



## PREVALENCE OF PARANASAL AIR SINUSITIS: COMPUTED TOMOGRAPHY FINDING IN A TERTIARY HOSPITAL, SOUTH EAST NIGERIA.

<b>Ugwuanyi, Daniel .C.*</b>	Lecturer 11, Department of Medical Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.*Corresponding Author
<b>Chiegwu, Hyacinth. U.</b>	Senior Lecturer, Department of Medical Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.
<b>Anakwue Angel-Mary. C.</b>	Senior Lecturer, Department of Medical Radiography and Radiological Sciences, University of Nigeria, Enugu Campus, Enugu State, Nigeria.
<b>Ajekwuenu, Emmanuel O.</b>	Consultant Radiologist, Department of Radiology Nnamdi Azikiwe University Teaching Hospital Nnewi Anambra State, Nigeria.
<b>Balogun, Oluwatoyin B.</b>	Radiographer, Department of Medical Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.

### ABSTRACT

**Objectives:** Paranasal Sinusitis is an inflammation of the mucosal lining of the paranasal sinuses. As the mucosa of the sinuses is continuous with that of the nose, rhinosinusitis is a more suitable term. Computerized Tomographic (CT) scan have been used to diagnose chronic rhinosinusitis. The prevalence of the disease has not been well investigated in the study population. Thus, the aim of this study is to indicate the prevalence of paranasal sinusitis and to determine the most common sinus that is being affected by the disease.

**Methods:** This study is a retrospective study of 326 patient's radiological CT scan reports which were derived by accessing the report database of the Nnamdi Azikiwe University Teaching Hospital Nnewi, Anambra State Nigeria. The level of the statistical significance after analysis was considered at  $p < 0.05$  and at confidence interval of ninety-five percent (95%).

**Results:** This result showed that all the paranasal sinuses cases were susceptible to rhinosinusitis and maxillary sinus with the left side was more infected than the right side. Thus maxillary sinus is the most common sinus to be infected with the prevalence value of 48.47%, followed by ethmoidal sinus of 27.30%, sphenoidal sinus of 23.31% and frontal sinus which is the least value of 13.80%. The most affected age is within 21-30years.

**Conclusion:** This study showed that rhinosinusitis is prevalence amongst the patients presented with brain CT scan, and has no age limit.

**Advances in knowledge:** Computed Tomography plays an effective role to classify and assess PNS that help in management and follow-up.

**KEYWORDS :** Prevalence, paranasal air sinusitis, computed tomography, Nnamdi Azikiwe University Teaching Hospital Nnewi.

### INTRODUCTION

Paranasal sinusitis can be broadly defined as inflammation of one or more of the paranasal sinuses. Classically, sinusitis is characterized as the following: Acute – symptoms last less than 4 weeks, Subacute – symptoms last 4-8 weeks, Chronic – symptoms last longer than 8 weeks and Recurrent – three or more acute episodes a year. Most chronic sinusitis is not an infectious disease and is better thought of as an inflammatory disease, much akin to asthma (Roxanne and Rohit, 2008).

Changes in the treatment of patients with sinusitis over the past 10 years have highlighted several aspects of imaging, which are important factors in the radiologic evaluation and diagnosis of sinusitis sited by Nooriyan and Motaghi 2012 in their work, in assessment of paranasal air sinuses (PNS). Computed Tomography (CT) is the gold standard for exact delineation of inflammatory sinus disease and has become a routine radiological examination in the diagnosis of sinusitis. It presents complete information and an unparalleled sight of the sinuses, mainly the bony anatomy (Hagtvedt *et al*, 2003).

Indications for paranasal air sinus CT include trauma, malignant disease, and chronic sinusitis, which accounts for the major part of examinations. Due to the benign character of the disease and the relatively moderate age of the patients involved, the radiation dose of paranasal air sinus CT plays an important role. The use of a low-

dose spiral CT technique and the reformation of coronal images out of the axial CT data instead of an additional direct coronal scan allow the effective dose of paranasal air sinus CT to be reduced to the order of a chest radiogram. MRI is the preferred imaging modality in malignant disease or complications of inflammatory sinus disease that extend beyond the limits of the paranasal air sinuses. The clinical value of other imaging modalities, including plain film radiography, ultrasound, or scintigraphy, is limited to special indications (Dammann F, 2007). Minimizing the level of radiation delivered to the patient is as important as obtaining a high-quality scan (Cagici *et al*, 2005).

