Study of anatomical variations on CT scan in chronic sinusitis

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ABSTRACT

Chronic rinosinusitis develops due to the narrowing of the space inside nose and sinus osteum region due to the inflammation for more than 3 months. Inflammation of the nose and parasinus cause obstruction of the sinus osteum, which results in the stagnation of secretions and further infection leads to rinosinusitis. Any anatomical variation at this region impairs the normal nasal function and predispose to recurrent and chronic rinosinusitis. This is a prospective study conducted on 100 patients diagnosed with chronic rhinosinusitis. All patients included in this study underwent diagnostic nasal endoscopy and CT scan of paranasal sinuses. Every possible anatomical variations are evaluated in this study. Out of 100 patients with CRS,55 were male and 45 females. CT scan of 100 patients with CRS was analyzed, the most common variation we found was the DNS, 90% of the patients had septal deviation, followed by hyperpneumatized ethmoid bulla 85%, and the agger nasi pneumatization in 82%. concha bullosa of 63%, paradoxical middle turbinate and middle turbinate sinus were 20% and 15% respectively. Haller cell were seen in 26%, and onodi in 55%, Optic nerve dehiscence and anterior clinoid process pneumatization also were observed in 9% and 32% respectively. Uncinate process pneumatization was not observed in any of the cases, where as crista galli pneumatization was seen in 3. Among all the sinuses, maxillary sinus was most commonly affected and it was showing the maximum number of anatomical variations, while sphenoid is the least detected. This study supports a significant correlation between the anatomical variation and chronic rhinosinusitis.

Keywords: NIL

INTRODUCTION

Chronic rhinosinusitis is the chronic inflammation of the mucous membranes of nose and paranasal sinuses, with duration of symptoms more than 12 weeks. It is a common disease, which affects around 15% of Indian population [1] and it impairs the quality of life in affected individuals. About 50 million people were affected with sinusitis every year. Rhinosinusitis is the fifth most common disease of paranasal sinuses (PNS) for which the antibiotics are prescribed [2]. Diagnosis of CRS is completely based on the clinical evaluation and nasal endoscopy. CRS is mainly due to the obstruction of the sinus ostia or due to abnormality of the mucociliary action. Any obstruction in the drainage pathway results in stasis of the mucus in the sinuses. This predisposes to further infections and causes rhinosinusitis. Most common site of obstruction is at the sinus ostia region (lateral nasal wall). There are considerable anatomical variations in this area that may interfere with normal nasal function and predispose to recurrent or chronic sinusitis [3].Co-relation between anatomical variations in the sinonasal region and the incidence of chronic rhinosinusitis has been extensively studied.

Aim of this study:

To study the frequency of occurrence of different anatomical variations in CT of paranasal sinuses

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To associate the anatomical variations in CT with the disease

To study the mode of presentation and symptomatology of the disease

MATERIAL AND METHODS

This is a prospective study conducted in the ENT opd in our hospital. Duration of the study was 2years with a sample size of 100. All patients who are diagnosed with CRS about the age of 12 were included in the study. Patients with acute sinusitis, malignancy and undergone previous nasal surgery were excluded. Detailed history of the patients with symptoms of sinusitis was taken, followed by a complete nose and paranasal sinus examination. Diagnosis of CRS was made based on the Task Force on Rhinosinusitis in 1997(Table-1) [4,5]. Initial medical management was given to the patients with symptoms, after completing the full course of medical therapy Diagnostic nasal endoscopy was done. CT scan was performed in all patients who were diagnosed with chronic rhinosinusitis. Unenhanced CT scan of the PNS was performed and these patients were evaluated in mucosal and bone windows in the coronal and axial planes with 5mm cuts were performed. Every possible anatomical variation in CT was noted.

Major factors	Facial pressure
	Facial congestion/fullness
	Nasal obstruction/blockage
	Anosmia/hyposmia
	Nasal discharge/purulence/discolored
	postnasal drainage
	Purulence in nasal cavity on examination
	Fever (acute rhinosinusitis only)
Minor factors	Fatigue
	Halitosis
	Cough
	Fever (all non acute)

Table 1: Modified Rhinosinusitis Task Force Diagnostic (RSTF) Criteria for CRS

OBSERVATION AND RESULTS

This study involves cases of 100 patients, with an age group between 10-70 years. The youngest among the group is 13 years and the eldest is 67, and the highest incidence of CRS is seen in the age group of 25-39. Comparing the sex predominance 55 was male and 45 were females, Male-female ratio of 1.2:1 which was clinically insignificant. We have considered all the presenting symptoms included in this study. 95% of the patients presented with nasal obstruction(31.4% is bilateral and 32% unilateral), 68% patients with PND, 67% patients with headache, 51% had facial fullness,47% had rhinorrhoea, 42% patients had allergy as one of the symptoms, 21% patients had smell disturbances (13 had anosmia and 8 had hyposmia). CT scan of 100 patients with CRS was analyzed and various anatomical variations were considered. In this study the most common variation

