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Original Research Article

ANATOMICAL VARIATIONS OF THE NASAL SEPTUM: A COMPUTED TOMOGRAPHY STUDY

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Abstract

Aim

To determine the frequency of anatomic variations of the nasal septum using computed tomography (CT) scans.

Materials and Methods

The present study was conducted using CT imaging of the lateral nasal wall, nasal septum, and paranasal air sinuses. The study population comprised patients referred to the radiology departments of Government ENT Hospital, Koti, Hyderabad, and Gandhi Hospital, Musheerabad, Secunderabad over a period of six months, from May 1st, 2016, to September 30th, 2016.

Results

In this study, the nasal septum was categorized under three headings: no deviation, unilateral deviation, and bilateral deviation. Among these categories, unilateral septal deviation was the most prevalent, observed in 82% of cases. Bilateral septal deviation was the least common, found in only 2% of cases. These findings are consistent with those reported in previous studies.

Conclusion

The study highlights the prevalence of unilateral septal deviation as the most common anatomic variation of the nasal septum, with bilateral deviation being rare. The results align with existing literature on the subject, underscoring the utility of CT scans in identifying and categorizing septal deviations.

Keywords: Nasal Septum (NS), Computed Tomography (CT Scan), Deviated Nasal Septum(DNS)

INTRODUCTION

The nose is an interesting structure from birth onwards it is "assaulted", but relatively speaking receives little medical attention **(Murray J.A 1987)**[15].

The nasal septum is a thin wall of cartilage and bone that separates the two sides of the nasal cavity. Its anatomy is highly variable. Nasal septum deviation (DNS) is a prevalent physical disorder involving the displacement of the nasal septum. Estimates suggest that approximately 80% of individuals have some form of nasal septum misalignment, often unknowingly. While many cases are asymptomatic, severe deviations can lead to significant breathing difficulties and necessitate medical intervention.

Understanding the anatomical variations of the nasal septum is crucial for clinicians, particularly with the advent of functional endoscopic sinus surgery (FESS). Accurate knowledge of these variations aids in pre-surgical planning and management, ensuring better surgical outcomes and patient care.

This study aims to determine the incidence and morphology of nasal septum anatomical variations using computed tomography (CT). Identifying these variations is vital for surgeons to plan and execute appropriate management or surgical interventions. Notably, the deviation of the nasal septum, in conjunction with structures such as the ethmoidal bulla, can impact the semilunar hiatus and the ethmoidal infundibulum, underscoring the importance of accurate anatomical knowledge in clinical practice and thorough pre-surgical evaluation.

MATERIALS AND METHODS

The study was conducted to investigate anatomical variations of the nasal septum using computed tomography (CT) imaging. The study was carried out over a six-month period, from May 1, 2016, to September 30, 2016, at the Government ENT Hospital, Koti, Hyderabad, and Gandhi Hospital, Musheerabad, Secunderabad.

Patients referred to the ENT department with symptoms including nasal obstruction, nasal discharge, post-nasal discharge, and headache, as well as those clinically diagnosed with chronic rhinosinusitis, were included in the study and excluding those with a history of nasal surgery or trauma.

The CT imaging was carried out using standard radiological techniques to ensure high-quality and consistent results across all patient scans. CT imaging of the lateral nasal wall, nasal septum, and paranasal air sinuses was performed.

RESULTS

In the present study the nasal septum was evaluated under three categories:

- No deviation
- Unilateral deviation (left or right)
- Bilateral deviation

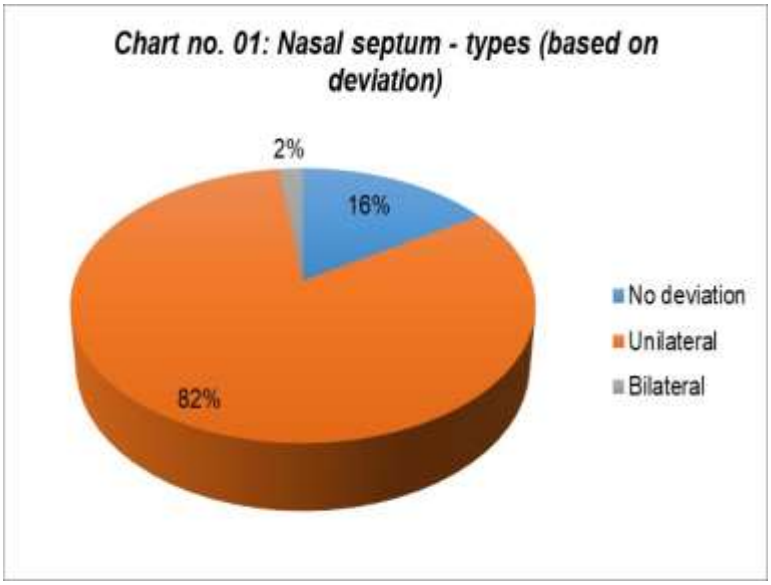
A total of 50 cases were included in the study. The findings were as follows:

