Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

Original research article

Variations of paranasal sinuses in patients with sinus disease: Age and gender distribution

[1]Dr. Chandan Giriyappa, [2]Dr. Arjun Bahaddur, [3]Dr. SSM Zainul Abidin Sarmast

[1]Professor, Department of Radiology, SS Institute of Medical Sciences and Research Centre, Davangere, Karnataka, India

[2]Associate Professor, Department of Radiology, Nandi Medical College and Research Institute, Chickaballapur, Karnataka, India

[3]Senior Resident, Department of Radiology, ESIC, Kalaburagi, Karnataka, India

Corresponding Author:
Dr. SSM Zainul Abidin Sarmast

Abstract

The prevalence of anatomic variations has been variously described, ranging from pure anatomic descriptions to descriptions based on CT examinations. These variations compromise already narrow drainage pathways and produce significant obstruction. CT examination of PNS will provide an anatomic road map of the PNS to identify the presence of significant anatomic abnormalities, the locations and severity of the disease and exact location of the obstruction. All the patients who satisfied the inclusion criteria of the study were subjected to history taking and physical examination to identify clinical signs at presentation. Then the patients were subjected to CT scan of nose and paranasal sinus region and the anatomy of the sinonasal region was thoroughly assessed after a probable diagnosis was made. There was no significant difference in Association between Anatomical Variations of Sinus and Age distribution. In the present study there was a significant difference in Association between Agger Nasi Cells (p value-0.030), Paradoxical Curvature (p value- 0.024), Haller cells (p value-0.045) and Frontoethmoidal Cell Variations-Type 1 (p value- 0.048) and Sex distribution. In the present study aggernasi cells were more commonly seen in males and paradoxical middle turbinate and type I frontoethmoidal cell variation were found to be more common in females.

Keywords: Paranasal sinuses, age, gender

Introduction

Certain anatomic variations are thought to be predisposing factors for the development of sinus diseases and thus it becomes necessary for the radiologist to be aware of these variations, especially if the patient is a candidate for functional endoscopic sinus surgery (FESS) [1].

For Endoscopic sinus Surgery, precise knowledge of the anatomy and variations of paranasal sinus is essential for surgeon. Computed tomography provides accurate evictions of the anatomy, the anatomical variants and the extent of the disease in and around the paranasal sinuses [2].

The advent of relatively less invasive techniques of functional endoscopic sinus surgery has provided an important role for coronal CT (computed tomography) of the PNS, both as a diagnostic tool and as an important part of preoperative planning [3].

The importance of anatomic variations as a predisposing cause for sinus disease, particularly in relation to the osteomeatal complex, has been stressed by several authors [4].

Numerous sinonasal anatomic variants exist and are frequently seen on sinus CT scans. The most common ones are Agger nasi cells, infraorbital ethmoidal (Haller) cells, sphenoethmoidal (Onodi) cells, nasal septal deviation, and concha bullosa.

Another important anatomical variation occurring along the ethmoid roof is described by the Keros classification. This measures the vertical height between the cribriform plate and fovea ethmoidalis and the depth is categorized as 1-3 mm (Keros I), 3-7 mm (Keros II) and 7-16 mm (Keros III). Clearly, as this bone is thin, an increased vertical height will result in an increased risk of intraoperative damage [5].

The prevalence of anatomic variations has been variously described, ranging from pure anatomic descriptions to descriptions based on CT examinations [13].

These variations compromise already narrow drainage pathways and produce significant obstruction [6].

CT examination of PNS will provide an anatomic road map of the PNS to identify the presence of significant anatomic abnormalities, the locations and severity of the disease and exact location of the obstruction [7].

CT scanning has allowed the radiologist to image PNS disease with accuracy and detail never before attainable. The information has made the image an important member of the Physician team that

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

evaluates the operability and treatment planning of these patients [8].

Methodology

Source of study: Patients referred by the out-patient department of ENT to the department of Radiology.

Study design: Prospective study.

Sample size: 50.

Sample design: A prospective study on correlation of anatomical variations of Paranasal Sinus region with chronic rhinosinusitis.

Method of collection of data

- All the patients who satisfied the inclusion criteria of the study were subjected to history taking and physical examination to identify clinical signs at presentation.
- Then the patients were subjected to CT scan of nose and paranasal sinus region and the anatomy of the sinonasal region was thoroughly assessed after a probable diagnosis was made.
- After completing all investigations, definitive management was done and the radiological features were correlated with the clinical and endoscopic diagnosis.

Inclusion criteria: All patients with clinical diagnosis of sinus disease between 18 to 65 years presenting to the OPD of department of Radiology.

