Original Research Article

A study of paranasal sinuses by computed tomography for etiopathological distribution and anatomical variants

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Abstract

Background: Anatomical variants of paranasal sinuses are important for accurate diagnosis of various paranasal sinus diseases. Computed tomography is helpful for studying anatomical variants because of accuracy. **Aim and objective:** To study anatomical variants and etiopathological distribution seen in paranasal sinuses with Computed tomography **Methodology:** Total 110 patients were studied in department of radiodiagnosis. Patients were recruited after considering inclusion and exclusion criteria. Data collected with pre tested questionnaire. It included sociodemographic data, clinical history and CT reports for studying anatomical variants of PNS. Data was analysed with appropriate statistical tests. **Results and discussion:** Agger Nasi (59.1%), Deviated nasal septum (DNS) (40%) and Concha Bullosa (43.6%) were the most common variants found. Haller cells were seen in 16.3% patients. Onodi cells were observed in 30.9% patients.
Key Word: paranasal sinuse.

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Email: rudhadve@gmail.com
Received Date: 30/12/2019 Revised Date: 13/01/2020 Accepted Date: 06/02/2020
DOI: https://doi.org/10.26611/10131422

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 01 May 2020

INTRODUCTION

The first part of the upper respiratory tract consists of paired nasal cavities. In the lateral walls of these cavities, and communicating with them are the paranasal sinuses. Paranasal sinuses include the bilaterally paired frontal, ethmoid, sphenoid and maxillary sinuses housed within the bones from which they are named. They originate as invaginations from the nasal fossae. Most of the sinuses are rudimentary at birth. They enlarge appreciably during eruption of permanent teeth and after puberty. All sinuses open into the lateral wall of the nasal cavity by small apertures, which allow the equilibration of air and movement of mucus.[1] Paranasal sinuses contribute to resonance of voice, light weight of the skull, humidify and warm inspired air. They form a collapsible framework that helps to protect the brain from blunt trauma[2]. There are great variations in the intricate anatomy of the sinonasal passages. The common variants are Nasal Septal Variants which manifest as Deviation of nasal septum and Septal spurs. Middle Turbinate Variants seen as Paradoxical Middle Turbinate and Concha Bullosa. Uncinate Process Variants observed as Uncinate bulla, Deviation of the Uncinate Process and Atelectatic Uncinate Process. Ethmoid Variants seen as Infraorbital Ethmoid Cells (Haller Cells), Agger Nasi Cells, Onodi Cells, Giant Ethmoid Bulla Dehiscence of the lamina papyracea. Sphenoid Variants seen as Excessive pneumatisation[3]. Accurate knowledge of nose and paranasal sinuses is required to correctly interpret imaging so this study was conducted to study anatomical variants seen in paranasal sinuses with Computed tomography

How to cite this article: Parag Vijaysingh Patil, Rajshree Uttam Dhadve, Vinod Yadav Attarde. A study of paranasal sinuses by computed tomography for etiopathological distribution and anatomical variants. *MedPulse International Journal of Radiology.* May 2020; 14(2): 32-35. http://www.medpulse.in/Radio%20Diagnosis/

Aim and objective: To study anatomical variants and etiopathological distribution seen in paranasal sinuses with Computed tomography

MATERIAL AND METHODS

The present prospective study was carried out on 110 patients attending department of radiodiagnosis. All referred patients from ENT department with symptoms and signs of paranasal sinus disease were studied. Following inclusion and exclusion criterias were used to recruit the patients.

Inclusion criteria: 1. Patients referred for CT of paranasal sinuses who were suspected to have paranasal sinus disease. 2. Patients who were suspected to have some paranasal sinus pathology on conventional radiographs and were then referred for CT of paranasal sinuses.

Exclusion criteria: 1.Patients presenting with trauma to face. 2. Patients with contrast allergy.3. Patients who were lost to follow up without a definite diagnosis.

Study was approved by ethical committee of the institute. A valid written consent was taken from the patients after explaining study to them. Data was collected with pretested questionnaire. Data included sociodemographic data like age, sex etc. Detailed clinical history was taken from patients. Through clinical examination was done. All patients underwent routine investigations like Complete BLOOD count, ESR, TLC/DLC were done. Whenever required FNAC/Biopsy was done for confirmation of diagnosis. Equipment used in this study was Multidetector Spiral CT, Siemens Somatom Volume Access Somaris, Siemens Medical Systems, Forchiem, Germany. Intravenous contrast was injected with concentration of 300mg/ml in a dose of 2ml/kg body weight. CT scan was taken in two planes coronal and axial. Routinely axial scanning was done in supine position. For direct coronal imaging the patient was kept in prone position or in supine position with head of the patient free leading edge of the table of the scanner. The gantry angle used in case of coronal imaging was perpendicular to the plane of hard palate. 3 mm sections from anterior margin of nose to the posterior margin of sphenoid sinus were taken. Diagnostic images were stored on computer in jpeg version after converting the DICOM file to jpeg file using an e –film software. Data was analysed with appropriate statistical tests.