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we found was the DNS, 90% of the patients had septal deviation, followed by hyperpneumatized ethmoid bulla 85%, and the agger nasi pneumatization in 82%. Variations over the middle turbinate like concha bullosa, paradoxical middle turbinate and middle turbinate sinus were also considered. We found that concha bullosa of 63%, paradoxical middle turbinate and middle turbinate sinus were 20% and 15% respectively. Haller cell

were seen in 26%, and onodi in 55%, Optic nerve dehiscence and anterior clinoid process pneumatization also were observed in 9% and 32% respectevily. We have observed that two or more anatomical variations were present in the same patient in many cases. Uncinate process pneumatization was not observed din any of the cases, where as crista galli pneumatization was seen in 3 cases out of 100.
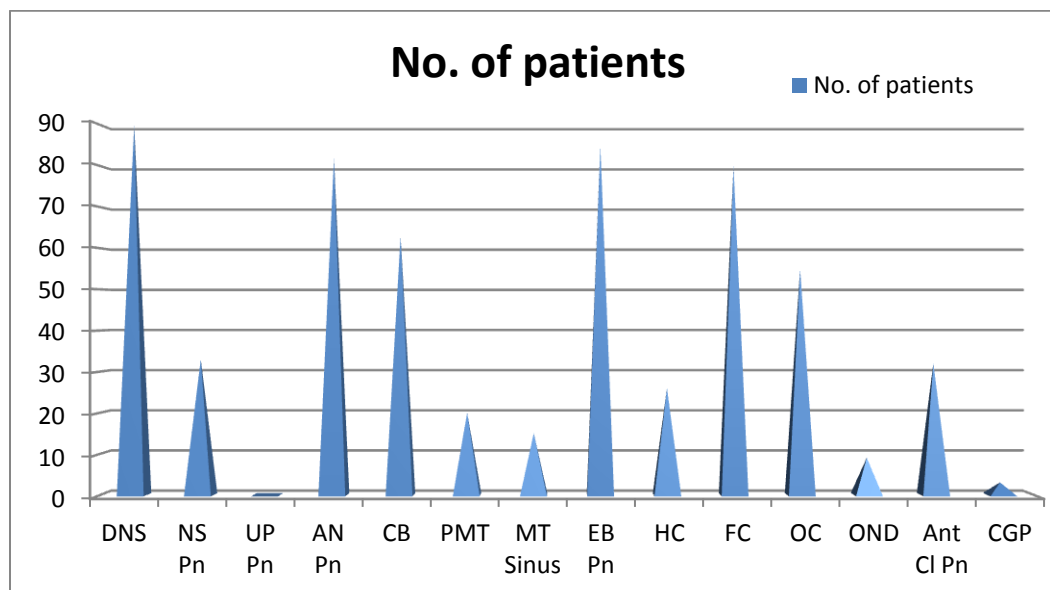
Graph 1: Distribution of anatomical variation seen in CT PNS

Among all the sinuses, maxillary sinus was most commonly affected and it was showing the maximum number of anatomical variations. Pneumatized ethmoid bulla 48.9% was observed in maximum number of patients with maxillary sinusitis, followed by pneumatized agger nasi 83.3%. Concha bullosa was affected in 72.2% of the patient with maxillary sinusitis, 24% with paradoxical middle turbinate and 14.8% with middle turbinate sinus. Haller cell was seen in 27.7% of the cases with maxillary sinusitis, haller cell was seen bilaterally in all the cases.

Anatomical variation	Maxillary sinusitis	Ethmoid sinusitis	Frontal sinusitis	Sphenoid sinusitis	Pan sinusitis
Nasal septal deviation (DNS)	47	30	14	11	26
Nasal septal pneumatization (NS Pn)	17	14	4	4	11
Uncinate process pneumatization (UP Pn)	0	0	0	0	0
Pneumatised agger nasi (AN Pn)	45	28	10	10	25

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Concha bullosa (CB)	39	23	8	9	14
Paradoxical middle turbinate (PMT)	13	10	5	4	3
Middle turbinate sinus (MT sinus)	8	7	3	2	3
Pneumatised ethmoid bulla (EB Pn)	48	32	13	12	25
Haller cell (HC)	15	8	1	2	9
Frontal cell (FC)	44	29	13	12	21
Onodi cell (OC)	28	19	6	8	17
Optic nerve dehiscence (OND)	5	5	0	2	2
Anterior clinoid process pneumatization (Ant cl Pn)	15	11	2	5	10
Crista galli pneumatization (CGP)	2	1	0	0	1

Table 2: Distribution of anatomical variation in association with sinusitis

Out of 100 cases, 36 patients were affected with ethmoidal sinusitis, in which maximum showed pneumatized ethmoidal bulla as an anatomical variant 88.9%. Frontal cell, DNS and pneumatized agger nasi found in 80.5%, 83.3% and 77.8% respectively. Paradoxical middle turbinate noticed in 27.8%, Middle turbinate sinus in 19.4%, Haller cell in 22.2%, Pneumatized septum in 38.8% and Onodi cell in 52.8% cases with ethmoidal sinusitis.