The most common variant identified was unilateral deviation, which accounted for 82% of the cases. Conversely, non-deviated nasal septum was the least common, representing only 2% of the cases.

Distribution of cases under these categories has been tabulated in Table and Chart no. 01.

Table no. 01: Nasal septum – types (based on deviation)

Types of Deviation	No. of cases n = 50	Percentage
No deviation	08	16%
Unilateral	41	82%
Bilateral	01	2%

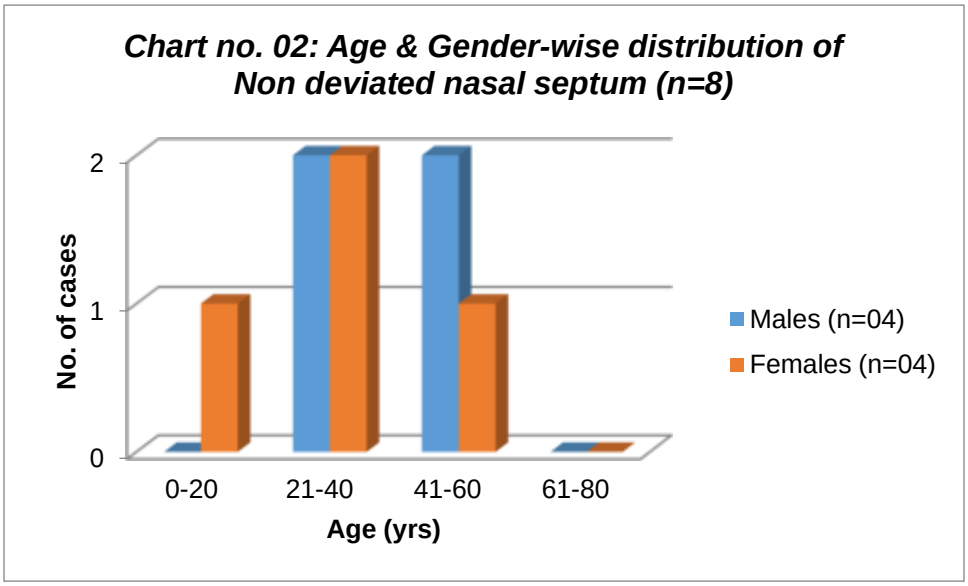


- **Non-Deviated Nasal Septum**:

Age and Gender-wise distribution of Non deviated nasal septum has been tabulated in Table and Chart no. 02.

Table no. 02: Age & Gender-wise distribution of Non deviated nasal septum

Age (yrs)	Males (n=04)	Females (n=04)
0-20	00	01
21-40	02	02
41-60	02	01
61-80	00	00



