ORIGINAL RESEARCH PAPER

ENT

KEY WORDS: anatomic variations, computed tomography scan, nasal septum, nose and paranasal sinuses

DISTRIBUTION OF ANATOMIC VARIATIONS OF THE NOSE AND PARANASAL SINUSES IN KASHMIRI POPULATION BY COMPUTED TOMOGRAPHY SCAN ANALYSIS.

Owais Makhdoomi* Medical Officer in Department Of Health Kashmir. *Corresponding Author

Syed Waseem Abass Post Graduate in Department Of ENT&HNS Government Medical College Srinagar.

Majid Ul Islam Masoodi Post Graduate in Department Of ENT&HNS Government Medical College Srinagar.

ABSTRACT

Background: Knowledge of anatomy constitutes an integral part of the total management of patients with sinonasal diseases. The aim of this study was to obtain the prevalence of sinonasal anatomic variations in the Kashmiri population and to understand their importance and impact on the disease process, as well as their influence on surgical management and outcome.

Materials and Methods: This study is a prospective review of retrospectively performed normal computed tomography (CT) scans of the nose and paranasal sinuses in the adult Kashmiri population at SMHS Hospital. The scans were reviewed by two independent observers.

Results: The most common anatomic variation after excluding agger nasi cells were pneumatized Crista Galli, which was seen in 69% of the scans. However, the least common variation seen in this series was Pneumatized inferior turbinate, which was encountered in 1.1 % of the cases.

Conclusion: A wide range of regional differences in the prevalence of each anatomic variation exists. Understanding the preoperative CT scan is substantially important because it is the roadmap for the sinus surgeon. Detection of anatomic variations is vital for surgical planning and the prevention of complications.

INTRODUCTION

The superiority of computed tomography (CT)unrecognized important anatomical landmarks and significant anatomic variations scan compared with conventional radiography has unquestionable importance for the evaluation of anatomic structure and pathology [1]. Nowadays, both radiologists and otolaryngologists depend on CT scans as the radiological modality of choice for the evaluation of the nose and paranasal sinuses [2]. CT scan has the ability to detect fine bone architecture of the nasal cavity and paranasal sinuses, the mucosa, and the air, thus making it a preferred tool for imaging [3]. Using multiplanar reformatted imaging of the sagittal and coronal views will help in identifying the anatomic variation in paranasal sinuses and eliminating the artefacts. In addition, using bone and soft tissue windows may help in the evaluation of dehiscence abnormalities [4]. It is essential to perform a CT scan of the paranasal sinuses before attempting sinonasal surgery, to avoid potential complications resulting from.

In the advanced era of endoscopic sinus and skull base surgery, a thorough knowledge of the precise anatomy and common anatomic variation of the nose and paranasal sinuses and the relation with the neighbouring structures constitute an integral part of the total diagnostic and therapeutic management of patients with the sinonasal disease [6,7]. As such, a detailed preoperative checklist evaluation of the sinonasal CT scan enhances the safety and efficacy of the nose and paranasal sinus surgery [8]. CT scan will help the otolaryngologist in understanding the complex anatomy, which could cause the sinonasal symptoms. In addition, it will Help in identifying the landmarks that play a significant role for orientation during endoscopic sinus surgeries (ESSs) and aid in performing successful surgery with avoidance of serious complications [9].

Although anatomic variation in the sinonasal region is not uncommon [10], it was found that the frequency of these variations may differ among the different ethnic groups [11].

The purpose of this study was to determine the background of the prevalence of the most common anatomic variations in the nose and paranasal sinuses among adults of Kashmiri Arabia and to compare our results with other published data.

MATERIALS AND METHODS

We conducted a prospective review of retrospectively performed normal CT scans of the nose and paranasal sinuses in the adult Kashmiri population. Patients consent for emolument in the study was obtained prior to the review. The study was conducted at the Otolaryngology Department of ENT in SMHS hospital in Kashmir.

In this study, we reviewed a total of 403 consecutive CT scans of the paranasal sinuses over a period of 2 Years. Of all CT scans reviewed, only 204 were normal adult CT scans that met our inclusion criteria.

Anatomic variations that have been investigated include the following: variations of the nasal septum(deviation, spur, and pneumatization), pneumatization of the crista Galli, variations of the turbinate's (inferior turbinate pneumatization, paradoxical middle turbinate, and pneumatized middle turbinate), variations of the maxillary sinus (hypoplasia and presence of septation), variations of the frontal sinus (aplasia and hypoplasia), and presence of variants of specific ethmoidal sinus cells (agger nasi cell, Haller's cell, an Onodi cell).

