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**Saint Paul's Hospital Millennium Medical Collage School of
Medicine, Department of radiology**

**Magnitude and Seasonal variation of Incidental Paranasal Sinus
Abnormalities in Adults Undergoing Head Computed Tomography
in St. Paul's Hospital Millennium Medical College**

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Medicine, Department of Radiology and Medical radiology
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Millennium Medical College.**

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TABLE OF CONTENTS

LIST OF TABLES	IV
LIST OF FIGURES	V
I. ACKNOWLEDGEMENT	VI
II. ACRONYMS AND ABBREVIATIONS.....	VII
3. ABSTRACT	VIII
1 INTRODUCTION.....	1
1.1 BACKGROUND	1
1.2 STATEMENT OF THE PROBLEM	2
1.2 JUSTIFICATION OF THE STUDY	3
2. LITERATURE REVIEW	4
2.1 OVERVIEW.....	4
2.2 PREVALENCE OF INCIDENTAL PARANASAL ABNORMALITIES	4
2.3 SEASONAL VARIATION OF INCIDENTAL PARANASAL SINUS ABNORMALITIES	6
2.4 SINO NASAL ABNORMALITIES	6
3. OBJECTIVES	7
3.1 GENERAL OBJECTIVE.....	7
3.2 SPECIFIC OBJECTIVES	7
4. METHODS.....	7
4.1 STUDY AREA AND STUDY PERIOD	7
4.2 STUDY DESIGN.....	7
4.3 SOURCE POPULATION.....	8
4.4 STUDY POPULATION	8
4.5 STUDY VARIABLES.....	8
4.6 INCLUSION CRITERIA	ERROR! BOOKMARK NOT DEFINED.
4.7 SAMPLE SIZE DETERMINATION AND SAMPLING TECHNIQUE	8
4.8 DATA COLLECTION	9
4.9 DATA ANALYSIS AND INTERPRETATION	10
5. ETHICAL CONSIDERATIONS	10
5.1 RESULT DISSEMINATIONS	10
6. RESULTS.....	11
7. DISCUSSION	17
8. CONCLUSION	19
9. LIMITATION OF THE STUDY	20
10. ANNEX.....	21
11. REFERENCES.....	22

List of Tables

Table 1 Gender frequency table of study population at SPHMMC from Sep. 2019 to Aug. 2021 GC

Table 2 Gender distribution of cases with incidental PNS abnormality at SPHMMC from Sep. 2019 to Aug. 2021 GC

Table: 3 shows incidental PNS abnormalities detected in specific sinuses at SPHMMC from Sep. 2019 to Aug. 2021 GC

Table: 4 Incidental PNS abnormalities detected in respective seasons at SPHMMC from Sep. 2019 to Aug. 2021 GC

Table 5 showing statistical significance of PNSA in age groups

Table 6 Sinus fluid levels in respective seasonal categories at SPHMMC from Sep. 2019 to Aug. 2021 GC

List of Figures

Figure 1. Age distribution of study population at SPHMMC from Sep. 2019 to Aug. 2021 GC

Figure: 2. Prevalence of incidental PNS abnormalities with age group categories at SPHMMC from Sep. 2019 to Aug. 2021 GC

Figure 3 shows variants of Incidental PNSA seen

I. Acknowledgement

I would like to Acknowledge St. Paul hospital millennium Medical College and department of radiology for giving me permission to conduct the study in this institution and their logistic support. Secondly I would like to express my deepest gratitude to my guide Mr. Andamlak G.(MPH,) and Dr Yonas kidane (MD ,Neuroradiologist) for allowing me to do under their knowledgeable supervision.

II. Acronyms and Abbreviations

CT SCAN: Computed Tomography

MRI: Magnetic resonance imaging

PACS: Picture Archive Imaging and Restoring

SPSS: Statistical Analysis in Social Science

SPHMMC: St. Paul's Millennium Medical College

IFS: Incidental findings

CNS: Central nervous system

IPNSA: Incidental paranasal sinus abnormalities

3. Abstract

Background: - The paranasal sinuses are air filled cavities which are extensions of the nasal cavities. Various pathological processes affect these structures but inflammatory conditions are the commonest. Even in asymptomatic patients who undergo brain imaging for other indications show one or more incidental abnormalities in their sinuses. Morphological changes in the paranasal sinuses are regularly noted on Imaging, but little is known about the incidence and significance of these changes such abnormalities are a concern if they are over reported.(1)

Objective:- The purpose of this study is to classify the morphological changes in the paranasal sinuses seen on Computed tomography and to investigate the magnitude, site and type of paranasal abnormalities and asses seasonal variation of the abnormalities with Ethiopian context.