Methods have obtained to use lower mAs settings (mAs = milliamperes of current X scanning time) for CT, but generate the similar image quality, resulting in lower radiation exposure than occurs with normal settings. In addition, reducing the number of slices in routine contiguous paranasal CT is another approach that is used to diminish expenditure and radiation exposure. Various terms have been used such protocols including limited CT, screening coronal CT and CT mini-series (Cagici *et al*, 2005). A statement made by Nooriyan and, Motaghi (2012) that the complete CT scan was the gold standard.

The Paranasal Sinusitis is a significant health challenges with its rising prevalence corresponding with the increasing frequency of allergic rhinosinusitis world wide (Enema *et al*, 2014). There were

more males with the disease from other similar studies on chronic rhinosinusitis where the disease has been reported to have a higher male sex prediction (Enema *et al*, 2014, Kolo, 2012, Iseh and Makusidi, 2010).

In this locality under study, there is limited literature available about the prevalence of paranasal air sinusitis to the best of the researcher's knowledge. Thus, the need to know the prevalence of paranasal air sinusitis in the study population. This study assessed the prevalence of paranasal air sinusitis and classified them according to the computerized tomography appearance. It also evaluated the relationship of paranasal air sinusitis with age and sex and determined the most common sinus that is mostly affected in the group.

**Objectives of the study**

- To assess the prevalence of Paranasal sinusitis examination in Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Anambra State.
- To determine the most common sinus that is mostly affected in the study group.

**Research methodology**

**Research design**

The study is a retrospective cross-sectional study, targeted at patients who have gone through paranasal air sinuses computed tomography scan examinations and a disease condition of the PNS certified by a consultant radiologist. The study was carried out in Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Anambra State from January 2014 to April 2017.

**Target population**

The population targeted for this research study was 326 patient reports from NAUTH radiology department report database.

**Area of study**

Computed Tomography unit of the Radiology Department of NAUTH.

**Sample size and sampling technique**

A total of 326 CT scan report was retrieved from the report database of the radiological department of the NAUTH, the sample size was obtained using a Taro Yamane formula (Uzoegbulu 2011).

$$n = \frac{N}{1 + Ne^2}$$

Where; n= sample size, N=population size, e= margin of error

$$n = \frac{326}{1 + 326(0.05^2)} = 180$$

Margin of error = 0.05, n = 180

**Equipment and materials:**

A General Electric (GE) bright speed Excel CT scanner with 4-slice rotation capacity was used. It is A proforma. Pen. 5.0 megapixel camera of Infinix HOT NOTE 3 version.

**Procedure for data collection**

Data were collected from report database, query or referral documents in the digital archive, of the CT unit including the radiologist's reports. The following information was collected from the patients' request, query and referral documents.

- Date of Examination
- Patient's number
- Patient age
- Sex
- Clinical indication/ nature of investigations
- Radiologist's final report

**Data analysis**

Data was analyzed using statistical package for social science, SPSS

(version 20) based on findings, prevalence, sex and age. Results were presented on frequency and percentage tables.

**RESULT**

This chapter presents the result of statistical analysis of data collected and interpretation. The analysis is based on the available data collected from three hundred and twenty - six (326) patients who visited the radiological department of the hospital for Paranasal sinusitis examination. The results of the examination are represented with the use of tables; charts, pie charts, simple percentage and inferential statistics for easy interpretation.

**Fig 1: Age Range of the Participants**

n=326

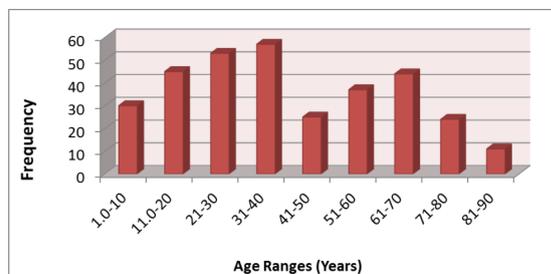


Figure 1: The above Bar chart shows the age range of the participants involved in the study. The figure revealed that those between the age range of 1-10 years had a frequency 30(9.2%), 11-20 years had 45(13.8%), 21-30 years had 53(16.3%), 31-40 years had 57(17.5%), 41-50 years had 25(7.7%), followed by those between the age bracket of 51-60 years 37(11.3%), 61-70 years had 24(7.4%), while those between the age brackets of 71-80 years had 44(13.5%) and finally, 81-90 years were 11(3.4%).

