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Prevalence And Morphometric Analysis Of Fossa Navicularis Magna In Dry Human Skulls

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Abstract

Objectives: This study aims to find the incidence and morphometry of this fossa in the Pakistani populace to avoid any misdiagnosis or misinterpretations.

Materials & Methods: This study was conducted on dry human skulls at King Edward Medical University Lahore. Fossa was measured in their transverse and vertical diameters and to locate the fossa its distance from various anatomical landmarks such as foramen ovale, foramen Lacerum, carotid canal, occipital condyles, pharyngeal tubercle and posterior border of vomer was noted.

Results: The incidence of this fossa was found to be 5.3% in the Pakistani population. Predominantly oval-shaped, the fossa measured 5.5 and 3.06 mm in vertical and transverse diameters respectively. It was 12.2 mm posterior to the vomer and 5.9 mm anterior to the pharyngeal tubercle.

Conclusion: This study is useful for radiologists and clinicians in avoiding any misinterpretations of radiographs and unnecessary investigations.

Keywords: Basiocciput, Fossa Navicularis Magna, meningitis

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1. Introduction

Fossa Navicularis Magna is an anatomical variation present at the basiocciput. The basiocciput is a wedge-shaped part of the occipital bone that lies anterior to the foramen magnum and connects with the body of the sphenoid bone[1]. Fossa Navicularis Magna is a bony, notch-like dehiscence at the basiocciput. The aetiology of this fossa is attributed to the defect in embryological synchondrosis fusion-junction of the body of the sphenoid bone with the basilar part of the occipital bone[2]. Even though this fossa is an incidental finding sometimes detected subsidiary in radiographs of the skull, its presence has significant diagnostic and clinical implications[3]. It is reported that a patent fossa navicularis magna could be a conduit for infection from the pharynx to the calvarial and intracranial structures[4]. The literature review has shown many case reports suggesting fossa navicularis as a cause of the spread of nasopharyngeal infection to the brain resulting in meningitis and clival osteomyelitis[4,5,6].

So far data available on this anatomical variation is mostly based on MRI and CT images with very little study on human dry skulls. Therefore, this study aims to provide the prevalence and morphometry of this fossa, especially in the Pakistani populace to avoid misinterpretations of radiological images and unnecessary investigations.

2. Materials & Methods

The study was conducted on 76 dry adult human skulls of unknown age and sex stored in the Department of Anatomy, King Edward Medical University, Lahore, Pakistan. All intact skulls were included while the spoiled ones (in which the base of the skull was broken) were excluded from the study. The transverse and sagittal diameters of the fossa were noted. To locate the fossa its distance from various anatomical landmarks was noted. These included the distance of the fossa from the pharyngeal tubercle, posterior border of the vomer, medial margin of foramen ovale, medial margin of foramen lacerum, occipital condyle and carotid canal on the right and left sides.

The shape and patency of the fossa were also noted. All the readings were recorded with a digital Vernier calliper (Fig.3) and were taken in millimetres. Data was entered and analyzed by taking out mean, maximum and minimum values.

3. Results

Out of 76 skulls studied, Fossa Navicularis was present in 4 making the prevalence of 5.3 % in the Pakistani populace. 25% of these were round in shape

(Fig.1) and the remaining 75% were oval-shaped (Fig. 2).

Figure-1 Round Fossa Navicularis

Figure-2 Oval Fossa Navicularis

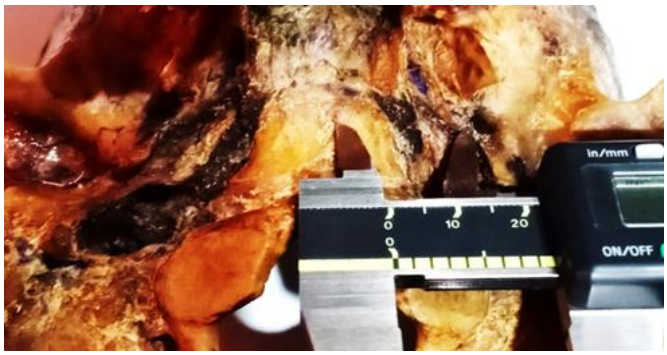

Figure-3 Measuring the distance of Fossa Navicularis from the medial margin of foramen Ovale using digital Vernier Caliper

The quantitative parameters for Fossa Navicularis are depicted in Table 1. The vertical diameter of the fossa ranged from 3.23 to 8.07mm with a mean value of 5.5mm whereas the transverse diameter was found to be between 1.39 and 4.32mm with a mean value of 3.06mm. The mean distance of fossa from the foramen Lacerum on the right and left sides was 10.7 and 10.8 respectively and from the foramen ovale was 21.3mm on the right and 22.7mm on the left side. To further locate the fossa its distance from both carotid canals and occipital condyles was also noted. These turned out to be 24.7,25.9,16.6 and 16.1mm (Table 1).