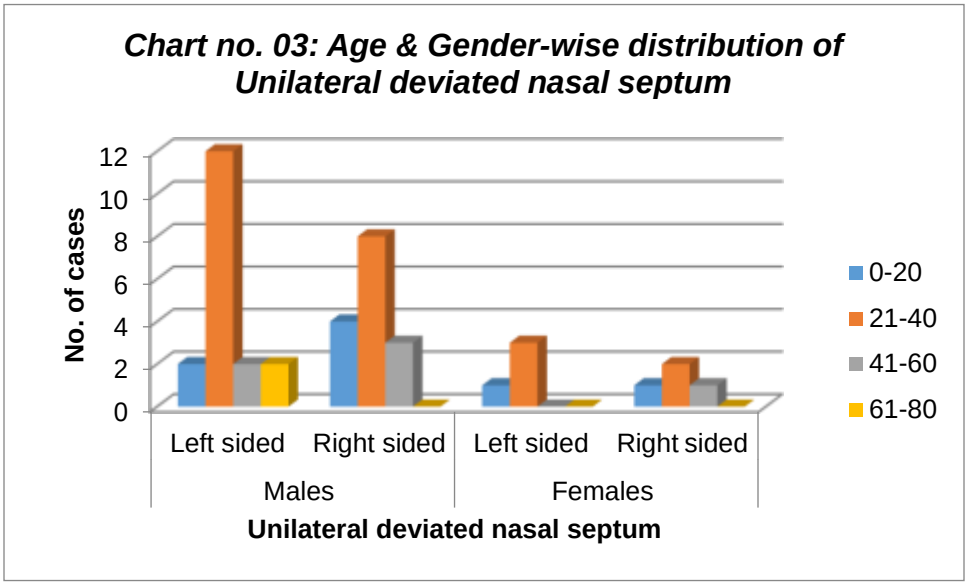
The study found an equal prevalence of non-deviated nasal septum among males and females, each comprising 4 cases [Prevalence: 2% (n=4 males, n=4 females)]. Specifically, among males, two cases were observed in each of the age groups 21-40 and 41-60. In females, two cases were found in the 21-40 age group, with one case each in the 0-20 and 41-60 age groups.

- **Unilateral Nasal Septal Deviation:**

Age and Gender-wise distribution of Unilateral deviated nasal septum has been tabulated in Table and Chart no. 03.

Table no. 03: Age & Gender-wise distribution of Unilateral deviated nasal septum

Age (yrs)	Males		Females	
	Left sided	Right sided	Left sided	Right sided
0-20	2	4	1	1
21-40	12	8	3	2
41-60	2	3	0	1
61-80	2	0	0	0



Overall Prevalence: 82%

Left-Sided Deviation:

Unilateral left-sided septal deviation was predominantly observed in males aged 21-40, totaling 12 cases. The remaining cases of left-sided deviation in males (6 cases) were distributed across other age groups, with two cases in each of the 0-20 and 41-60 age groups. In females, left-sided deviation was more common in the 41-60 age group (3 cases) and less common in the 0-20 age group (1 case).

Right-Sided Deviation:

Right-sided septal deviation also showed a higher prevalence in males aged 21-40, with 8 cases. The remaining right-sided deviations in males (7 cases) were observed in the 0-20 (4 cases) and 41-60 (3 cases) age groups. In females, right-sided deviation was noted in the 21-40 (2 cases), 0-20 (1 case), and 41-60 (1 case) age groups.

Comparison: Left-sided deviation (n=22) was more common than right-sided deviation (n=19).

- **Bilateral Nasal Septal Deviation:**

Prevalence: 2% (n=1 case)
Case Details: S-shaped deviation in a 37-year-old male.

