

ORIGINAL ARTICLE

Role of CT- Scan in Assessment of Anatomical Variants of Nasal Cavity and Paranasal Sinuses

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ABSTRACT:

Objective: To evaluate the role of CT scan of nasal cavity and paranasal sinuses in preoperative assessment of anatomical variants and in determining their frequencies.

Materials and Methods: This descriptive study was done as a part of residency training for FCPS in the subject of Radiology on 132 patients who visited the hospital, Sindh Institute of Urology and Transplantation (SIUT) from March 2012 to April 2013. All CT scans were reviewed for presence of concha bullosa, variations of uncinata process, haller cell, onodi cells, agger nasi cells, ethmoid bulla, paradoxical middle turbinate, deviated nasal septum (DNS), pneumatization in the nasal septum, superior and middle turbinate, and uncinata process. Frequencies of all anatomical variants were calculated using SPSS version 16.

Results: Deviated nasal septum was found to be the most frequent variant 31% followed by Concha bullosa 18.9% and variations in uncinata process 12%. Rhino sinusitis was found in all cases with paradoxical medial turbinate and patients with variation in uncinata process.

Conclusion: CT scan can play an important role in preoperative assessment of variants and in determining their frequencies in nasal cavity and paranasal sinuses. It could be of great help for surgical planning and minimizing the surgical complications in patients.

Keywords: CT-Scan, Anatomical variants, Nasal cavity, Paranasal sinuses, Rhino sinusitis, Preoperative assessment

INTRODUCTION:

The advent of less invasive endoscopic technique of sinus surgery (ESS) has emerged with an important role of CT scan of paranasal sinuses, not only as diagnostic tool but also as an important part in surgical planning.¹

Unlike plain radiography, sinus CT shows excellent anatomical details. Endoscopic sinus surgery (ESS) is a frequently performed procedure which requires a meticulous evaluation of patient and a detailed radiological description of the anatomy and its anatomical variations in nose and paranasal sinuses (PNS).² Although the part of anatomical variations of osteomeatal complex in the etiology of sinonasal disease is controversial³ but knowledge of these variations in every patient is important for surgical planning in order to avoid damage to surrounding vital structures like the orbit and the brain. The frequency of these variations may differ among different ethnic groups.^{4,5}

The classic transbuccal maxillorhinostomy, described first in 1893 by George Caldwell and then in 1897 by Henry Luc of Paris (Caldwell-Luc operation), was one of the most common techniques for the relief of maxillary sinusitis.^{6,7} This operation is now rarely used for chronic hyperplastic rhinosinusitis. It is used mainly for the removal of tumors of the maxillary sinus and for patients in whom intranasal antrostomy or endoscopic decompression of the osteomeatal complex is not effective.⁸ Likewise, in many instances, for patients with chronic hyperplastic rhinosinusitis, procedures such as transantral ethmoidectomy, external ethmoidectomy, external fronto-ethmoidectomy, and standard intranasal sphenoidectomy have been replaced by endoscopic sinus surgery. The proponents of endoscopic sinus surgery advocate conservative approaches for chronic hyperplastic nasal and paranasal diseases. It has been argued that limited procedures aimed at mechanical clearance of the osteomeatal complex might be effective in controlling chronic sinonasal diseases.^{9,10}

The paranasal sinuses, like other parts of the upper respiratory system, are lined with a pseudostratified, columnar, ciliated epithelium interspersed with goblet cells. Under the epithelium is a tunica propria containing mucous and serous glands that open onto the epithelial surface via branched ducts.^{11,12} Certain anatomic variants are thought to be predisposing factors for the development

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of sinus diseases and thus it becomes essential for the radiologist to be aware of these variations, and should mention it in radiology reports. Hence present study was conducted to evaluate the role of CT scan of nasal cavity and paranasal sinuses in preoperative assessment of anatomical variants and in determining their frequencies.

MATERIALS AND METHODS:

This descriptive study of CT scans PNS was done at the Sindh Institute of Urology and Transplantation (SIUT), Karachi, as a part of residency training for FCPS in the subject of Radiology and comprises of data from 132 patients who had visited the hospital from March 2012 to April 2013. All patients had CT scan done for sinonasal symptoms. Patients who had previous sinonasal surgery or had neoplastic disease, inflammatory or polypoidal mucosal diseases of paranasal sinuses obscuring anatomical details were excluded from study. Pediatric age group patients less than 14 years of age were also excluded. CT scan images of all 132 patients were reviewed for anatomical variations. Coronal and axial images on bone algorithm were obtained. Each scan was reviewed by two senior radiologists for presence of concha bullosa, variations of uncinete process, haller cell, onodi cells, agger nasi cells, ethmoid bulla, paradoxical middle turbinate, deviated nasal septum (DNS), pneumatization in the nasal septum, superior and middle turbinate, and uncinete process. A septum was termed DNS when it was obstructing at least half of the nasal cavity. Frequencies of all anatomical variants were calculated using SPSS version 16.

RESULTS:

Out of 132 patients 78 (60%) were males and 54 (40%) were females, ranging in age from 15 to 78 years with mean age of 46.5 years. No anatomical variation was found in 46 (34.8%) patients.

