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# Computerized Tomographic Evaluation Of Anatomical Variations Of Paranasal Sinus And Nose

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**Abstract:**

In the era of ESS (Endoscopic sinus surgery), the pre-operative evaluation of anatomical variation of PNS and nose is very important. Computed Tomography is the investigation of choice for detailed evaluation of PNS. Total 120 patients were included in the study from July 2012 to December 2014. The age group 21-40 years was most commonly involved 46.67%. Males are more affected and valued 56.67%. DNS was the most common variation 75% followed by Paradoxical thickend middle turbinate 40.8%, Choncha Bullosa 32.5%, Bony Spur 11.67%, Onodi cells 5.8%, Haller"s cells 5%, Agger Nasi cells 2.5 % and Hypoplasic frontal sinus 1.6%. CT evaluates various anatomical variations of PNS accurately which helps surgeon to be aware of variations which may predispose patients to intra-operative complications. Thus pre-operative CT evaluation of PNS help surgeon for better management and patient care

**Keywords:** Anatomical variation, PNS, CT evaluation,

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## Introduction:

Computed tomography (CT) of the para-nasal sinuses (PNS) and nose has nowadays become the investigation of choice for the radiological diagnosis of nasal and sinus diseases.[1] Unlike plain radiography, sinus CT shows an excellent anatomical soft tissue and bony details, helps in the diagnosis, and gives detail of sinonasal anatomy for safe surgery. Endoscopic sinus surgery (ESS) is a common procedure which requires a meticulous assessment of patient and a detailed radiological description of the anatomy and its anatomical variations in nose and PNS.[2]

The anatomy is very well seen in coronal study of CT scan. It is not possible to study nasal cavity and PNS in detail by conventional radiology and CT scan has largely replaced the conventional radiography. With the advent of functional endoscopic sinus surgery (FESS) and coronal computed tomography (CT) imaging, considerable attention has been directed toward paranasal region anatomy. Currently, CT scanning is the standard imaging in the evaluation of the paranasal sinuses. This gives an applied anatomical view of the region and of the anatomical variants that are very often found. Anatomical variations studied on CT scan are found to block the osteomeatal complex (OMC) and cause chronic sinusitis.

## Various Anatomical variations of PNS and nose:

*Nasal septal deviation:* It is the deviation of the nasal bone dividing the nose into two nostrils to one side. Hence the patient may have recurrent blockage of one nostril. Septal deviations, though common, require to be treated only if they produce symptoms

affecting nasal function. Malalignment of components of the adult nasal septum (septal cartilage, perpendicular ethmoid plate, and vomer) may cause deviation of the nasal septum.

*Concha bullosa:* A concha bullosa is an aerated turbinate, most often the middle turbinate, less commonly, of the inferior and superior turbinate. It is often bilateral than unilateral.

Paradoxic curvature of Middle turbinate – It is an anatomical variation of middle turbinate, where in it's convexity is reversed to face laterally. However it is not associated with any change in the normal middle turbinate attachments. This may lead to impingement of the middle meatus and thus sinusitis or other mucosal diseases of sinus, specially the large ones.

Haller's cells are also known as infraorbital ethmoidal air cells or maxilloethmoidal cells. They are extramural ethmoidal air cells that extend into the inferomedial orbital floor .They may become clinically significant in a number of situations, when become infected, with the potential for extension into the orbit Or may narrow the ipsilateral ostiomeatal complex (OMC) if large .

*Agger nasi cell:* are the most anterior ethmoidal air cells lying anterolateral and inferior to the frontoethmoidal recess and anterior and above the attachment of the middle turbinate. They are located within the lacrimal bone and therefore have as lateral relations the orbit, the lacrimal sac and the nasolacrimal duct. The roof of the aggernasi cell is the floor of frontal sinus, and is therefore, an important landmark for frontal sinus surgery.

*Onodi cells:* The Onodi cell (sphenoethmoidal cell) is an anatomical variation of the most posterior ethmoid air cell that pneumatizes laterally and/or superiorly to the sphenoid sinus and is intimately in contact with the optic nerve. If it is infected or goes unrecognized during surgery it may result in serious damage to the optic nerve.

