Age Determination From Macroscopic Examination Of Sphenooccipital Synchondrosis Closure

Dr. Krunal N. Pipaliya *, Dr. Viral J. Aghera*, Dr. Dipen M. Dabhi****, Dr. H. M. Mangal**, Dr. Prince J. Manvar***,Dr. Pratik R. Varu*****

* Assistant Professor, Department of forensic medicine, Pacific Medical College & Hospital, Udaipur, Rajasthan, ** Professor & Head, ***Tutor, Department of Forensic Medicine, P.D.U. Govt. Medical College, Rajkot, Gujarat, ****Tutor, M.P. Shah Medical College, Jamnagar, Gujarat, India.

Abstracts: Background & Objective: Age determination from degree of closure of sphenooccipital suture (Synchondrosis). Methodology: This study was conducted during the period of January 2012 to August 2013 at Department of Forensic Medicine, P.D.U. Govt. Medical College & Hospital, Rajkot. 100 cases of age between 8 to 26 years have been taken to cover minimum period of starting the fusion and maximum period of completion of fusion for age determination from sphenooccipital suture. Results**:** For male, minimum age for open, semi closed and closed sphenooccipital suture was 8 years, 13 years and 18 years respectively while for female, it was 8 years, 13 years and 16 years respectively. For male, maximum age for open, semi open and closed sphenooccipital suture was 13 years, 18 years and 26 years respectively while for female, it was 13 years, 16 years and 26 years respectively. Conclusion: Commencement of union at sphenooccipital suture occurs at the age of 13 years in both sex and complete obliteration of cartilaginous disc occurs at the age of 18 years in male and 16 years in female. [Pipaliya K NJIRM 2015; 6(3):22-25]

Key Words: Sphenooccipital Synchondrosis, Sphenooccipital Suture, Age.

Author for correspondence: Dr. Krunal N. Pipaliya, Assistant Professor, Department of Forensic Medicine, Pacific Medical College & Hospital, Udaipur, Rajasthan, India. Email: pipaliya@gmail.com

Introduction: Identification is recognition of an individual by means of various physical features and biological parameters, which are unique to each individual. There are various established parameters for identification of an individual. Among them estimation of age is very important. Skull is one of the important bone among skeleton which is used for estimation of age.

Synchondrosis is defined as the development of a union between two bones by the formation of either hyaline cartilage or fibro-cartilage. A synchondrosis is usually temporary and exists during the growing phase until the intervening cartilage becomes progressively thinner during skeletal maturation and ultimately becomes obliterated and converted into bone before adult life. In simple terms, a synchondrosis is a cartilaginous joint. Three synchondrosis are present along the midline of the cranial base: the sphenoethmoidal synchondrosis between the sphenoid and ethmoidal bones, the intersphenoid synchondrosis between two parts of the sphenoid bone and the sphenooccipital synchondrosis between the sphenoid and basioccipital bones.[1]

Cranial base synchondrosis are regarded as important growth centers of the craniofacial skeleton, particularly the sphenooccipital synchondrosis because of its late ossification and important contribution to post-natal cranial base growth.[2-6] The sphenooccipital synchondrosis seems to have a more prominent role in growth (ontogeny) of the human skull up to adult life than other midline chondral structures.[5]

The cranial base is also the first region of the skull to reach adult size and is the structural foundation of many aspects of the craniofacial architecture.[7] Any cartilage remaining between the bones in the form of synchondrosis acts as a growth center in a similar way to the epiphyseal plates of the long bones. Any interference that causes early or late ossification will result in shortening or lengthening of the cranial base, respectively, leading to serious consequences in craniofacial development.[8]

Material and Methods: This study was conducted during the period of January 2012 to August 2013 at Department of Forensic Medicine, P.D.U. Govt. Medical College & Hospital, Rajkot. 100 cases of age between 8 to 26 years have been taken to

cover minimum period of starting the fusion and maximum period of completion of fusion for age determination from sphenooccipital suture.

Following cases were excluded.

1. Cases showing deformed, diseased or fractured skull, severe burnt bodies.
2. Unknown, unidentified bodies or where exact age was not confirmed.

The closure stage of the sphenooccipital suture (synchondrosis) of 100 cadavers was assessed during autopsy. After opening of skull vault, brain was removed. The state of closure of the suture was established after stripping the dura completely from the surface of the endocranium, between the rostral margin of the foramen magnum, through the body of the sphenoid bone and the anterior clinoid processes. The length of cartilaginous part of the suture was measured and its consistency examined with scalpel.