Deviated nasal septum was seen in 42 (31%) patients, concha bullosa was present in 25 (18.9%) patients whereas variation in uncinete process was seen in 16 (12%) patients. Haller cells and agger nasi cells were found in 5 (3.7%) and 9 (6.8%) patients respectively (Figure 1, 2, 3). Pneumatization of nasal septum was seen in only one patient (0.7%). Pneumatized turbinates were not seen in any patient, although pneumatization of uncinete process was observed in 3 (2.2%) patients. Paradoxical middle turbinate was present in 12 (9%) cases. Septal spur was identified in 4 (3%) patients (Table 1).

15 cases came out with more than single anatomical variants. In 3 (2.2%) cases concha bullosa and haller cell both were present. In 3 (2.2%) variation in uncinete process with paradoxical medial turbinate were seen. In 7 (5.3%) patients deviated nasal septum was present along with septal spur and in 2 (1.5%) patients pneumatized nasal septum with pneumatized uncinete process was seen.

Table: 1
Anatomical variants and their frequencies

Variants	Frequencies
Deviated nasal septum	31%
Concha bullosa	18.9%
Variation in uncinete process	12%
Haller cells	3.7%
Agger nasi cell	6.8%
Pneumatization of nasal septum	0.7%
Septal spur	4%
Pneumatization of uncinete process	2.2%
Paradoxical medial turbinate	9%

Figure: 1
CT coronal image of 32 years old male showing concha bullosa bilaterally

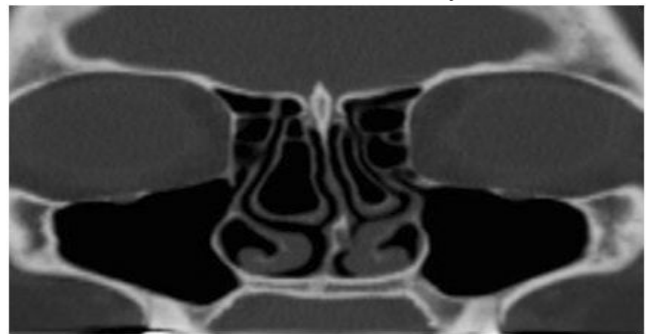


Figure: 2
CT scan paranasal sinuses coronal image of 22 year old female showing prominent agger nasi cell on left side



Figure: 3
CT scan paranasal sinuses coronal image showing haller cells on both sides



DISCUSSION:

A detailed knowledge about the anatomical variations of paranasal sinuses before may prove beneficial during endoscopic sinus surgery. The contribution of these variants to disease has been questioned as the variant are equally prevalent in asymptomatic patients and in a group with proven sinusitis. Deviated nasal septum can be defined in a number of ways. In this study any deviation causing at least 50% of blockage of nasal cavity is taken as deviated nasal septum. Significantly deviated nasal septum may cause compressive effect over inferior or middle nasal turbinates, resulting in obstruction of normal mucosal flow and consequently leads to inflammation and infection.^{13,14} In our study frequency of anatomical variations in paranasal sinuses upon comparison to a local study done by Adeel¹⁵ showed deviated nasal septum as the most frequently found variant. In present study deviated nasal septum was seen in 31% patients and in compared study it was present in 26% patients. Shpilberg has also reported deviated nasal septum as the most frequently found variant in his study.¹⁶

Air cells in the nasal septum are commonly found within the posterior portion of the septum and communicate with the sphenoid sinus and harvest the infections from paranasal sinuses. In our study pneumatized nasal septum was seen in 1 (0.7%) patient whereas none of the patient had pneumatized septum in the study of Adeel.¹⁵ Concha bullosa can limit the surgical field, if enlarges it can also obstruct the osteomeatal complex and lead to inflammatory disease of paranasalsinus. In our study concha bullosa was the second commonest anatomical variant found in 18.9% cases. The reported prevalence of concha bullosa varies widely from 14-80%¹⁷ however Adeel also found it to be the second most common anatomical variant and reported it to be 18.2%.¹⁵ Aerated turbinates were not seen in our study whereas prevalence of pneumatized middle turbinate varies from 4% to 73%.^{18,19,20} Haller's cells (Infraorbital ethmoid cell) are the anterior ethmoid cells that project along the medial roof of the maxillary sinus and the inferior most portion of the lamina Papyracea. Our study reported 3.7% cases with Haller cells. Careful preoperative assessment for presence of onodi cell has a great impact on surgery as onodi cell is the posterior most air cell of posterior ethmoid which can extend near to carotid canal and close to optic nerve. Onodi cell was not seen in any patient in present study probably due to our small sample size whereas it was observed in 7.8% patients in other studies.^{21,22}

In present study 12% patients had variants of uncinat process. Moreover pneumatization of uncinat process was seen in 2.2% cases whereas a study has documented prevalence rates of 5%.¹³ Paradoxical medial turbinate is the convex outward curvature of medial turbinate which may cause narrowing of medial meatus and compromise the ventilation of osteomeatal complex.^{23,24,25} Paradoxical medial turbinate was seen in 9% of study cases. Other studies found it from 11-25%.^{13,24} Interestingly in our study rhinosinitis was found in all

cases with paradoxical medial turbinate and patients with variation in uncinat process.

CONCLUSION:

Formal preoperative assessment of variants in paranasal sinuses in nasal cavity have great impact over surgical planning and minimizing the surgical complications in patients undergoing head and neck surgery in the mentioned area.

Radiologist can play a vital role in providing the information required by head and neck surgeons. Working as a team benefits to patients can be maximized and conversely complications can be minimized.

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