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A clinico-radiological study of anatomical variations of nose and para-nasal sinuses in chronic rhinosinusitis patients

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ABSTRACT

Background: There are a lot of anatomical variations in para-nasal sinuses that are responsible for various sinus pathologies. CT scan of paranasal sinuses prior to functional endoscopic sinus surgery has become extremely important to know the anatomy and its variations to avoid complications during surgery.
Methods: This study was performed in 100 patients at King George's Medical University, Lucknow UP, India to compare the anatomical variations between nasal endoscopy and CT scan findings. The outcome measures were deviated nasal septum, paradoxical middle turbinate, concha bullosa, medialized/lateralised uncinate process, pneumatized uncinate process, large ethmoid bulla, accessory ostium, Agger nasii cells, Haller's cells and Onodi cells.
Results: In this study the age of the patients were 30.00±9.56 yrs. with male to female ratio 1.9:1. Deviated nasal septum was the most common anatomical abnormality (70%) followed by large bulla ethmoidalis 17%. Occurrence of different types of special cells were studied which are better visualized on coronal CT scan images. Among these cells Agger nasi was the most common variety (15%) followed by Haller's cells (11%) and Onodi cell (3%). Concha bullosa was present in 8%.
Conclusions: The importance of CT and nasal endoscopy can be seen in patients with persistent symptoms to identify the anatomical variations that may responsible for the development of chronic sinus disease. In cases of sinusitis patients all the para-nasal sinus should be properly investigated to avoid complications.

Keywords: Anatomical variations, Paranasal sinuses, Chronic rhinosinusitis, CT scan, Nasal endoscopy

INTRODUCTION

CT scan has become the investigation of choice for the radiological diagnosis of nasal and paranasal sinus diseases.[1] In comparison to plain X-ray, paranasal sinus CT scan is best to know about the normal as well as variations in anatomical soft tissue and bony details. Proper pre-operative knowledge of paranasal sinus anatomy and its variation helps in the safe functional endoscopic sinus surgery.[2]

Functional endoscopic sinus surgery (FESS) is a common procedure for the sinus pathologies which requires a proper assessment of patient as well as detailed radiological examination to know the sinus anatomy and its variations.[3] The importance of anatomical variations of osteo-meatal complex in the etiology of para nasal disease is well established thus the knowledge of these anatomical variations in each patient is important pre-operatively to avoid injury to surrounding important structures like the orbit and the brain.[4] The aim of this study was to compare the findings of nasal endoscopy

and radiological investigation (CT scan) in terms of various anatomical variations in patients with rhinosinusitis.

METHODS

This study was conducted at tertiary care centre in department of ENT and Head Neck Surgery, King George's Medical University, Lucknow, India from August 2014 to August 2016. Total 100 Patients of chronic rhinosinusitis (age 20-60 years) were included in the study. Patients not giving consent, acute rhinosinusitis, fungal rhinosinusitis, pregnant women, patients with history of previous nasal surgery were excluded from the study. After complete history and clinical examination diagnostic nasal endoscopy and CT scan was done in all the patients. Various anatomical variations of nose and paranasal sinuses in terms of deviated nasal septum, concha bullosa, paradoxical middle turbinate, medialised or lateralised uncinate process, accessory ostia, agar nasii cell, haller cell, Onodi cell were studied.

Statistical analysis

Continuous data were summarized as Mean±SD while categorical groups were compared using chi-square (χ^2) test. A two-tailed (α=2) p value less than 0.05 ($p<0.05$) was considered statistically significant. Analysis was performed using SPSS software (Windows version 17.0).

RESULTS

Total 100 symptomatic patients of either sex were recruited and evaluated. The age of patients were from 16-50 yrs with mean (±SD) 30.00±9.56 yrs and male female ratio 1.9:1 (Figure 1).

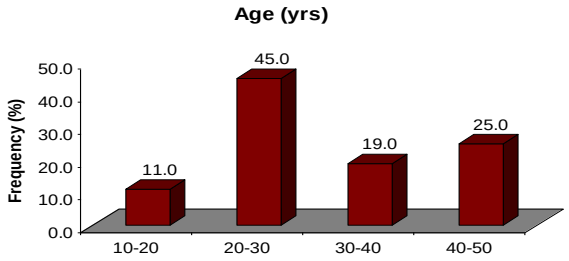

Figure 1: Age distribution of patients.

Table 1: Distribution of common symptoms among patients.

Complaints	Patients (n=100) (%)
Headache	79 (79.0)
Nasal obstruction	64 (64.0)
Nasal discharge	71 (71.0)
Altered sense of smell	19 (19.0)
Facial pain	47 (47.0)

Common symptoms

Among patients, headache (79.0%) was the most common presenting symptom followed by nasal discharge (71.0%), nasal obstruction (64.0%), facial pain (47.0%) and altered sense of smell (19.0%) (Table 1).