Materials and method: - A retrospective cross-sectional study is conducted by collecting soft copies of Brain Computed Tomography scan Images from Picture archiving and communications system of St. Paul's hospital millennium medical college and jointly evaluated with the investigator and advising senior neuroradiologist at the radiology department of St. Paul's hospital millennium medical college and data was entered and analyzed using SPSS version 26. Descriptive statics was used and ninety-five percent confidence intervals are computed to assess the presence and degree of association between variables

Result: - Incidental Paranasal abnormalities are more commonly detected in Men and are most commonly seen kiremt or summer season of Ethiopia followed by Belg or autumn Ethiopian season and least involved season is Bega or winter season of Ethiopia. Out of these the most common involvement is seen in age group of 35 to 45 with median age of 44 years in all seasons, Most commonly involved paranasal sinus is maxillary sinus followed by ethmoid sinus, and frontal sinus and sphenoid sinus,

Mucoperiosteal thickening is the most common category of abnormality in all paranasal sinuses, and bone destruction being the least common abnormality detected.

Paranasal sinus abnormality is a frequent incidental head Computed Tomography scan finding that is more commonly detected in kiremt or summer Ethiopian season. Regardless of the season, incidental paranasal sinus abnormality is more commonly found in men compared to women. Awareness of incidental paranasal sinus abnormality and knowledge of its frequency contribute positively to clinical applications

1 Introduction

1.1 Background

The paranasal sinuses are air-filled spaces located within the bones of the skull and facial bones. There are four paired sinuses surrounding the nasal cavity: maxillary, frontal, sphenoid, and ethmoid. These sacs precisely surround the nasal cavity(2).

They are centered on the nasal cavity and have various functions, including lightening the weight of the head, humidifying and heating inhaled air, increasing the resonance of speech, and serving as a crumple zone to protect vital structures in the event of facial trauma(2)(3).

The advent of CT scan has thrown a lot of light as far as paranasal sinus anatomy is concerned. Plain film radiographic examinations, the historical standard, is rapidly being replaced by computed tomography (CT) in the diagnosis of rhino sinusitis, especially with availability of more CT scan machines in most tertiary institutions in the last few years. Sinus disease is often reported as an incidental finding in patients undergoing CT for non sinus related pathologies, which sometimes leads to referrals to otolaryngologists(4).

With the introduction of endoscopic nasal surgery, assessment by CT scan has become the gold standard. Although the proponents of endoscopic nasal surgery often advocate operating on any abnormality of the ostiomeatal complex it is being increasingly appreciated that sinus abnormalities are often shown on CT evaluation and may not correlate with the clinical picture(5)(6)(7).

Pre-operative assessment of patients for endoscopic sinus surgery is based on symptomatic assessment, and clinical and radiological examination. Computed Tomography provides excellent assessment of the extent and distribution of sinus disease in such patients. The incidence of sinus opacification in the general population, especially in those with no symptoms of sinus disease, has been addressed by a number of authors(5)(6)(7).

The incidence of CT abnormality in this group will have a bearing on the significance of radiological abnormality in symptomatic patients. This study analyses the incidence of sinus symptomatology, and of CT-demonstrated opacification in patients undergoing head scans for conditions other than sinus disease(5)(6)(7).

1.2 Statement of the problem

Diagnostic imaging of the head is used with increasing frequency, and often includes the paranasal sinuses, where incidental opacification is found. However, these techniques often give rise to findings that are incidental to the reason the study was ordered. The growing number of imaging techniques performed per patient causes an increase in the number of incidental findings. How these findings should be managed is far from settled(8).

Clinicians need to know how to deal with unexpected findings in order to avoid any undesirable consequences. The absence of convincing evidence from controlled studies leads to unawareness of the prognostic significance and treatment implications for unexpected findings. However, there are some studies describing the frequency of these findings in different clinical settings, using several imaging techniques, and providing some recommendations to deal with them(8).

To determine the clinical relevance of such findings can be challenging, and Knowledge about opacifications and incidental abnormalities of the paranasal sinuses is useful, because such findings are frequent, and can represent clinical challenges and give rise to costly additional investigations and unnecessary concern for the patient if interpreted wrongly(9).

Neuroimaging often unmask Incidental Findings (IFs). The negative impacts of IFs, such as 'patient' anxiety, present clinician with management dilemmas, largely due to the limited knowledge base surrounding the medical significance of these IFs. In particular, the lack of evidence-based clinical trials investigating the efficacy of treatments for subclinical IFs makes management protocols challenging(10).

A study done in turkey showed Paranasal sinus abnormality is a frequent incidental brain cross sectional Imaging finding which is more commonly detected in winter. Awareness of incidental

paranasal sinus abnormalities and knowledge of its frequency contribute positively to clinical applications(11)

The role of the radiologist is crucial in deciding whether an image feature is normal or a potentially important diagnostic discovery. Nevertheless, with a different perspective, the incidental finding is also a problem for clinicians, and the collaboration between radiologists and clinicians is essential to deal with these abnormalities(8).

1.2 Justification of the study

Each radiologist and clinician should try to balance the potential to diagnose a disease that may cause morbidity and mortality against unnecessary testing and treatment, which carry their own risks together with patient anxiety and the cost to society(8).

