

A Hospital-Based Study to Assess Normal Anatomical Variations in Paranasal Sinuses using CT

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Abstract

Aim: The aim of the present study was to assess normal anatomical variations in paranasal sinuses using CT.

Methods: The present study was conducted in the Department of Radiodiagnosis for the period of 12 months. 100 patients were included in the study.

Results: In the present study, maximum patients belonged to 31-40 years followed by 20-30 years. There were 65% male as compared to females. According to anatomical variation, 32% were single and 68% were multiple. According to CT detected anatomical variation, 85% had Deviated nasal septum followed by 51% Concha bullosa and 47% prominent bulla ethmoidalis.

Conclusion: According to the results, nasal septal deviation was the most common anatomic variation. Haller cell and pneumatized septum are the rarest ones noted in our study. Also, there was a strong correlation between the unilateral Concha bullosa and contra lateral septal deviation, which was evident based on the studies.

Keywords: normal anatomical variations, paranasal sinuses, CT

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Introduction

The paranasal sinuses are group of air-filled spaces surrounding the nasal cavity. [1] Radiological evaluation of the sinuses is essential to define the location and extent of sinonasal diseases and in planning for surgical intervention. Diseases of the ethmoidal sinus cannot be read as easily as maxillary or frontal sinus diseases using standard plain films due to its overlap of surrounding structures. [2] The role of magnetic resonance imaging is limited but may provide information on fungal infections or differentially thickened mucosa from fluid retention in paranasal sinuses. Computed tomography (CT) is considered the method of choice in delineating normal anatomy and evaluating variations in the paranasal sinuses, and it is extremely useful in the pre- and post-operative planning and follow-up in cases of endonasal interventions. Anatomical variations of ethmoid labyrinth during the development of the paranasal sinuses are common. [3] Recognition of these

variants is important to both the rhinologist and radiologist.

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, sphenoidal (Onodi) cells, nasal septal deviation, and concha bullosa. [4-8] The Agger nasi cells are the most anterior ethmoidal air cells. Their location is anterior, lateral, and inferior to the frontal recess. [4,9] Infraorbital ethmoidal (Haller) cells are ethmoidal cells that extend downward under the medial floor of the orbit adjacent to and above the maxillary sinus ostium lateral to the infundibulum. [4,10] Sphenoidal (Onodi) cells are posterior ethmoidal cells that extend laterally, superiorly, and posteriorly to the sphenoid sinus and are intimately associated with the optic nerve. [4]

A supraorbital ethmoidal air cell is located posterolateral to the frontal sinus, superior and lateral to the lamina papyracea, and anterior to the anterior ethmoidal artery and can be identified by the presence of a bony septum between the frontal and anterior ethmoidal sinuses on axial CT images. [11] Pneumatization of the crista galli originates from the frontal sinuses. [12] In one study [13], the presence of infraorbital ethmoidal (Haller) cells and narrow infundibula was associated with recurrent acute rhinosinusitis.

The aim of the present study was to assess normal anatomical variations in paranasal sinuses using CT.

Materials and Methods

The present study was conducted in the Department of Radiodiagnosis, PMCH, Patna, Bihar, India for the period of 12 months. 100 patients were included in the study.

Inclusion Criteria

- Patients complains pertaining to PNS and referred from the ENT OPD and wards
- Those who are willing to participate in study after written consent

Exclusion Criteria

- Sinonasal anatomy alteration or obscuration due to inflammatory diseases (When bony detail was obscured by polypoid mucosal disease)
- Previous sinonasal surgery (excluding nasotruncal window antrotomy)
- Facial trauma
- Paranasal sinus neoplasm
- Pregnancy
- Paediatric age group

Results

Table 1: Distribution according to age, gender and anatomical variation number

| Age group in years | N | % |
|------------------------------------|----|----|
| 20-30 | 24 | 24 |
| 31-40 | 31 | 31 |
| 41-50 | 13 | 13 |
| 51-60 | 18 | 18 |
| >60 | 14 | 14 |
| Gender | | |
| Male | 65 | 65 |
| Female | 35 | 35 |
| Anatomical variation number | | |
| Single | 32 | 32 |
| Multiple | 68 | 68 |

In the present study, maximum patients belonged to 31-40 years followed by 20-30 years. There were 65% male as compared to females. According to anatomical variation, 32% were single and 68% were multiple.

Table 2: Distribution according to CT detected anatomical variation

| Anatomical variation | N | % |
|-------------------------------------|----|----|
| Deviated nasal septum | 85 | 85 |
| Concha bullosa | 51 | 51 |
| Prominent bulla ethmoidalis | 47 | 47 |
| Paradoxical middle turbinate | 7 | 7 |
| Medialised incinate process | 14 | 14 |
| Pneumatized uncinated process | 17 | 17 |
| Agger nasal cell | 59 | 59 |
| Frontal cell | 10 | 10 |
| In tum escentia septi nasi anterior | 28 | 28 |
| Onodi cell | 12 | 12 |
| Haller cell | 3 | 3 |
| Pneumatization of septum | 5 | 5 |

According to CT detected anatomical variation, 85% had Deviated nasal septum followed by 51% Concha bullosa and 47% prominent bulla ethmoidalis.

Discussion

The variation in size and shape of maxillary sinus is not uncommon. Pneumatization of maxillary sinus can extend toward palatine, and alveolar

recess and also septations of the maxillary sinuses can occur. Accessory maxillary ostium may be congenital or secondary to sinonasal diseases. [14] The presence of septa at or near the floor of the sinus is of interest to the dental clinician when performing sinus floor elevation procedures because of an increased likelihood of surgical complications, such as tearing of the Schneiderian membrane. [15] Maxillary sinus pneumatization is characterized by the maxillary sinus extension to alveolar ridge, anterior region, maxillary tuberosity, palate, zygomatic bone, and/or orbital region. Pneumatization, particularly the alveolar extension, can exacerbate the problem of remnant bone caused by atrophy of the maxilla, leaving only few millimeters of bone to implant insertion. [15]

A markedly medially bent or pneumatized uncinate process with a corresponding area of extensive contact with the middle turbinate can cause sinusitis. Combination of some anatomic variations such as uncinate bulla and Haller's cell may increase pathogenic effect compared to the effect of single variant. In the present study, maximum patients belonged to 31-40 years followed by 20-30 years. There were 65% male as compared to females. According to anatomical variation, 32% were single and 68% were multiple. According to CT detected anatomical variation, 85% had Deviated nasal septum followed by 51% Concha bullosa and 47% prominent bulla ethmoidalis.

Zinreich S et al [16] found that 62% of his patients presented at least one anatomic variant, against 11% in the normal control group. These findings seem to suggest a positive correlation between anatomical variants and the appearance of inflammatory sinus pathology. However, Bolger et al [17] 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. Located anterior to the middle turbinate and anterior to the frontal recess is the agger (ridge) nasi. The cells open into the ethmoidal infundibulum. Even after functional endoscopic sinus surgery, most of the air cells cannot be completely removed hence allowing persistent mucosal disease and recurrent infection. Several authors reported varied prevalence of this variant Bolger et al [17] had very high prevalence of 98.5%, while Aramani et al [18] very low prevalence of 1.9%. In this study, we got a prevalence of 45 (21.64%) which is comparable to that of Dua et al [19] who got prevalence of 40%.

Conclusion

According to the results, nasal septal deviation was the most common anatomic variation. Haller cell and pneumatized septum are the rarest ones noted in our study. Also, there was a strong correlation

between the unilateral Concha bullosa and contralateral septal deviation, which was evident based on the studies.

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