**Fig 2: Gender of the Participants**

n=326

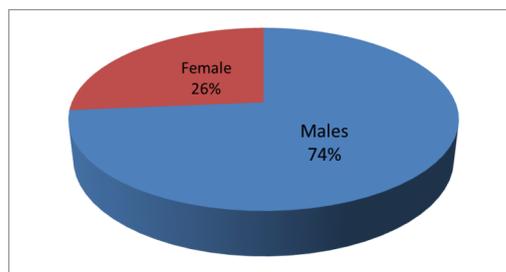


Figure 2: Pie chart showing the gender of the respondents involved in the study. The figure showed that 240(73.6%) of the respondents were males while 86(26.4%) of them were females.

**Table 4.1:** Prevalence of Para-nasal sinusitis found within the Maxillary sinus based on Age range.

Age (years)	Frequency (%)	No. Not Infected (%)	No. infected (%)	Prevalence (%)
1-10	30(9.2)	20(6.13)	10(3.07)	3.07
11-20	45(13.8)	19(5.83)	26(7.98)	7.98
21-30	53(16.3)	19(5.83)	34(10.43)	10.43
31-40	57(17.5)	36(11.04)	21(6.44)	6.44
41-50	25(7.7)	12(3.68)	13(3.99)	3.99
51-60	37(11.3)	21(6.44)	16(4.91)	4.91
61-70	44(13.5)	23(7.06)	21(6.44)	6.44
71-80	24(7.4)	9(2.76)	15(4.60)	4.60
81-90	11(3.4)	9(2.76)	2(0.61)	0.61
Total	326(100)	168(51.53)	158(48.47)	48.47

Table 4.1, The table result above indicated that out of three hundred and twenty - six (326) patients that came for Para-nasal sinusitis,

about one hundred and fifty- eight (158) patients represented (48.47%) were diagnosed of maxillary Para-nasal sinusitis. Those between the age range of 1-10 years were 10(3.07%), 11-20 years had 26(7.98%), 21-30 years had 34(10.43%), 31-40 years had 21(6.44%), 41-50 years had 13(3.99%), followed by those between the age bracket of 51-60 years had 16(4.91%), 61-70 years had 21(6.44%), while those between the ages brackets of 71-80 years had 15(4.60%), and finally, 81-90 years were 2(0.61%).

**Table 4.2: Prevalence of Para-nasal sinusitis found within the Sphenoidal sinus of patients based on Age range.**

Age (years)	Frequency (%)	No. Not Infected (%)	No. infected (%)	Prevalence (%)
1-10	30(9.2)	24(7.36)	6(1.84)	1.84
11-20	45(13.8)	36(11.04)	9(2.76)	2.76
21-30	53(16.3)	33(10.12)	20(6.13)	6.13
31-40	57(17.5)	45(13.80)	12(3.68)	3.68
41-50	25(7.7)	25(7.67)	0(0.00)	0.00
51-60	37(11.3)	27(8.28)	10(3.07)	3.07
61-70	44(13.5)	36(11.04)	8(2.45)	2.45
71-80	24(7.4)	16(4.91)	8(2.45)	2.45
81-90	11(3.4)	8(2.45)	3(0.92)	0.92
Total	326(100)	250(76.69)	76(23.31)	23.31

Table 4.2, reveals the prevalence of Para-nasal sinusitis in patients attending NAUTH Nnewi based on Age range of the participants involved in the study. The table result indicated that out of three hundred and twenty - six (326) patients that came for Para-nasal sinusitis, about one hundred and fifty - eight (76) patients represented (23.31%) were diagnosed of Sphenoidal Para-nasal sinusitis based on ages.