Studies of incidental findings in the paranasal sinuses have been conducted mostly in patients referred for diagnostic imaging, hence the prevalence in the hospital-based population is not precisely known.

According to the previous studies, the prevalence of IPSA on brain Cross sectional imaging shows variations within a wide range (29.5-66%), probably depending on the climatic characteristics of the geographic region where the studies were carried out. In addition to the variations in the prevalence, the relation of these findings to the season as well as to age and sex show inconsistency among previously reported studies.(6)-(11)

The purpose of this study is to determine the prevalence, variants and size of incidental abnormalities in the paranasal sinuses in adult population using Computed Tomography (CT-scan) with other medical and surgical indication, and to relate the results to sex, age and to asses' seasonal variations on specific incidental paranasal sinus abnormalities.

2. Literature review

2.1 Overview

During fetal development, the paranasal sinuses originate as invagination of the nasal mucosa into the lateral nasal wall, frontal, ethmoid, maxilla and the sphenoid bones. This unique development explains the enormous amount of anatomical variation(2).

Computed tomography (CT) is an excellent means of providing anatomical information of this region, assessing disease extent, assisting endoscopic evaluation and guiding treatment. The role of magnetic resonance imaging is limited but may provide further information on fungal infection and differentiating thickened mucosa from fluid retention(12).

2.2 Prevalence of Incidental paranasal abnormalities

Previous studies on various population subsets have reported the prevalence of sinus abnormality to range from 16% to 60% [8]. Bolger *et al.* however, suggested that the incidence rate on CT may not be reflective of the true rate of sinus mucosal abnormalities, due to the undocumented concurrent use of antibiotics for other reasons(12).

Many studies showed that incidental paranasal sinus abnormalities are common findings on brain MRI images done for other CNS problems. Among the commonly detected abnormalities, mucosal thickening involving the ethmoidal & maxillary sinuses is the highest. Up to 6mm thickness was seen in asymptomatic individuals. Hence, it is recommended that reporting such findings is unnecessary unless there are concomitant clinical symptoms(13)(14).

Diagnosis of rhino sinusitis is still primarily done clinically(15), whereas the function of CT and MRI in these cases is supplementary, usually as a pre-surgical tool(15).

Several systems on sinus abnormality staging based on cross-sectional imaging have been developed and studied. In 2004, Zinreich compared 4 different staging systems for rhino

sinusitis, namely, the Kennedy, Levine and May, Harvard, and Lund-Mackay (LM) systems and concluded that the Lund-Mackay system was the most objective and reproducible system due to its simplicity and widespread acceptance(15).

Study done in Africa Nigeria incidental paranasal sinus abnormalities, Mucosal abnormality was commonest in the anterior ethmoids (34%), followed by the maxillary antrum (30%), frontal sinus (13%) posterior ethmoids (12%), and least occurring in the sphenoidal sinus (11%)(16).

Studies done in Australia on incidental paranasal abnormalities, showed the radiologic abnormality was most commonly evident in the ethmoid sinuses (28.4%) followed by the maxillary sinuses (24.8%) and of which Mucosal thickening was the most Common category of abnormality(5).

A prospective Incidental study done in UK showed Seventy-four per cent showed no radiological abnormality, 19% showed minor sinus opacification (mean score 21), 5% intermediate disease (mean score 70) and 2% major opacification (mean score 170). No polyps or bony erosions were seen on any scan(17).

According to a retrospective study done at Addis Ababa University on paranasal abnormalities of brain MRI taken in private hospitals, of the total 115 patients involved on the study, 66 were males & 49 females. From all, 62.2% showed abnormalities in at least one of their sinuses. Significant paranasal mucosal thickening was the commonest finding followed by presence of polyps or retention cysts. The most involved sinus groups were the ethmoid & maxillary sinuses.(14)

This study showed inflammatory changes in the PNS of patients scanned for other neurologic problems. Of these patients 62.6% showed abnormality in one or more sinus groups. The most common finding was mucosal thickening & the most affected sinus group was the ethmoid sinuses. Most of fluid levels & retention cysts/ polyps were found in the maxillary sinuses followed by the ethmoid sinuses.(14)

2.3 Seasonal variation of incidental paranasal sinus abnormalities

A study done in turkey on seasonal variation of incidental paranasal sinus abnormalities showed Paranasal sinus abnormality is a frequent incidental brain cross sectional Imaging finding which is more commonly detected in winter. Awareness of incidental paranasal sinus abnormalities and knowledge of its frequency contribute positively to clinical applications(11).

There are varying data reported for the seasonality of the prevalence of Incidental Paranasal Sinus abnormalities. While some authors reported no difference between the summer and the winter frequencies of Incidental Paranasal Sinus abnormalities(11)(18), others noted significantly higher frequencies in winter.

A recent study showed that mucosa of the maxillary and ethmoid sinuses have higher proliferation ability and superior capacity to secrete immunomodulatory cytokines compared to that of the other regions in the sinonasal tract (17). Different regional tissue characteristics of maxillary and ethmoid sinuses may have an impact on their mucosal responses to seasonal temperature changes. And this may be the cause of the difference between paranasal sinuses in terms of the season related inflammatory manifestations.

