Section: Anatomy

Original Research Article

RETROSPECTIVE EVALUATION OF ANATOMICAL VARIATIONS OF PARANASAL SINUSES AT A TERTIARY CARE HOSPITAL: A RADIOLOGICAL STUDY

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Abstract

Background: The nasal cavity and paranasal sinuses occupy the top of the upper respiratory tract and form pneumatic spaces connected with the atmosphere. They are located immediately beneath the base of the cranium, where crucial vital structures are harbored. Hence, the present study was conducted for evaluating anatomical variations of paranasal sinuses. **Materials and Methods:** A total of 100 patients were evaluated. Sinonasal CT examinations were reviewed to determine anatomic variations. All patients had CT scan done for sinonasal symptoms. Complete demographic and clinical details of all the patients were obtained. A Performa was made, and detailed variations were recorded separately. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. **Result:** Anatomical variations of paranasal sinuses were seen in 52 percent of the patients. The incidence of nasal septum deviation was seen to be 65 percent. Out of these 65 patients, single curvature was seen in 52 patients while double curvature was seen in 13 patients. The incidence of Pneumatization of superior nasal concha, middle nasal concha and inferior nasal concha was 15 percent, 48 percent and 2 percent of the patients. **Conclusion:** In PNS, many anatomical variants with anatomic and surgical importance may be often observed. Therefore, in order to optimize patient benefit and prevent major complications, each case needs to be thoroughly examined before surgery.

INTRODUCTION

The nasal cavity and paranasal sinuses occupy the top of the upper respiratory tract and form pneumatic spaces connected with the atmosphere. They are located immediately beneath the base of the cranium, where crucial vital structures are harbored. From this region, very much exposed to airborne agents, arise some of the more complex and rarer benign and malignant lesions seen in humans, whose difficulties in interpretation make this remarkable territory one of the most challenging in the practice of surgical pathology.[1-3] It is important to understand the developmental anatomy of the paranasal sinuses. This is because accurate knowledge of sinus growth patterns is vital to our ability to diagnose pathology and plan appropriate treatment. These paired paranasal sinuses arise from the cartilaginous nasal capsule and develop with unique and highly variable growth patterns. This has important implications for surgical intervention—especially with the increasing use of functional endoscopic sinus surgery (FESS).[4,5]

Especially for the functional endoscopic surgery and its large use in treating chronic sinusopathy refractory to medication, optimal evaluation of this region is of great importance for the safety and success of the procedure. Nouarei et al. in their study on 278 patients in 2009 concluded that the anatomic variants of the bone structures were not increasing the risk to develop mucosal disease of the sinus, but they cannot exclude the potential impact on the safety of the surgery. Therefore, these anatomic variations need to be assessed in the preoperative evaluation.[6-8] Hence; the present study was conducted for evaluating anatomical variations of paranasal sinuses.

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MATERIALS AND METHODS

The present study was conducted for evaluating anatomical variations of paranasal sinuses. A total of 100 patients were evaluated. Sinonasal CT examinations were reviewed to determine anatomic variations. All patients had CT scan done for sinonasal symptoms. Complete demographic and clinical details of all the patients were obtained. A Performa was made, and detailed variations were recorded separately. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

Table 1: Incidence of anatomical variations

Anatomical variations	Number	Percentage
Present	52	52
Absent	48	48
Total	100	100

Table 2: Incidence of nasal septum variations

Anatomical variations	Number	Percentage
Present	65	65
Absent	35	35
Total	100	100

A total of 100 patients were evaluated. Out of these 100 patients, anatomical variations were seen in 52 percent of the patients. The incidence of nasal septum deviation was seen to be 65 percent. Out of these 65 patients, single curvature was seen in 52 patients while double curvature was seen in 13 patients. The incidence of Pneumatization of superior nasal concha, middle nasal concha and inferior nasal concha was 15 percent, 48 percent and 2 percent of the patients.