Prevalence of sinus opacities

Among patients, maxillary sinusitis was the most common (60.0%) followed by frontal (28.0%), anterior ethmoid (27.0%), posterior ethmoid (20.0%) and sphenoid (9.0%). Posterior ethmoiditis was associated with maxillary and/anterior ethmoid sinusitis (Figure 2).

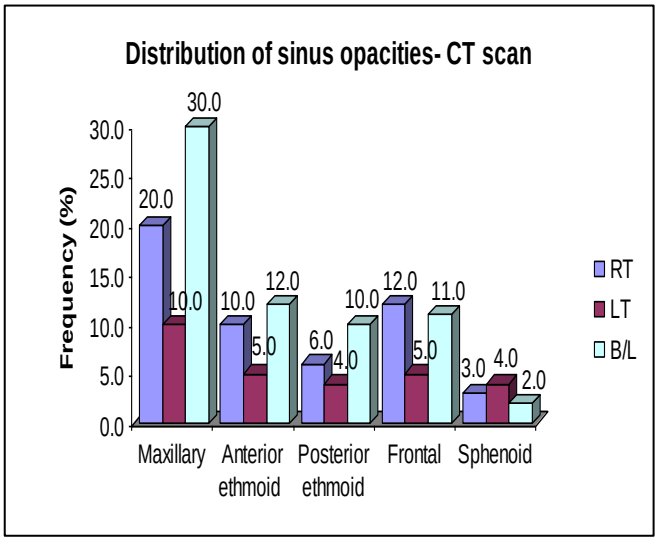

Figure 2: Sinus opacities in patients according to CT scan.

Outcome measures

Various anatomical variants (deviated nasal septum, paradoxical middle turbinate, concha bullosa, large ethmoid bulla, accessory ostium, Agger nasii cells, Haller's cells and Onodi cells) of nose and paranasal sinuses were evaluated on diagnostic nasal endoscopy and CT scan and compared using χ^2 test.

Deviated nasal septum

Both diagnostic nasal endoscopy and CT scan showed 40 (40.0%) on left (LT) and 30 (30.0%) on right (RT) side deviated nasal septum. Comparing the findings of two diagnostics, χ^2 test showed similar findings between the two diagnostics (χ^2=0.00, p=1.000) suggest both diagnostics statistically similar and thus can be used interchangeably in DNS findings (Table 2).

Paradoxical middle turbinate

The paradoxical Middle Turbinate was present in 9 patients on Diagnostic Nasal Endoscopy and CT scan.

Comparing the findings of two diagnostics, χ^2 test showed similar findings between the two diagnostics (χ^2=0.00, p=1.000) suggesting both diagnostics statistically similar and thus can be used interchangeably in paradoxical middle turbinate findings.

Concha bullosa was present in 8% of patients with more on left side. 17 (17.0%) patients had large ethmoid bulla and 18% patients had accessory ostium on diagnostic nasal endoscopy and CT scan.

Agger nasii cells was present bilaterally in 9.0% of patients while 6.0% on left side. 11% patients had Haller's cells while Onodi cell was present in 3% of patients (Table 3).

Table 2: Distribution and comparison of DNS between nasal endoscopy and CT findings in chronic rhinosinusitis patients.

DNS	Nasal endoscopy (%)	CT scan (%)	χ^2 value	p value
LT	40 (40.0)	40 (40.0)	0.00	1.000
RT	30 (30.0)	30 (30.0)		

Table 3: Distribution and comparison of Onodi cells between nasal endoscopy and CT findings in chronic rhinosinusitis patients.

Onodi cells	Nasal endoscopy (%)	CT scan (%)	χ^2 value	P value
LT	0 (0.0)	3 (3.0)	3.05	0.081

DISCUSSION

Advances in the understanding of mucociliary drainage patterns and patho-physiology of paranasal sinus inflammatory disease, coupled with availability of high resolution CT necessitate the clinician to have a precise knowledge of sino-nasal anatomy and the anatomical variants in this region. Detailed knowledge of anatomic structures helps in understanding the localization and extent of the pathophysiology of sino-nasal diseases.

In the present study, normal anatomy of nose and paranasal was observed in only 7% (8.06% males and 5.26% females) whereas the total prevalence of anatomical variations in study population was 93%.