2.4 Sino nasal abnormalities

Sino nasal abnormalities are categorized and defined as follows:

- i) Mucosal thickening, identified by a soft tissue attenuating periosteal based foci following the peripheral border of the sinus. (11)
- ii) Polyps and retention cysts, identified as circumscribed, homogeneous, dome-shaped areas with soft tissue density. Polyps and retention cysts cannot be unambiguously differentiated by cross sectional Imaging (CT and MRI), and were therefore merged in one group.(11)
- iii) Fluid, identified CT scan by a distinct air-fluid level, and measured from the sinus border to the air-fluid level. In each paranasal sinus, all opacifications were measured in millimeters (mm). The opacifications will be visually determined at their maximum thickness using axial and coronal reformatted images. The opacifications visible, but measuring less than 1 mm were categorized as 0 mm. When mucosal thickening,

polyps and retention cysts, and/or fluid found in one and the same sinus, all abnormalities will be measured separately.(11)

3. Objectives

3.1 General Objective

To determine the prevalence of incidental paranasal sinus abnormalities on head CT scan in SPHMMC in Year 2019 to 2021 GC

3.2 Specific Objectives

- To assess magnitude of paranasal abnormalities on CT scan in SPHMMC in Year 2019 - 2021 GC
- To describe the variants of incidental paranasal abnormalities in SPHMMC in Year 2019 - 2021 GC
- To describe seasonal variation of specific abnormalities

4. Methods

4.1 Study Area and study period

St. Paul's Hospital Millennium Medical College (SPHMMC) is one of the biggest government Hospital among 94 hospitals in Addis Ababa under the Ethiopian Federal Ministry of Health. It is a teaching hospital for medical and health science students enrolled in various undergraduate and postgraduate programs and also for students from other medical and health science colleges. The hospital gives service to about 300,000 people annually with catchment population of more than 5 million. It has a total bed capacity of 392 and on average 698 patients visits the hospital's outpatient and emergency departments daily. There are around 1300 clinical and non clinical staffs. The hospital provides both academic and service in various clinical disciplines.

The study was conducted from April 2021 to October 2021 G.C.

4.2 Study design

A hospital based retrospective cross-sectional study design was used

4.3 Source population

The source population is patients who have undergone CT-scan imaging in SPHMMC from Sep 1 2019 to Aug 30 2021. There was a total of 4,927 head CT scans were imaged in this period at SPHMMC.

4.5 Inclusion criteria

Inclusion criteria

- Patients above 18 years old who undergo Head CT scan
- Patients undergoing CT examinations of the head for symptoms unrelated to the paranasal sinuses like headache, stroke, trauma, suspected intracranial tumor, and seizures.

4.6 Study population

Out of the 4,927 head CT scans taken in study time 3,737 met the inclusion criteria

4.7 Study variables

Dependent variables; are the presence or absence of paranasal sinus abnormalities

- Mucoperiosteal thickening /Opacification
- Retention cyst/Polyp
- Fluid level
- Bone destruction

Independent Variables

- Age
- Sex
- Season

4.7 Sample size determination and sampling technique

Single population proportion formula for estimating sample size will be used as follows:

$$n = \frac{(Z_{\alpha/2})^2 p(1-p)}{W^2}$$

Where: n= is the minimum sample size required

p = Estimated proportion of incidental paranasal sinus abnormalities in SPHMMC

w= Margin of error for sampling

Z- The standard normal value at (100%- α) confidence level.

Assumptions: $Z_{\alpha/2}$ = 95 % CI (=1.96), p=50 % (because we don't know the proportion), $w=0.05$.

Therefore, $n = Z^2 * P * (1-p)$,

$$n = (1.96)^2 \times 0.4 \times (1 - 0.4) / (0.05)^2,$$

$$n = 384$$

Adding 10% for inadequate data recording

$$n = 423$$

Stratified random sampling method is used. Out of 33,737 patients, 860 (22.9%) were taken in tsedey, 953 (25.5%) were taken in bega, 867 (23.2%) were taken in belg and 1062 (28.8%) was taken in kiremt Ethiopian season. After study population is classified according to seasons of the CT scan taken and sampled by proportionate simple random method according to the proportion of number of CT scan taken in respective seasonal strata and 88, 98, 89 and 109 samples obtained from each stratum respectively.

4.8 Data collection

Soft copy of Brain CT scan images is archived from the picture archiving and communication system (PACS) of SPHMMC from elective and emergency CT scan lists from sep 1 2019 to Aug 30 2021 and PNS is evaluated by trained senior radiology residents of SPMMC with an experienced neuroradiologist and a standard questionnaire is filled. In order to meet the inclusion criteria, cases with an indications sinus-related pathology, trauma patients and patients deliberately referred for imaging of the paranasal sinuses where excluded.