DISCUSSION

The success of functional endoscopic surgery depends on adequate knowledge of the complicated anatomy of the paranasal sinuses, which is variable. It is important to recognize the clinical and surgical significance of these variations. This cell is present in nearly all patients and is an ethmoturbinal remnant. It is the most anterior ethmoidal air cell and extends anteriorly into the lacrimal bone. It lies anterior, lateral, and inferior to the frontal recess and borders the primary ostium of the frontal sinus. A good view of frontal recess is obtained when the agger nasi cells are opened. Thus, its size may directly influence the patency of the frontal recess and the anterior middle meatus.[9-11] Hence; the present study was conducted for evaluating anatomical variations of paranasal sinuses.

A total of 100 patients were evaluated. Out of these 100 patients, anatomical variations were seen in 52 percent of the patients. The incidence of nasal septum deviation was seen to be 65 percent. Out of these 65 patients, single curvature was seen in 52 patients while double curvature was seen in 13 patients. Devaraja et al evaluated the anatomical variations in computed tomographic (CT) images of paranasal sinuses. The studied characteristics in the CT images included the deviated nasal septum (DNS), concha bullosa (CB), Haller cell (HC), Onodi cell (OC), pneumatization of anterior clinoid process (ACP), pterygoid base (PB), superior turbinate, inferior turbinate, crista galli (CG), and nasal septum. The associations between these factors, and with maxillary sinus opacifications were also investigated. A total of 151 adult patients' CT images were analyzed. The most common manifestations noted were DNS, CB and pneumatized PB, seen in 83.4%, 49% and 47% of the patients respectively. The rates of HC, OC, pneumatized septum, pneumatized CG, and pneumatized ACP were 39%, 23%, 27%, 43% and 27% in that order. Rates of most of these variations were within the range reported in the literature. Chi square test revealed that the OC was independently associated with pneumatized CG and pneumatized septum. The maxillary sinus opacification was related to DNS and CB, but not with protrusion of tooth root into the sinus.[12]

In the present study, incidence of Pneumatization of superior nasal concha, middle nasal concha and inferior nasal concha was 15 percent, 48 percent and 2 percent of the patients. Papadopoulou et al reviewed the prevalence of anatomical variations in the sinonasal area. They performed on PubMed a literature search from October 2004 until May 2020. The search strategy included the following keywords: ('paranasal sinus' OR 'frontal sinus' OR 'maxillary sinus' AND ('anatomical variants' OR 'anomalies'). Fifty studies were eligible and included in the analysis. Overall, the studies encompassed a total of 18,118 patients included in this review. Most common anatomical variations include agger nasi cells, nasal septum deviation and concha bullosa. Other variations seen in this region are uncinate process variations, paradoxical middle turbinate, Haller, Onodi and supraorbital ethmoid cells, accessory ostia of maxillary sinus. Less common variations include any sinus aplasia, crista galli pneumatization and dehiscence of the optic or maxillary nerve, internal carotid artery and lamina

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papyracea. Anatomical variations of this region also differ among ethnic groups. Their study highlighted the amount, variability and significance of most anatomical variants reported in the literature in the last years.[13] Roman et al assessed, by using the Cone Beam CT (CBCT) reformatted images, the presence of anatomical variants of the sinonasal cavities. The anatomical variants were detected both in the inflammation and control group. From the spectrum of variations concha bullosa, deviation of uncinate process and asymmetrical ethmoid roof presented significant association with sinusitis. The deviated position of the uncinate process appeared in more than 50% of patients in the positive group [OR=2.55] compared with a third of the control group. Concha bullosa was observed in 31% cases, 23% in the control group and 34% in the positive group [OR=1.73]. Haller cells showed a small difference between groups [OR=1.14] whereas the ethmoid roof asymmetry was evidently more prevalent in the inflammation group. The anatomical variants of the paranasal sinuses are not incidental, being found in a large number of patients and may be a predisposing factor in the onset and recurrence of sinuses inflammation.[14]

CONCLUSION

In PNS, many anatomical variants with anatomic and surgical importance may be often observed. Therefore, in order to optimize patient benefit and prevent major complications, each case needs to be thoroughly examined before surgery.

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