The aims and objectives of the study were to evaluate the anatomical variation of PNS by CT scan, to compare and analyze congenital anatomical variations of paranasal sinuses in male and female and to assess frequency of anatomical variation of PNS.

## Materials and Methods:

The study was conducted from July 2012 to December 2014 at Peoples College of Medical Sciences Bhopal. All patients were included who were referred for CT scan of PNS,

Investigations were performed by using SIEMENS SIEBHO-5120 (40 Slice MDCT). Axial, Coronal and Sagittal images were obtained for these patients.

Paediatric ages, pregnant women, patients with history of sinonasal surgery or past history of surgery in the paranasal region were not included in the study. Analysis of anatomical variants was performed both using a soft part window and bone density window. In all cases existence of following variants was investigated— 1. Nasal septum 2. Turbinates 3. Uncinate process 4. Ethmoid air cells 5. Other variants e.g. Hypoplasia of maxillary sinus, nasal septum, frontal sinus & asymmetry of both cavities of sphenoid sinus. Additional points were noted for mucosal thickening, polyp & bone destruction.

## Observations & Results:

Total 120 patients were included in the study. The criteria for inclusion of the patients in the study include persistence of symptoms of chronic sinusitis after 15 days of medical treatment. Congenital and anatomical variations are one of the causes of persistent symptoms in the patients of sinusitis. Determination of various anatomical variations helps the treating doctor and surgeon to know about these variations as it helps in the treatment particularly in the endoscopic surgeries. This study has been done to know about the anatomical variation. These findings are recorded in various sub groups.

## Age related anatomical variations:

CT scan detection of anatomical variation according to age group are as follows:

In our study age group of patients was from 16 to above 60 years in which 21 to 40 years is most common age group. This age group may be more prone to external environment and infection. These congenital and anatomical variants are the predisposing factor for the symptoms developed in the cases of refractory sinusitis.

### Sex related anatomical variations:

There is slight male predominance in the various anatomical variations of sinuses. No definite cause could be found in the literature for this variation.

### The incidence of presenting symptoms:

Patients are presenting with nasal obstruction and nasal discharge in the ENT department as main complains. These may be because of thickened mucosa of nasal cavity or thickened turbinate causing the reduced space in the nasal cavity. The next common complaint is headache which may be due to inflamed mucosa of PNS. It causes blocking of nasal passages so that mucus cannot drain properly. Rest of the patients presented with complaint of throat pain, snoring & fever. It is because of infection of sinuses for longer time (more than 2 weeks) with nasal passage block.

Deviated Nasal Sinus (DNS) was the commonest finding seen. Out of 120 patients 90 cases (75%) were present with DNS in which 49 cases (40.83%) were male and 41 cases (34.17%) were female. This study shows slight increase in percentage as compared to other authors. The cause may be that more patients are included in this study than others. DNS was followed by Paradoxical thickened middle turbinate, concha bullosa, bony spur, haller's cells, agger nasi cells, onodi cells and hypoplastic frontal sinus.

**Table 1:**
**Age related anatomical variations**

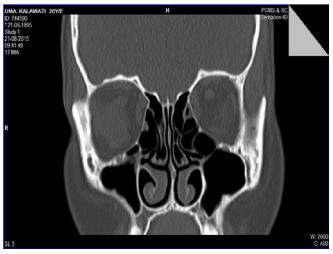
| Age (Years) | Number of cases | Percentage |
|---|---|---|
| 16 to 20 | 23 | 19.17% |
| 21 to 40 | 56 | 46.67% |
| 41 to 60 | 33 | 27.5% |
| Above 60 | 08 | 6.6% |

**Table 2:**
**Sex related anatomical variations**

| Gender | Number of cases | Percentage |
|---|---|---|
| **Male** | 68 | 56.67% |
| **Female** | 52 | 43.33% |