The Patient sex and month of CT scan is recorded. Seasons defined according to Ethiopian context as follows: Kiremt or Meher (summer) – June, July and August are the summer season. Heavy rain falls in these three months., Tseday (spring) – September, October and November are

the spring season sometime known as the harvest season., Bega (winter) – December, January and February are the dry season with frost in morning specially in January and, Belg (autumn) – March, April and May are the autumn season with occasional showers.

4.8.1 Data quality assurance

Each image is analyzed by a trainee radiologist and by senior neuroradiologist (with more than 10 years of experience) involved in the study. Assessors were blinded to the patients' clinical imaging indication. Image manipulation other than that would be employed during regular reporting of the cases was not allowed, as these findings are incidental. Windowing (contrast adjustment) of the images was allowed

4.9 Data Analysis and Interpretation

The magnitude of the three groups of opacifications and bone destruction is determined for in respective seasons and each sinus, and related to sex and season. The data is analyzed using SPSS version 26. For comparison between men and women, and between seasons of CT scan, the Chi-squared test is used for proportions of participants with opacification (e.g. mucosal thickening yes/no, polyps/retention cysts yes/no, and fluid yes/no) for each sinus. In addition, prevalence of participants with opacifications in several sinuses is calculated. $P \leq 0.05$ is considered statistically significant.

4.10 Ethical Considerations

The study proposal will be forwarded for approval by the Directorate of Research and publication committee of SPHMMC. Moreover, letter of cooperation will be written from the Department of radiology. Subject confidentiality and any special data security requirements will be maintained and assured.

4.11 Result disseminations

The result of this study will be presented in the department's research defense day and also submitted. As well as it will be presented to the scientific community in the College of Health

Science. It will also be disseminated through presentation in conferences and possibly through publication in scientific journal

6. Results

6.1 Socio-demographic characteristics of the study population

384 adult greater than 18 years age patients who were underwent brain CT scan for an indication other than known or suspected PNS abnormalities at SHMMC. Of those, 214 (55.7%) of the patients were Males and 170 (44.3%) were Female. The minimum age in study is 18 years and maximum age 81 years old from those 155 (40.4%) were in age group of 35 to 45 years old with mean age being 44 years old.

		Gender			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Male	214	55.7	55.7	55.7
	Female	170	44.3	44.3	100.0
	Total	384	100.0	100.0	

Table 1 Gender frequency table of study population at SPHMMC from Sep. 2019 to Aug. 2021 GC

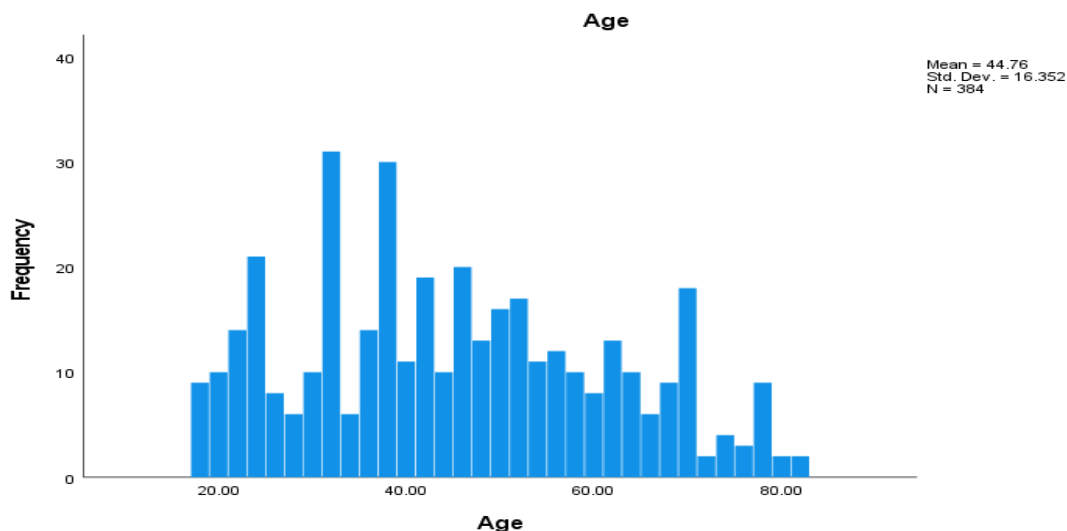


Figure 1. Age distribution of study population at SPHMMC from Sep. 2019 to Aug. 2021 GC

6.2 Gender and paranasal sinus abnormalities

As shown in Table 2 Incidental PNS abnormalities are detected in (61.8%) Men and (38.2%) Female

Table 2 Gender distribution of cases with incidental PNS abnormality at SPHMMC from Sep. 2019 to Aug. 2021 GC

PNS Abnormality detected in male and female patients in study population					
			PNS Abnormality detected		
			Yes	No	Total
Gender	Male	Count	102	113	215
		% within Gender	47.4%	52.6%	100.0%
		% within PNS Abnormality detected	61.8%	51.6%	56.0%
		% of Total	26.6%	29.4%	56.0%
	Female	Count	63	106	169
		% within Gender	37.3%	62.7%	100.0%
		% within PNS Abnormality detected	38.2%	48.4%	44.0%
		% of Total	16.4%	27.6%	44.0%
		% of Total	43.0%	57.0%	100.0%

As shown in Table PNSA are seen in 102 (47.4%) of Male patients and 63 (37.3%) of Female patients. Out of those shown PNSA in CT scan 61.8% were Males and 38.2% were Females.

