Original Article

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Prevalence of Onodi cells - A Cone Beam Computed Tomography analysis

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ABSTRACT-

The onodi cells, which extend superolaterally to the sphenoid sinus, are the most posterior ethmoid air cells. Because Onodi cells can have important anatomical variances and connections to important nearby structures including the internal carotid artery, sphenoid sinus, and optic canal, it is crucial to identify them in clinical and forensic perspectives. The present study aimed to assess the prevalence of Onodi cells through CBCT. We assessed 50 CBCT scan of both the genders to evaluate. Out of 23 males 10 patients and out of 27 female patients 12 patients showed positive result and the position of the onodi cells were further evaluated. The results of the current investigation showed a significant prevalence of Onodi cells, with almost similar distribution in males and females with most of them located above the sphenoid sinus.

Keywords

Onodi cell, optic neuritis, cone-beam computed tomography, sphenoid sinus

Introduction:

Dr. Odolfo Onodi was the first person to describe Onodi cells.1 Intimately connected to the optic nerve, Onodi cells are the most posterior ethmoid air cells that extend superolaterally to the sphenoid sinus, according to Dr. Adolfo Onodi. Unrecognised Onodi cells can seriously harm the optic nerve during sinus procedures. As they relate to endoscopic sinus and endonasal sellar surgery, it has become more important to describe these cells and their variants. Because Onodi cells can have important anatomical variances and connections to important nearby structures including the internal carotid artery, sphenoid sinus, and optic canal, it is crucial to identify them.[1,2] For the removal of pituitary adenomas, the endonasal transsphenoidal procedure has recently become the method of choice. Because it is less intrusive, this method is preferred to the transcranial way. It is crucial to clearly define the surrounding anatomy because this process is becoming more and more common in order to guarantee an accurate and safe dissection.[2,3]

In order to maximise exposure and lower the danger of damaging nearby structures, it is essential to identify Onodi cells during surgery. Various identifying techniques result in varied Onodi cell prevalence rates.

Materials & Methods

From the digital imaging, the CBCT scan data from January 2020 to February 2022 were obtained. From the previous study, the power was 80%, the estimated prevalence was 0.39 (39%) and the Z statistic was 1.96 for the 95% confidence interval. Given that the calculation called for a minimum sample size of 45, we chose to select 50 CBCT scans from the archive folder that met the requirements for inclusion.

Two independent reviewers - radiologists with a minimum of five years of expertise interpreting images reviewed the

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CBCT scans. Subjects with a history of surgery in the sinus region, trauma to the area, or tumours that caused anatomical deformation were not included in this study. The Kodak CS 9300 3D system (Carestream Health, Inc., Rochester, NY, US) was used to capture the CBCT scans, which had the following specifications: a field of view of 17 X 13.5 cm, voxel size of 250 250 250µm, 10mA, X-ray pulse duration of 30 ms, and 70 kVp. Before the trial began, a training session was scheduled for the observers to learn how to properly identify Onodi cells. On a workstation with a 16-inch ASUS LCD laptop monitor, the CBCT pictures were assessed using three-dimensional imaging communication software (CarestreamHealth, Inc., Rochester, NY, US). The two observers were permitted to utilise the contrast and zoom tools, and they each independently evaluated the scans. The same observers assessed 10 scans twice, 15 days apart, to determine intraobserver agreement using the Kappa (κ) statistic. The Statistical Package for the Social Sciences (SPSS, SPSS, Inc., Chicago IL, US) programme, version 17.0, was used for calculating the descriptive statistics. The Chi-square ($\chi 2$) test was used to assess a cross-tabulation of gender with the presence and positioning of Onodi cells.