RESULTS

Table 1: Distribution of patients according to sex

SEX	NOS.	PERCENTAGE
FEMALE	36	32.73 %
MALE	74	67.27 %
Grand Total	110	100 %

Table 2: Distribution of patients according to sinuses involved

SINUS INVOLVED	NUMBER	PERCENTAGE
MAXILLARY	95	86.36 %
ETHMOIDAL	59	53.63 %
FRONTAL	34	30.9 %
SPHENOIDS	23	20.9 %

Table 3: Distribution of patients according to anatomical variants

ANATOMICAL VARIANT	TOTAL	PERCENTAGE
Deviated nasal septum (DNS)	44	40 %
Concha Bullosa	48	43.6 %
Agger Nasi	65	59.1 %
Haller Cells	18	16.3 %
Onodi Cells	34	30.9 %
Enlarged Ethmoid Bulla (EEB)	9	8.2 %
Paradoxical Middle Turbinate (PMT)	15	13.6 %
Deviated Uncinate Process (DUP)	12	10.9 %
Pneumatized Uncinate Process (PUP)	4	3.6 %

Table 1 shows gender distribution of the cases. In present study, majority of the patients were male (74). The gender ratio was found to be 2.05: 1 (Male: Female). Figure 1 shows distribution of patients according to age. In our study majority of the patients were in the age group of 11-20 years (22.72%) and 21-30 years (22.72%). Paranasal sinus disease were rare below 10 years . The incidence increased above 50 years. In our study we found that maxillary sinus was the most frequently involved sinus (86.36%) followed by ethmoid (53.63%), frontal (30.9%)

sinuses. Sphenoid sinus was least involved (20.9%) The table 3 shows various anatomical variants found. Agger Nasi (59.1%), Deviated nasal septum (DNS) (40%) and Concha Bullosa (43.6%) were the most common variants found. Haller cells were seen in 16.3% patients. Onodi cells were observed in 30.9% patients. Enlarged ethmoid Bulla and Paradoxical middle turbinate were seen in 8.2% and 13.6% patients respectively. Deviated Uncinate Process and Pneumatized Uncinate Process were observed in 10.9% and 3.6% respectively.

DISCUSSION

In present study 110 patients were evaluated for anatomical variants of PNS. The male to female ratio in this study was 2.05: 1. In our study it was observed that maximum numbers of patients were in age group of 11 to 20 years and 21 to 30 years followed by 51 to 80 years. Considering the inflammatory etiology of the various sinuses, following was the percentage affection of individual sinuses. Maxillary (89.4 %) Frontal(31.8 %) Sphenoids (15.2 %)and Ethmoidal (50 %). Thus, maxillary sinus was most commonly involved and sphenoid sinus was least involved in inflammatory conditions. In the study conducted by Smith and Brindley[4], maxillary sinus was involved in 55.5 % of cases, ethmoidal air cells were involved in 46.5 % of cases, frontal sinus in 30 % and sphenoid in 20 %. Similarly Maru *et al*[5] reported maxillary sinus to be the most frequently involved sinus in inflammatory lesions (70.4 %) followed by ethmoids (52.4%), frontal (48.3 %) and sphenoid sinuses (40.8 %). Zinreich *et al*[6] published in his study that the maxillary sinus involvement was the most frequent in inflammatory lesions i.e. 65 % followed by ethmoid cells 40 %, frontal sinus in 34 % and sphenoid sinus in 29 % of cases. In our study we came across some anatomical variants. Almost all types of anatomical variants were diagnosed. In descending order of their occurrence we found Agger Nasi in 59.1 %, Concha Bullosa in 43.6 %, Deviated Nasal Septum (DNS) in 40 %, Onodi in 30.9 %, Haller cells in 16.3 %, Paradoxical Middle Turbinate (PMT) in 13.6 %, Deviated Uncinate Process (DUP) in 10.9 %, Enlarged Ethmoid Bulla in (EEB) 8.2 % and Pneumatized Uncinate Process (PUP) in 3.6 % of cases. Deviated nasal septum (DNS) causes decrease in the critical area of Osteomeatal complex (OMC) predisposing it to obstruction and related complications. It was found to be the one of the common anatomical variant in our study (40 %).It was less than 55.7% in study by Maru *et al*[5] and more than that of 38% reported by Asruddin *et al*[7]. Agger nasi cells lie anterior to the anterosuperior attachment of middle turbinate and frontal recess. This is the most common variant found in our study. These cells were present in 59.1 % of cases in our study as compare to 48 % of cases studied by Asruddin *et al*[7] and 88.5 % as studied by Maru *et al*[4] . Concha Bullosa has been implicated as an etiological factor in the causation of chronic sinusitis due to compromise in the space of middle meatus region as quoted by Tonai *et al*[8]. The incidence was found to be 43.6 % in our study which is comparable to Bolger *et al*[9]who reported the incidence to be 53 %. Onodi cells are the extension of the posterior ethmoidal cells into the sphenoid sinus lying medial to optic nerve. The chances of injury to optic nerve are increased when the bony canal of the nerve is lying dehiscent. This is one of the noted complications in FESS (Functional Endoscopic Sinus Surgery). The incidence of onodi cells was found to be 30.9 % in our study. Other study that closely matched with the incidence in our study was conducted by Driben *et al*[10]where the incidence was 39 %. Haller cells may narrow the adjacent ostium of the maxillary sinus, especially when they become infected. The incidence of haller cells in our study was 16.3 % as compared to 16 % reported by K. Dua *et al*[11]. However, Asruddin *et al*[7] and Maru *et al*[4] reported higher incidence of haller cells of about 28 % and 36 % respectively.

CONCLUSION

The anatomic variants occurring which can only be detected on CT scan, were easily diagnosed. The common variants were Agger Nasi cells, deviated nasal septum cells and concha bullosa.

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Source of Support: None Declared
Conflict of Interest: None Declared