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Some Morphometric Measurements Of Foramen Magnum, Orbita And Calvaria[1]

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Abstract

In this study it was aimed to examine and to compare some important formations on cranium morphometrically according to age. This study has been done on 78 skulls in Necmettin Erbakan University, Meram Faculty of Medicine, which 45 of them belonging to men and 33 of them were belonging to women. Sagittal and transverse diameter of calvaria (A1A1, A2A2, respectively), transverse diameter of both aditus orbita (right;A3A3, left;A4A4), distance between medial sides of aditus orbitas (A5A5), distance between lateral sides of aditus orbitas (A6A6), sagittal and transverse diameter of foramen magnum (A7A7, A8A8, respectively) were measured as cm by caliper. Male and female comparison was examined statistically with the student t-test in SPSS program. It has been observed that all the parameters were higher on men except only transverse diameter of calvaria (P<0,05). Also medium and high correlation values have been determined between parameters. Differences which determined in morphometric datas on specific areas of cranium on men and women could be useful in diagnostic and therapeutic practices of neuroradiology and neurosurgery.

Keywords: Cranium, Morphometry, Adult

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Introduction

Osteomyelitis, meningitis, cerebral abscess of calvaria could be spread by cerebral, meningeal emissary and diploic veins. And serious hemorrhages may be occurred in the surgical attempts of fossa (Boyd,1930) cerebelaris. Fronto-occipital circumference, inner canthal distance, outer canthal distance and interpupillary distance are important measurements in the evaluation of several systemic syndromes and craniofacial abnormalities and in the surgical treatment of posttraumatic telecanthus (Evereklioğlu et al., 2002; Laestadius et al., 1979; Farkas et al.,1992). Canthal index and circumference-interorbital index, which are derived from the measured parameters are also an important tool to anatomists and craniofacial surgeons (Farkas et al., 1992; Lakshminarayana et al., 1991). Craniofacial dimensions may be determined by a single gene, gene groups or environmental factors (Evereklioğlu et al., 2001). In diagnosing certain anomalies and syndromes, abnormal facial features such as telecanthus, ocular hypertelorism are

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taken into consideration by many clinicians, geneticists and maxillofacial surgeons. Measurement becomes stable once it has reached adult levels in the mid-to late twenties (Poswillo, 1963; Pryor, 1969). Visual impression is mostly used to describe the anatomical interpupillary distance. However, this descriptionis is not adequate because of variations in facial features such as wide nasal bridge, epicanthus and telecanthus. When comparing normative population values, groups must be matched for age, sex and race. This is especially important in the early ages.

The space-occupying lesion ventral to the spinal canal at the level of the foramen magnum can be reached using a ventral or dorsal approach. The difficulties and high rate of morbidity associated with ventral approaches dictates to use a dorsal approach to the ventral processes of the foramen magnum. Such an approach needs a transcondylar approach. Partial resection of the occipital condyle as made during transcondylar surgical approaches, has been an important step for access to the ventral and ventrolateral foramen magnum (Fledelius et al., 1986; Naderi et al., 2005; Al-Mefty et al.,1996; Wen et al., 1997).

Therefore it has been aimed to clarify the subject by a study on calvaria, orbita and foramen magnum which are clinically so important. Also the results taken have been compared with the results of other studies on the subject.

Method

Our study has been done between 2015-2016 and was approved by the ethical council of Necmettin Erbakan University Meram Faculty of Medicine, according to Copenhagen criteria (2008/213). 78 skulls (44 male, 34 female) in Necmettin Erbakan University Meram Faculty of Medicine were measured (excluding the broken and damaged ones which might disrupt the measurement). Calipers (with sensitivity of 0.1 mm) have been used as a measuring device. To specify measurement parameters (Evereklioğlu et al.,2002;Muthukumar et al.,2005) studies have been used.

Exact information of the subjects' ages was not available. Measurements have been done by same person to minimize the errors caused by measurement. Measurements were designed as follows:

Calvaria: Length (A1A1);Distance between most anterior and posterior points of the calvarial. Width (A2A2); Distance between calvaria at greatest width,

Orbita: Transverse diameters of the right and left aditus orbita (A3A3, A4A4, respectively): Distance between the midpoint of the medial margin and the midpoint of the lateral margin of the aditus orbita.

