CLOSURE TIME OF SPHENO-OCCIPITAL SUTURE IN THE MALE CADAVERS REFERRED TO LEGAL MEDICINE ORGANIZATION

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Abstract- The identity of dead is an essential part of post-mortem examination. The identification of unknown human remnants begins with the creation of an anthropological profile, which includes sex, biological age, stature and individualizing features. The estimation of age at death is based on the bodily biological changes that occur throughout life. Closure of spheno occipital synchondrosis is one of factors used for age estimation although its importance and reliability has been challenged with different authors. We studied its closure time among Iranian 8 to 26 years old male cadavers with direct inspection during autopsy. We divided synchondrosis situation depending on its fusion state into three categories: open, semi closed and closed. During 2004-5, 107 cases studied. Mean age of open, semi closed and closed were 12.78, 16.86 and 21.36 years, respectively. Their difference was significant ($p< 0.05$). Partial fusion (semi closed) was seen at 12 years while complete fusion (closed) should be 15 years or above. Spearman's correlation ratio coefficient showed linear correlation between age and suture situation (rho = 0.684, $P < 0.05$). Our results showed that closure of spheno occipital suture can be used as a good indicator for age estimation in males. With sensitivity of 88.31% and specificity of 79.31% males can be correctly grouped above or below 16 years.

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Key words: Spheno occipital suture, synchondrosis, age, male

INTRODUCTION

Estimation of age is one of the important factors that helps identification. The estimation of biological age is usually most accurate in the early phases of development and greatly depends on the state of preservation diagnostic features in the remnants. Macroscopically, two types of parameters are useful indicators of biological age: dental development and epiphyseal closure throughout the skeleton. One of the features that have been advocated as a good age indicator is the state of fusion of the spheno-occipital synchondrosis, although there are different ideas about its reliability. Apparently, the discrepancies in the reported age of its closure are related in some degree to the methods of assessment, *i.e.*, direct inspection, imaging or histological examination and to the discipline of the investigator, *i.e.*, odontology or anatomy (1). In addition probably ethnical and genetic have an important role in determining cranial suture patterns and closure (2-4). In this study we investigated the closure time of this synchondrosis to corroborate its validity as an indicator of biological age especially in Iranian population. Because of some limitations we studied only the males.

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MATERIALS AND METHODS

The closure stage of the basilar synchondrosis of 106 male cadavers was assessed during autopsy. The sample included 8 to 26 years old male cadavers that had been referred to legal medicine organization in Tehran during 6/2004 until 6/2005. Cases with developmental abnormalities excluded. There were 4 cases from Afghanistan and all others from Iran.

The calvarium was removed with the help of an electric saw and brain taken out after dividing medulla just below the foramen magnum. The state of closure of the suture was established after stripping the dura matter completely from the surface of the endocranium, between the rostral margin of the foramen magnum, through the body of the sphenoid bone and the clinoid anterior processes (1). The length of cartilaginous part of the suture was measured and its consistency examined with scalpel. It was divided to three groups: 1) open (0): suture was open or less than ¼ has been calcified. 2) Semi closed (1+): more than ¼ and less than ¾ of cartilage had been calcified. 3) Closed (2+): more than ¾ has been calcified.

The statistical analysis was conducted on SPSS for Windows 12.

RESULTS

The sample included 106 male cadavers whose age ranged from 8 to 26years. Table 1 shows age distribution and their suture situation. The mean age of cadavers with open suture (Fig. 1), was 12.78 years (SD: 3.001). Maximum age in group with open suture was 19 years. 14 cases had semi closed suture that their mean age was 16.86 (SD: 2.685). In group with semi closed suture minimum and maximum age were 12 and 21 years respectively. Mean age of closed suture group was 21.36 (SD: 3.221). The lowest age in closed suture group was 15 years (Table 2, Fig. 2). One way ANOVA showed significant difference between age and suture closure ($P < 0.05$). Spearman's correlation ratio coefficient showed linear correlation between age and suture closure ($P < 0.05$, rho = 0.684).