15 patients were affected with frontal sinusitis, in which maximum got nasal septal deviation 93.3%,

followed by ethmoid bulla and frontal cell 86.7%. 66.7% showed pneumatized agger nasi in patients with frontal sinusitis, 53.3% had concha bullosa, 40% showed onodi cell.

Among 14 patients who had sphenoid sinusitis showed 12 patients showed pneumatized ethmoid bulla, 11 had septal deviation. 9 patients out off 14 had concha bullosa, 5 with anterior clinoid process pneumatisation, 8 patients with sphenoid sinusitis had Onodi cell in the CT scan.
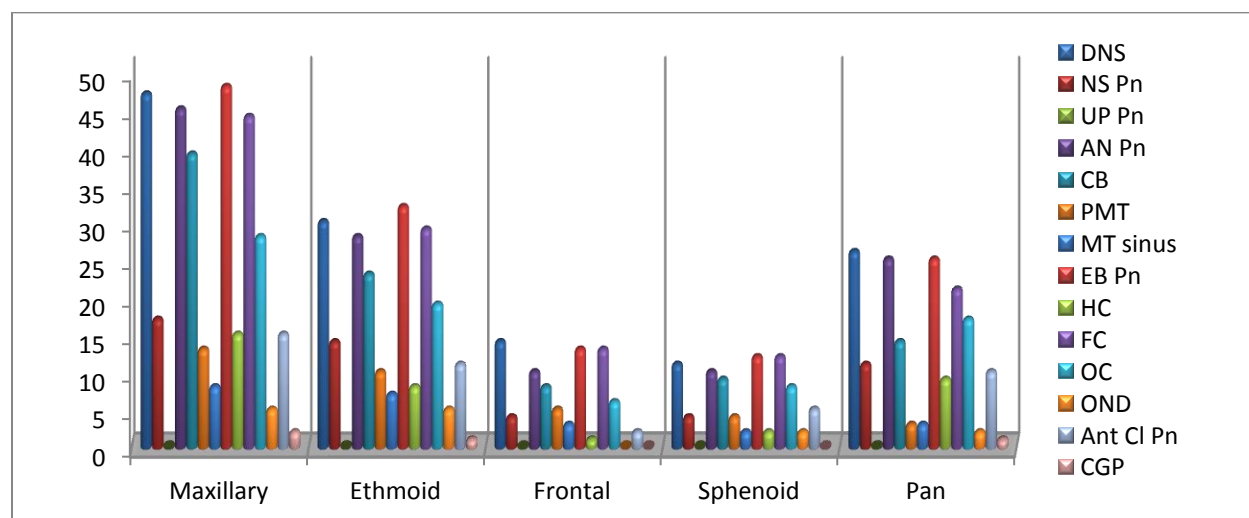
Graph 2: Distribution of anatomical variation in association with sinusitis

DISCUSSION

In order to study the association of the anatomical variations in the sinusitis patients, we have selected 100 cases. After taking a detailed history and nasal endoscopic examination, we have analyzed the CT scan of these chronic sinusitis patients. We randomly chose 100 cases with male female ratio of 1.2:1. This ratio falls well within 2:1 as reported by Moorthy et al. [6], and that reported in Madani et al. [7] which is 0.9:1. The most frequently observed anatomical variations in our study were mainly DNS (90% of cases), followed by pneumatized ethmoid bulla (85%) and agger nasi (82%). Concha bullosa was observed in 63% of patients, while onodi cell and haller cell were found in 55% and 26% respectively. We also note that uncinate process pneumatization was not noticed in any of the patients. Chakraborty et al. [8] and Moorthy et al. [6] also detected DNS as the most frequent anatomical variations in their study, which are 93% and 91% respectively. Among the 100 cases, we observed that the maximum people were affected with maxillary sinusitis (54), followed by ethmoid (36), sphenoid (14) and frontal (15) sinusitis on the other hand were the least commonly observed. Some of the patients presented with two or more types of sinusitis. These results are well in agreement with many studies, namely Chakraborty et al.[8], Mundra et al.[9] and Calhoun et al.[10], in which maxillary sinusitis were the most commonly observed. Fadda et al. [11], Mohebbi et al. [12] also noticed that sphenoid and frontal sinusitis is the less frequently observed sinusitis.

CONCLUSION

We have randomly chosen 100 cases who presented with sinusitis. We did not find significant difference in the male female ratio. We noted that the most frequently observed sinusitis is maxillary, while sphenoid is the least detected. The highly noticed anatomical variation is DNS, followed by ethmoid bulla and agger nasi. We did not find any case in which the patient had pneumatised uncinate process. It is also interesting to note that we found a significant amount of patients who have two or more anatomical variations.

We have found that, apart from DNS, pneumatised agger nasi is mostly associated with maxillary sinusitis however ethmoid sinusitis is closely associated with pneumatized ethmoid bulla. In the case of frontal and sphenoid sinusitis pneumatised ethmoid bulla and frontal cells are frequently observed. In pan sinusitis pneumatized agger nasi and pneumatised ethmoid bulla were commonly seen. Hence, this study supports a significant connection between the anatomical variations and sinusitis.

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