Chi square test

		Value	Approximate Significance
Nominal by Nominal	Phi	.102	.046
	Cramer's V	.102	.046
	Contingency Coefficient	.101	.046

Association between IPNSA and Gender was evaluated by chi-square test with confidence interval of 95% and showed small to negligible association (p value of 0.046 and Phi value of 0.102)

	PSA detected		Cases Not detected	
	N	Percent	N	Percent
Frontal sinus	52	13.5%	332	86.5%
Ethmoid sinus	122	31.8%	262	68.2%
Sphenoid sinus	37	9.6%	347	90.4%
Maxillary sinus	117	30.5%	267	69.5%

a. Dichotomy group tabulated at value 1.

Table: 3 shows incidental PNS abnormalities detected in specific sinuses at SPHMMC from Sep. 2019 to Aug. 2021 GC

As shown in Table 2 above the most common PNS involvement seen at Ethmoid sinus (31,8%) followed by maxillary sinus (30.5%) and frontal sinus and sphenoid sinus involvement is seen by 13.8% and 9.6 % respectively out of all incidental abnormalities detected..

Association between IPNSA and specific sinus groups is tested by chi-square test and showed statistically significant association with P value <0.001 and contingency coefficient of 0.7 suggesting strong association.

		PNS Abnormality detected		Total
		Yes	No	
Season Of CT Scan Taken	Tsedey or spring	Count	18	70
		%	10.9%	32.0%
	Bega or winter	Count	11	87
		%	6.7%	39.7%
	Belg or autumn	Count	44	45
		%	26.7%	20.5%
	Kiremt or summer	Count	92	17
		%	55.8%	7.8%

Table: 4 Incidental PNS abnormalities detected in respective seasons at SPHMMC from Sep. 2019 to Aug. 2021 GC

As shown in Table 3. Incidental PNS abnormalities are most commonly seen kiremt or summer season of Ethiopia (55.8%) followed by Belg or autumn Ethiopian season (26.7%) and least involved season is Bega or winter season of Ethiopia (6.7%). There is statistically significant association seen between the presence of incidental PNS abnormality and kiremt or summer and Ethiopian season and similarly between the absence of incidental PNS abnormality and bega or winter Ethiopian season with (P value <0.01) and (Phi 0.596) suggesting the association is strong. comparison done using the Benjamini-Hochberg correction. is described in table below.

		PNS Abnormality detected	
		Yes	No
		(A)	(B)
Season Of CT Scan Taken	Tsedey or spring		A(.001)
	Bega or winter		A(.002)
	Belg or autumn		
	Kiremt or summer	B(.000)	

Results are based on two-sided tests. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.

Significance level for upper case letters (A, B, C): .05

a. Tests are adjusted for all pair wise comparisons within a row of each innermost sub table using the Benjamini-Hochberg correction.

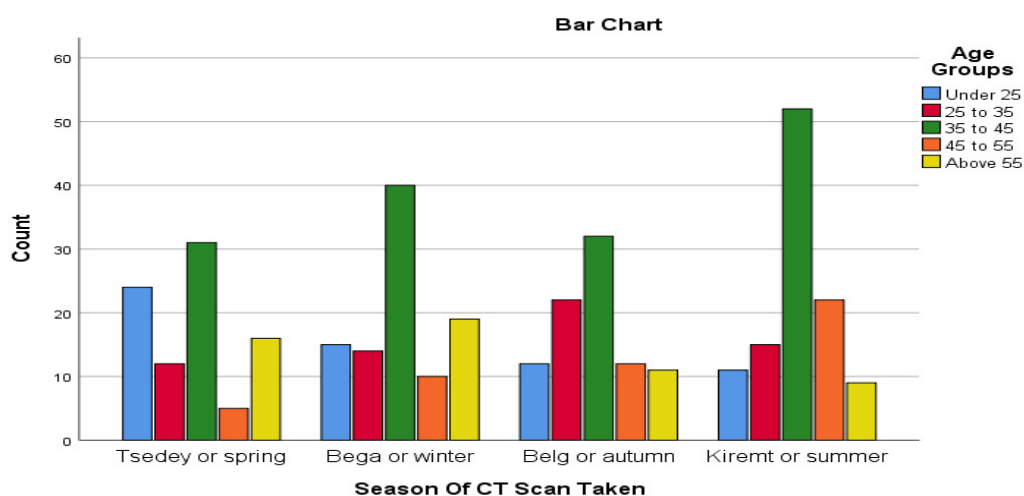


Figure: 2. Prevalence of incidental PNS abnormalities with age group categories at SPHMMC from Sep. 2019 to Aug. 2021 GC

As shown in Figure above Incidental PNS abnormalities were most commonly seen in age groups of 35 to 45 years in all seasonal categories. However there is no significant association seen with in the age groups or over all age with presence of IPNA (P value – .246) as shown in Table below.