It was divided to three groups:[9]

1) Open (0): suture was open or less than ¼ had been calcified.
2) Semi closed (1+): more than ¼ and less than ¾ of cartilage had been calcified.
3) Closed (2+): more than ¾ had been calcified.

With use of Microsoft excel 2007 and Statistical programme for social science (SPSS), the descriptive statistics of sphenooccipital suture status and the significance of the mean differences in relation to age was calculated using one way anova analysis ($p < 0.05$).

Results & Discussion: Table no.1 shows distribution of cases as per age, sex and stage of suture. Out of total 100 cases, 50% cases were male and 50% cases were female. Out of 50 male cases, suture stage open in 28% cases, semi closed in 24% cases and closed in 48% cases. Out of 50 female cases, suture stage open in 24% cases, semi closed in 22% cases and closed in 54% cases.

Table no. 2 shows descriptive statistics of the study sample for closure state of sphenooccipital suture. Mean age for open, semi closed and closed stage of sphenooccipital suture was higher in male than female. For male, minimum age for open, semi closed and closed sphenooccipital suture was 8 years, 13 years and 18 years respectively while for female, it was 8 years, 13 years and 16 years respectively. For male, maximum age for open, semi open and closed sphenooccipital suture was 13 years, 18 years and 26 years respectively while for female, it was 13 years, 16 years and 26 years respectively. There was significant mean age difference observed among Male ($F(2, 47) = 119.45$, $p<0.001$), Female ($F(2, 47) = 79.23$, $p<0.001$) and total cases ($F(2, 97) = 193.12$, $p<0.001$) for the open, semi-closed and closed sphenooccipital suture.

Table 1: Distribution of Cases as Per Age, Sex and Stage Of Suture

Age (in yrs)	No. of Male Cases				No. of Female cases				Total No. of Cases
	Suture stage			Total	Suture stage			Total	
	(O)	(S-C)	(C)		(O)	(S-C)	(C)		
8	2	0	0	2	3	0	0	3	5
9	2	0	0	2	1	0	0	1	3
10	3	0	0	3	3	0	0	3	6
11	0	0	0	0	1	0	0	1	1
12	6	0	0	6	2	0	0	2	8
13	1	1	0	2	2	2	0	4	6
14	0	3	0	3	0	3	0	3	6
15	0	2	0	2	0	4	0	4	6
16	0	2	0	2	0	2	2	4	6
17	0	3	0	3	0	0	3	3	6
18	0	1	3	4	0	0	3	3	7
19	0	0	3	3	0	0	1	1	4
20	0	0	5	5	0	0	3	3	8
21	0	0	2	2	0	0	3	3	5
22	0	0	2	2	0	0	3	3	5
23	0	0	2	2	0	0	2	2	4
24	0	0	3	3	0	0	3	3	6
25	0	0	3	3	0	0	2	2	5
26	0	0	1	1	0	0	2	2	3
	14 (28 %)	12 (24 %)	24 (48 %)	50 (50%)	12 (24 %)	11 (22 %)	27 (54 %)	50 (50%)	100 (100 %)

(O) – Open, (S-C) – Semi Closed, (C) - Closed

Table 2: Descriptive Statistics of the Study Sample for Closure State Of Sphenooccipital Suture

Sex	Suture	Mean Age (yrs)	SD	Std error of Mean	No. of subjects	Min age (yrs)	Max age (yrs)	Range
Male	O	10.64	1.69	0.45	14	8	13	5
	S-C	15.50	1.56	0.45	12	13	18	5
	C	21.50	2.53	0.51	24	18	26	8
	Total	17.02	5.13	0.72	50	8	26	18
Female	O	10.33	1.87	0.54	12	8	13	5
	S-C	14.55	1.04	0.31	11	13	16	3
	C	20.93	3.11	0.59	27	16	26	10
	Total	16.98	5.18	0.73	50	8	26	10
Both sex	O	10.50	1.74	0.34	26	8	13	5
	S-C	15.04	1.39	0.29	23	13	18	5
	C	21.20	2.84	0.39	51	16	26	10
	Total	17.0	5.13	0.51	100	8	26	18

(O) – Open, (S-C) – Semi Closed, (C) - Closed

ANOVA one way: For Male: F (2, 47) =119.45, p<0.001.,
For Female: F (2, 47) = 79.23, p <0.001.,
Both sexes: F (2, 97) =193.12, p <0.001.

Figure 1: Box-Plot of Sphenooccipital Suture Status By Age.

