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The Radiological Study of Onodi Cells Among Adult Sudanese Subjects

Kamal Badawi [1],Gesma Ahmed Madani [2]Yasser Seddeg [3]
[1](Department of Anatomy, Faculty of Medicine, / The National Ribat University, Sudan)
[2](Department of Anatomy, Faculty of Medicine, / Ibn Sina National College, KSA)
[3](Department of Anatomy, Faculty of Medicine, / The National Ribat University, Sudan)

Abstract : *The Onodi cell (sphenoethmoidal cell) is an anatomical variation of the most posterior ethmoidal air cell that pneumatizes superolateral to the sphenoid sinus and is intimately related to the optic nerve and internal carotid artery, hence their clinical relevance in the event of sinusopathy. Recently, there has been more interest in defining these cells and their variations as they pertain to endoscopic sinus and endonasal sellar and parasellar surgery. The development and refinement of computerized tomography (CT) imaging has allowed detailed assessment of each individual's paranasal sinus anatomy, thus providing a map that allows the surgeons to operate safely. This study aimed to determine the prevalence of Onodi cell on CT scan in Sudanese population and to compare them statistically with available data worldwide. The study population involved 29 males (47.5%) and 32 females (52.5 %) with a mean age of 37 years. They were explored in the radio-diagnostic department of Ribat University Teaching Hospital, Khartoum- Sudan in the period from March to September 2015. Patients were scanned on slice collimation of 1mm thickness with slice thickness of 4mm. The name, age, and sex were recorded. CT scans were reviewed in axial, coronal, and sagittal planes in bony windows and reported the results in data sheet. Statistical analysis was performed using SPSS version, and compared with previous results in similar studies. Onodi cells were present bilaterally in 7 cases (11.5%), unilaterally in 11 cases (18.0%) and were completely absent in 43 cases (70.5%). Determination of these variations aids in providing a better surgical orientation and avoiding or minimizing the possible complications.*

Keywords : *Computed tomography scans, Onodi cell, Paranasal sinuses, Sphenoethmoidal cell, Posterior ethmoidal air cell.*

I. Introduction

Endoscopic sinus surgery (ESS) is a common procedure which requires a meticulous assessment of patients and a detailed radiological description of the anatomy and its anatomical variations in nose and paranasal sinuses (PNS).[1] Certain anatomical variations are thought to be predisposing factors for the development of sinus diseases and thus it becomes necessary for the radiologist to be aware of these variations, especially if the patient is a candidate for functional endoscopic sinus surgery (FESS).[2] The anatomy of nasal cavity and paranasal sinuses differ significantly from patient to patient; certain distinct variations are found most frequently among the general population.[3] The presence of anatomical variations must be noted in order to attain a full understanding of the individual patient as well as to develop an accurate diagnosis. The development and refinement of computerized tomography (CT) imaging has allowed detailed assessment of each individual's paranasal sinus anatomy, thus providing a map that allows the surgeons to operate safely.[6]

The Onodi cells were first described in 1903 by Dr. Adolfo Onodi as the most posterior ethmoidal cells that extend superolateral to the sphenoidal sinus.[7, 8] The presence of a horizontal septum, dividing the sphenoid sinuses in "two floors", suggests the presence of an Onodi cell.[9] These cells are intimately related to the optic nerves and internal carotid arteries, hence their clinical relevance in the event of sinusopathy.[10] The Onodi cells may also be mistaken for the sphenoidal sinus, resulting in incomplete functional endoscopic sinus surgery in a patient with sphenoid sinus disease.[11]

This study aimed to determine the prevalence Onodi cells on CT scan in Sudanese population according to location, sex and age and to compare them statistically with available data worldwide.

II. Methods

This was an observational analytical cross-sectional study of adult Sudanese subjects depending on their age and sex. The study was conducted to determine the prevalence of clinically significant anatomical variations of the ethmoidal sinuses at radio-diagnostic department of Ribat University Teaching Hospital, Khartoum- Sudan. Subjects with congenital deformities, previous surgery, trauma or malignancy of the nose, paranasal sinuses or maxillofacial region were excluded from the study.

The study variables were age, sex and prevalence of the Onodi cell. Presence of specific anatomical variations was also recorded (Agger nasi cell, Haller's cell, Supra-orbital cells, Concha Bullosa and Paradoxical middle turbinate). Subjects were scanned on slice collimation of 1mm thickness with slice thickness of 4mm. The name, age, and sex were recorded. CT scans were reviewed in axial, coronal, and sagittal planes in bony windows and reported the results on a data sheet. Statistical analysis was performed using SPSS version, and compared with previous results in similar studies.

III. Results

A total of 61 patients were enrolled in this study. There were 29 males (47.5%) and 32 females (52.5%), The age of the subjects range from 10-85 yrs with 60.7% between the ages 21-50 yrs. Onodi cells were present bilaterally in 7 cases (11.5%), unilaterally in 11 cases (18.0%) and were completely absent in 43 cases (70.5%) (Table1). An Onodi cell was found bilaterally in 4 males (13.8%), while it was present unilaterally in 6 males (20.7%) and absent in 19 males (65.5%), (Table 2). It was found bilaterally in 3 females (9.4%), while it was present unilaterally in 5 females (15.6%) and absent in 24 females (75.0%), (Table 3). Regarding the age most cases of bilateral Onodi cells (4 cases) were found in (41-50 yrs.) age group, unilateral Onodi cell was found equally in (10-20, 21-30 and 31-40 yrs.) age groups, with 3 cases for each, and 1 case in (41-50 and 51-60) age groups, while there was no Onodi cell in (61-70, 71-80 and 81-90 yrs.) age groups, (Table 4). Onodi cells are best visualized on coronal CT scan images (Fig 1).