The age ranges of 1-10 years were 6(1.84%), 11-20 years had 9(2.76%), 21-30 years had 20(6.13%), 31-40 years had 12(3.68%), followed by those between the age bracket of 51-60 years had 10(3.07%), 61-70 years had 8(2.45%), while those between the ages brackets of 71-80 years had 8(2.45%), and finally, 81-90 years had years were 3(0.92%),

**Table 4.3: Prevalence of Para-nasal sinusitis found within the Ethmoidal sinus of patients based on Age range.**

Age (years)	Frequency (%)	No. Not Infected (%)	No. infected (%)	Prevalence (%)
1-10	30(9.2)	23(7.06)	7(2.15)	2.15
11-20	45(13.8)	33(10.12)	12(3.68)	3.68
21-30	53(16.3)	28(8.59)	25(7.67)	7.67
31-40	57(17.5)	47(14.42)	10(3.07)	3.07
41-50	25(7.7)	21(6.44)	4(1.23)	1.23
51-60	37(11.3)	25(7.67)	12(3.68)	3.68
61-70	44(13.5)	34(10.43)	10(3.07)	3.07
71-80	24(7.4)	17(5.21)	7(2.15)	2.15
81-90	11(3.4)	9(2.76)	2(0.61)	0.61
Total	326(100)	237(72.70)	89(27.30)	27.30

Table 4.3, indicates details prevalence result of Para-nasal sinusitis in patients attending NAUTH Nnewi based on Age range of the participants involved in the study. The table result revealed that out of three hundred and twenty six (326) patients that came for Para-nasal sinusitis, about one hundred and fifty eight (89) patients represented 27.30% were diagnosed of Ethmoidal Para-nasal sinusitis based on ages.

Those with age ranges of 1-10 years were 7(2.15%), 11-20 years had 12(3.68%), 21-30 years had 25(7.67%), 31-40 years had 10(3.07%), 41-50 years had 4(1.23%), followed by those between the age bracket of 51-60 years had 12(3.68%), 61-70 years had 10(3.07%), while those between the ages brackets of 71-80 years had 7(2.15%), and finally, 81-90 years had years were 2(0.61%).

**Table 4.4: Prevalence of Para-nasal sinusitis found within the Frontal sinus of patients based on Age range.**

Age (years)	Frequency (%)	No. Not Infected (%)	No. infected (%)	Prevalence (%)
1-10	30(9.2)	29(8.90)	1(0.31)	0.31
11-20	45(13.8)	41(12.58)	4(1.23)	1.23
21-30	53(16.3)	38(11.66)	15(4.60)	4.60
31-40	57(17.5)	48(14.72)	9(2.76)	2.76
41-50	25(7.7)	25(7.67)	0(0.00)	0.00
51-60	37(11.3)	29(8.90)	8(2.45)	2.45
61-70	44(13.5)	40(12.27)	4(1.23)	1.23
71-80	24(7.4)	21(6.44)	3(0.92)	0.92
81-90	11(3.4)	10(3.07)	1(0.31)	0.31
Total	326(100)	281(86.20)	45(13.80)	13.80

Table 4.3, indicates details prevalence result of Para-nasal sinusitis in patients attending NAUTH Nnewi based on Age range of the participants involved in the study. The table result revealed that out of three hundred and twenty six (326) patients that came for Para-nasal sinusitis, about one hundred and fifty eight (45) patients represented (13.80%) being the least type diagnosed from Frontal Para-nasal sinusitis based on ages.

The result indicated that the age ranges of 1-10 years had 1(0.31%), 11-20 years had 4(1.23%), 21-30 years had 15(4.60%), 31-40 years had 9(2.76%), followed by those between the age bracket of 51-60 years had 8(2.45%), 61-70 years had 4(1.23%), while those between the ages brackets of 71-80 years had 3(0.92%), and finally, 81-90 years had years were 1(0.31%).