Exclusion criteria

- Paranasal sinus neoplasms.
- Previous sinonasal surgery.
- Facial trauma.
- Sinonasal anatomy alteration or obscuration due to inflammatory diseases.
- Younger age of the patients (<18 years).

Results

Table 1: Association between Anatomical Variations of Sinus and Age distribution

		Age										P value
		<30 years		31 to 40 years		41 to 50 years		>50 years		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	
Agger Nasi Cells	Right	2	13.33	2	11.76	0	0.00	0	0.00	4	8.00	0.480
	Left	3	20.00	1	5.88	0	0.00	0	0.00	4	8.00	0.203
Nasal Septal Deviation (Towards Right)	With Spur	1	6.67	3	17.65	1	8.33	0	0.00	5	10.00	0.574
	Without Spur	4	26.67	4	23.53	1	8.33	1	16.67	10	20.00	0.657
Nasal Septal Deviation (Towards Left)	With Spur	0	0.00	3	17.65	1	8.33	0	0.00	4	8.00	0.264
	Without Spur	2	13.33	1	5.88	4	33.33	2	33.33	9	18.00	0.189
S Shaped	S Shaped	1	6.67	0	0.00	0	0.00	1	16.67	2	4.00	0.262
Uncinate Process Variations	Lateralised	0	0.00	2	11.76	1	8.33	1	16.67	4	8.00	0.523
	Medialized	1	6.67	1	5.88	1	8.33	0	0.00	3	6.00	0.916
	Pneumatised	0	0.00	2	11.76	0	0.00	0	0.00	2	4.00	0.257
	Bent	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00	0.357
Concha Bullosa	Right	5	33.33	5	29.41	3	25.00	2	33.33	15	30.00	0.968
	Left	2	13.33	6	35.29	2	16.67	2	33.33	12	24.00	0.429
Lamellar Concha	Right	3	20.00	5	29.41	1	8.33	0	0.00	9	18.00	0.306
	Left	6	40.00	3	17.65	2	16.67	0	0.00	11	22.00	0.178
Paradoxical Curvature	Right	1	6.67	1	5.88	1	8.33	2	33.33	5	10.00	0.243
	Left	1	6.67	1	5.88	1	8.33	1	16.67	4	8.00	0.86
Haller Cells	Right	0	0.00	3	17.65	1	8.33	0	0.00	4	8.00	0.264
	Left	0	0.00	3	17.65	2	16.67	1	16.67	6	12.00	0.403
Supraorbital Ethmoid Cell	Right	2	13.33	3	17.65	2	16.67	0	0.00	7	14.00	0.743
	Left	2	13.33	4	23.53	2	16.67	0	0.00	8	16.00	0.584
Frontoethmoidal Cell Variations	Type 1	4	26.67	2	11.76	4	33.33	0	0.00	10	20.00	0.265
	Type 2	5	33.33	6	35.29	1	8.33	1	16.67	13	26.00	0.334
	Type 3	2	13.33	3	17.65	5	41.67	2	33.33	12	24.00	0.302
	Type 4	0	0.00	2	11.76	0	0.00	0	0.00	2	4.00	0.257
Onodi Cell	Right	2	13.33	3	17.65	1	8.33	0	0.00	6	12.00	0.68
	Left	1	6.67	3	17.65	0	0.00	0	0.00	4	8.00	0.29
Pneumatised ACP	Right	1	6.67	2	11.76	1	8.33	0	0.00	4	8.00	0.829

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

	Left	0	0.00	3	17.65	0	0.00	0	0.00	3	6.00	0.102
Pneumatised Pterygoid process	Right	5	33.33	1	5.88	3	25.00	2	33.33	11	22.00	0.24
	Left	5	33.33	1	5.88	3	25.00	1	16.67	10	20.00	0.26
Optic Nerve Variations	Type 1	13	86.67	12	70.59	11	91.67	6	100.00	42	84.00	0.259
	Type 2	1	6.67	3	17.65	0	0.00	0	0.00	4	8.00	0.29
	Type3	1	6.67	2	11.76	0	0.00	0	0.00	3	6.00	0.539
	Type 4	0	0.00	0	0.00	1	8.33	0	0.00	1	2.00	0.357
Kero's Types	Type 1	2	13.33	4	23.53	3	25.00	1	16.67	10	20.00	0.855
	Type 2	13	86.67	13	76.47	9	75.00	5	83.33	40	80.00	0.855
	Type 3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	
Aerated Crista Galli		0	0.00	0	0.00	2	16.67	1	16.67	3	6.00	0.129
Variations of Maxillary Sinuses	Hypoplastic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	
Septations	Right	1	6.67	3	17.65	2	16.67	1	16.67	7	14.00	0.81
	Left	1	6.67	4	23.53	3	25.00	1	16.67	9	18.00	0.559
Other Incidental Findings	Mastoid Sclerosis	1	6.67	1	5.88	1	8.33	0	0.00	3	6.00	0.916

There was no significant difference in Association between Anatomical Variations of Sinus and Age distribution.