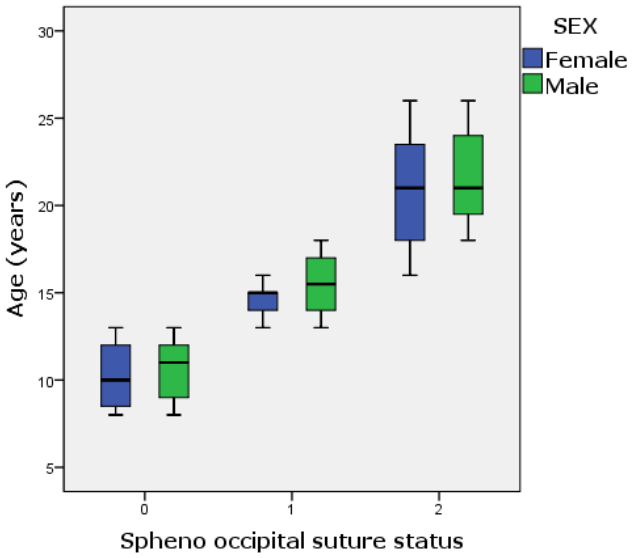

Figure. 1 shows Box-Plot of Sphenooccipital Suture Status by Age. It shows comparison median age, minimum age and maximum age of male and female for sphenooccipital suture status.

Akhlaghi et al[10] had done Cross-sectional analysis of the closure degree of sphenooccipital suture through direct inspection of 376 autopsies from both sexes whose ages ranged between 8 and 26 years in Legal Medicine Organization of Tehran, Iran from 1st of July 2007 to 1st of July 2009. Mean ages of open, semi-closed and closed sutures were 12.27, 16.12 and 21.17 years in males, and 9.04, 12.38 and 19.44 in females, respectively. Seemingly, their difference was significant (p < 0.001). Partial fusion (semi-closed) was seen at the age of 12 in both sexes while complete fusion (closed) was seen at 15 year olds or above in males and 12 year olds or above in females. Cadavers can be correctly grouped above or below 16 years old with sensitivity of 79.82% and specificity of 89.47% in males and above or below 13 years old with sensitivity of 100.00% and specificity of 81.58% in females. Our current study results are comparable with akhlaghi et al (2010)[10] study.

Conclusion: So it is evident from above study, commencement of union at sphenooccipital suture occurs at the age of 13 years in both sex and complete obliteration of cartilaginous disc occurs at the age of 18 years in male and 16 years in female.

So from study we can conclude that in male if complete fusion has been occurred, age of boy should be 18 years or above; while in female if complete fusion has been occurred, age of girl should be 16 years or above.

References:

1. Teddy Cendekiawan, Ricky WK Wong, A Bakr M Rabie. Relationships Between Cranial Base Synchondroses and Craniofacial Development: A Review. The Open Anatomy Journal 2010; 2:67-75
2. Bjork A. Cranial base development. Am J Orthod 1955; 41:199-255.
3. Ford E. Growth of the human cranial base. Am J Orthod 1958; 44:498-506.
4. Koski K. Some aspect of the growth of the cranial base and upper face. Odont Tidskr 1960; 68:344-58.
5. Scott JH. The growth of the human skull. J Dent Ass S fr 1958b; 13:133.
6. Stramrud L. External and internal cranial base, A cross sectional study of the growth and association in form. Acta Odonto Scand 1959; 17:239-266.
7. Moore WJ, Lavelle CLB. Growth of the facial skeleton in the hominoidea. London: Academic Press. 1974.

8. Dixon AD, Hoyte DAN, Ronning O. Fundamentals of craniofacial growth. Boca Raton: CRC Press 1997.
9. M. Akhlaghi, B Valizadeh, J Gharedaghi. Closure Time Of Spheno-Occipital Suture In The Male Cadavers Referred To Legal Medicine Organization. Acta Medica Iranica 2008; 46(2):105-108.
10. Akhlaghi M, Taghaddosinejad F, Sheikhazadi A, Valizadeh B, Shojaei SM. Age-at-death estimation based on the macroscopic examination of spheno-occipital sutures. J Forensic Leg Med. 2010 Aug ;17(6):304-308.

Conflict of interest: None

Funding: None

Cite this Article as: Pipaliya K, Mangal H, Aghera V, Manvar P, Varu P, Dabhi D, Age Determination From Macroscopic Examination Of Sphenooccipital Synchondrosis Closure. Natl J Integr Res Med 2015; 6(3): 22-25