In the present study, most common sinus affected due to infection/inflammation was maxillary sinus (60%). Scribano et al, studied the correlation between anatomic variations of osteomeatal unit and chronic maxillary sinusitis. They examined the paranasal sinuses in 73 consecutive patients using high resolution CT and found 113 anatomic variations of the osteomeatal unit. The following bony anatomic variations were found: Concha bullosa in 67 cases, abnormalities of the uncinate process in 18 cases, Haller cells in 24 cases and large ethmoidal bulla in 4 cases.[4]

In present study of 100 patients, 70% patients had septal deviation on nasal endoscopy and CT scan similar to Perez et al who reported deviated nasal septum in 80%.[5] In fact in various studies the finding of nasal septal deviation ranged from 44% Dua et al, 14.1% to 80%.[7]

In our study prevalence of paradoxical middle turbinate was seen in 9% patients, almost similar to that of 15% Llyod.[8] Concha bullosa was observed in 8% patients consistent with Dutra et al (11%) and Bolger et al, (15.7%).[7,9]

In a study conducted by Saxena et al, medialised uncinate process was seen in 63.33% cases. Medial deflection of uncinate process was previously described in 3-19% of case while in the study conducted by Fadda et al, medialized uncinated process was detected in 22.08% patients.[10,11] In our study medialized and lateralised uncinate process was seen in 18% and 16% respectively while in the study conducted by Fadda et al, lateralized uncinate process was seen in 21.4% patients.[11] Pneumatized uncinate process was seen in 5% in our study consistent with Perez et al, 4% cases and Fadda et al, 2.8% of patients.[6,11]

In our study large ethmoid bulla was seen in 17% of patients while Scribano et al, Fadda et al, and Krzeski et al, reported large ethmoid bulla in 32.8%, 26.75% and 3.5% patients respectively.[4,11,12]

In our study Agger nasii cells and Haller's cell was present in 15% and 11% patients respectively consistent with while Dutra et al, Fadda et al and Krzeski.[8,11,12] Onodi cell was present in 3% patients, consistent with Perez et al 10% patients, Fadda et al, (8.5%) and Nouraei et al, (4.7%).[6,11,14]

CONCLUSION

Due to wide range of anatomical variations in nose and paranasal sinuses, it is mandatory to detect such type of variations prior to every endoscopic sinus surgery. Every individual should be planned carefully to avoid complications. Diagnostic nasal endoscopy as well as CT scan provides details about such types of variations.

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REFERENCES

1. Adeel M, Muhammad S, Akhter S, Mubasher I, Arain A, Khattak Y. Anatomical variations of Nose and paranasal sinuses; CT scan review. JPMA. 2013;63(3):317-9.

2. Bradoo R. Endoscopic anatomy. In: Anatomic principles of Endoscopic sinus surgery: A step by step approach Edn. New Delhi: Jaypee Bros; 2005:59-70.
3. Benninger MS, Ferguson BJ, Hadley JA, Hamilos DL, Jacobs M, Kennedy DW, et al. Adult chronic rhinosinusitis: Definitions, diagnosis, epidemiology, and pathophysiology. Otolaryngol Head Neck Surg. 2003;129(3):1-32.
4. Scribano E, Ascenti G, Loria G, Cascio F, Gaeta M. The role of the ostiomeatal unit anatomic variations in inflammatory disease of the maxillary sinuses. Eur J Radiol. 1997;24:172-4.
5. Perez P, Sabate J, Carmona A, Catalina-Herrera CJ, Jimenez-Castellanos J. Anatomical variations in the human paranasal sinus region studied by CT. J Anat. 2000;197:221-7.
6. Dua K, Chopra H, Khurans AS, Munjal M. CT scan variations in chronic sinusitis. Ind J Radio Imag. 2005;15:315-20.
7. Dutra DL, Marchiori E. Helical CT of the paranasal sinuses in children: evaluation of inflammatory sinus disease. Radiol Bras. 2002;35:161-6.
8. Llyod GA, Lund VJ, Scadding GK. CT of the paranasal sinuses and functional endoscopic surgery: a critical analysis of 100 symptomatic patients. J Lar Oto. 1991;105:181-5.
9. Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and Mucosal abnormalities. CT analysis for endoscopic sinus surgery. Laryngoscope. 1991;101:56-4.
10. Saxena R, Kanodia V, Srivastava M. Role of CT paranasal sinuses and diagnostic nasal endoscopy in the treatment modification of chronic rhinosinusitis. Gujarat J Otorhinolar Head Neck Surg. 2010;7(1):7-11.
11. Fadda GL, Rosso S, Aversa S, Petrelli A, Ondolo C, Succo G. Multiparametric statistical correlations between paranasal sinus anatomic variations and chronic Rhinosinusitis. Acta Otorhinolaryngol Ital. 2012;32(4):244-51.
12. Krzeski A, Tomaszewska E, Jakubczyk I. Anatomic variations of the lateral nasal wall in the chronic rhinosinusitis. Am J Rhinol. 2001;15:3715.
13. Van Alyea OE. Ethmoid labyrinth: anatomic study, with consideration of the clinical significance of itsstructural characteristics. Arch Otolaryngol Head Neck Surg. 1939;29:881-01.
14. Nouraei SAR, Elisay AR, Dimarco A. Variations in paranasal sinus anatomy: implications for the pathophysiology of chronic rhinosinusitis and safety of endoscopic sinus surgery. J Otolaryngology Head Neck Surg. 2009;38:32–7.

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