Outer orbital distance (A5, A5); Distance between the midpoint of the lateral margin of the right aditus orbita and the midpoint of the lateral margin of the left aditus orbita. Innerorbital distance (A6A6);Distance between the midpoint of the medial margin of the right aditus orbita and midpoint of the medial margin of the left aditus orbita.

Foramen magnum: The antero-posterior diameter of the foramen magnum (A7A7). The transverse diameter of the foramen magnum (A8A8).

Obtained data was loaded to computer from the forms and has been determined with variance analysis and t test asisted by SPSS statistical analysis program. Mean, standard deviation (SD), were calculated for measurements for each subject.

Findings

Table 1: Some morphometric measurements of the skul arel compared according to mean±SD and Max-min (cm) (n: 45 men, n: 33 women).

Parameters	Mean+ SD	Min – max
A_1 A_1	16.40± 1.71	14 – 21
A_2A_2	13.50 ± 0.78	12 – 15
A_3A_3	3.5.1.6 ±6.60	4 – 4.7
A_4A_4	3,4.64 ± 6.28	4.4 – 42.8
A_5A_5	2.4.15 ± 3.39	16.4 – 31.8
A_6A_6	8.9.76 ± 14.58	13.6 – 101.4
A_7A_7	3.4.48 ± 1.74	3.2 – 3.8
A_8A_8	2.8.84 ± 1.80	2,5.7 – 3.2.7

Tablo 2: Some morphometric measurement of skull are compared according to gender (Men- women) (cm) (n:45 men, n: 33 women) (mean ± SD and P values)

Parameters	**Male**	**Female**	**P**
	Mean ± SD cm	**Mean ± SD cm**	
A_1 A_1	15.50± 2.32	12.13 ± 1.45	0.446
A_2A_2	12.93 ±1.94	15.33 ± 1.84	0.371
A_3A_3	13.80 ± 2.07	63 ± 6.90	0.860
A_4A_4	14.20 ± 2.13	47.88 ± 6.30	0.021
A_5A_5	13.80 ±2.07	08.6 ± 6.90	0.063
A_6A_6	15.00 ± 2.25	8.33 ± 7.50	0.021
A_7A_7	5.33 ± 1.60	4.00 ± 2.00	0.547
A_8A_8	5.00 ± 1.50	4.20 ± 2.10	0.577

Result

78 skulls, 45 belonging to males and 33 belonging to females males were examined in the study. Measured length and diameter data of the structures of skull has been statistically determined. With parameters belonging to bones which are described as normal, minimum-maximum, mean ± SD (standard deviation) values of length and diameter acquired and these values were showed in table1 These measurements give an idea about the size of the head. Length and diameter data belongs to skull has been determined with the consideration of genders. In these parameters no significant difference has been observed for the genders except the wideness of calvaria (Table 2). All the values except the wideness of calvaria have been observed lower in females ($p>0.05$).

Discussion

Anthropometric studies are an integral part of craniofacial surgery and syndromology (Laestadius et al.,1979; Farkas et al 1992). Ocular adnexal changes and somatometric traits of the face such as epicanthus, telecanthus flat nasal bridge, widely spaced eyebrows and blepharophimosis may create an illusory error in the identification of certain craniofacial syndromes,and reliable methods are needed for the diagnosis of some craniofacial anomalies (Laestadiusetal.,1979; Farkas et al., 1992; Poswillo, 1963; Karakaş et al; 2002). Therefore, fronto-occipitol circumference, innerchantal distance, outer chantal distance, near interpupillary distance, distant interpupillary distance are integral measurements in the evaluation of telecanthus, ocular hypotelerism (decrease interpupillary distance), or hypertelerism (increased

interpupillary distance). Congenital and posttraumatic deformities (e.g.,traumatic telecanthus) can also be better treated with the knowledge of normal values for this region to produce the best esthetic and functional result. The keystone for successful reconstruction of the medial canthal area is adequate positioning of the medial canthal complex to maintain proper inner canthal distance. For these reasons, standarts based on ethnic or racial data are desirable because these standarts reflect the potentially different patterns of craniofacial growth resulting from racial, ethnic and sexual differences. In this study inter-orbital distances have been determined as 10 mm in females and 20 mm in males. This values have been determined as 22 mm in females and 28 mm in males in the study of Evereklioğlu et al. and outer orbital distance was determined higher value in males than in females in their study (75 in males, 53 mm in females). In our study these values have been determined as 150 mm in males, 80 mm in females.

