Short Communication

Indian Journal of Forensic Odontology
Volume 8 Number 3-4, July - December 2015
https://dx.doi.org/10.21088/ijfo.0974.505X.83415.8

Cranial Suture: A Morphological Tool in Age Determination

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Abstract

Age estimation by means of closure of skull sutures is a very important tool to solve the cases of suspicion and identification of criminals. The cranial sutures generally fuse with increasing age although there is considerable variability in closure rates and patterns. These article insights different aspects of cranial sutures and their role in human identification.

Keywords: Human Identification; Cranial Sutures; Forensic Odontology; Morphological Tool, Cephalic viscera.

Age estimation in living, dead or human remains is a complex problem in medical justice in both civil and criminal matters such as identification, senior citizen concession, retirement benefits, competency as witness, attainment of majority, marriage, impotency, sterility, consent, juvenile offender, kidnapping and rape . In case of cranial sutures, age estimation is done by team of forensic expert and radiologist and if proper opinion regarding the age is not given then injustice may occur to the patient. Cranial sutures are classified as fibrous joints as they lack a synovial cavity and the bones are held together firmly by fibrous connective tissue. The functions of sutures are prevention of separation of the bones when external forces are applied, to allow some movement to occur between bones during rapid growth of the cephalic viscera [1]. Age estimation by means of closure of skull sutures is a very important tool to solve the cases of suspicion [2].The bones of the skull have two layers, the tabula interna and externa which are separated by a vascular spongy bone space [3].These bones are separated by sutures which are analogous to the epiphyseo diaphyseal planes that both have a sequence of timing and union [4].Just as the epiphyseo diaphyseal union most frequently begins centrally and proceeds peripherally, so does suture closure begin endocranially and proceed ectocranially. Closure of sutures occurs when small tongues of ossified tissue stretch across the sutural gap and link up slowly along the length of the suture until the union is complete [4]. The cranial sutures generally fuse with increasing age, although there is considerable variability in closure rates and patterns [5].

Traditionally evaluation of cranial sutures involves assessment of ecto and endocranial sutures with the naked eye requiring the removal of skin, temporal muscles and epicranial aponeurosis from cranial bones. Evaluation of the sagittal suture with modern radiographic modalities such as CT would enable assessment without removal of the soft tissue [6]**.** Dwight identified that the posterior portion of sagittal suture and inferior portion of coronal suture shows first sign of obliteration, lambdoid closes slower than coronal and the frontal suture is the last to close [7].

Parson and box, revised the above chronology to report that lower half of the internal coronal suture is the spot for initial commencement followed by the internal region of the sagittal suture at obelion and the lambdoid suture being the last to close. Frederic was the first to announce that it is not possible to age a skull to within any more than 10 years [8].

Todd and Lyon [4] were the first to use scoring system, suture sites were recorded a score from zero

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(no closure) to four (complete closure). The different landmarks on each suture (i. e. , pars bregmatica, pars vertices, pars obelica, and pars lambdica) were averaged together and observed individually for trends in closure. Using this system, they observed that endocranial suture is more active from 26-30 years. Additionally, the ectocranial sutures are highly unreliable for age estimation [8]. Perizonius [6] in 1984 added a new life to the criticism over age estimation by suture closure by adding that all sutures especially the coronal suture exhibited a significant degree of positive correlation with age in the 20-49 years of age. He also added that there is a negative correlation with age from 70 to 79 years [9].

Acsadi Nemeskeri complex method [10] given a scale for suture closure and age estimation-

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 recognized.

According to Buikstra and Ubelaker [11] Suture Score is described as follows-

1. Score 0 (Open)- there is no evidence of any ecto-cranial closure at site
2. Score 1 (Minimum closure)- Some closure has occurred. This score is given for any minimal to moderate closure i.e. from a single bony bridge across the suture to about 50% synostosis at the site.
3. Score 2 (Significant closure)- There is a marked degree of closure but some portion of the site is still not completely fused.
4. Score 3 (Completely obliterated)- Advanced closure

However only pits indicate where the suture is located as per Meindl and Lovejoy suture scoring system (1985) [12]. According to J.B.Mukherjee estimation of age from suture closure of skull can be given in a range of 5-10 yrs in age of 30-60 yrs, the range may even be more in higher age groups [13]. Dorandeu et al [14] assessed the value of microscopic analysis of the fronto-sphenoidal sutures for age estimation using the vascular skull sutures and the degree of apoptosis of conjunctive cells as parameters which could establish the predictive model with a standard error of 1.6 years. Harth et al [15] used a Flat-Panel-CT modality and a cross-sectional view of the sagittal, coronal, and lambdoid sutures to create a regression model for estimating age at death in which the standard error was 31.1 years. Parmerl et al (2012) [16] concluded that each suture was found to close at particular age group. Suture closure occurred for sagittal, lambdoid, coronal, parieto-mastoid, parieto-temporal and baso-occiput with baso-sphenoid at age group of 50-60 years, 45-55 years, 50-60 years, 55-70 years, 60-70 years and 18-25 years respectively.

Conclusion

Suture closure was a valid method for age determination but due to evolution of different new methods the validity of it has reduced but still it holds a scientific value in age determination.

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