

Original Research Article

Correlation of anatomical variations in chronic sinusitis with diagnostic nasal endoscopy and CT scan of paranasal sinuses: an observational study

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Received: 16 October 2018

Revised: 31 October 2018

Accepted: 02 November 2018

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ABSTRACT

Background: Drainage and ventilation of paranasal sinuses are important for normal function which depends on effective mucociliary clearance. In present study we tried to emphasize variations in lateral wall of nose and clinical features leading to nose and paranasal sinus disease using diagnostic nasal endoscopy and variations in CT scan of paranasal sinuses. The objectives of the study are to observe various anatomical variations in nose and paranasal sinuses and their clinical presentation using diagnostic nasal endoscopy and CT scan of paranasal sinuses and to compare various anatomical variations in nose and paranasal sinuses.

Methods: Present study included 54 patients presenting in Department of ENT, Head and Neck Surgery, during February 2015 to February 2017.

Results: Diagnostic nasal endoscopy findings reveal that most common finding was polypoidal changes in nasal mucosa in 36 (66.67%) of patients, followed by mucopurulent discharge in 26 (48.14%), postnasal discharge in 20(37.03%) and 4 (7.40%) patients showed prominent agger nasi cell. CT scan of paranasal sinuses revealed multiple sinus involvement in 41 (75.92%) of patients with partial involvement of sinuses. Complete sinus opacification with pan sinusitis was observed in 9 (16.67%), blockade at osteomeatal complex was observed in 46 (85.18%), paradoxical middle turbinate was observed in 5 (9.25%), Concha bullosa was observed in 12 (22.23%) of patients.

Conclusions: Each variation have an anatomic and surgical significance, hence each and every case should be individually studied in detail before undergoing functional endoscopic sinus surgery to maximize patient benefit and to prevent unnecessary complications. Diagnostic nasal endoscopic examination is clinical guide to evaluate disease.

Keywords: Paranasal sinus diseases, CT scan para nasal sinus, Endoscopic sinus surgery

INTRODUCTION

Chronic sinusitis is the chronic inflammation of mucous membrane of nose and one or more of paranasal sinuses. In the early life during fetal development, the paranasal sinuses originate as invagination of the nasal mucosa into the lateral nasal wall, frontal, ethmoid, maxilla and the sphenoid bones. This unique development explains the

enormous amount of anatomical variation.¹ Drainage and ventilation of paranasal sinuses are important for the normal function which in turn depends on effective mucociliary clearance.² Patency of the pathways through which the sinuses drain is crucial of adequate mucociliary function and subsequent sinus drainage. Osteomeatal complex obstruction may lead to fluid accumulation and stagnation, creating a moist, hypoxemic environment ideal for growth of pathogens.³

Certain anatomic variations of the lateral wall of the nose are very important because they contribute to the blockage of the osteomeatal units, drainage, and ventilation and can thereby increase the risk of sinus mucosal disease.⁴ Anatomic variations - such as deviation of the nasal septum, concha bullosa or paradoxical middle turbinate, agger nasi cell, lateral or medial attachment of uncinat process, and Haller cells affect the drainage and ventilation of Para nasal sinuses.⁵ Also these anatomic variants need to be specifically sought as part of the pre-operative evaluation as they have a potential impact on the safety of the patient during surgery.

Although chronic sinusitis is a clinically diagnosable condition, imaging studies are essential for assessing the extent of the disease and planning for surgical treatment. Diagnostic nasal endoscopy and CT scan of paranasal sinuses have been used potential diagnostic modalities in understanding the anatomy of sinus diseases.⁶ These investigations help us to delineate mucosal disease, demonstrate a primary obstructive pathology and bony anatomic variations of paranasal sinuses.

Functional endoscopic sinus surgery is being preferred as treatment of choice for chronic sinusitis. Surgeons should require a detailed anatomy of osteomeatal complex of nose and paranasal sinuses and its anatomical variations to prevent complications during surgery.⁷

In the present study we tried to emphasize the variations in lateral wall of the nose and their clinical features leading to nose and paranasal sinus disease using diagnostic nasal endoscopy and their variations in CT scan of paranasal sinuses.