Table (1): Presence of Onodi cells among the study group

Pattern	Frequency	Percent
Bilaterally	7	11.5
Unilaterally	11	18.0
Absent	43	70.5
Total	61	100.0

Table (2): The Onodi cells pattern in males

Pattern	Frequency	Percent
Bilaterally	4	13.8
Unilaterally	6	20.7
Absent	19	65.5
Total	29	100.0

Table (3): The Onodi cells pattern in females

Pattern	Frequency	Percent
Bilaterally	3	9.4
Unilaterally	5	15.6
Absent	24	75.0
Total	32	100.0

Table (4): The correlation between age groups and pattern of the Onodi cells

Age groups	Pattern	Frequency	Percent
10-20	Bilaterally	1	1.6
	Unilaterally	3	4.9
	Absent	9	14.8
21-30	Bilaterally	2	3.3
	Unilaterally	3	4.9
	Absent	10	16.4
31-40	Bilaterally	0	0
	Unilaterally	3	4.9
	Absent	4	6.6
41-50	Bilaterally	4	6.6
	Unilaterally	1	1.6
	Absent	10	16.4
51-60	Bilaterally	0	0
	Unilaterally	1	1.6
	Absent	6	9.8
61-70	Bilaterally	0	0
	Unilaterally	0	0
	Absent	2	3.3
71-80	Bilaterally	0	0

	Unilaterally Absent	0 1	0 1.6
80+	Bilaterally Unilaterally Absent	0 0 1	0 0 1.6
Total		61	100

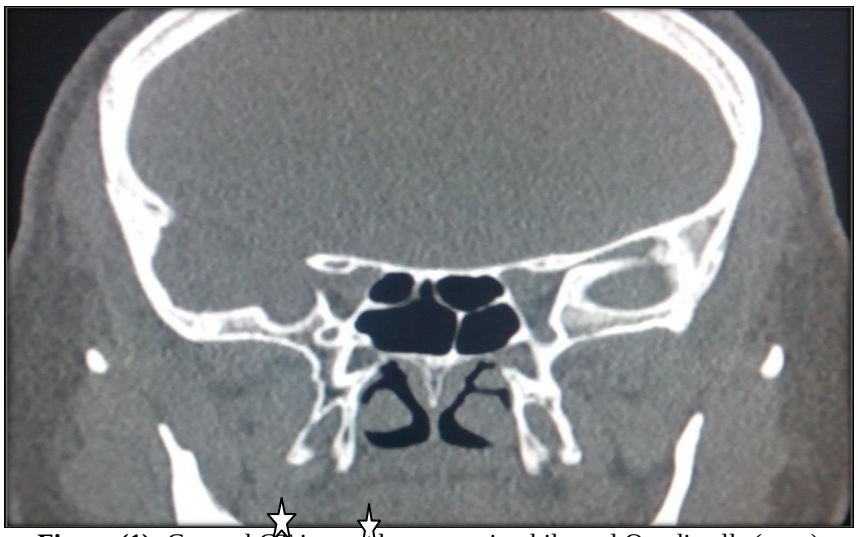

Figure (1): Coronal CT image demonstrating bilateral Onodi cells (stars)

IV. Discussion

Endoscopic sinus surgery in patients who have an Onodi cell (sphenoethmoid cell) carries a high risk for optic nerve injury.[12] Identification of Onodi cell in CT scans of the paranasal sinuses is very important to prevent optic nerve injury. Studies performed to determine the prevalence of Onodi cells in the population have used a variety of analytical methods; consequently, their results vary widely. Driben et al [13] and Weinbeger et al [14] compared the findings from CT scans with those from endoscopic examination. They found that fewer Onodi cells were identified on CT scans than by endoscopic examination. In the current study using CT scanning, we reported a prevalence of 29.5% of the examined group of patients. They were observed bilaterally in 7 cases (11.5%), unilaterally in 11 cases (18.0%) and they were absent in 43 cases (70.5%). This finding is consistent with that of Nitinavakarn et al (25%),[15] but is much higher than those found by other CT studies such as those of Daghighi and Daryani [16] and Weinberger et al[17] where the prevalence was (0.40%) and (8%) respectively. No cases with Onodi cells were encountered in the study done by Mohammad and Abd El-Monem.[18]

V. Conclusion

Computed tomography provides greater anatomical detail and higher spatial resolution for the study of the paranasal sinuses anatomy. Anatomical variations in ethmoidal sinuses are common in the Sudanese patients. The Onodi cells are important to identify because they may have several anatomical variations and relationships to vital adjacent structures. [19] Onodi cells were noted in 29.5% of the cases examined in the present study using CT PNS. Determination of these variations aids in providing a better surgical orientation and avoiding or minimizing the possible complications. Our study did not find any gender or age variations in Onodi cell distribution.

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[22]. Corresponding author: Kamal Badawi Faculty of medicine / The National Ribat University /Sudan.
drkamal624@gmail.com