**Table 4.5: Chi-square analysis showing the Association between Para-nasal sinusitis found within different types of sinuses of patients.**

MAXILLARY	Clinical Findings				Pearson Chi-square value (p-value)
	Sinus itis	Others pathology	Bilateral Sinusitis/ other pathology	Total	
Right	17	6	3	26	12.158(0.433)
Left	35	7	3	45	
Bilateral	64	6	14	84	
Total	116	19	20	155	
<b>SPHENOIDAL</b>					
Right	7	2	1	10	12.409(0.406)
Left	14	1	1	16	
Bilateral	40	4	5	49	
Total	61	7	7	75	
<b>ETHMOIDAL</b>					
Right	7	2	1	10	9.077(0.646)
Left	12	1	0	13	
Bilateral	50	3	10	63	
Total	69	6	11	86	
<b>FRONTAL</b>					
Right	8	0	0	8	7.777(0.617)
Left	6	1	0	7	
Bilateral	25	2	3	30	
Total	39	3	3	45	

Table 4.5: Chi-square analysis showing the Association between Para-nasal sinusitis found within different types of sinuses of patients attending NAUTH Nnewi

Table 4.5: reveals a Chi-square association between Para-nasal sinusitis found within different types of sinuses of patients attending NAUTH Nnewi. From the Chi-square result there is no statistical association (p>0.05) between Para-nasal sinusitis found

within different types of sinuses of patients, details of the result are shown in the table above.

**Table 4.6: Association between Para-nasal sinusitis found within different types of sinuses of patients Nnewi.**

Diagnosis Versus Types Of Sinuses	R-Value	P-Value
Findings Versus Maxillary	0.561	0.000*
Findings Versus Sphenoidal	0.353	0.000*
Findings Versus Ethmoidal	0.377	0.000*
Findings Versus Frontal	0.218	0.000*

Table 4.6: shows Correlation analysis between Para-nasal sinusitis and different types of sinuses of patients attending NAUTH Nnewi. The table result revealed that when the findings of the participants were correlated with the different types of sinuses (Maxillary, Sphenoidal, Ethmoidal and Frontal sinuses) they all showed a statistical significant relationship with ( $p < 0.05$ ) when correlated with clinical findings.

### Discussion

The Paranasal Sinusitis best called Rhinosinusitis is a significant health challenges with its rising prevalence corresponding with the increasing frequency of allergic rhinosinusitis world wide (Enema *et al*, 2014). This study was purely retrospective by retrieving the report forms of the subjects that were referred to the radiological department of NAUTH for the Paranasal sinuses and cranial CT scan within the period of three years (2015 -2017). There were more males with the disease in this study and this agrees with findings from other similar studies on chronic rhinosinusitis where the disease has been reported to have a higher male sex prediction (Enema *et al*, 2014, Kolo, 2012, Iseh and Makusidi, 2010).

There was total number of 326 reports retrieved from the department report database archive and out of the 326 sample population report form. 183 of these, as reported by the Radiologists indicated rhinosinusitis. The clinical findings from the analysed data result were correlated with the age and also each sinus were correlated with the clinical findings.

The age was correlated with the clinical finding and it revealed that between the age 21 - 30 years age range has the highest prevalence in four paranasal sinuses; maxillary, sphenoidal, ethmoidal, and frontal with prevalence value of 10.43%, 6.13%, 7.67%, and 4.6% respectively. This was in line with the work of Safar *et al* (2016). They concluded that the prevalence of sinusitis was 30% in patients under 20 years of age, 61% in age 20 -30 years and 61 % in adults over 50 years. The result indicated that with increased age, the prevalence of sinusitis increased.

Moreover, the prevalence of maxillary sinusitis was 48.47%, ethmoidal sinusitis 27.30%, sphenoidal sinusitis 23.31% and frontal sinusitis 13.80%. This indicated that maxillary sinusitis is the most common and the least is the frontal sinusitis. This was in line with the review and meta-analysis study by Safar *et al*. (2016), Nair (2009), Schwartz *et al*, (2001). The most infected part of the maxillary sinus was the left maxillary sinus. This can be due to variation in the maxillary according to Aliu (2016), research done on normal anatomical variations of maxillary sinus septa using computerized tomography from Sokoto Northwestern Nigeria. It was stated that right maxillary sinus has double or more septa whereas the left sinus has no septa and this can makes left maxillary sinus to be more prone to sinusitis due to large area.

Correlation analysis between para-nasal sinusitis and different types of sinuses of patients was done and it revealed that each of the sinus (Maxillary, Sphenoidal, Ethmoidal and Frontal sinuses) showed a statistical significant relationship with ( $p < 0.05$ ) when correlated with clinical findings.