Table 2: Association between Anatomical Variations of Sinus and Sex distribution

		Sex						P value
		Female		Male		Total		
		Count	%	Count	%	Count	%	
Agger Nasi Cells	Right	1	3.85	3	12.50	4	8.00	0.26
	Left	0	0.00	4	16.67	4	8.00	0.030*
Nasal Septal Deviation (Towards Right)	With Spur	4	15.38	1	4.17	5	10.00	0.187
	Without Spur	6	23.08	4	16.67	10	20.00	0.571
Nasal Septal Deviation (Towards Left)	With Spur	3	11.54	1	4.17	4	8.00	0.337
	Without Spur	5	19.23	4	16.67	9	18.00	0.814
S Shaped	S Shaped	0	0.00	2	8.33	2	4.00	0.133
Uncinate Process Variations	Lateralised	3	11.54	1	4.17	4	8.00	0.337
	Medialized	2	7.69	1	4.17	3	6.00	0.6
	Pneumatised	1	3.85	1	4.17	2	4.00	0.954
	Bent	1	3.85	0	0.00	1	2.00	0.332
Concha Bullosa	Right	9	34.62	6	25.00	15	30.00	0.459
	Left	8	30.77	4	16.67	12	24.00	0.243
Lamellar Concha	Right	4	15.38	5	20.83	9	18.00	0.616
	Left	3	11.54	8	33.33	11	22.00	0.063
Paradoxical Curvature	Right	5	19.23	0	0.00	5	10.00	0.024*
	Left	2	7.69	2	8.33	4	8.00	0.933
Haller Cells	Right	4	15.38	0	0.00	4	8.00	0.045*
	Left	4	15.38	2	8.33	6	12.00	0.443
Supraorbital Ethmoid Cell	Right	4	15.38	3	12.50	7	14.00	0.769
	Left	3	11.54	5	20.83	8	16.00	0.37
Frontoethmoidal Cell Variations	Type 1	8	30.77	2	8.33	10	20.00	0.048*
	Type 2	6	23.08	7	29.17	13	26.00	0.624
	Type 3	6	23.08	6	25.00	12	24.00	0.874
	Type 4	2	7.69	0	0.00	2	4.00	0.166
Onodi Cell	Right	2	7.69	4	16.67	6	12.00	0.329
	Left	2	7.69	2	8.33	4	8.00	0.933
Pneumatised ACP	Right	2	7.69	2	8.33	4	8.00	0.933
	Left	2	7.69	1	4.17	3	6.00	0.6
Pneumatised Pterygoid process	Right	4	15.38	7	29.17	11	22.00	0.240
	Left	3	11.54	7	29.17	10	20.00	0.119
Optic Nerve Variations	Type 1	21	80.77	21	87.50	42	84.00	0.517
	Type 2	2	7.69	2	8.33	4	8.00	0.933
	Type3	2	7.69	1	4.17	3	6.00	0.6
	Type 4	1	3.85	0	0.00	1	2.00	0.332
Kero's	Type 1	6	23.08	4	16.67	10	20.00	0.571
	Type 2	20	76.92	20	83.33	40	80.00	0.571
	Type 3	0	0.00	0	0.00	0	0.00	
Aerated Crista Galli		2	7.69	1	4.17	3	6.00	0.6
Variations of Maxillary Sinuses	Hypoplastic	0	0.00	0	0.00	0	0.00	
Septations	Right	3	11.54	4	16.67	7	14.00	0.602
	Left	6	23.08	3	12.50	9	18.00	0.331

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

Other Incidental Findings	Mastoid Sclerosis	2	7.69	1	4.17	3	6.00	0.6

In the present study there was a significant difference in Association between Agger Nasi Cells (p value-0.030), Paradoxical Curvature (p value-0.024), Haller cells (p value-0.045) and Frontoethmoidal Cell Variations-Type 1 (p value-0.048) and Sex distribution.
In the present study agger nasi cells were more commonly seen in males and paradoxical middle turbinate and type I frontoethmoidal cell variation were found to be more common in females.