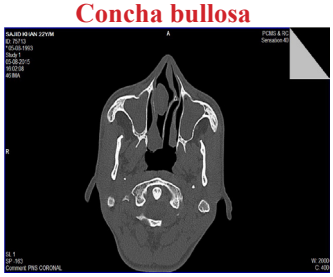
**Table 3:**
**Various types of anatomical variations in paranasal sinus & nasal cavity**

| Variation | Total cases | Male | Female | Age (Years) | | | |
|---|---|---|---|---|---|---|---|
| | | | | 16-20 | 21-40 | 41-60 | Above60 |
| DNS | 90( 75%) | 49 | 41 | 21 | 33 | 32 | 04 |
| Paradoxical Middle Turbinate | 49(40.8%) | 31 | 18 | 12 | 19 | 17 | 01 |
| Concha Bullosa | 39(32.5%) | 21 | 18 | 08 | 14 | 15 | 02 |
| Bony Spur | 14(11.6%) | 08 | 06 | 05 | 04 | 04 | 01 |
| Onodi cells | 7( 5.8%) | 4 | 3 | 1 | 3 | 2 | 1 |
| Haller'S Cells | 6(5%) | 05 | 01 | 01 | 03 | 02 | 00 |
| AggerNasi Cells | 3(2.5%) | 01 | 02 | 01 | 02 | 00 | 00 |
| Hypoplastic frontal sinus | 2(1.66%) | 00 | 02 | 01 | 01 | 00 | 00 |

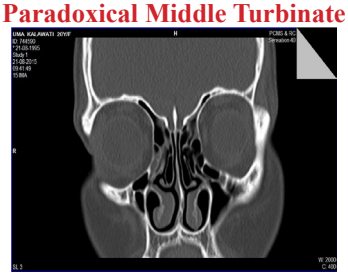


Concha bullosa

Paradoxical Middle Turbinate



DNS with Bony spur



Haller cells

## Discussion:

Many different anatomical variation and congenital anomalies were seen in para nasal sinuses region. Their pre-operative knowledge is very important because they have serious pathological consequences as may cause complication during Endoscopic sinus surgery (ESS).

In our study Deviated nasal septum is the most common variation which was found in 90 (75%) patients in which Males 49(40.8%) and females 41 (34.1%) which are similar to incidence found by Mohammad Hosein Daghighi *et al*[1] 39% in males and 35.2% in females. Majority of the studies showed DNS as the most common anatomical variations, as does the present study. Talaiepour *et al.* (2005)[2], H. Mamatha *et al.* (2010)[3] and recently A. K. Gupta *et al*. (2012)[4] had prevalence rate of DNS as an anatomical variation 65%, 65% and 65.2% in their respective studies.

Presence of choncha bullosa has found in range of 4% to 80% in different studies. In our study it is found in 32.5%which is less compared to 53.6% observed by Bolger and Woodruff[5]. More incidence reported by Zindreich et al[6] (36%) Dua K[7] (16%) and Perez et al[8] (24.5%).

Paradoxical middle turbinate was found in 40.8% in our study is less compared to 58.1% incidence found by Perez et al. It is more than the study of Tonai and Baba's (1996)[9] and Fikret K. et al. (2009)[10] who were found 25.3% and 16.3% respectively. In our study it was found in 56 patients in which 37(30.8%) Unilateral and 19 Bilateral (15.8%).

Haller"s cells was found in 6 (5%) cases in our study while Zinreich and Kenedy[11] reported incidence 10% . It is less than the Incidence reported by Bolger[5] (45.9%) and Asruddin[12] (28%).

In our study Agger nasi cells was found in 3 cases (2.5%) in which 1(0.83%) male and 2 (1.6%)were females, which are similar as reported by Perez- Pinas et al[8]. (2000) 2.7%, S. Lerdlum *et al.*[13] (2005) 7.9% and Fikret K. et al. [10] (2009) 4.7%.

In our study we had found 7(5.8%) cases of Onodi cells, similar incidence was found by Jones[14] in 4% patients.

## 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. Variations studies 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 to avoid these to improve success of management strategies

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