Table 5 showing statistical significance of PNSA in age groups

		Score	df	P value
Variables	Age Groups	5.435	4	.245
	Age Groups(1)	.032	1	.858
	Age Groups(2)	.067	1	.796
	Age Groups(3)	.086	1	.769
	Age Groups(4)	2.335	1	.127
Overall Statistics		5.435	4	.245

		Season Of CT Scan Taken							
		Tsedey or spring		Bega or winter		Belg or autumn		Kiremt or summer	
		Table		Table		Table		Table	
		Count	Valid N %	Count	Valid N %	Count	Valid N %	Count	Valid N %
Frontal sinus fluid level	Yes	0	0.0%	1	0.3%	0	0.0%	3	0.8%
	No	18	4.7%	10	2.6%	44	11.5%	89	23.2%
	Normal	70	18.2%	87	22.7%	45	11.7%	17	4.4%
Ethmoid sinus fluid level	Yes	1	0.3%	0	0.0%	3	0.8%	15	3.9%
	No	15	3.9%	11	2.9%	41	10.7%	77	20.2%
	Normal	70	18.3%	87	22.8%	45	11.8%	17	4.5%
Sphenoid sinus fluid level	Yes	1	0.3%	2	0.5%	0	0.0%	3	0.8%
	No	17	4.4%	9	2.3%	44	11.5%	89	23.2%
	Normal	70	18.2%	87	22.7%	45	11.7%	17	4.4%
Maxillary sinus fluid level	Yes	0	0.0%	4	1.0%	4	1.0%	28	7.3%
	No	18	4.7%	7	1.8%	40	10.4%	64	16.7%
	Normal	70	18.2%	87	22.7%	45	11.7%	17	4.4%

Table 6 Sinus fluid levels in respective seasonal categories at SPHMMC from Sep. 2019 to Aug. 2021 GC

As shown above in Table 5 , Out of various incidental PNS abnormalities reviewed in study population a non specific finding which may suggest acute sinusitis is most commonly seen at maxillary sinus (9.3%) and more prevalent in kiremt or summer Ethiopian season(7.3%).

As described in Figure below the most common IPNS abnormality out of all IPNSA described on the study was Maxillary sinus mucoperiosteal thickening which was seen in 117 patients (20.83) followed by Ethmoid sinus mucoperiosteal thickening which is seen in 98 (22.48%) patients. The least of all IPNS abnormalities was frontal sinus fluid level which was seen only in 4(0.92%) of patients with PNSA.

