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Evaluation of Anatomical Variants of Paranasal Sinuses on Hrct With Assessment of Their Clinical Importance

KEYWORDS: PNS, HRCT.

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ABSTRACT *50 patients with sino-nasal complaints underwent MSCT scan of the PNS in the prone position and were evaluated for the presence of normal anatomical variants which were seen in 48 (96%) patients with PNS mucosal abnormalities. CT scan serves as a "road map" for the surgeon to negotiate areas of anatomical variation in the paranasal sinus unit. Being rapid, convenient and noninvasive investigation it is of immense help in management of patients undergoing surgery.*

Introduction

Anatomical variations studied on CT scan are found to obstruct the osteomeatal complex (OMC) and cause chronic sinusitis. A precise knowledge of the anatomy of the paranasal sinuses is essential for the clinician. With the advent of functional endoscopic sinus surgery (FESS) and coronal computed tomography (CT) imaging, considerable attention has been directed toward paranasal region anatomy. Conventional radiology does not permit a detailed study of the nasal cavity and paranasal sinuses, and has now largely been replaced by computerized tomographic (CT) imaging. Current endoscopic surgery mandates the prior detection of these variants for successful surgical outcome and prevent any potential surgical complications. Presently CT scanning is the standard imaging modality in the evaluation of the paranasal sinuses and gives an applied anatomical view of the region including anatomical variants thus optimizing the outcome of surgery.

methods and materials

This is a prospective study conducted in the department of Radiodiagnosis and imaging, Bharati hospital, Pune.

We included all patients who were referred for CT scan of PNS in Bharati Hospital and Research Centre during a period of 18 months from September 2013 through September 2015. Unenhanced CT of the PNS was performed using PHILIPS BRILLIANCE 16 SLICE CT machine for 50 patients with sinonasal complaints in the coronal plane and multiplanar reconstruction.

statistical anlysis

Results are calculated using chi square test and bar charts were obtained using the statistical software.

observation and results

CHART: 1

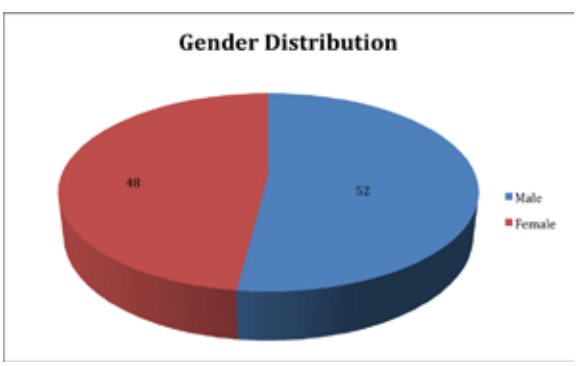

CHART 2: CT SCAN DETECTION OF ANATOMICAL VARIANTS IN PATIENTS WITH MUCOSAL ABNORMALITIES

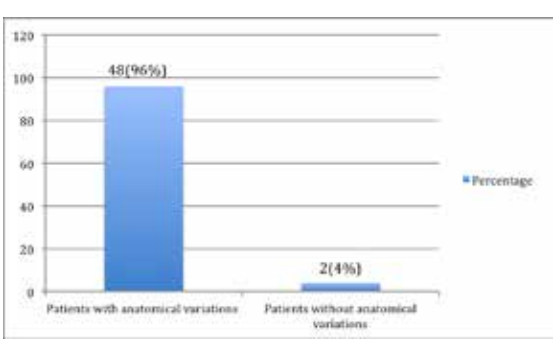

TABLE 2: THE AGE DISTRIBUTION OF THE CASES STUDIED

Age Group (years)	No. of cases	% of cases
<20.0	4	8.0
20.0 – 29.0	11	22.0
30.0 – 39.0	16	32.0
40.0 – 49.0	12	24.0
>50.0	7	14.0
Total	50	100.0

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Comments:
The mean ± standard error of mean (SEM) of age of the cases studied was 34.90 ± 1.81.

CHART 3:

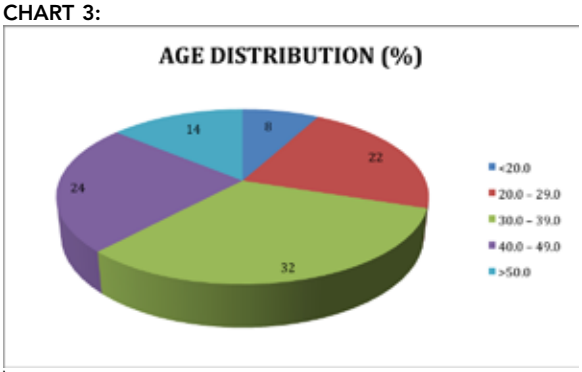

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TABLE 3: THE DISTRIBUTION OF MUCOSAL ABNORMALITIES BY CT SCAN.