Result

The data of the 50 patients was included according to the eligibility criteria. Of these, 27 patients were female and 23 were male. Onodi cells were identified in 22 patients (44%) (Figure.1).The descriptive analysis revealed that Onodi cells were present in 12 (44.44%) females and 10 (43.48%) males. Onodi cells were present superior in position with respect to the sphenoid sinus in 13 (59.09%) of the patients, superolateral in 6 (27.27%), and lateral to the sphenoid sinus in 3 (13.64%) of the patients. No significant association was observed on the $\chi 2$ test between gender and presence of Onodi cells (Table 1), or regarding the position of the Onodi cells with respect to the sphenoid sinus (Table 2).

Discussion

It is crucial to understand the complex anatomy of the base of the skull as endoscopic transsphenoidal and skull base procedures establish becoming more common. The Onodi cell, which is the most posterior ethmoid cell and pneumatizes superiorly and laterally to the sphenoid sinus, is situated adjacent to the internal carotid artery and the optic nerve canal. While cadaver studies revealed a higher incidence range of 42% to 60%, earlier research on CT scans suggested that the prevalence of Onodi cells varies from 8% to 24%.[4,5,6] It can have significant forensic implications since the presence of these cells can indicate normal growth of nearby structures, including paranasal sinus.

Figure 1: Coronal section of CBCT scan showing Onodi cell

Table 1: Association of gender and the presence of Onodi cells (Chi-squared test)

GENDER	ONODI CELLS		TOTAL
	Present n %	Absent n%	n%
Male	10 (43.48)	13 (56.52)	23 (100)
Female	12 (44.44)	15 (55.56)	27
Total	22 (44)	28 (56)	50

Table 2: Association of gender and the position of Onodi cells (Chi-squared test)

GENDER	ONODI CELLS			TOTAL n%
	Superolateral	Superior	Lateral	
Male	3 (30)	5 (50)	2 (20)	10 (100)
Female	3 (30)	8 (66.67)	1 (8.33)	12 (100)
Total	6 (27.27)	13 (59.09)	3 (13.64)	22 (100)

In their analysis of 162 preoperative CT scans and intraoperative endoscopic endonasal findings, Shin et al. found a strong connection between CT and intraoperative findings, reporting an incidence of Onodi cells of 33.3% after transsphenoidal surgery and 32.7% on the preoperative CT. Onodi cells have been shown to be more or less common in cadaveric versus radiographic anatomical investigations. Preoperative planning is vital for safe and effective surgical treatments, thus this conundrum must be resolved.[7,8,9]

The prevalence of Onodi cells was 42.8% in the current study, which is greater than the prevalence discovered in a recently published study. The results of the current study may point to the value of the CBCT scan in identifying bony structures, such as the paranasal sinus.[10,11] The current work offers evidence that, in comparison to CT, the CBCT

technique may be used to get comprehensive images of the bone structures in the paranasal sinus area at significantly lower radiation doses. In the current investigation, we discovered that Onodi cells were distributed virtually equally across male and female patients.[9,11,12]

This result was in line with what Tomovic et al. found in their investigation. Onodi cells were more frequently found in the superior position in the study under consideration than in the superolateral position in the study by Chmielik and Chmielik[12,13]. Onodi cells are quite common, thus it's crucial to determine their precise location and how they relate to the pituitary gland, internal carotid artery, and optic nerve because an Onodi cell is frequently found in the optic nerve.[13,14,15,16]

When there are many Onodi cells present, the surgeon may mistake it for the sphenoidal sinus and do surgery to excavate the sinus, which might result in potentially fatal consequences. The absence of endoscopic exams of the patients to establish the presence and location of the Onodi cells is one of the limitations of this finding. To compare the outcomes of the two imaging modalities in connection to the gold standard, the endoscopic finding, we propose doing a research on the prevalence of Onodi cells on CBCT and CT exams with endoscopic examinations.[15,17,18]

Conclusion

According to the current study, Onodi cells were highly prevalent in CBCT, and their superior location was the most frequent, followed by their superolateral position, which had a frequency that was roughly equal between men and women. This can have forensic relevance related to normal growth of nearby anatomical structures and also clinical relevance as the precise relationship between the Onodi cells and significant anatomic structures should be determined in order to avoid postoperative surgical difficulties.

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