



## Original Article

# A CT Scan Study Showing Prevalence of Onodi Cells in Patients with Sinonasal Complaints

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## Abstract

**Introduction:** *Posterior ethmoid cells may pneumatize the sphenoid bone posteriorly to give rise to a cell, which extends superolateral to the sphenoid sinus for a much longer distance which is known as the Onodi cell. Onodi cell may complicate the outcome of functional endoscopic sinus surgery (FESS) as it may be confused with the sphenoid sinus. The present study was undertaken to determine the prevalence of Onodi cells on CT scan in patients having sinonasal complaints.*

**Materials & Methods:** *This was a descriptive observational study carried out on 150 patients who presented with various sino-nasal complaints and underwent CT Scan in the Department of Radiodiagnosis, Bangur Institute of Neurosciences, Kolkata. Their CT scans were studied retrospectively for the presence of Onodi cells. Radiological variations data were summarized by routine descriptive statistics namely counts and percentages for categorical variables. Fisher's Exact Tests and were applied to calculate the 'p' value to find out any statistically significant difference between males and females.*

**Results:** *Onodi cells were found in 6.6% (10 cases) in the present study, 4.6% in males and 2% in females. 'p' value in this case was 0.334 on applying Fisher's Exact test.*

**Conclusion:** *Onodi cell being in the close vicinity of sphenoid sinus is a very important variation which should be looked for by the surgeon before planning any endoscopic surgery. This study tried to find out the prevalence of the Onodi cells in Eastern India to help the FESS surgeons and improve its outcomes.*

**Keywords:** *posterior ethmoid cell, functional endoscopic sinus surgery, optic nerve.*

## Introduction

Functional Endoscopic Sinus Surgery (FESS) requires a full radiological assessment of patients and a detailed radiological description of the anatomy of paranasal sinuses (PNS)<sup>[1]</sup>. Some anatomical variations predispose to the development of sinus diseases, therefore it is very

important for the surgeon to be aware of them before planning any FESS<sup>[2]</sup>. Dr. Adolfo Onodi in 1903 first described the Onodi cells<sup>[3]</sup>. Posterior ethmoid cells may pneumatize the sphenoid bone posteriorly to give rise to a cell, which extends superolateral to the sphenoid sinus for a much longer distance. This is the Onodi cell. Thus the

Onodi cell when present insinuates itself between the optic nerve and the sphenoid sinus<sup>[4]</sup>. Usually, the optic nerve passes adjacent to the sphenoid sinus or it may produce a bulge in the sphenoid sinus. These courses of optic nerve have been classified into different types. But, when Onodi cell is present between the nerve and the sinus, then the optic nerve produces a bulge in the Onodi cell instead of in the sphenoid sinus<sup>[4]</sup>.

The present study was aimed to find the prevalence of Onodi cells which will help the clinicians to understand the disease processes in a much better way and to proceed accordingly. This will also help the surgeons performing endoscopic sinus surgeries to have a better knowledge of prevalence of Onodi cells which will lead to better surgical outcomes.

### Materials and Methods

A descriptive observational study was conducted in the Department of Anatomy, IPGME&R, Kolkata for a period of 1 year from March, 2015 to February, 2016 after obtaining ethical clearance from Institute's Ethical Committee. It mainly focused on the CT scan anatomy of the paranasal sinus region to find out the prevalence of Onodi cells. CT scans of 150 patients who attended the Department of Radiodiagnosis, Bangur Institute of Neurosciences, Kolkata were taken after studying their history and complaints. Being a descriptive study, formal sample size calculation was not done. It was proposed to recruit 150 subjects over a period of 1 year.

The CT scans of the patients fulfilling the inclusion and exclusion criteria were then collected for the present study to determine the variation in the prevalence of Onodi cells.

### Inclusion Criteria

Patients with sino-nasal symptoms (as obtained from records) who underwent CT scan.

### Exclusion Criteria

CT scans which were revealing - any sino-nasal disease which caused any type of bony deformity or destruction, polyp, nasopharyngeal tumors, H/O trauma or injury (as obtained from the

records), H/O previous surgeries which involved the nasal cavity and paranasal sinuses (as obtained from the records). The scan was performed by keeping the patient in prone position. Axial sections were taken from tip of the nose to the roof of the frontal sinus. Coronal sections were taken from tip of the nose to the roof of sphenoid sinus perpendicular to the hard palate. Sagittal sections were also taken after reconstruction.

Prevalence of Onodi cell was seen on the CT scans and the results were analysed as percentage. Fischer's Exact Test was applied to calculate the 'p' value to find out any statistically significant difference between males and females.