Abnormalities	Unilateral		Bilateral		Total	
	n	%	n	%	n	%
FRONTAL SINUSITIS	2	4.0	6	12.0	8	16.0
MAXILLARY SINUSITIS	14	28.0	21	42.0	35	70.0
ANT. ETHMOID SINUSITIS	0	0.0	24	48.0	24	48.0
POST. ETHMOID SINUSITIS	0	0.0	9	18.0	9	18.0
SPHENOID SINUSITIS	10	20.0	5	10.0	15	30.0
PAN SINUSITIS	--	--	--	--	5	10.0

Values are n (% of cases).

CHART 4:

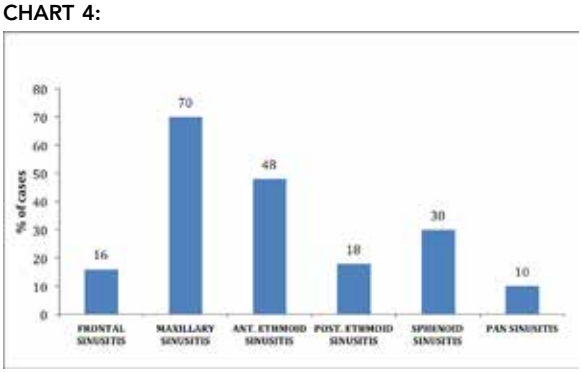


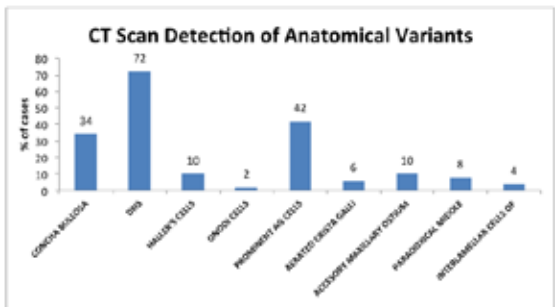
Figure 4) The distribution of CT scan detection of Mucosal abnormalities in individual sinusitis.

Table 4) The distribution of CT scan detection of anatomical variants.

Variation	Unilateral		Bilateral		Total	
	n	%	n	%	n	%
CONCHA BULLOSA	7	14.0	10	20.0	17	34.0
DNS	36	72.0	--	--	36	72.0
HALLER'S CELLS	3	6.0	2	4.0	5	10.0
ONODI CELLS	1	2.0	0.00	0.00	1	2.0
PROMINENT AG CELLS	15	30.0	6	12.0	21	42.0
AERATED CRISTA GALLI	--		--		3	6.0
ACCESORY MAXILLARY OSTIUM	2	4.0	3	6.0	5	10.0
PARADOXICAL MIDDLE TURBINATE	3	6.0	1	2.0	4	8.0
INTERLAMELLAR CELLS OF GRUNWALD	2	4.0	0.00	0.00	2	4.0

Values are n (% of cases).

CHART : 5



	Our Study	Azila A et Al	Peres – Pinas et Al	Dua K et Al	Zinreich S et Al
Year	2015	2012	2005	2000	1993
NUMBER OF PATIENTS	50	120	115	55	230
CONCHA BULLOSA	34%	47.50%	24.5	16%	36%
PARADOXICAL MIDDLE TURBINATE	8%	12%	10%	-	15%
DNS	72%	56%	58%	44%	21%
HALLER CELLS	10%	51%	2.70%	16%	10%
ONODI CELLS	2%	8%	10.9%	6%	8%
PROMINENT AGGER NASI CELLS	42%	83%	98%	40%	-

TABLE 5: COMPARISON OF CT SCAN DETECTION OF ANATOMICAL VARIANTS IN VARIOUS STUDIES

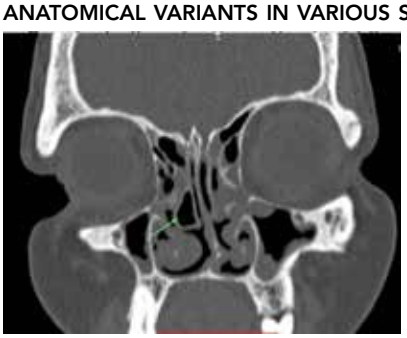


FIGURE – 1. CT scan PNS coronal section showing right middle concha bullosa.

FIGURE – 2. CT scan PNS coronal section showing left paradoxical middle turbinate.

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FIGURE – 3. CT scan PNS coronal section showing Two Haller cells on the left.

FIGURE – 4. CT scan PNS coronal section showing agger nasi cell on the left.

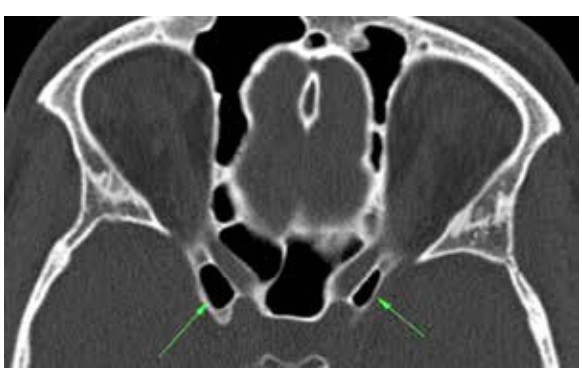

FIGURE – 5. CT scan PNS axial section showing bilateral Onodi cells, just medial to the optic canal.