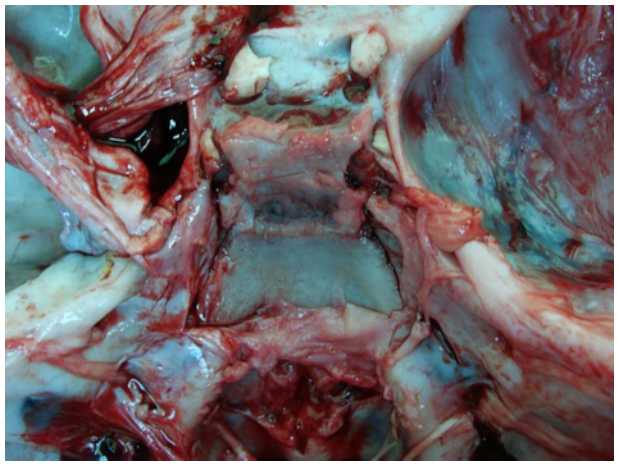

Fig 1. Open (unfused) spheno-occipital suture

Regression analysis was carried out taking age as a dependent variable (Y) and degree of fusion (0, 1 and 2) as an independent variable (X). Regression equation: $Y = 12.71 + 4.32 \times X$ ($R^2 = 0.537$). With sensitivity of 88.31% and specificity of 79.3% males can be correctly grouped above or below 16 years.

Table 1. Spheno-occipital suture stage by age

Count		Suture			Total
		open	Semi closed	closed	
age	8	2	0	0	2
	9	1	0	0	1
	11	1	0	0	1
	12	5	1	0	6
	13	3	0	0	3
	14	3	1	0	4
	15	1	4	1	6
	16	0	1	5	6
	17	0	1	5	6
	18	0	1	8	9
	19	2	2	4	8
	20	0	2	8	10
	21	0	1	5	6
	22	0	0	7	7
	23	0	0	4	4
	24	0	0	10	10
	25	0	0	12	12
	26	0	0	5	5
Total		18	14	74	106

Table 2. Descriptive means of age in different groups by closure state of spheno-occipital suture

Age suture	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Range
open	12.78	18	3.001	.707	8	19	11
Semi closed	16.86	14	2.685	.718	12	21	9
closed	21.36	74	3.221	.374	15	26	11
Total	19.31	106	4.545	.441	8	26	18

ANOVA one way: F=59.747, df = (2,103).

DISCUSSION

In the complete cadavers depending on the developmental phase: prenatal, childhood, adolescence and adulthood, different parameters can be used for age estimation. Using multiple age indicators makes age estimation more accurate (5, 6). But sometimes there are only remnants of cadaver or skeleton. In this situation accuracy of age estimation greatly depends on the state of preservation of diagnostic features in the remnants. The stage of fusion of the basilar synchondrosis (spheno-occipital fissure) has been regarded as a trustworthy indicator of biological age (6, 7). A number of authors proffer that the synchondrosis remains open throughout childhood and adolescence and coalesces as the individual reaches adulthood (8-17); a second group proposes that fusion commences during the adolescent stage concomitant with eruption of the second permanent molars (4, 18-23);

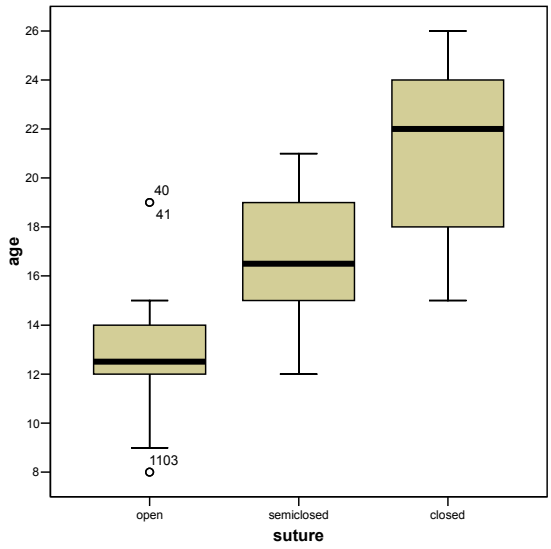

Fig. 1. Box-Plot of state of spheno-occipital suture by age

Ferick *et al*. (24) Reported a wide variation in the fusion of this feature. In the recently studies Sahni *et al*. (25) showed that in the male if a complete fusion has been occurred, the age of the boy should be 15 years or above. In the cases where there is no fusion or partial fusion, he should be below 19 years. In the case of females, fusion occurs between the 13 and 17 years. But Kahana *et al*. (1) found no correlation between chronological age and the time of closure of the synchondrosis and in females found it possibly a reliable indicator of age but they had not more than 21 female cases. We tried to study on a larger sample. Our results showed that closure of spheno-occipital suture has a linear correlation with age. Mean age of open, semi closed and closed suture groups were 12.3, 16.86 and 21.36 respectively. When the suture is closed, age is 15 years or above and where the suture is open or semi closed, age is below 21 years. With a high sensitivity and specificity we can divide males above and below 16 years according to the suture closure (open and semi closed are considered open). Our results are compatible with Sahni *et al.* findings. Ethnically differences that have been among Kahana *et al.* materials may be responsible to their wide discrepancy of synchondrosis fusion time. The same study on females is recommended.

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Conflict of interests

We have no competing interests.

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