Table-1 Measurements of Fossa Navicularis and Distances Between Certain Landmarks

Measurement	Minimum value mm	Maximum value Mm	Mean
FN vertical diameter	3.23	8.07	5.5
FN transverse diameter	1.39	4.32	3.06
FN-foramen Lacerum (R)	9.08	11.4	10.7
FN-foramen Lacerum (L)	8.79	11.97	10.8
FN-foramen Ovale (R)	19.69	22.79	21.3
FN-foramen Ovale (L)	21.45	23.86	22.7
FN-Carotid canal (R)	23.01	26.85	24.7
FN-Carotid canal (L)	23.96	26.94	25.9
FN-anterior margin of occipital condyle (R)	14.81	19.48	16.6
FN-anterior margin of occipital condyle (L)	14.3	19.7	16.1
FN-posterior border of Vomer	7.91	16.74	12.2
FN-pharyngeal tubercle	4.40	8.83	5.9

Moreover, the fossa was located as near as 7.91 mm from the posterior border of the vomer to as far as 16.74mm. Similarly, its distance showed variation from pharyngeal tubercle also ranging from 4.40 to 8.83mm

5. Discussion

The basilar part of the occipital bone named basiocciput articulates with the sphenoid bone and is located anterior to the foramen magnum[7]. It results from the fusion of basisphenoidal and basioccipital bones in 2nd month of intrauterine life until spheno-occipital synchondrosis ossification[8]. Sometimes this ossification remains incomplete due to the remnant of notochord and results in the formation of a notch-like rounded osseous defect named Fossa Navicularis Magna[9,10].

Fossa Navicularis Magna, first time reported in 1989, was an incidental finding in a patient who was sent for radiological evaluation for sinusitis[3]. Since then this fossa became a point of interest for researchers. Many CT and MRI studies were conducted to elaborate on this fossa[11,12]. Later few case reports brought it into consideration of clinicians also. These reports highlighted the fossa as a cause of the spread of infection from the nasopharynx to the brain resulting in intracranial infections[5],meningitis[4,13] and clival osteomyelitis[6].

To avoid unnecessary investigations and misinterpretations this study was planned to know the prevalence and morphometry of fossa Navicularis in the Pakistani population. The incidence of fossa was found to be 5.3% in the Pakistani population. This incidence is comparable to the one found in the Turkish population by Cankal et. al. who reported the incidence to be 5.28%[2] but this was contrary to Beltramello et. al. who mentioned 2.1% incidence of fossa Navicularis in the Italian population[3]. This difference can be attributed to the difference in races.

In our study, the sagittal diameter of the fossa ranged from 3-8 mm. These values are concomitant with the values in the Turkish populace reported to be between 2-9mm by Cankal et. al. but were lesser than the Italian populace where the range was 7-13mm as reported by Beltramello et. al. Similarly in transverse diameter our values of 1-4mm were closer to Turkish community being 2-4 mm and lesser than Italian community where values were reported to be 5-8mm. The difference from the Italian population can again be attributed to the racial difference.

The results of other measurements such as the distance of the fossa from the foramen Lacerum was found to be 10.7mm and 10.8 mm on the right and left side respectively. To locate the fossa its distance from the foramen ovale, carotid canal and occipital condyle was also measured and the results obtained were found close to the one found in the Turkish community except for the distance of the fossa from the posterior border of the vomer which was found to be 12.2 mm in Pakistani populace and 8.55mm in Turkish population. These results could not be compared with the Italian populace as their data was not enough.

Fossa Navicularis Magna might be responsible for the spread of infection from the nasopharynx to the brain. Therefore keeping an incidence of 5.3% in mind further CT and MRI studies should be planned to report the incidence and to set the SOPs for all corona-positive patients that whether they should undergo CT or MRI brain to exclude any chances of developing intracranial infections

5. Conclusion

Fossa Navicularis Magna is present in 5.3% of the Pakistani population mainly as an oval shaped osseous defect. Since this is responsible for the spread of infections therefore this anatomical variation must be kept in mind to avoid any misdiagnosis and misinterpretations.

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M.T, M.H - Experimentation/Study conduction
M.T, - Analysis/Interpretation/Discussion
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I.A, R.T - Facilitation and Material analysis

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