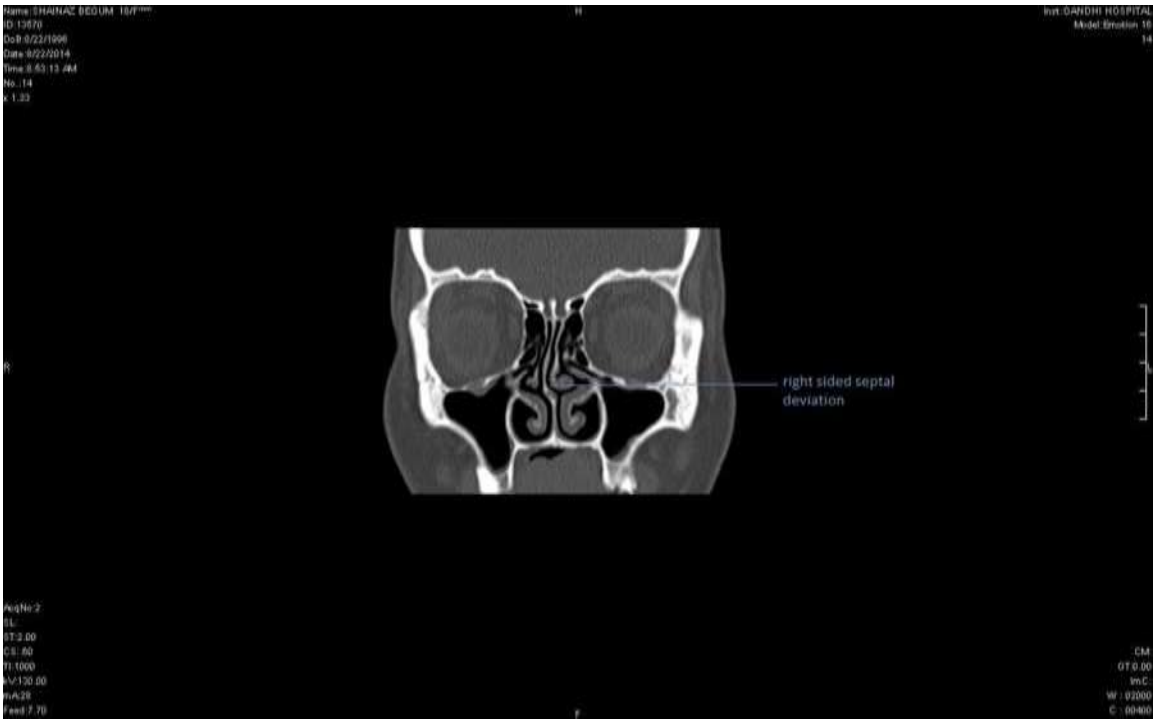


Fig no. 01. CT scan of Paranasal sinuses showing right sided septal deviation

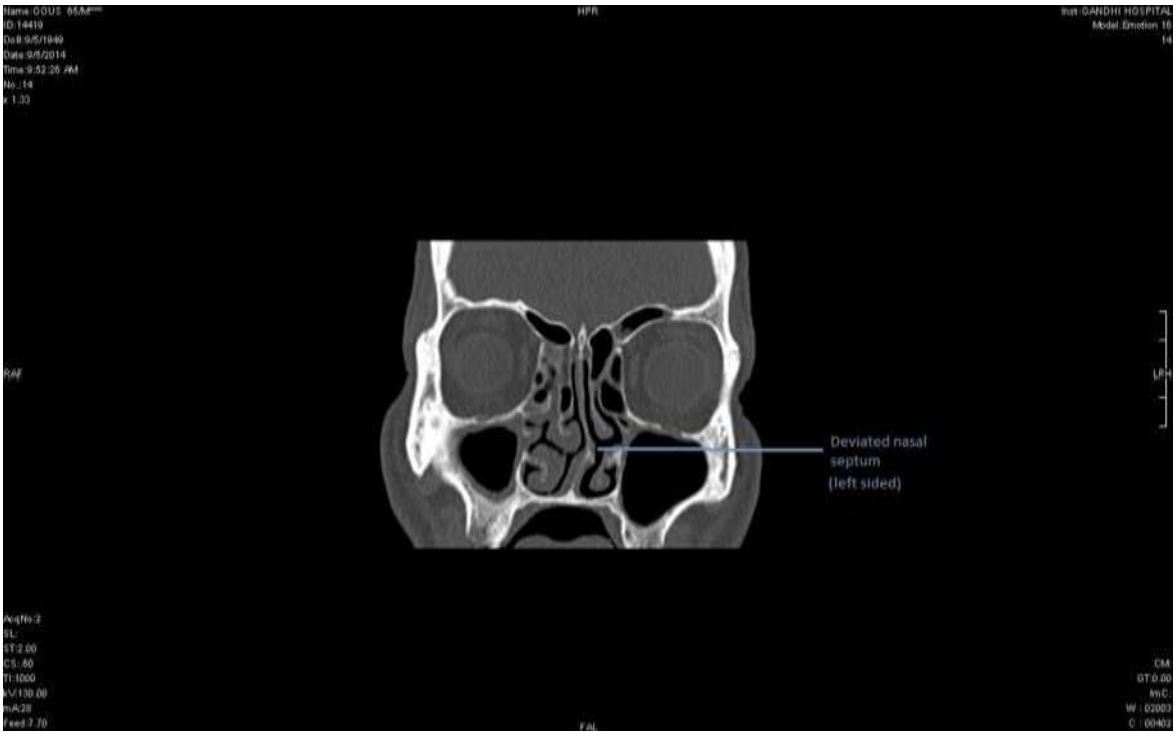


Fig no. 02. CT scan of Paranasal sinuses showing left sided deviated nasal septum

Fig no. 03. CT scan of Paranasal sinuses showing bilateral septal deviation

DISCUSSION

Nasal septum (Table and Chart no. 01)

Table No. 05: Percentage of cases encountered with Deviated Nasal Septum (DNS) in various studies.

