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Morphological And Metrical Study Of The Cribriform Plate Of The Ethmoid Bone Of Male Nigerians

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ABSTRACT

A morphological and metrical study of the cribriform plate of the ethmoid bone was carried out on dry skulls to determine the degree of asymmetry and establish a base line data for Nigeria. Measurements were taken on the cribriform plate of 21 dry skull samples which were gotten from three different Nigerian Universities. The skulls were all male specimen of Nigerian origin within the age range of 25-30years. The length of the cribriform plate was measured by carefully placing a pair of divider across the length of the right and left halves from apex to base. The divider was then removed and transferred to a meter rule for a reading to be taken. The width of the right and left halves of the cribriform plate was also measured across the widest area (base) of the bone. The perforations on the right and left halves of the cribriform plate were counted using the hand lens and the total number noted. The results showed that there was no significant difference ($p>0.05$) between the length and width of the right and left halves of the cribriform plate and in the mean number of perforations. The mean of the length of the right half of the cribriform plate is (2.66± 0.05)cm while that of the left is (2.62± 0.06) cm. The mean of the width of the right half is (0.64± 0.02)cm while that of the left is (0.63± 0.02)cm. the mean number of the perforations on the right is (32.2± 1.8) while that of the left is (34.3± 1.5). An insignificant level of asymmetry was found in the cribriform plate which is in the form of bulging or flattening of the crista galli and the lateral borders of the plate.

Key words: Cribriform plate, Ethmoid bone, Nigerian male.

The cribriform plate is one of the four components of the ethmoid bone which is located on the anterior portion of the floor of the cranium, between the orbits where it forms the roof of the nasal cavity. Other parts of the ethmoid bone includes: two lateral masses or labyrinths and the vertical perpendicular plate (De Graaf 1998, Peter et al 1995). A study by Kalmey et al (1998) has shown that age related changes occur in the cribriform plate of the ethmoid bone. This was based on the investigations carried out on an area of patent foramina in 57 cribriform plates of 40 skulls of known age and sex. Their results revealed that the area of patent foramina decreased with increasing age and that age is a strong covariate with foramina (P=0.0025).The regression equation for the patent foramina is 8.17- (0.06).A knowledge of the deep lying cribriform plate which is important in endoscopic sinus surgery has become an increasingly popular procedure for the management of paediatric sinus disease (Anderhuber et al 1998). The cribriform plate has been observed to ossify completely by the end of the 1st year of life. The ossification of the cribriform plate initially displayed a vertical position which later became horizontal in the course of the 1st year (Krmpotic et al 1998). Ossification occurs partly from the perpendicular plate and partly from the labyrinths (Henry Gray 1918). The radiographic anatomy of the cribriform plate was investigated in sixteen canine cadaver heads and the findings revealed that the cribriform plate appeared as a "v" shaped multilinear bone, opaque stripped in the caudal nasal region in projections perpendicular to the hard palate in the six specimens with a skull index of between 50.00and 54.00 (Schwarz et al 2000). All other specimen with a skull index of between 55.40 and 74.40 had a more "c" shaped appearance (Schwarz et al 2000). In 1999, Erdem et al compared paranasal computerized tomographic scans of 136 healthy individuals with the ethmoid roof and depth of the cribriform plate, middle turbinate length, and the maximal orbital height. They discovered that the maximal orbital height was the most constant anatomic measurement and that the mean level difference between the ethmoid roof and the cribriform plate is 6.1± 2.3 range (1-12) mm on the left side while it is 6.1± 2.2 range (1-15) mm on the right side. The middle turbinate length was longer in Keros type 1 group than other groups ($P<0.05$).The development of the cribriform plate have been carefully observed in macerated isolated 60 ethmoid bones specimen from late fetal life to the

stage of its final shape. Also interesting is the work done by Keros, who studied the ethmoidal roof and the cribriform plate in 450 adult specimen. Retrospective analysis in 272 patients between 0 and 14 years was performed by means of CT scans of their paranasal sinuses with thickness of 2mm. His results showed a possible classification into 3 (Keros type 1, 11 and 111) groups based on the types of positions of the cribriform plate and the ethmoid roof starting from the second year of life. There was also a prevalence of asymmetric position of the ethmoid roof of about 15% (Anderhuber et al 1998). Silver et al (2002) reported the impact of blocking cerebrospinal fluid transport through the cribriform plate. They discovered that a significant proportion of C.S.F drainage occurs through the cribriform plate into the nasal mucosal lymphatics.The present study is aimed at determining the morphology and incidence of asymmetry in the cribriform plate of ethmoid bone in Nigerian males.

