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A PROSPECTIVE STUDY OF SINONASAL VARIATIONS BY CT SCAN AND NASAL ENDOSCOPY IN CHRONIC SINUSITIS

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Abstract

Introduction: The two cardinal factors in the maintenance of normal physiology of the paranasal sinuses and their mucous membranes are drainage and ventilation. Mucous transport from the sinuses into the nose is greatly enhanced by unimpeded nasal airflow creating negative pressure within the nasal cavity during inspiration.[1] The secretions of the various sinuses do not reach their respective ostia randomly, but by definite pathways which seem genetically determined. The two of the largest sinuses, the frontal and maxillary, communicate with the middle meatus via narrow and delicate prechambers. In each of these prechambers, the mucosal surfaces are closely opposed such that mucus can be more readily cleared by an effective ciliary action on two or more sides.

Materials and Methods: This present study is a prospective study of sinus diseases using diagnostic endoscopy and computed tomography was conducted in the Department of ENT, Rangaraya Medical College, Kakinada from January 2023 to December 2023. All the patients attending the ENT Outpatient Department, who had chronic sinusitis for more than three months' duration not responding to the medical line of treatment and who were willing to undergo Functional Endoscopic Sinus Surgery.

Results: Pneumatization of agger nasi was seen in 72 (72%) nasal cavities. When present, the agger cells were always bilateral. The frontal sinus was present in 93 (93%) cases, absent in 10 (6.25%) cases and Hyperpneumatized in 28 (27.5%). The sinus was larger on the right in 48 subjects and on the left in 52 subjects. Interfrontal cells were seen in 16 (16%). The frontal recess was found to be obstructed in 28 of 100 (28%). Of these 16 (57%) were on the right and 12 (43%) were on the left. The obstruction was caused by agger nasi cells in 12 (43%), ethmoidal bulla or accessory cells in 8 (28.5%) and polyps in 8 (28.5%).

Conclusion: All the variations of sinonasal anatomy described in literature except the presence of supreme turbinate were encountered in our study. The medialized uncinate process (Double middle turbinate) was most common uncinate process variation and pneumatized middle turbinate was the most common middle turbinate variation. Extramural pneumatization like septal, supraorbital, sphenoid wing and pterygoid plates was quite common. The depth of olfactory fossa was of Keros type II in majority of patients.

Key Words: paranasal sinuses, chronic sinusitis, sinonasal anatomical variation, Functional endoscopic sinus surgery.

INTRODUCTION

The two cardinal factors in the maintenance of normal physiology of the paranasal sinuses and their mucous membranes are drainage and ventilation. Mucous transport from the sinuses into the nose is greatly enhanced by unimpeded nasal airflow creating negative pressure within the nasal cavity during inspiration.[1] The secretions of the various sinuses do not reach their respective ostia randomly, but by definite pathways which seem genetically determined. The two of the largest sinuses, the frontal and maxillary, communicate with the middle meatus via narrow and delicate prechambers. In each of these prechambers, the mucosal surfaces are closely opposed such that mucus can be more readily cleared by an effective ciliary action on two or more sides.[2]

However, when surfaces become more closely apposed due to mucosal swelling, the ciliary action is immobilized. This impairs the ventilation and drainage of larger sinuses, result in mucus stasis, predispose to further infection and establish a vicious cycle causing chronic sinusitis. The key region for these changes is that part of the lateral nasal wall that encloses the sinus ostia and their adjacent mucosa and prechambers.[3]

There is considerable anatomical variation in this area that may interfere with normal nasal function and predispose to recurrent or chronic sinusitis. Functional endoscopic sinus surgery restores normalcy by working on the key regions rather than on the larger sinuses.[4] The safe and effective performance of any surgery is dependent on a sound knowledge of anatomy. This is most true during endoscopic sinus surgery because of the intimate association with such vital structures as the orbit, optic nerve, anterior and posterior ethmoidal vessels, skull base and internal carotid artery.[5]

The difficulty is compounded by the occurrence of variations in sinonasal anatomy. The incidence with which these variations are seen in a normal population is less frequent than in those individuals with chronic sinusitis. The incidence of the sinonasal anatomical variation reported in literature shows considerable variation between populations. This study aims to study the various sinonasal anatomical variations in our population.

MATERIALS AND METHODS

This present study is a prospective study of sinus diseases using diagnostic endoscopy and computed tomography was conducted in the Department of ENT, Rangaraya Medical College, Kakinada from January 2023 to December 2023.

Source of Data

All the patients attending the ENT Outpatient Department, who had chronic sinusitis for more than three months' duration not responding to the medical line of treatment and who were willing to undergo Functional Endoscopic Sinus Surgery.

Sample Size: 100

Sampling: Prospective Study

Inclusion Criteria

All the patients with clinically proven chronic sinusitis not responding to routine medical line of treatment.

Exclusion Criteria

1. Patients with acute attack of sinusitis.

2. Patient with sinus malignancies.

3. Patient who were not willing to undergo FESS.

Methods of Collection of Data

1. The cases selected for the study were subjected to detailed history taking and examination.

2. A routine haemogram (HB, BT, CT, TC, DC) and urine examination (Albumin, Sugar, Microscopy), swab from middle meatus for culture sensitivity along with X-ray paranasal sinuses were done for the patients.

3. All the patients in active stage of the disease were treated with course of suitable antibiotic, systemic antihistamines and local decongestants. They were also treated for medical conditions like diabetes mellitus, hypertension, nasal allergy. No patient received steroid therapy or immunotherapy.

4. Each patient underwent a systematic diagnostic nasal endoscopy and computed tomography of nose and paranasal sinuses.

RESULTS

The following was the incidence of various skull base types.

