RESEARCH

ASSESSMENT OF OLFACTORY FOSSA DEPTH ON COMPUTED TOMOGRAPHY IN ADULTS IN A TERTIARY CARE HOSPITAL IN INDIA

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Abstract

Background: Olfactory fossa (OF) is a depression in the anterior cranial cavity, and the cribriform plate of the ethmoid forms its bottom. When performing functional endoscopic sinus surgery, the lateral lamella, a small bone plate that defines its lateral boundary, is vulnerable to damage, especially if the fossa is deep or asymmetric. The objective is to measure the variations in the CT depth of OF among the study population using Keros classification. **Materials and Methods:** This study is a hospital based cross sectional study where patients undergoing CT scan of paranasal sinuses (PNS) were included. Coronal PNS CT scan studies of 300 patients were reviewed. The depth of OF was measured from vertical height of lateral lamella. **Result:** PNS CT scans of 300 subjects were included in the study. OF had a depth range of 1 to 13 mm. The mean depth of the OF under study was 4.85 mm. With an SD of 1.52, the mean depth of OF on the right side was 4.92 mm, and on the left, it was 4.78 mm. There was no discernible difference between the mean depth of OF on the two sides using the independent sample t-test, as the P value was 0.658. The mean depth of OF between boys and females was statistically different. Keros type II was the commonest type. **Conclusion:** The study identified the type of OF that is most common. There is even data on the prevalence of various types of OF in both men and women.

INTRODUCTION

In the anterior cerebral cavity, there is a depression called the Olfactory Fossa (OF). The cribriform plate of the ethmoid forms the bottom of the olfactory fossa. The nasal cavity and the anterior cerebral fossa are divided by this fine bony plate. OF is bordered medially by the crista galli and laterally by the lateral lamella of the cribriform plate.[1] The olfactory bulbs and tracts are inside. The anterior skull base's lateral lamella is the thinnest bone. In up to 14% of patients, it is dehiscent.[2]

In order to prevent iatrogenic harm, a number of parameters, including asymmetry of the ethmoidal fovea, the olfactory fossa (OF), anatomical abnormalities in the lateral lamella, and the course of the anterior ethmoid artery, are crucial in FESS. Computed tomography (CT) preoperative examination is therefore required before FESS.[3]

Following Keros, various research studies on the ethmoid roof and OF based on Keros classification among different populations have been out. Varied racial populations have different ethmoid roof configurations. There is a dearth of information on OF analysis in the Indian setting. Depending on the vertical extent of the lateral lamella, the levels of the ethmoid roof/fovea ethmoidalis and cribriform plate may vary even within the same individual.[4]

In 1962, Keros investigated the relationship between the OF and the ethmoid roof in 450 skulls. In order to classify the depth of the OF in relation to the ethmoid roof, he arrived with a three-category system. The vertical height of the lateral lamella of the cribriform plate (LLCP), or the height differential between the cribriform plate and ethmoid roof, is used to determine the depth of OF.[5,6]

oid roof. In type II relationships, the OF is deeper and the lateral lamella is higher than in type I The depths of Keros types I, II, and III are 1-3 mm, 4-7 mm, and 8-16 mm respectively. The OF is flat in Keros type I. Nearly in the same plane as the cribriform plate is the ethm relationships. The lateral lamella is higher and the OF is deeper in type III. The ethmoid roof is elevated above the cribriform plate by a substantial amount.[7] For endoscopic sinus procedures, type III relationships are the riskiest. Keros type III is hence referred to as hazardous ethmoid.[8] The likelihood of penetration via the LLCP is substantial.

During procedures like FESS, asymmetry in the depth of the OF or the height of the ethmoidal roof is also linked to a higher risk of cerebral penetration.[9] A variety of complications, such as ascending

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meningitis, intracranial hypotension from a cerebrospinal fluid leak, meningocele, or meningoencephalocele, can result from iatrogenic damage.[10] Therefore, the preoperative assessment of OF depth is crucial to a successful FESS.