Objectives

- To observe the various anatomical variations in the nose and paranasal sinuses and their clinical presentation using diagnostic nasal endoscopy and CT scan of paranasal sinuses and to compare the various anatomical variations in the nose and paranasal sinuses.

METHODS

The present study included 54 patients presenting in Department of ENT, Head and Neck Surgery, during February 2015 to February 2017.

Patients presenting with chronic sinusitis with symptoms persisting beyond three months despite adequate medical treatment were included in the study. Patients with allergic rhinitis, chronic sinusitis with complications of orbital cellulitis, osteomyelitis, meningitis, and mucocoeles and also patients with previous history of nose and paranasal sinus surgeries were excluded from the study.

After obtaining a detailed clinical history, patients underwent complete ear, nose, and throat examination. Diagnostic nasal endoscopy was performed in all these patients to observe the anatomical variations and their clinical presentation. Further evaluation of these patients was done using CT scan of paranasal sinuses coronal section with 3 mm cuts at osteo meatal complex.

RESULTS

Role of sinonasal anatomical variations in the causation of chronic rhinosinusitis is still debated though it cannot be ruled out altogether. In the present study a total of 54 cases suffering with chronic rhinosinusitis were studied for their various anatomical variations in lateral wall of nose and their clinical features were studied through diagnostic nasal endoscopy and CT scan of paranasal sinuses images.

In the present study 54 patients were selected for the anatomical variations in the nose. When the clinical symptoms of the patients were analyzed it was observed that the most common symptom in our study was nasal obstruction (74.07%), followed by headache, and nasal discharge. The details of these findings were mentioned in the Table 1 mentioned below.

Table 1: Clinical features of the patients of sinusitis (n=54).

Clinical symptom	No. of patients	%
Nasal obstruction	40	74.07
Headache	36	66.67
Nasal discharge	30	55.55

Clinical examination of these patients revealed that patients presented with deviated nasal septum, turbinate hypertrophy and paradoxical middle turbinate. The details of clinical presentation of these patients were mentioned in the Table 2 mentioned below.

Table 2: Clinical examination findings of patients of sinusitis (n=54).

Clinical examination finding	No. of patients	%
Deviated nasal septum	36	66.67
Turbinate hypertrophy	10	18.51
Paradoxical middle turbinate	4	7.40

Diagnostic nasal endoscopy findings reveal that the most common finding was polypoidal changes in nasal mucosa in 36 (66.67%) of patients, followed by mucopurulent discharge and postnasal discharge. Prominent agger nasi cell was seen in 4 (7.40%) of patients. These results were mentioned in the Table 3 mentioned below.

Table 3: Diagnostic nasal endoscopy findings of patients of sinusitis (n=54).

Diagnostic nasal endoscopy finding	No. of patients	%
Polypoidal changes of nasal mucosa	36	66.67
Mucopurulent nasal discharge	26	48.14
Post nasal discharge	20	37.03
Prominent agger nasi cell	4	7.40

In our study CT scan of paranasal sinuses revealed multiple sinus involvement in 41 (75.92%) of patients with partial involvement of the sinuses. Complete sinus opacification with pan sinusitis was observed in 9(16.67%) of patients. Other CT scan findings include blockade at the osteomeatal complex, paradoxical middle turbinate, concha bullosa. These results were mentioned in Table 4 mentioned below.

Table 4: CT scan findings in patients of chronic rhinosinusitis (n=54).

CT scan findings	No. of patients	%
Multiple sinus involvement	41	75.92
Complete sinus opacification with pan sinusitis	9	16.67
Osteomeatal complex blockade	46	85.18
Paradoxical middle turbinate	5	9.25
Concha bullosa	12	22.23
Uncinate process variation	17	31.48
Onodi cell	3	5.55
Haller cell	1	1.85
Supraorbital pneumatization	1	1.85
Frontal sinus variations	29	53.70

Similarly variations in the attachment of the uncinate process was observed in 17 (31.48%) with most common variation of attachment being observed as attachment to skull base in 9 (16.67%) of patients.

