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Research Article

COMPUTERIZED TOMOGRAPHIC EVALUATION OF ANATOMICAL VARIATIONS OF PARANASAL SINUS REGION AND THEIR CLINICAL IMPORTANCE

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Abstract :

The presence of Anatomical variation is found to block the osteomeatal complex (OMC) and cause chronic sinusitis. The detection of these variants to prevent potential hazards is essential for the use of current endoscopic surgery of the sinuses. With the advent of Functional Endoscopic Sinus Surgery (FESS) and coronal computed tomography (CT) imaging, considerable attention has been directed towards paranasal sinus anatomy. CT has improved paranasal sinus (PNS) anatomy and allowed greater accuracy in evaluation. It will help the surgeon to be aware of variations that may predispose patients to increased risk of intra operative complications. The purpose of this study was to assess the frequency of anatomical variations in the chronic sinusitis patients referred for CT scan of PNS. Total 180 patients were included in the study. We found paradoxical thickened middle turbinate in 46.1% cases, concha bullosa in 32.7 % cases, bony spur in 12.7%, Haller cells in 5% cases, AggerNasi Cells in 2.2% cases and Hypoplastic frontal sinus in 1.1 % cases. The presence of anatomical variants does not mean a predisposition to sinus pathology but these variations may predispose to increase risk of intra operative complications.

Keywords—FESS—Functional Endoscopic Sinus Surgery, PNS—Paranasal Sinus, CT—Computed Tomography, OMC—Osteomeatal Complex.

INTRODUCTION

Various anatomical variations found on CT scan studies are found to block OMC and cause chronic sinusitis. In current endoscopic surgery of sinuses necessitate detecting these variants to prevent potential hazards. A precise knowledge of the anatomy of paranasal sinus is essential for the clinician. To be conversant with PNS anatomy has become essential part of investigation to have better results in FESS. 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. Currently CT has become the standard imaging modality to study PNS. CT provides an applied anatomical view of the region and the anatomical variants, often found.

Anatomical variations and congenital anomalies are—

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. Concha bullosa can be determined in coronal CT image clearly.

PARADOXIC CURVATURE – Normally, the convexity of middle turbinate bone is directed medially, towards the nasal septum. As with concha bullosa, the most significant paradoxical turbinates involve the middle turbinate. The inferior edge of the middle turbinate may assume various shapes with excessive curvature, which in turn may narrow and / or obstruct the nasal cavity, infundibulum and middle meatus.

NASAL SEPTAL DEVIATION – The nasal septum is fundamental to the development of the nose and paranasal sinuses. Nasal septum deviation is usually congenital but may be post traumatic. Malalignment of components of the adult nasal septum (septal cartilage, perpendicular ethmoid plate, and vomer) may cause deviation of the nasal septum, deformity of the chondrovomirine articulation, or a septal spur.

INFRAORBITAL ETHMOID CELLS (HALLER'S CELLS) – Infraorbitalethmoid cells are pneumatizedethmoid air cells that project along the medial roof of the maxillary sinus and the most inferior portion of lamina papyracea, below the ethmoid bulla and lateral to the uncinate process. These cells were identified by Haller in1765 and subsequent named after him.

AGGER NASI CELL – The cell found in the lacrimal bone anterior and superior to the junction of the middle turbinate with the nasal wall (often described as the bulge in the lateral nasal wall where middle turbinate attaches). It is hidden behind the anterior most aspect of the uncinate process and drains into hiatus semilunaris. It is the first cell to pneumatize in the new born and is prominent through childhood. The roof of the aggernasi cell is the floor of frontal sinus, and is therefore, an important landmark for frontal sinus surgery.

AIMS & OBJECTIVES

1. To evaluate the anatomical variation of PNS region by CT scan.
2. To study the incident of anatomical variations in PNS in patients with or without sinusitis.
3. To assess the clinical significance of the anatomical variations of PNS.

MATERIALS AND METHODS

The study was conducted from January 2010 to December 2010 at Mahatma Gandhi Medical College, Jaipur. All patients were included who were referred for CT scan of PNS, who were not responding to medical treatment for more than 15 days. Investigations were performed by using SIEMENS SOMATOM PLUS 4 single slice spiral CT scan machine. Coronal studies were done for these patients complimented by axial views in selected cases.

Paediatricage, pregnant women, patients with history ofsinonasal surgery or past h/o 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 & RESULT

Total 180 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 is:

Age (Years)	Number of cases	Percentage
16 to 20	38	21.1%
21 to 40	75	41.6%
41 to 60	54	30%
Above 60	13	7.2%

From the observation it is concluded that 21 to 60 years is most common (71.6%). 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

Gender	Number of cases	Percentage
Male	98	54.5%%
Female	82	45.5%

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:

Nasal obstruction (63.3%) and nasal discharge (35.0%) are main common presenting symptoms in this study. These may be because of thickened mucosa of nasal cavity & thickened turbinate causing the reduced space in the nasal cavity.

Headache (33.3%) is next common symptom in this study. This may be because healthy sinus allows mucus to drain & to circulate throughout the passage. When sinuses are inflamed these areas get blocked and mucus cannot drain, leads to nose blocked, congested & filled with mucus. This is also cause of presenting symptoms in facial congestion, facial pressure, followed by sneezing which occur when inflamed thickened turbinate gets foreign allergen stimulus (smoke, pollution etc.), followed by nasal drip and it is because when nasal passages are irritated by allergen, air pollution or smoke, nose and sinus membrane secrete more than normal amount of mucus.