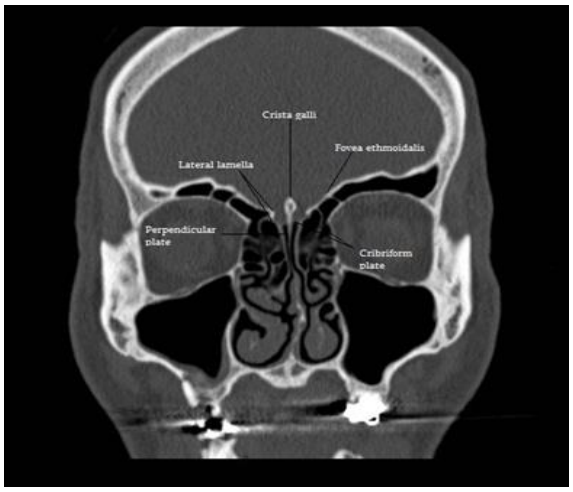

Figure 1: Coronal section showing structures around olfactory fossa

Figure 2: Olfactory fossa Keros type 1- The depth of olfactory fossae is not deep. The cribriform plate and ethmoid roof are nearly in the same plane.

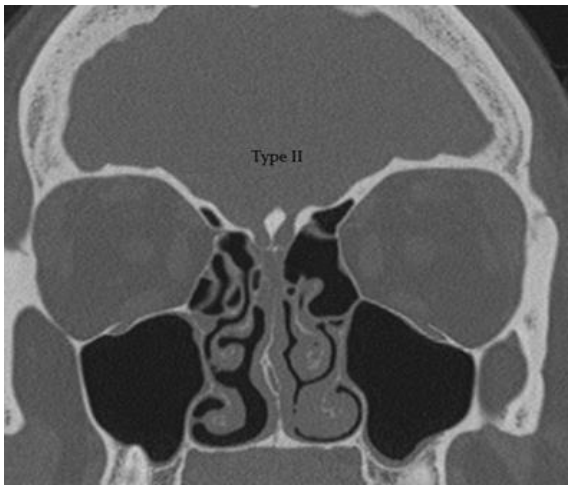

Figure 3: Type II Keros categorization as shown by a coronal CT. Compared to type I, the lateral lamellae are longer and the olfactory fossae are deeper.

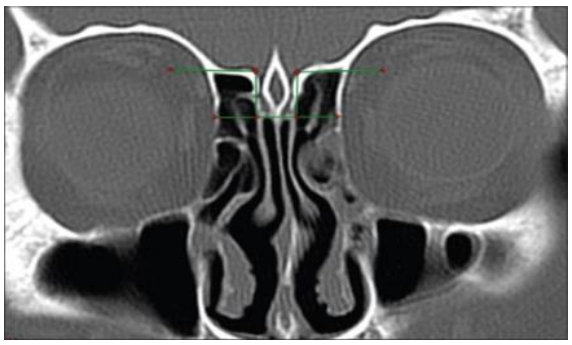

Figure 4: Type III Keros categorization as shown by a coronal CT. Compared to types I and II, the olfactory fossae in this region are deeper.

Objective

To measure the variations in the CT depth of OF among the study population using Keros classification.

MATERIALS AND METHODS

The present study was conducted in RIMS teaching hospital Raichur, Karnataka, India. It is a hospital based cross-sectional study. Patients above 18 years of age, who were referred for undergoing non-contrast CT of the PNS were included in the study. Patients with a history of bone-damaging disorders such as malignancies, operations, congenital facial deformities, sino-nasal polyposis, or nasal trauma were excluded from the study. While the patient was in the prone position, CT scans were taken perpendicular to the hard palate, from the anterior margin of the frontal sinus to the anterior margin of the clivus. In the bone window, the images were examined.

The anatomical landmarks utilised to measure OF depth were the medial ethmoidal roof point, the cribriform plate, and the LLCP (medial end of ethmoid roof articulating with LLCP). Horizontal lines were drawn at the medial ethmoid roof point and along the cribriform plate. The vertical height of the lateral lamella was measured between these two horizontal lines using the distance-measuring tool. The depth of the Olfactory Fossa corresponds to the vertical height of the lateral lamella. Both the right and left lateral lamella's heights were measured individually. Keros type I was assigned to OF depths between 1-3.9 mm, type II to 4-7.9 mm, and type III to 8 mm. 300 scans from the study's 6-month time frame were included.

