10 out of 11; Right to Bregma - 7, Left to Bregma - 3. Incomplete type. Double Y suture incidence is 1.2 % (6 out of 500 individuals); more common in Male (4 out of 6). It may be loosely associated with suicidal tendencies.

Chart 1: Progression of Stages of fusion



Conclusion:

Sagittal suture in skull is still valued for finding out age at death of an individual. However, age can only be given in range of decades. More such studies with equal gender and age distribution can be carried out. Anatomical variations like Metopic suture, Double Y suture claim its importance in Osteo – pathology (aberrant bone fusion), Radiology (fracture artefact), Anatomy, and Forensic Medicine and even in Genetics (Metopica syndrome and anomalies).

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