Data recording and statistical analysis were carried out using Excel Microsoft Workbook. The study was approved by the local institutional research and ethics committee.

RESULTS

A total of 403 consecutive CT scans of the paranasal sinuses were reviewed over a period of 2 years, of which 204 were excluded. Reasons for exclusion include the presence of sino-nasal disease in 199 scans, no images available in 140 scans.

The rest of the CT scans were performed with a helical multislice GE scanner (GE, Standish, Maine, USA). Specification of this device includes 0.63–1mm section thickness and interval direct coronal and axial cuts. Images were installed and archived from the Picture Archiving Communication System (PACS) software.

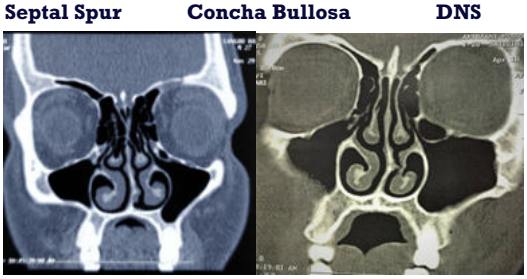
We excluded patients who were less than 12 years of age,

those of non-Kashmiri nationality, patients who had previously undergone nasal or paranasal sinus surgery, patients in eight cases. The 199 included scans were of Kashmiri adults with clear paranasal sinuses or minimal mucosal disease and with no history of previous sino-nasal surgery. All CT scans were requested by otolaryngologists to rule out sino-nasal disease. Agger nasi cell was found in the entire study sample bilaterally. The most common anatomic variation after excluding agger nasi cells was pneumatized Crista Galli, which was seen in nearly 3/4th of the scans. However, the least common variation seen in this series was hypoplasia of the maxillary sinus, which was encountered in 5% of the cases. We did not detect a single pneumatized inferior turbinate among the studied scans. Frequency and prevalence of the anatomical variations in the studied population is described in Table 1.

Table 1 Frequency & Prevalence of anatomic variations

Variants	N	Percent
Agger nasi cell	199	100
Pneumatized crista galli	137.31	69
Pneumatized middle turbinate	83.58	42
Deviated nasal septum	71.64	36
Haller's cell	59.899	30.1
Septal spur	59.501	29.9
Frontal hypoplasia	55.322	27.8
Paradoxical middle turbinate	53.133	26.7
Pneumatized septum	30.049	15.1
Onodi cell	26.069	13.1
Maxillary sinus septum	18.109	9.1
Frontal agenesis	16.318	8.2
Maxillary hypoplasia	11.542	5.8
Pneumatized inferior turbinate	2.189	1.1

Septal Spur **Concha Bullosa** **DNS**



HIT **Agger Nasi**

DISCUSSION

ESS is a minimally invasive procedure that has been introduced as a valuable option in the management of sinonasal diseases [12]. The success, outcome, and completeness of the ESS procedure are directly related to the understanding of sinus anatomy [13]. As such, it is substantially important for otolaryngologists to study the detailed normal anatomy and anatomic variations of the nose and paranasal sinuses for each individual patient before ESS [14].

In this report, we studied different important anatomic variations in the nose and paranasal sinuses in adult Kashmiri patients and we compared our results with other reports in the literature. There is a significant body of literature supporting the link between the presence of anatomic variations and the development of sinonasal disease [15].

The overall prevalence of anatomic variations in our study is higher than that reported in the literature. This was not expected as our study population has no or very minimal sinus disease. Such an unexpected result could be due to the difference in population size, the difference in selecting the studied CT scans (disease, undiseased, or mixed group), the number and nature of included anatomical variations, the quality and standards of the CT scan used, and the subjectivity in reading the CT images. In addition, it has been reported that ethnic differences may influence the prevalence of some anatomic variations in the sinonasal region [11].

Badia et al. [11] reported a significantly higher incidence of sphenoid ethmoid cells (Onodi cells) in the Chinese population in comparison with the Caucasian population.

In a different report, Cho et al. [16] found a significantly low incidence of supraorbital ethmoid cell in the Korean population at 2.6% compared with 64.6% in the white population, which could be attributed to the pronounced glabella and superior orbital rim found in Caucasians.

The difference in the prevalence of anatomical variation in our study population and others reported in the literature can be seen in Tables 2.