Statistical analysis was done using IBM SPSS Ver 23. The results were categorised using the Keros system, and the distributions of those results were examined in terms of gender and laterality. Statistical significance was defined as a P value less than 0.05. Before the study began, it received permission from the institutional ethics committee.

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RESULTS

PNS CT scans of 300 subjects were included in the study. Out of 300 participants, 168 men (about 56% of them) and 132 women (44%). The oldest subject was 85 years old, and the youngest was 18 years. The study group's mean age [standard deviation (SD)] was 39.3 (18.41) years. OF had a depth range of 1 to 13 mm. With an SD of 1.62, the mean depth of the entire OF under study was 4.85 mm. With an SD of 1.52, the mean depth of OF on the right side was 4.92 mm, and on the left, it was 4.78 mm. There was no discernible difference between the mean depth of OF on the two sides using the independent sample t-test, as the P value was 0.658.

In males (both sides included), the mean depth of OF was 5.28 mm with an SD of 1.62, and in females, it was 5.17 mm with an SD of 1.54. The mean depth of OF between boys and females was statistically different, according to the independent sample t-test, with a P value of 0.019.

Keros type I was seen on 51 (17%), type II on 224 (74.67%), and type III on 25 (8.33 %). On the right side of males, Keros type I OF was present in 28 patients (16.7%), type II in 119 subjects (70.8%), and type III in 21 subjects (12.5%). On the right side, there were 9 (6.8%%) females with type III OF, 24 (18.2%) with type I, and 99 (75%) with type II. P value for the Chi-square test was <0.05. Therefore, on the right side, there was a substantial correlation between sex and Keros type. On the left side, Keros type I was present in 27 (16.1%), type II in 126 (75%) and type III in 15 (78.9%) males.

Similar to this, among females on the left side, type I OF was found in 24 (18.2%), type II in 99 (75%) and type III in 9 (6.8%) cases. Chi-square test P value was 0.34, indicating that there was no correlation between gender and Keros type on the left side.

DISCUSSION

With the exception of a few research that are included below, there aren't many in-depth studies on OF analysis in the Indian context. In the past, OF analysis among the Indian population from different states had been carried out by Salroo et al,[11] (200 subjects), Pawar et al,[12] (200 subjects), Satish Nair,[13] (180 subjects), Ali et al,[14] (75 subjects), Gupta et al,[15] (100 subjects), and Jacob et al,[1] (32 cadaveric skulls). Our study, which is more thorough than earlier Indian studies, tries to concentrate on the distribution of Keros kinds and numerous asymmetry factors in detail. Additionally, compared to earlier studies, this one is more thorough and provides extensive data on the Indian population.

The most prevalent type of OF in this study was type II. 17.5% of cases were type I, while 7.9% were type III. Type II OF was the most prevalent, followed by types I and III, in earlier Indian investigations as well. Similar investigations examining the ethmoid roof and OF in accordance with Keros categorization have been done all around the world. The distribution of configuration among various racial populations around the world varies. In our study, there was a statistically significant relationship between sex and Keros type, particularly on the right side. The deadly type III Keros was observed more frequently in males than in females, and even more frequently in males on the right side. However, there was no statistically significant variation in the distribution of Keros categorization between males and females in the Salroo et al. study.[11]

In our study, the average depth of OF was 5.28 mm. Jacob et al had studied and found a mean depth of 5.08 mm, while Salroo et al study calculated a mean depth of 4.9 mm.1,11 In our study, the analysis of OF depth in relation to gender revealed a statistically significant difference between males and girls. Salroo et al. found a considerable variation between males and girls in the depth of the OF.[11] In the present study, there was no discernible difference between the mean depth of OF on the right and left sides.

Furthermore, Jacob et al. discovered no appreciable difference in OF depth between the sides.1 Salroo et alstudy's on the other hand, revealed a large divide between the two.[11] Only in males did a study by Pawar et al. reveal a statistically significant variation in the depth of the OF between the right and left sides.[12]

CONCLUSION

The Keros classification provides an objective evaluation of the anterior skull base architecture, guiding the surgeon during FESS and raising the procedure's safety profile. Being prepared for any surgical problems will be beneficial. As a result, the surgical strategy can be properly planned and the anticipated complications can be avoided. The study identified the type of OF that is most common. There is even data on the prevalence of various types of OF in both men and women.

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