### Results

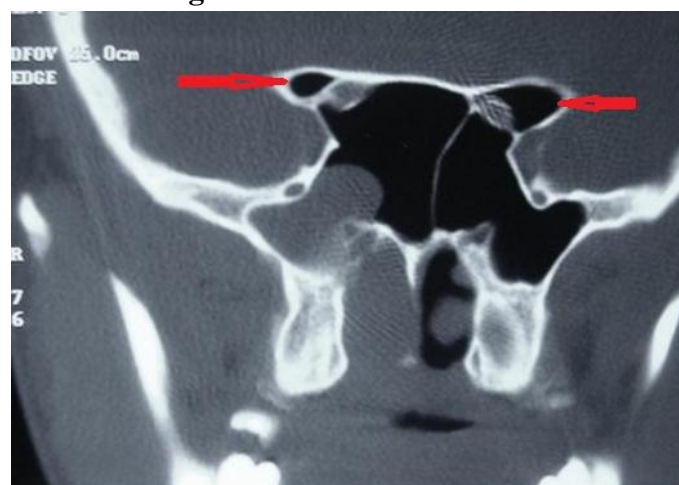
Onodi cells were found in 6.67% cases in the present study, 4.67% in males and 2% in females. [Table 1].

**Table 1:** Distribution of Onodi cells in males and females

Gender	Study cases with Onodi cell (%)	Study cases without Onodi cell (%)	Total (%)
Male	7 (4.67%)	72 (48 %)	79 (52.67%)
Female	3 (2%)	68 (45.33%)	71 (47.33%)
Total	10 (6.67%)	140 (93.33%)	150 (100%)

Fisher's Exact test was applied and 'p' = 0.334 which was statistically not significant but was clinically significant.

### CT Scan Image



**Fig 1:** CT of PNS - Axial section showing bilateral Onodi cell

## Discussion

In the present study, 6.6% of the cases were noted with the presence of Onodi cells. There was a wide variation in the occurrence of onodi cells in different studies of different geographical locations. A study was conducted at the Aga Khan University Hospital, Karachi by **Mohammad Adeel et al**<sup>[5]</sup> in 2013. CT scans of 77 patients were studied. In this study, Onodi cell was observed in 7.8% of the cases. **Perez Pinas et al**<sup>[6]</sup> in 2000 studied 110 CTs of sino nasal region of Spanish population. Patients with suspected inflammatory sinus pathology were included. Onodi cells were found in 10.9% cases. **D. Krishna Chaitanya et al in 2015**<sup>[7]</sup> conducted a study in Department of Radiology in Kamineni Institute of Medical Sciences, Narketpally, Andhra Pradesh on 100 patients with suspected nasal pathology. They observed Onodi cells in 12% cases. **Arslan et al**<sup>[8]</sup> conducted a study on patients who had to undergo functional endoscopic sinus surgery for the treatment of chronic rhinosinusitis. They studied the CT scans of 200 patients with chronic sinusitis and analyzed them to determine the prevalence of anatomical variations. They observed Onodi cells in 12% cases. **Shpilberg KA et al**<sup>[9]</sup> conducted a retrospective evaluation of 192 sinus CT examinations of patients with a clinical history of rhinosinusitis. They also observed Onodi cells in 12% cases. **Mazza D et al**<sup>[10]</sup> in 2007 selected 100 patients who were 45 caucasian women and 55 menaged between 18 and 70 years and performed a 64-slice CT evaluation to find out some important anatomic variants of paranasal sinuses. Onodi cells were observed in 9% cases. **Chandel N S et al**<sup>[11]</sup> in 2015 conducted the study in Bhopal to evaluate the anatomical variation of PNS by CT scan and compared and analyzed congenital anatomical variations of paranasal sinuses in male and female and assessed frequency of anatomical variation of PNS. Onodi cells were found in 5.8% cases. A cross sectional study was conducted at NKP Salve Institute of Medical Sciences, Nagpur by **Nitin V Deosthale et al**<sup>[12]</sup> in 2014. They

performed 'Nasal Endoscopy', and 'Computed Tomography' to find out the prevalence of anatomical variations of nose and paranasal sinuses in Chronic Rhinosinusitis (CRS). They further correlated the above mentioned investigations modalities and also detected the association of such variations in Chronic Rhinosinusitis. They observed Onodi cells in 4.09%. **K Dua et al**<sup>[13]</sup> in 2005 studied the variations of paranasal sinus on CT scan in chronic sinusitis. They studied 50 patients suffering from chronic sinusitis and analyzed their CT Scans for the anatomical variations and changes in osteomeatal complex. They found Onodi cells in 6% cases. A study was performed by **Priyanko Chakraborty et al**<sup>[14]</sup> in 2016 in Sir Sunderlal Hospital, Banaras Hindu University, Varanasi. They included 82 patients in the study. They were subjected to CT scan after being diagnosed as cases of chronic rhinosinusitis on the basis of history and endoscopy of nasal cavity. Onodi cells were found in 10.97% cases. The accuracy of limited CT with the full CT was compared by **Tantilipikorn P et al**<sup>[15]</sup> in 2009. They used them as the tools for standard evaluation for inflammatory diseases of paranasal sinus and the identification of anatomical variations. They observed Onodi cells in 8.33% cases. **Maru Y K et al**<sup>[16]</sup> in 2001 studied the sinonasal CT scan of 61 patients with symptoms of chronic sinusitis and found Onodi cells in 9.8% cases. **Nitinavakarn B et al in 2005**<sup>[17]</sup> performed their study on adult Thai patients and studied the anatomical variations of the paranasal sinuses and the lateral nasal wall. They studied 88 CT scans of paranasal sinuses and orbits retrospectively. Onodi cell was found in 25%.

