A study of sutural bones in Anatolian-Ottoman Skulls*

In this study, a total of 302 adult Anatolian-Ottoman skulls were classified into three morphological forms (dolichocephalic, mesocephalic, brachycephalic), and were examined in order to find the incidence of sutural bones in each forms. In addition, the cranial capacity was measured in the skulls with and without sutural bones. Comparison of the incidence of sutural bones in each form of the skulls, and cranial capacity in skulls with and without sutural bones showed no significant difference. In most populations, the average measure of difference between Anatolian-Ottoman and the others was statistically significant. In conclusion, the incidence of sutural bones is well suited for comparative studies as an anthropological marker or an indicator of population distance.

Introduction

Sutural (Wormian) bones are small, irregularly shaped ossicles, which are found in the cranial sutures and at the fonticulus. Generally when there are sutural bones present there are only two or three, but they may also be present in greater number in skulls of hydrocephalics (Warwick & William, 1989). The mechanism of formation of sutural bones is not been entirely known. Some authors claim that the bones are developed from external influences (Hess,1946; Bennett,1965; Finkel,1971), and the others believed that sutural bones derive from normal developmental processes and are genetically determined (Murphy,1956; El-Najjar & Dawson 1977; Pal & Routal 1986; Pal et al. 1986).

In this study, the incidence of sutural bones in three different morphologic forms (dolichocephalic, mesocephalic, brachycephalic) were determined, and compared to other populations. Additionally, cranial capacity of skulls was measured with and without sutural bones, in order to estimate the role of external factors.

Material and Method

302 adult skulls (192 male, 110 female) belonging to the period of Anatolian-Ottoman period (A.D. 18th century) were examined in the Department of Paleoanthropology, Faculty of Language-History-Geography, Ankara University, Ankara. The cephalic index of each

*This study was presented in the 3rd National Anatomy Congress (6-9 Sept 1995) Izmir, Türkiye.
skulls was calculated using this formula; \( k = \text{Breadth} \times 100 / \text{Length} \). According to the \( k \) value, the cephalic index were classified as follows: 1) Brachycephalic; \( k > 80 \). 2) Mesocephalic; \( 75 < k < 80 \). 3) Dolichocephalic; \( k < 75 \). Cranial capacity was measured using the following formulas (Olivier, 1969).

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\begin{align*}
524.6 cm^3 + 266 \times 10^{-6} (\text{length} \times \text{breadth} \times \text{basio-bregmatic height}) & \text{ for male} \\
812.0 cm^3 + 156 \times 10^{-6} (\text{length} \times \text{breadth} \times \text{basio-bregmatic height}) & \text{ for female}
\end{align*}
\]

Comparison of the incidence of sutural bones in Anatolian-Ottoman crania with other populations was calculated using the multivariate distance statistic method developed by C.A.B. Smith and used by Berry & Berry (1967).

A measure of difference, \( X \), between two population, 1 and 2, with incidences for a single variant of \( p_1 \) and \( p_2 \) respectively, is given by: \( X = (q_1 - q_2)^2 - (1/N_1 + 1/N_2) \) where \( q_1 \) and \( q_2 \) are the angular values corresponding to \( p_1 \) and \( p_2 \) measured in radians, \( N_1 \) and \( N_2 \) are the sample size of the two populations. The value of \( \theta \) is obtained from \( \theta = \sin^{-1}(1-2p) \). In case where several characters, \( n \), are classified, a mean measure of difference between two populations is used, \( (\Sigma x/n) \). The variance of a mean measure of difference is given by the formula: \( (1/N_1 + 1/N_2) \Sigma (\theta_1 - \theta_2) - (1/N_1 + 1/N_2)/n \). Using this variance (\( V \)), the significance of divergence can be calculated. \( X \) is significant at \( p=0.05 \) when greater than \( 3V \), at \( p=0.01 \) when greater than \( 6V \).

Chi-square (\( x^2 \)) and Fisher exact tests were applied to know sex and side differences, and the difference in distribution of a sutural bone in three morphological forms of skulls. The calculations were made by Epi Info database program (Dean AG, Burton A and Dicker R. MSC 08 Centers for Diseases Control, Atlanta, GA 30333, USA).

**Results**

Table 1 shows the distribution of sutural bones in two sexes. Table 2 presents the distribution of unilateral sutural bones in three morphological forms of skulls. Bilateral sutural bones and their side difference in three morphological forms of skulls were given Table 3-4 respectively. While the incidence of bregmatic bone was the least (0.66%), the incidence of lambdoid bone was the highest (61.89%) among the others (Table 1). There were no significant difference between the two sexes. No statistically significant difference was observed in the distribution of unilateral and bilateral sutural bones and their side differences in three types of skulls (Table 1-3). Additionally, comparison of cranial capacity in skulls with and without sutural bones showed no significant difference (Table 5). Table 6 gives the mean measure of divergence between Anatolian-Ottoman and other population's skulls.

**Discussion**

The incidence of sutural bones in present and other studies were given Table 7 (Berry & Berry 1967; Kellock & Parsons 1970; Corruccini, 1974; Pal et al. 1986). North America shows the highest frequency for three sutural bones (lambda, coronal, asterion). American Blacks represent the lowest for three sutural bones (asterion, lambdoid, epipteric) (Corruccini, 1974). Bregmatic bone is least (0.66%), while lambdoid bone is too much (61.89%) than the others in our study. The incidence of bregmatic bone was reported as 0.6% by Cireli (1985), 0.2% by Magden & Müftüoğlu (1990), 1.09% by Aycan (1993).