S.No	Author	Deviated nasal septum (%)
01.	Talaiepour et al. (2005)[1]	65%
02.	Adeel M. et al (2013)[2]	26%
03.	Biswas J. et al (2013)[3]	78%
04.	Bolger W.E et al (1987)[4]	18.8%
05.	Dua et al. (2005)[5]	44%
06.	Deosthale, et al (2014)[6]	50.81%
07.	M. Sasirekha and A. Ashok kumar (2014)[7]	30%
08.	Mamatha.et al (2009)[8]	70%
09.	Anazy F.H.A (2011)[9]	64.6%
10.	Jyothi A. C, et al. (2013)[10]	30%
11.	Alsubael M.O. et al (2009)[11]	78%
12.	Al- Qudah M.A (2009)[12]	43%
13.	Gupta A.K. et al (2012)[13]	65.2%
14.	Earwaker (1993)[14]	44%
15.	Present study (2016)	84%

The present study highlights the prevalence and characteristics of anatomical variations of the nasal septum using computed tomography (CT). Among the variations observed, deviated nasal septum (DNS) was the most common, accounting for 84% (n=42) of cases. This finding is consistent with the results of **Alsubael M.O. et al. (2009)[11]** and **Biswas J. et al. (2013)[3]**, who also identified DNS as a predominant anatomical variation.

Prevalence and Distribution

Our study's results align with those of **Talaiepour et al. (2005)[1]**, **K. Dua et al. (2005)[5], Mamatha et al. (2010)[8], Gupta A.K et al. (2012)[13], and Deosthale et al. (2014)[6],** which reported DNS prevalence rates ranging from 44% to 78%. These studies collectively affirm that DNS is a common anatomical variation across different populations. The slight left-sided preponderance observed in our study (22 cases) compared to the right side (19 cases) supports previous findings that DNS can occur more frequently on one side of the nasal septum.

Etiology and Clinical Significance

The etiology of DNS is multifactorial, with trauma being the most significant factor. Impact trauma, such as blows to the face, can rupture the chondro-osseous joint capsule of the septum, leading to dislocations and fractures. Additionally, congenital factors, such as compression during childbirth, can also result in DNS. As noted by **Metson and Mardon[16]**, the condition

can be congenital, with about 2% of newborns having a permanently deviated septum due to excessive moulding of the head during birth **(Murray, 1987)[15].**

Septal deviation is more prevalent in European populations compared to Asian or African races and is associated with a male preponderance **(Maqbool et al., 2007)[19].** Hereditary factors may also play a role in the development of DNS.

Clinical Implications

Clinically, DNS can lead to various complications. Asymmetric bowing of the nasal septum can compress the middle turbinate laterally, narrowing the middle meatus and potentially leading to bony spurs, which may compromise the osteomeatal unit **(Kaliner M.A., 1996)[17].** This can have significant implications for sinus surgeons, as the deviation can limit access to the nasal cavity and/or middle meatus. Depending on the extent of the deviation, surgical intervention may range from a limited endoscopic procedure to a more extensive surgical approach **(Hechl P.S. et al., 1997)[18].**

Association with Sinusitis

DNS is often observed in asymptomatic individuals, with an estimated prevalence of 20-30%. However, more significant deviations, particularly at the level of the chondrovomerine articulation, can contribute to symptoms of sinusitis. Severe nasal septal deviation can lead to obstruction, secondary inflammation, swollen membranes, and infection of the middle meatus **(Annilco M. et al., 2010)[20]. Al-Qudah M.A. (2009)[12]** suggested that septal deviation might induce chronic rhinosinusitis by altering the mechanical and aerodynamic status of the nasal cavity, thus affecting sinus ventilation and antral pressure.

CONCLUSION

In this study, we found that a deviated nasal septum was the most common anatomical variation observed in patients undergoing computed tomography of the nasal septum. The deviation of the nasal septum, along with the presence of an ethmoidal bulla, significantly limits the semilunar hiatus and the ethmoidal infundibulum. These variations can have substantial implications for nasal airflow and sinus drainage, highlighting the necessity for surgeons to accurately identify and understand these anatomical deviations prior to any surgical intervention.

Given their high prevalence and frequent association with osteomeatal complex obstruction, special attention should be directed toward the existence of nasal septal deviation and pneumatized middle concha during preoperative planning and management. Recognizing these variations is crucial for improving surgical outcomes and reducing the risk of postoperative complications.