The anatomy of the medial wall is important for successful results of some orbital procedures such as ethmoidal vessel ligation, medial wall fractures, orbital decompression, ethmoid sinus exentration, transethmoidal sphenoidotomy and transethmoidal sphenoidal hypophysectomy. The anatomic landmark on this wall is the anterior lacrimal crest. There are some individual variations in this crest. Thus surgically it is difficult to find middle point of the lacrimal crest. The anterior ethmoidal artery was found beyond 2 cm from this point and the upper extent of the medial wall was constant. From clinical experience the anterior ethmoidal foramen and the area where the artery leaves the ethmoid medially are the most critical regions for frontobasal fractures (Muthukumar et al., 2005; Kainz,Stammberger, 1988). During dissection the posterior ethmoidal foramen was found along the plane of the anterior ethmoidal foramen (Kainz and Stammberger, 1988). As noted by Caliot et al (Caliot et. al., 1995). The variability of the anterior and posterior ethmoidal foramino through which the ethmoidal vessels pass is also related to anterior cranial fossa surgery. The anterior ethmoidal artery is a key structure for this cranial fossa because it is attached to the skull base (Lee et al., 2000). The anterior ethmoidal artery is also found in relationship with bony medial wall of the orbit (Ducasse et al., 1985). A third ethmoidal foramen was occasionally found (28% of kulls) that was called the middle ethmoidal foramen (Williams et al., 1995). Kirschner et al. (1961) had noted that it might be important to find all posterior ethmoidal vessels in surgery for epistaxis.

Some bony defects of the anterior ethmoidal canal were observed in eight of 70 cases in a cadaveric study (Moon et al., 2001).

Surgical approach to this artery must be performed with great caution, as inadvertent injury to the artery may result in hemorrhage and orbital hematoma (Lee et al., 2000; Moon et al; 2001; Stankiewicz, 1987). The optic canal is found behind the posterior ethmoidal foramen. The distance between the posterior ethmoidal foramen and the optic nerve is variable but not less than 3 mm (Rontal et al., 1979). On the same wall, Rontal et al. (1979) made morphomeric measurements in 24 dry İndian skulls and found the distances from the midpoint of the anterior lacrimal crest to the anterior ethmoidal foramen, posterior ethmoidal foramen, midpoint of the medial margin of the optic canal and midpoint of the posterior lacrimal crest to be 24mm, 36mm, 42mm and 8 mm respectively.

The lateral wall is the guide to lateral orbitotomy and lacrimal gland excision (Hwang and Baik, 1999; Simontol et al., 1977). The landmark on this wall is the superior orbital fissure, through which pass the major orbital vessels and nerves with the exception of the optic nerve of the ophthalmic artery (Williams et al., 1995; Stellard, 1996) On the lateral wall, Rontal et al. (1979). Have reported the distance from the frontozygomatic suture to the midpoint of the superior orbital fissure to be 35 mm.

Wackenheim (1974) obtained radio graphically mean values of 35 mm and 30 mm for the sagittal and transverse diameters of the foramen magnum, respectively. Compared with our results, without sex distinction, we can see that these values are slightly lower than ours. In Catalina-Herrera's (1987) anatomic study of the foramen magnum, the diameters were 35.2 mm for the sagittal and 30.3 mm for the transverse diameter. Similar values were obtained by Testut and Latarjet (1977). These results are similar to our findings.

We conclude that the results of the present study can be useful in cranial surgery and that a knowledge of the anatomical features of this regions is very important for surgical approaches

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