Discussion

In this study there was no significant difference in Association between anatomical Variations of Sinus and Age distribution.
In a study conducted by Ibrahim Sumaily out of 420 patients, ages ranged from 15 to 87 years with the mean age being 37.8 years. It was found that Crista Galli Pneumatization and Type I Frontal air cells were commonly seen in senior adults.
Concha bullosa and sphenoid sinus lateral pneumatization was less common in senior adults, rest of the anatomical variations showed no significant correlation with age.
In the present study there was a significant difference in Association between Agger Nasi Cells (p value-0.030), Paradoxical Curvature (p value-0.024), Haller cells (p value-0.045) and Frontoethmoidal Cell Variations-Type 1 (p value-0.048) and Sex distribution.
In the present study agger nasi cells were more commonly seen in males and paradoxical middle turbinate and type I frontoethmoidal cell variation were found to be more common in females.
In a study by Dr. Aprajita Awasthi No significant difference was found in the distribution of anatomical variations among males and females.
In a study conducted by Ibrahim Sumaily it was found that Concha Bullosa, Basal Lamellar Pneumatization and Crista Galli Pneumatization was more prevalent in males.
In the present study there was positive association between Concha bullosa and sinus disease (p value-0.044).
There was no positive association with the sinus disease in other variations.
These findings are similar to a study conducted by Esin Kurtulus Ozturk [9] where there was statistically significant relation between concha bullosa and Sinus disease (p=0.009). There was no positive association with the sinus disease in other variations.
In a study conducted by Neeraj Suri [10] there was significant correlation between nasal septal deviation, uncinate process anomalies to paranasal sinusitis (p value <0.05 for each). However in the present study there was no significant correlation between nasal septal deviation or uncinate process anomalies with sinus disease.
Study conducted by Katya A. Shpilberg [11] showed no statistically significant difference in the prevalence of any of the paranasal sinus or nasal cavity anatomic variants between the minimal and significant disease groups. It was also in par with other study [12].

Conclusion

There was no significant difference in Association between Anatomical Variations of Sinus and Age distribution. However in this study positive association was seen between anatomical variations and sex distribution i.e., agger nasi cells were more commonly seen in males and paradoxical middle turbinate and type I frontoethmoidal cell variation were found to be more common in females.

References

1. Zinreich SJ, Kennedy DW, Gayler BW. CT of nasal cavity, paranasal sinuses: an evaluation of anatomy in endoscopic sinus surgery. Clear image. 1998;2:2-10.
2. Buljcik-Cupic M, Savovic S, Jovicevic J. Influence of anatomic variations of the middle nasal meathus on sinonasal diseases. Medical review. 2008;61(3-4):135-141.
3. Kayalioglu G, Oyar O, Govsa F. Nasal cavity and paranasal sinus bony variations: a computed tomographic study. In Rhinology. 2000 Sep;38(3):108-13.
4. Caughey R, Jameson M, Gross C, Han J. Anatomic Risk Factors for Sinus Disease: Fact or Fiction? American Journal of Rhinology. 2005;19(4):334-339.
5. Kamel R. Nasal endoscopy in chronic maxillary sinusitis. The Journal of Laryngology & Otology. 1989;103(3):275-278.
6. Stammberger H, Wolf G. Headaches and Sinus Disease: The Endoscopic Approach. Annals of Otology, Rhinology & Laryngology. 1988;97(5):3-23.
7. Kennedy D, Zinreich S, Rosenbaum A, Johns M. Functional Endoscopic Sinus Surgery: Theory and Diagnostic Evaluation. Archives of Otolaryngology-Head and Neck Surgery. 1985;111(9):576-582.
8. Rice DH. Basic Surgical Techniques and Variations of Endoscopic Sinus Surgery. Otolaryngol Clin North Am. 1989;22:713-726.
9. Kurtuluş Öztürk E, Öztürk S, Turan Ş, Acu B. Sinonasal anatomic variations and relationship with

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

sinonasal inflammatory mucosal disease: a computed tomography study. Journal of Contemporary Medicine. 2020;10(3):348-353.
10. Suri N, Janardan T, Parmar H. Correlation of anatomical variations of Paranasal sinuses and Chronic Rhinosinusitis. IAIM. 2016;3(12):84-88.
11. Shpilberg K, Daniel S, Doshi A, Lawson W, Som P. 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. 2015;204(6):1255-1260.
12. Cashman EC, MacMahon PJ, Smyth D. Computed tomography scans of paranasal sinuses before functional endoscopic sinus surgery. World J Radiol. 2011;3(8):99-204.