1. Keros Type I: 12 (12%).

2. Keros Type II: 64 (64%).

3. Keros Type III: 24 (24%).

SKULL BASE TYPES		
Variation	**Number**	**Percentage**
Keros Type I	12	12
Keros Type II	64	64
Keros Type III	24	24

Table 1: Showing Variations of Skull Base Configuration

Pneumatization of agger nasi was seen in 72 (72%) nasal cavities. When present, the agger cells were always bilateral.

The frontal sinus was present in 93 (93%) cases, absent in 10 (6.25%) cases and Hyperpneumatized in 28 (27.5%). The sinus was larger on the right in 48 subjects and on the left in 52 subjects. Interfrontal cells were seen in 16 (16%).

The frontal recess was found to be obstructed in 28 of 100 (28%). Of these 16 (57%) were on the right and 12 (43%) were on the left. The obstruction was caused by agger nasi cells in 12 (43%), ethmoidal bulla or accessory cells in 8 (28.5%) and polyps in 8 (28.5%).

Variation	Number	Percentage
Typical	50	50
Paradoxically curved	12	12
Pneumatized	34	34
Large non-pneumatized	4	4

Table 2: Middle Turbinate Variations

The uncinate was typical in 58 (58%), medialized in 44 (44%), anteriorly turned in 2 (2%), hypertrophied in 12 (12%) and pneumatized in 4 (4%). The superior attachment of the uncinate process was as follows: middle turbinate in 44 (42%), lamina papyracea in 36 (36%) and skull base in 22 (22%).

Attachment	Number	Percentage
Middle turbinate	42	42

Lamina papyracea	36	36
Skull base	22	22

Table 3: Uncinate Superior Attachment

Typical	62	62
Large	22	22
Hypoplastic	16	16

Table 4: Ethmoidal Bulla Variations

S.No	1	2	3	4	5	6
Parameter	**Middle Turbinate**	**Middle Meatus**	**Bulla Ethmoidalis**	**Hiatus Semilunaris**	**Frontal Recess**	**Sphenoethmoid Recess**
Normal DE(N) +CT (N)	76	54	64	50	102	64
Abnormal DE(A) +CT(A)	70	92	26	60	54	6
False positive DE(A) +CT(N)	24	16	16	4	6	0
False negative DE(N) +CT(A)	14	26	20	44	10	16
Sensitivity	74.47	85.19	61.9	93.75	90	100
Specificity	84.44	67.50	76.19	53.19	91.07	80
Predictive +ve	83.33	77.97	56.52	57.69	83.38	27.27
Predictive – ve	76.00	77.14	80	92.59	94.44	100

Table 5: Correlation of Diagnostic Endoscopy Finding with Computed Tomography Findings

DISCUSSION

We found pneumatization of the agger nasi cells in 72.5%. In all patients, the pneumatization when present was bilateral. The prevalence of agger nasi cells varies widely as reported by various workers: 10-15% (Messerklinger.3); 14% (Lloyd et al.4); 65% (Davis.5); 89% (Van Alyea.6) and 100% (Kennedy and Zinreich.7). Depending on the degree of pneumatization. Agger nasi cells may reach laterally to the lacrimal fossa and superiorly to cause narrowing of frontal recess.[6]

On coronal CT, these cells appear inferior to frontal recess and lateral to the middle turbinate. Because of this intimate relationship, these cells form excellent surgical landmarks. Opening the

agger nasi cells usually provides a good view of the frontal recess. Therefore, identification of this variation is important in diagnosis and treatment of recurrent or chronic frontal sinusitis.[7]

Frontal Sinus

We found the prevalence of non-pneumatization of frontal sinus in 6.25%. This correlates with the study by Natsis K. who reported a prevalence of 5%. In all our patients, frontal sinuses on either sides were always asymmetrical with right being large in 47.5% and the left sinus being large in 52.5%.[8]

Frontal Recess

As the axis of the frontal recess is tilted approximately 50 degrees to the canthomeatal line, this drainage pathway cannot be included entirely within a single coronal section. Therefore, coronal oblique views are required for complete information.[9]

Our results are close to that reported by Liu X et al.Presence of a concha bullosa does not suggest a pathological finding. However, in the setting of chronic sinus disease, resection of the concha bullosa should be considered to improve paranasal sinus access. Further, the concha bullosa interior may be affected by disease in other sinuses.

The accessory ostia of the maxillary sinus are present in the anterior and posterior nasal fontanelles, the bone deficient areas in lateral nasal wall behind and below uncinate process. In our study, accessory ostia were present in 15% of nasal cavities. Earwaker has reported an incidence of 13.75%. Our results are very close to that of Earwaker.[10]

A large cell representing a point of access between the inferior part of the ethmoid base and the posterosuperior part of the nasal surface of the maxilla behind and above the hiatus semilunaris: Kimpoti, Nemanic, et al.

Ethmoid bulla occupying a lower position than normal, whereby the outer wall of the lowest cell is formed by the orbital wall of the superior maxilla instead of the lamina papyracea: Skillern. Air cells located below the ethmoid bulla, along the maxillary sinus roof and most inferior portion of lamina papyracea including air cells located within the infundibulum.

CONCLUSION

All the variations of sinonasal anatomy described in literature except the presence of supreme turbinate were encountered in our study. The medialized uncinate process (Double middle turbinate) was most common uncinate process variation and pneumatized middle turbinate was the most common middle turbinate variation. Extramural pneumatization like septal,

supraorbital, sphenoid wing and pterygoid plates was quite common. The depth of olfactory fossa was of Keros type II in majority of patients.

In view of the presence of these significant variations, we reemphasize the need for proper preoperative assessment in every patient in order to accomplish a safe and effective endoscopic sinus surgery.

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