When the presence or absence of individual sinus cells was analyzed it was observed that Onodi cell was present in 3 (5.55%), other cells like Haller cells were observed in 1 (1.85%), and supraorbital pneumatization was observed in 1 (1.85%) of the patients. When the variations in frontal sinus cells were analyzed it was observed that Type I air cells was most common in 29(53.70%) of patients. When the variations in Sphenoid sinus was compared it was observed that presellar pneumatization was observed in 2 (3.70%) of patients, postsellar pneumatization was observed in 36 (66.67%) of patients.

DISCUSSION

Rhinosinusitis has a significant impact on the quality of life of affected individuals. The causes of chronic

rhinosinusitis are multiple and include infectious viral, bacterial, and fungal, allergic, anatomic, mucociliary dysfunction due to cystic fibrosis, primary or acquired ciliary dyskinesia and systemic disorders.⁸

The most common anatomical variation in the present study was deviated nasal septum (66.67%). The mere presence of a septal deviation does not suggest pathology. However, a marked deviation can force the middle turbinate laterally, thus narrowing the entrance to the middle meatus and ultimately blocking drainage of the ipsilateral maxillary, anterior ethmoid and frontal sinuses that leads to sinusitis. The prevalence of deviations of nasal septum as reported as 57.1% by Chandrasekhar et al, 73.2% by Murthy et al, 79.2% by Madani et al.⁹⁻¹¹ However, some studies have not demonstrated a causal relationship between nasal septal deviation and sinusitis.

The next most common anatomical variation in the present study is anatomical variations of the middle turbinate and its attachments. In the present study pneumatized middle turbinate was seen in 18.5% of cases. Literature reports a wide variation in the incidence of middle turbinate pneumatization and is as follows Chandrasekhar et al (16.6%), Murthy et al (45.5%).^{9,10}

Concha bullosa of middle turbinate causes recurrent sinusitis and it may be due to its negative influence on paranasal sinus ventilation and mucociliary clearance in the middle meatus region. If the concha is expanded significantly, it will limit the exposure of surgical field, and also block osteomeatal complex thus leading to sinusitis.¹² In the present study paradoxical middle turbinate was seen in 7.4% of cases.

A middle turbinate that is concave medially rather than laterally is called paradoxical. Usually paradoxical turbinates occur where the maxillary sinus is hyperplastic. The overgrowth causes the mucosa to buckle and fold inwards, with the resultant curve pointing towards the septum. Exaggeratedly curved paradoxical turbinate compresses the uncinate process leading to middle meatal obstruction leads to sinusitis.² Stammberger and Wolf accepted paradoxical curvature of the middle turbinate as an etiological factor for chronic sinusitis because it may cause obliteration or alteration in nasal air flow dynamics.¹³

Other anatomical variant in our study was prominent agger nasi cell seen in 7.4% of patients. The agger nasi is the most superior remnant of the first ethmoturbinate, which persists as a mound or tuberosity immediately anterior and superior to the insertion of the middle turbinate. An agger nasi cell results when this area becomes pneumatized. These increased dimensions of the agger nasi cell in patients may lead to frontal sinusitis. The clinical importance of agger nasi cell as defined by Brunner et al in 1996 states that the cell and its extensive pneumatization with consequent narrowing of the frontal sinus ostium is the main and clinically significant cause

of persistent front ethmoid pain and chronic frontal sinusitis.¹⁴

CONCLUSION

It is observed that people who are suffering from the nasal obstruction with one or more anatomical variations are prone for chronic sinusitis. Each variation have an anatomic and surgical significance, hence each and every case should be individually studied in detail before undergoing functional endoscopic sinus surgery to maximize patient benefit and to prevent unnecessary complications. Diagnostic nasal endoscopic examination is the clinical guide to evaluate the disease. Deviated nasal septum is the major anatomical variation leading to chronic sinusitis followed by concha bullosa, paradoxical middle turbinate and prominent agger nasi cell. CT scan of the paranasal sinuses is the investigation of choice to evaluate the osteomeatal complex anatomy with greater accuracy to study the anatomical variations causing chronic sinusitis.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Babu GR, Kumar GR, Chaitanya VK. Correlation of anatomical variations in chronic sinusitis with diagnostic nasal endoscopy and CT scan of paranasal sinuses: an observational study. Int J Otorhinolaryngol Head Neck Surg 2019;5:41-4.