REFERENCES

[1]. Talaiepour A. R, Sazgar A. A and Bagheri A (2005), "Anat- omic Variations of the Paranasal Sinuses on CT Scan Images," Journal of Dentistry, Tehran University of Me- dical Sciences, Vol. 2, No. 4, 2005, pp. 142-146.
[2]. Adeel, M., Rajput, M. S., Akhter, S., Ikram, M., Arain, A., Khattak, Y. J. (2013). Anatomical variations of nose and para-nasal sinuses; CT scan review. Journal of the Pakistan Medical Association, 63(3), 317-319.
[3]. Biswas J et al (2013). Tomographic Evaluation of Structural Variations of Nasal Cavity in Various Nasal Pathologies, International Journal of Otolaryngology and Head & Neck Surgery, 2, 129-134
[4]. Bolger W E, Woodruff W and Parsons D S (1990), CT demonstration of pneumatization of the uncinate process. Am. J. Neuroradiol 1990; 11: 552.
[5]. Dua K, Chopra H, Khurana AS and Munjal M (2005). "CT scan variations in chronic rhinosinusitis." Ind. J. Radiol. Imag. 15(3): 315-320.
[6]. Deosthale NV, Khadakkar SP, Singh B, Harkare VV, Dhoke PR, Dhote KS (2014), Anatomical variations of Nose and Paranasal Sinuses in Chronic Rhinosinusitis. PJSR2014;7(2):1-7.
[7]. M. Sasirekha and A. Ashok kumar (2014), A Study of Anatomical Variations of Osteomeatal Complex in Correlation with Computed Tomography, Volume: 4 | Issue: 1 | Jan 2014 | ISSN - 2249-555X
[8]. H. Mamatha, N.M. Shamasundar, M.B. Bharathi and L.C. Prasanna (2010), Variations of ostiomeatal complex and its applied anatomy: a CT scan study, Indian Journal of Science and Technology Vol. 3 No. 8
[9]. Fatma Homoud Al Anazy, MD (2011), The Incidence of Concha Bullosa and Its Association with Chronic Rhinosinusitis Deviated Nasal Septum and Osteomeatal Complex Obstruction, Bahrain Medical Bulletin, Vol. 33, No. 4.
[10]. Jyothi A. C, Shrikrishna B. H, Sanjay G, Sandeep Samson G (2013)., Anatomical Variations Of The Osteomeatal Complex tomographic Findings In 100 Patients, Journal of Evolution of Medical and Dental Sciences/ Volume 2/ Issue 22
[11]. Mohammad Omar Alsubael and Abd El-Monem Awad Mustafa Hegazy (2009), Anatomical Variations Of The Human Nasal Osteomeatal Complex, Studied By Ct, Zagazig University Medical journal, Special Issue, for 16th Zagazig Annual Conference, March, 2009; 72-83.
[12]. Mohammad A. Al- Qudah (2010), Anatomical Variations in Sino-Nasal Region: A Computer Tomography (CT) Study J Med J: Vol. 44(3)
[13]. Ashok K Gupta et al (2012), Computerized Tomograophy of Paranasal air sinuses: A Roadmap to Endoscopic sinus surgery, 10.5005/JP-journals-10013-1106
[14]. Earwaker J. Anatomic variants in sinonasal CT. Radiographics. 1993;13(2):381-415
[15]. Murray JA. The behavior of nasal septal cartilage in reponse to trauma. Rhinology. March 1987; 25(1): 23-27.
[16]. Harvard Medical School Guide to Healing Your Sinuses By Ralph Metson, Steven Mardon · 2005
[17]. Kaliner.M.A (1996) Chapter III Pg.69, Diseases of the Sinuses – A Comprehensive Textbook of Diagnosis & Treatment, M. Eric Gershwin, Gary Incaudo , 1st edition.
[18]. Peter S. Hechl, Reuben C. Settiff, Manfred Tschabitscher (1997), Endoscopic Anatomy Of Paranasal Sinuses, 3rd edition, chapter I, Pg 1 & 9

[19]. Mohammad Maqbool, Suhail Maqbool (2007), Textbook of Ear Nose and Throat Diseases, 11th edition, Pg 183
[20]. M. Annilco, M. Bernal, V. Bonkowsky, P. Bradley and S. Curato (2010), Otolaryngology, Head & Neck Surgery, Pg 190-191