Table 2 Prevalence of Anatomic variations

References	% Anatomic Variations	Remarks
This study	49.7	Kashmiri population
Bolger et al	64.9	Mixed group
Earwaker	93	Sinus Patients
Perez Penas et al	67.3	Spanish Sinus population
Zinreich	13-62	Non sinus and sinus groups
Adeel et al	51.9	Pakistani population

In this study, we have utilized specific definitions for the variations in the nasal cavity and paranasal sinuses. In addition, we highlighted the clinical significance of each one of them.

CONCLUSION:

Considering the wide range of variations in the anatomy, each paranasal sinus case should be planned individually and carefully to avoid dreadful complications and maximize patients' benefit. There is an obvious wide range of prevalence among all anatomical variations. Our results generally were found to fall into those reported ranges with the exception of the higher prevalence of pneumatized Crista Galli and paradoxical middle turbinate. This can be attributed to many factors such as our sample size of patients, the investigator error, possible differences in the CT imaging techniques, and ethnic variations. Because of the differences in various populations, identification of anatomic variations within the paranasal sinuses in every individual patient with the sinonasal disease is substantially important to ensure safe and complete surgery.

Declaration:
Source of funding: None
Conflict of Interest: None

Ethical Clearance: Taken from the Institutional Ethical committee of Government Medical College Srinagar

Patient Consent: Written Inform consent was taken from each patient before recruiting them for this study.

REFERENCES

1 GülerC, UysalIÖ,PolatK,SalkI,MüderrisT,Kosa□rMI.Analysisofethmoid roof and skull base with coronal section paranasal sinus computed tomography. J Craniofac Surg. 2012;23:1460–1464.
2 Zinreich SJ. Rhinosinusitis: radiologic diagnosis. Otolaryngol Head Neck Surg 1997;117:S27–S34.
3 Aygun N, Zinreich SJ. Imaging for functional endoscopic sinus surgery. Otolaryngol Clin North Am 2006;39:403–416.
4 Midilli R,Aladag G,Erginöz E, Karci B,Savas□R. Anatomicvariations ofthe paranasal sinuses detected by computed tomography and the relationship between variations and sex. Kulak Burun BogazIhtisDerg2005;14:49–56.
5 Jaworek JK, Troc P, Chrzan R, Sztuk S, Urbanik A, Walocha J. Anatomic

variations of the septation within the sphenoid sinus on CT scan images □ an initial report. Przegl Lek 2010; 67:279–283.
6 Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities: CT analysis for endoscopic sinus surgery. Laryngoscope 1991; 101(Pt 1):56–64.
7 Zinrech SJ. Functional anatomy and computed tomography imaging of the paranasal sinuses. Am J Med Sci 1998; 316:2–12.
8 SimmenD,SchuknechtB.Computerizedtomographyofparanasalsinuses □ a preoperative check list. Laryngorhinootologie 1997; 76:8–13.
9 Prescher A. Clinical anatomy of the paranasal sinuses. Descriptive anatomy, topographyandimportantvariations. HNO. 2009;57:1039–1050.
10 Becker SS. Preoperative computed tomography evaluation in sinus surgery: a template-driven approach. Otolaryngol Clin North Am 2010; 43:731–751.
11 Badia L,LundVJ,Wei W, Ho WK.Ethnic variationin sinonasalanatomyon CT-scanning. Rhinology 2005; 43:210–214.
12 Silva LC, Zoppa AL, Fernandes WR, Baccarin RY, Machado TS. Bilateral sinus cysts in a filly treated by endoscopic sinus surgery. Can Vet J 2009; 50:417–420.
13 Adeel M, Rajput MS, Akhter S, Ikram M, Arain A, Khattak YJ. Anatomical variations of nose and para-nasal sinuses; CT scan review. J Pak Med Assoc 2013; 63:317–319.
14 Kantarci M, Karasen RM, Alper F, Onbas O, Okur A, Karaman A. Remarkable anatomic variations in paranasal sinus region and their clinical importance. Eur J Radiol 2004; 50:296–302.
15 Fadda GL, Rosso S, Aversa S, Petrelli A, Ondolo C, Succo G. Multiparametric statistical correlations between paranasal sinus anatomic variations and chronic rhinosinusitis. Acta Otorhinolaryngol Ital 2012; 32:244–251.
16 Cho JH, Citardi MJ, Lee WT, Sautter NB, Lee HM, Yoon JH, et al. Comparison of frontal pneumatization patterns between Koreans and Caucasians. Otolaryngol Head Neck Surg 2006; 135:780–786.