Rest of the patients present with complaint of throat discomfort, snoring, fever. It is because of infection of sinuses for longer time (more than 2 weeks) with nasal passage block.

Various types of anatomical variations in paranasal sinus & nasal cavity—

Variation	Male	Female	Age (Years)			
			16-20	21-40	41-60	Above 60
ChonchaBullosa	32	27	13	22	22	02
Paradoxical Middle Turbinate	52	31	20	33	28	02
DNS	77	65	29	44	44	05
Haller's Cells	07	02	01	04	04	01
AggerNasi Cells	00	04	00	01	01	00
Bony Spur	13	10	06	07	07	00
Hypoplastic frontal sinus	00	02	01	00	00	00

Variation	Unilateral		Bilateral		Total	Percentage
	Cases	Percentage	Cases	Percentage		
ChonchaBullosa	54	30%	05	2.7%	59	32.7%
Superior ChonchiBullosa	08	4.4%	05	2.7%	13	7.2%
Paradoxical MiddleTurbinate	56	31.1%	27	15%	83	46.1%

DEVIATED NASAL SINUS (DNS)—

It is the commonest finding 142 cases (78.8%)

Out of 180-- Males 77 cases (54.46%)

Females 65 cases (45.54%)

Age group—21 to 40 years –64 patients

41 to 60 years –44 patients

16 to 20 years –29 patients

> 60 years – 05 patients

The commonest age group is 21 to 60 years

This study shows slight increase in percentage as compared to other authors. The cause may be that more patients are included in thisstudy than others.

PARADOXICAL THICKENED MIDDLE TURBINATE –

It is next common finding- 83 cases (46.1%)

Out of 83 cases – Males 52 cases (62.7%)

Females 31 cases (37.3%)

Age group---21 to 40 years – 33 cases

41 to 60 years –28 cases

16 to 20 years –20 cases

> 60 years –02 cases

The commonest age group is 21 to 60 years

Out of total 83 cases (46.1%) of Paradoxical thickened middle turbinate 27 cases (15%) were found bilateral and 56 cases (31.1%) were unilateral.

It is slightlymore than other studies.

CONCHA BULLOSA—

Next common finding – 59cases (32.7%)

Out of 59 cases – Males 32 cases(54.2%)

Females 27 cases (45.8%)

Age group--- 21 to 40 years – 22 cases

41 to 60 years – 22 cases

16 to 20 years –13 cases

> 60 years –02 cases

Most common age group 21 to 60 years

Out of 59 cases (32.7%) only 5 cases (2.8%)were found bilateral and 54 cases (30.0%) were unilateral.

Findings are same as those of other authors.

BONY SPUR—

Next common finding – 23 cases (12.7%)

Out of 23 cases – Males 13 cases (56.5%)

Females 10 cases (44.5%)

Age group--- 21 to 40 years – 03 cases

41 to 60 years –04 cases

16 to 20 years –01case

> 60 years - 01 case

Most common age group 21 –60 years

It is shown more in American & Japanese study. This may be due to geographical variation.

HALLER'S CELLS--

Only 9 (5%) cases were found

Males – 7 cases

Females – 2 cases

Age group - 41 to 60 years – 04 cases

21 to 40 years –03 case

16 to 20 years – 01 case

>60 years – 01 case

Commonest age group 21 -- 60 years

It is shown more in American & Japanese study. This may be due to geographical variation.

AGGER NASI CELLS--

Only 4 (2.2%) were found and all cases were females

Age group --- 21 to 40 years – 03 cases

41 to 60 years –01 case

Commonest age group 21 -- 60 years

This study shows decreased in cases of Aggernasi cells & it may be because of geographical distribution. Further studies are required to know exact cause.

HYPOPLASTIC FRONTAL SINUS--

It is the least variation (1.1%) in the present study & female predominance of 2 cases out of 180 were noted and both were females. Regarding age group 16–40 years age group has a higher number of incidence. In comparison to other study, no incidence was detected in various authors' literature

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.

SUMMARY

- This study was undertaken to evaluate the anatomical variations in paranasal region by CT scan and evaluate their clinical importance.
- The study includes 180 patients referred for CT of PNS.
- Unenhanced CT of PNS was performed for these patients in the coronal plane, complemented by axial views in selected cases.
- 180 patients who fulfilled the criteria were studied, out of which 82 (45.45%) were female and 98 (54.55%) were male.
- According to the age group the various anatomical variation were noted are,16-20 years (21.1%), 21-40 years 75 cases (41.6%), 41-60 years 54 cases (30%), 61 and above 13 cases (7.2%).Higher incidence of anatomical variation is noted in age group 21-60 years 129 cases (71.66%).
- Deviated nasal septum was the most common variation in 142 (78.8%) followed by middle concha bullosa in 59 (32.7%) patients. Other variations found were Paradoxical middle turbinate in 81 (46.1%), Superior chonchabullosa in 13 (7.2%), prominent aggernasi cells in 4 (2.2%), haller's cells in 9 (5%).
- The presence of anatomical variants does not mean a predisposition to sinus pathology but these variations may predispose patients to increased risk of intra-operative complication. The radiologist must pay close attention to anatomical variants in the

preoperative evaluation and provide a road map to surgeon and help avoid possible complications and improve success of management strategies.

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