MATERIALS AND METHOD

A total number of 21 dry skulls wee used for this study. They were gotten from Cadavers in the laboratories of the Department of Anatomy, University of Nigeria Nsukka, Department of Anatomy, Nnamdi Azikiwe University Awka and Department of Anatomy, University of Port Harcourt. The cadavers were all confirmed to be Nigerians by the chief laboratory technologist. All the skulls were prepared by adopting the standard anatomical procedures which included dissecting out of the soft tissues as much as possible, soaking the detached heads in water at about 60ºC for 12 hours to aid softening of tissues. An antiseptic (Dettol) was then added to the water which was then covered and left to stand at room temperature for 10 days.

The skulls were then taken out of water and the soft tissues removed with the help of a sharp knife after thorough maceration. The skulls were then collected and immersed in 20% Caustic Soda for 2 hours. They were rinsed in water and allowed to dry in the sun. The skulls were further immersed in 10% hydrogen peroxide for 3 days, rinsed in water, dried for 2 days and then polished. Measurements were taken by using a pair of divider to carefully span across the length and width of the right and left halves of the cribriform plate. The divider was then transferred to a meter rule where the readings were taken. The perforations on the right and left halves of each of the cribriform plate were counted using the hand lens and the total numbers were noted. Only skulls with intact cribriform plate were used for this study. The results were then compared and data analyzed statistically.

RESULTS

The result of this is as shown in table 1. Result revealed no significant difference between the right and left halves of the cribriform plate and also the right and left perforations. Table shows the mean values for the length, width and perforations of the right and left halves of the cribriform plate. The mean values for the right half is (2.66± 0.05)cm while that of the left half is (2.26± 0.6)cm.There was no significant difference between them ($P>0.05$). The mean values for the right perforations is (32.2 ±1.8) while that of the left is (34.3± 1.5). However, there is no significant difference between the right and left perforations ($P>0.05$).

DISCUSSION

This study has revealed that the normal limit of the length of the right and left halves of the cribriform plate range from 1.9cm to 3.1cm and 2.0 to 3.05cm respectively. The number of perforations ranged from 19 to 44 and 22 to 45 respectively. A mild degree of asymmetry is found in the roof of the ethmoid bone, fovea ethmoidalis (lebowitz et al 2001), there is yet no past record of studies which have been done regarding the asymmetry of the cribriform plate. Therefore, there seems to be an inadequacy of detailed literature to which these data could be compared with.

It had been observed that obstruction of CSF transport through the cribriform plate increased the peak intracranial pressure after infusion and so the cribriform plate is an important site for CSF clearance (silver et al 2002).The relevance of this study is that it has noted the normal range of the length, width and perforations in the cribriform plate of ethmoid for which a drastic reduction in these values will drastically affect CSF transport and result in increased intracranial pressure. The

Table 1: Mean standard deviation and standard error of mean for the length, width and perforations of the cribriform plate.

Length (cm)	N	X	SD	S.E
Right	12	2.66	0.26	0.05
Left	21	2.62	0.28	0.06
Width				
Right	21	0.64	0.13	0.02
Left	21	0.63	0.09	0.02
Perforations				
Right	19	32.2	7.85	1.80
Left	19	34.3	6.54	1.50

N= No. of skulls, x= mean, S.D= standard deviation, S.E standard error.

end organ for smell lies in the olfactory mucosa of the upper and posterior parts of the nasal cavity. Nerves arising from the mucosa join to form bundles of olfactory nerve that reach the olfactory bulb through the perforations of the cribriform plate. A reduction in the normal number of the perforations of the cribriform plate will limit the nerves that reach the olfactory bulb with further negative implications for the already unsatisfactory olfactory system of man. The delicate nature of the cribriform plate and of the ethmoid bone at large renders the cribriform plate prone to injuries. The cribriform plate is often affected in injuries of the ethmoid bone, which could be as a result of an upward blow to the nose on striking an automobile dash board in a collision. Consequently, the force of a blow can drive bone fragments through the cribriform plate into the meninges or brain tissue. These kinds of injury often lead to the drainage of CSF into the nasal cavity. Similarly blows to the head can also damage the olfactory nerves that pass through the cribriform plate to cause anosmia and a reduction in the sense of smell. However most previous studies were carried out with the view of demonstrating the correlation of asymmetry in such regions to the incidence of certain conditions such as paranasal sinusitis and nasal septum deviation. Radiological anatomic studies of the cribriform plate compared with constant structures which are concerned with the cribriform plate of the ethmoid bone have enhanced the knowledge of the microsurgical anatomy of the cribriform plate and its adjacent areas (Vasvari G et al 2005). The metrical values provided here will further improve microsurgical techniques as it concerns the cribriform plate of the ethmoid. Our result revealed that only an insignificant level of asymmetry can be found in the cribriform plate of the ethmoid bone, so we advocate that in unilateral anosmia, the anatomy of the cribriform should be investigated.

This study is probably the first on the cribriform plate in our environment and could be of immense importance to anthropologists, forensic scientists and clinicians in areas of ear, nose and throat.

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