During the course of this research, it was noted that some of these cases of sinusitis were incidental findings. This means that some of the patient's request cards had clinical histories/indications other than for sinusitis. It could be that these patients are asymptomatic for the referring clinician to miss indicating sinusitis as a clinical history. This is in strong relationship with the work of Kolawole *et al* 2002 and Gwaltney *et al* 1994 that stated that up to 40% of asymptomatic adults have abnormalities on sinus on CT scan.

### Conclusion

From the result of this study, the prevalence of sinusitis in NAUTH is high. The disease condition is predominant among male subject that visited hospital for CT scan of the paranasal sinuses and cranial CT. It also showed that left maxillary sinus is the most infected among other sinuses while the frontal sinus is the least which supports the results from previous researchers. Although the most prevalent age in this study is between the age range of 21-30 years but the result showed that sinusitis does not have any age limit.

This research has also proved that all the sinuses can be infected in an individual at a time, or two of it can be infected. Cases of incidental finding also showed that some subjects are asymptomatic or undergoing self-medication such that they did not complain to their Physicians of any symptom.

### REFERENCES

1. Aliu A., Zagga A.D., Ma'aji S.M., Bello A., Bello S.S., Usman J.D., Musa M.A. (2016). Normal anatomical variations of maxillary sinus septa using computerized tomography from Sokoto Northwestern Nigeria. *West African Journal of Radiology*. 23 (1): 12-15.
2. Cagici C.A., Cakmak O., Hurcan C., and Tercan F. (2005). Three-slice computerized tomography for the diagnosis and follow-up of rhinosinusitis. *Eur Arch Otorhinolaryngol*. 262(9):744-50. doi: 10.1007/s00405-004-0896-8. [PubMed].
3. Dammann F. (2007) Imaging of paranasal sinuses today US National Library of Medicine National Institutes of Health; 47 (7):576, 578-83.
4. Enema J.A., Ayotunde J.F., Aliu O.A., and Abiodun D.O. (2014). Chronic rhinosinusitis: correlation of symptoms with computed tomography scan findings. *The Pan African medical journal* 18:40. Doi:10.11604/pamj.2014.18.40.2839.
5. Gwaltney J.M. Jr., Philips C.O., Miller R.D., Riker O.K. (1994). Computed radiographic study of the common cold. *National English Journal for medicine*. 330:25-30.
6. Hagtvedt T., Aalokken T.M., Notthellen J., and Kolbenstvedt A. (2003). A new low-dose CT examination compared with standard-dose CT in the diagnosis of acute sinusitis. *European Radiology*. 13 (5):976-80. doi: 10.1007/s00330-002-1652-3. [PubMed]
7. Iseh K.R., and Makusidi M.M., Aliyu D. (2009). Surgical management of chronic rhinosinusitis in North Western Nigeria and challenges for the future. *Niger Journal Medicine*. 18 (3):277-281.
8. Kolawole S., Okuyemi M.D., and Terance T.T. (2002). Radiologic imaging in the management of sinusitis. *American family physician journal* 15;66 (10):1882-1887.
9. Kolo E.S. (2012). The role of plain radiographs in the diagnosis of chronic maxillary rhinosinusitis in adults. *African Health Science Journal*. 12(4):459-463. PubMed.
10. Nair S. (2009). Correlation between symptoms and radiological findings in patients of chronic rhinosinusitis: a modified radiological typing system. *Rhinology*. 47(2):181-186. PubMed.
11. Nooriyan V., and Motaghi A. (2012) Assessment of the Diagnostic Accuracy of Limited CT Scan of Paranasal Sinuses in the Identification of Sinusitis. *Iran Red Crescent Medical Journal*. 2012;14 (11):709-12. DOI: 10.5812/ircmj.1797.
12. Roxanne S.L., and Rohit K. (2008). The Diagnosis and Management of Acute and Chronic Sinusitis. *Primary care: Clinics in office practice*. 35:11-24.
13. Safar A.A., Diana S., and Mostafa R.T. (2016). Prevalence of sinusitis in Iran: A systematic review and meta-analysis study. *Scholar Research. Library. Der pharmacia letter*. 8(5):31-39.
14. Schwartz R.H., Pitkaranta A., and Winther B. (2001). Computed Tomography imaging of the maxillary and ethmoid sinuses in children with short - duration purulent rhinorrhea. *Otolaryngology Head and Neck Surgery* 124(2):160-163.