## Conclusion

In the growing field of Functional Endoscopic Sinus Surgery (FESS), the knowledge of normal anatomical variations has become very important. The surgeon cannot take a single step without knowing the different types of variations because that may lead to inadvertent injury to some of the

vital structures. This study has attempted to find out the prevalence of a very important variation of paranasal sinus region i.e. Onodi cell. When Onodi cell is present between optic nerve and the sphenoid sinus, then optic nerve produces a bulge in the Onodi cell instead of in the sphenoid sinus. So, the presence of Onodi cell is really important to know before performing sphenoid sinus surgery.

Thus, it can be concluded that this study will provide a baseline data for the prevalence of Onodi cell and will help the surgeons to plan for the surgery accordingly. It can also be concluded that the prevalence differs in the different parts of the world including different populations and ethnicities.

### References

1. Ludwick JJ, Taber KH, Manolidis S, Sarna A and Hayman LA. A computed tomographic guide to endoscopic sinus surgery: axial and coronal views. *J Comput Assist Tomogr* 2002; 26: 317-22.
2. Reddy UM, Dev B. Pictorial essay: Anatomical variations of paranasal sinuses on multidetector computed tomography-How does it help FESS surgeons? *Indian J Radiol Imaging* 2012 Oct; 22 (4): 24-317.
3. Keast A, Yelavich S, Dawes P and Lyons B. Anatomical variations of the paranasal sinuses in Polynesian and New Zealand European computerized tomography scans. *Otolaryngol Head Neck Surg* 2008; 139: 216-21.
4. Bradoo R. *Anatomical Principles of Endoscopic Sinus Surgery: A Step by Step Approach*. Jaypee Brothers Medical Publishers (P) Ltd. 2007.p.23.
5. Adeel M, Rajput M S, Akhtar S, Ikram M, Arain A, Khattak YJ. Anatomical variations of nose and paranasal sinuses: CT scan review. *J Pak Med Assoc* 2013 Mar;63(3):317-9.
6. Pinas IP, Sabate J, Carmona A, Catalina-Herrera CJ, Castellanos JJ. Anatomical variations in the human paranasal sinus region studied by CT. *J Anat* 2000 Aug;197(pt2):221-227.
7. Chaitanya D, Suseclamma D, Singh V. Anatomical variations of paranasal air sinuses – A CT scan study. *Journal of the Anatomical Society of India* June 2015;64(1):87-90.
8. Arslan H, Aydinlioglu A, Bozkurt M, Egeli E. Anatomic variations of the paranasal sinuses: CT examination for endoscopic sinus surgery. *Auris Nasus Larynx* 1999 jan;26(1):39-48.
9. Shpilberg KA, Daniel SC, Doshi AH, Lawson W, Som PM. CT of Anatomic Variants of the Paranasal Sinuses and Nasal Cavity: Poor correlation with radiologically significant rhinosinusitis but importance in surgical planning. *American Journal of Roentgenology* June 2015;204(6):1255-60.
10. Mazza D, Bontempi E, Guerisi A, elonti S, Cipolla G, Perrone A, Lomele L, et al. Paranasal sinuses anatomic variants : 64-slice CT evaluation. *Inerve Stomatol* 2007 Jun; 56(6):311-18.
11. Chandel NS, Gupta R, Vyas MM. Computerized Tomographic Evaluation of Anatomical Variations of Paranasal Sinus & Nose. *National Journal of Medical & Dental Research* Oct- Dec 2015;4(1):48-72.
12. Deosthale NV, Sonali P, Singh B, Hrkare VV, Dhoke PR, Dhote KS. Anatomical variations of nose and paranasal sinuses in chronic rhinosinusitis. *People's Journal of Scientific Research* July 2014;vol 7(2).
13. Dua K, Chopra H, Khurana AS, Munjal M. CT scan variations in chronic sinusitis. *Indian J Radiol Imaging* 2005; 15:315-20.
14. Chakraborty P, Jain RK. Radiologic variations of nose and paranasal sinuses: A CT based study. *JMSCR* May 2016;4(5):10536-41.

15. Tantilipikorn P, Churojana A, Chiewwit P, Phuttharak W, Lerdlum S, Aeumjaturapat S, et al. The accuracy of limited CT in the evaluation of chronic rhinosinusitis and for endoscopic sinus surgery: A multicenter study. *Siriraj Medical Journal* 2009;61(1):3-7.
16. Maru YK, Gupta V. Anatomic variations of the bone in sinonasal CT. *Indian Journal of Otolaryngol and Head Neck Surgery* 2001;53:123-28.
17. Nitinavakarn B, Thanaviratananich S, Sangsilp N. Anatomical variations of the lateral nasal wall & paranasal sinuses: A CT study for endoscopic sinus surgery (ESS) in Thai patients. *J Med Assoc Thai* 2005 Jun;88(6):763-8.