Discussion-

The paranasal sinuses are a region which is commonly involved in a wide spectrum of disease conditions. Congenital anomalies and normal anatomical variations in this region are important as they may have a bearing on surgical outcome and can be a source of difficulty and complication during surgery. Stumberger et al proposed that stenosis of the osteomeatal complex, from either the anatomical configuration or hypertrophied mucosa, can cause obstruction and stagnation of secretions that may become infected or perpetuate infection.[1]

Concha bullosa (pneumatised middle turbinate) has been implicated as a possible aetiological factor in the causation of recurrent chronic sinusitis due to its negative influence on PNS ventilation and mucociliary clearance in the middle meatus region(Figure -1). The presence of a concha bullosa has ranged between 4% and 80% in different studies; our data gave 34 % which compares with the study of Zinreich S et al [2] (36%).

The middle turbinate may be paradoxically curved i.e. bent in the reverse direction. This may lead to impingement of the middle meatus and thus to sinusitis. In our study it was found in 4 patients (8%) - 3 unilateral and 1 bilaterally. The incidence of 8% in our study is close to the 10 % incidence described by Peres et al (Figure 2). [3]

Haller's cells are ethmoid air cells that project beyond the limits of the ethmoid labyrinth into the maxillary sinus(Figure -3). They are considered as ethmoid cells that grow into the floor of orbit and may narrow the adjacent ostium. The incidence of Haller's cells in our study was 5 (10%) – 3 unilateral and 2 bilateral. Kenedy and Zinreich reported an incidence of 10%. [6,4,7]

Agger nasi cells lie just anterior to the anterosuperior attachment of the middle turbinate and frontal recess(Figure – 4). These can invade the lacrimal bone or the ascending process of maxilla. These cells were present in 21 patients (42%) in our study. This compares well with the study 40% as reported by Dua K[4]. The incidence is less as compared to 98.5% by Bolger. [5]

Onodi cells are posterior ethmoid cells that extend posteriorly, laterally and sometimes superior to sphenoid sinus, lying medial to the optic nerve (Figure – 5). The chances of peri-operative injury to optic nerve are increased when the bony canal of the nerve is lying dehiscent. Most authors have found an incidence of 8–14%.[3,4] It was found only in 1 patient in our study (2%).

Various studies have reported the incidence of mucosal changes in paranasal sinuses. In our study maxillary sinus was involved in 70 %, anterior ethmoids in 48%, sphenoid sinus in 30%, posterior ethmoids in 18 % and frontal sinus in 16%. Pansinusitis was seen in 14 %. The extent of involvement reported by other authors was also in the same range. [3,4]

The clinical significance of anatomical variants of the nasal sinus region is controversial. Most CT anatomical studies of the sinus region have been made in patients suspected of a clinical syndrome suggesting inflammatory sinus pathology. Zinreich found that 62% of his patients presented at least one anatomic variant, against 11% in the normal control group.[9] These findings seem to suggest a positive correlation between anatomical variants and the appearance of inflammatory sinus pathology. However, Bolger et al., in a series of 202 patients studied by CT, observed 131 anatomical variants, but found the incidence in patients with sinus pathology was similar to that in persons studied for other reasons.[4] Bolger et al. and Stammberger & Wolf detected the presence of anatomical variants both in patients studied for sinus problems and in those studied for other reasons.[10,11] They concluded that the simple presence of variants does not mean a predisposition to sinus pathology, except when other associated factors are present. This opinion is not shared by Yousem, who claimed that the anatomical variants may be predisposing factors, depending on their size.[12] In our study anatomical variation were seen

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in 48 (96%) out of 50 patients with PNS mucosal abnormalities conforming with the findings and observations of Zinreich et al and Yousem [9,12.]

scan serves as a "road map" for the surgeon to negotiate potentially hazardous clefts of the para- nasal sinus unit. Being noninvasive, rapid and convenient investigation it helps both surgical planning and documentation. It also delineates the extent of disease, anatomical and pathological variations better than other modalities. Nasosinosal endoscopy and CT scan can be considered complementary techniques for effective demonstration of nasal anatomy and paranasal sinuses.

CONCLUSION:

Computed Tomography of the paranasal sinus has improved the visualization of paranasal sinus anatomy and has allowed greater accuracy in evaluating paranasal sinus disease. It evaluates the osteomeatal complex anatomy which is not possible with plain radiographs. Improvement in FESS and CT technology has concurrently increased interest in the paranasal region anatomy and its variations. Anatomical variations of PNS were found along with sinusitis. The radiologist must pay close attention to anatomical variants in the preoperative evaluation. It is important for surgeon to be aware of variations that may predispose patients to increased risk of intraoperative complications and help avoid possible complications and improve success of management strategies.

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