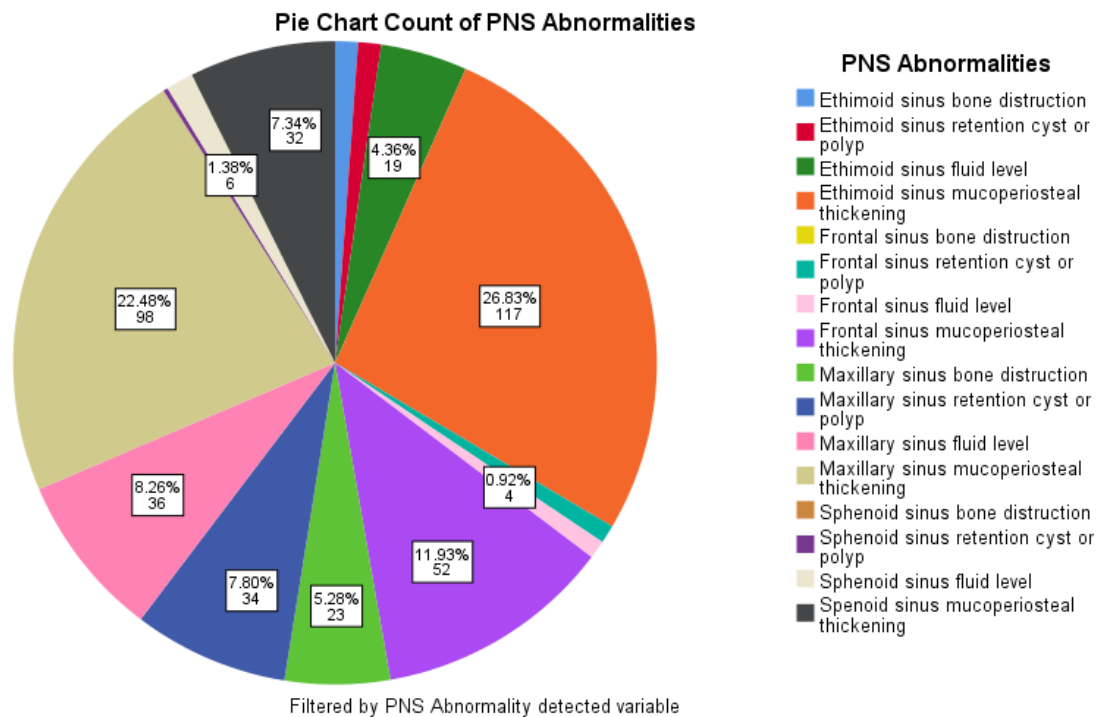


Figure 3 shows variants of Incidental PNSA seen

7. Discussion

With recent advance of cross sectional imaging Computed Tomography is widely used for evaluation of paranasal sinus abnormalities with superior and precise assessment of bone abnormalities & detection of calcifications.

To our knowledge, this is the first large cross sectional study reporting incidental findings in the paranasal sinuses in an adult with seasonality in context of Ethiopian climate.

In our study three hundred eighty four (384) patients were undergone in the study period of Sep 1, 2019 - Aug 30, 2021. From those patients, 165 (43%) were paranasal sinus abnormality detected. Out of these the most common involvement is seen in age group of 35 to 45 with median age of 44 years in all seasons, maxillary sinus (30.8%), sphenoid sinus (9.6%), ethmoid sinus (31.8%), and frontal sinus (13.5%) were abnormalities detected. Mucoperiosteal thickening is the most common category of abnormality in all paranasal sinuses (24.8%), and bone destruction being the least common abnormality detected (0.9%). These values are comparable with a retrospective study done at Addis Ababa University on paranasal abnormalities of brain MRI taken in private hospitals, in which 62.6% showed abnormality in one or more sinus groups.(14) according to this study the most common finding was mucosal thickening & the most affected sinus group was the ethmoid sinuses. Most of fluid levels & retention cysts/ polyps were found in the maxillary sinuses followed by the ethmoid sinuses.(14)

Our study showed incidental PNS abnormalities are detected in (61.8%) Men and (38.2%) Females in study group, but doesn't show statistically significant association with gender, this is in agreement with study done in Addis Ababa involving 115 patients, One of the findings of this study was that, there was no statistically significant correlation found between pattern of PNS abnormalities & age or sex of the study population.(14) Other studies also showed no significant association between age and sex with prevalence of incidental paranasal abnormalities. (9,14,19) Except for a study done in Norway involving 938 patients, stated that Opacifications were observed more frequently in men (342/464, 73%) than in women (308/518, 59%), $P < 0.01$. This was true both for mucosal thickening (men: 267/464, 57%, women: 17/518,

42%, $P < 0.01$), and for polyps and retention cysts otherwise fluid levels doesn't show significant association with gender.(20)

Incidental PNS abnormalities are most commonly seen kiremt or summer season of Ethiopia (55.8%) followed by Belg or autumn Ethiopian season (26.7%) and least involved season is Bega or winter season of Ethiopia (6.7%). There is statistically significant association seen between the presence of incidental PNS abnormality and kiremt or summer and Belg or autumn Ethiopian season similarly between the absence of incidental PNS abnormality and bega or winter Ethiopian season with (P value < 0.05). The seasonal variation doesn't show significant variation with in different age groups and gender with (P value of 0.544 and 0.21) respectively. According to a recent study the proposed reason for seasonal variation is that the mucosa of the maxillary and ethmoid sinuses have higher proliferation ability and superior capacity to secrete immunomodulatory cytokines compared to that of the other regions in the sinonasal tract.(11)

There are varying data reported for the seasonality of the prevalence of Incidental Paranasal Sinus abnormalities. While some authors reported no difference between the summer and the winter frequencies of Incidental Paranasal Sinus abnormalities(18), others noted significantly higher frequencies in winter(11).

8. Conclusion

Our study showed incidental PNS abnormalities are more commonly detected in Men and are most commonly seen kiremt or summer season of Ethiopia followed by Belg or autumn Ethiopian season and least involved season is Bega or winter season of Ethiopia.

Out of these the most common involvement is seen in age group of 35 to 45 with median age of 44 years in all seasons, Most commonly involved paranasal sinus is maxillary sinus followed by ethmoid sinus, and frontal sinus and sphenoid sinus,

Mucoperiosteal thickening is the most common category of abnormality in all paranasal sinuses, and bone destruction being the least common abnormality detected.

Paranasal sinus abnormality is a frequent incidental head CT scan finding that is more commonly detected in kiremt or summer Ethiopian season. Regardless of the season, IPSA is more commonly found in men compared to women. Awareness of IPSA and knowledge of its frequency contribute positively to clinical applications.

9. Limitation of the study

The limitation of the study is that PNS evaluation was done on standard protocol of brain CT scan with 5mm slice thickness which limited the quantitative assessment of the PNS abnormalities. This study is limited to the clinical information given by clinician ordering the CT scan retrospectively acquired from Radiology information system

10. Recommendations

Since these paranasal sinus abnormalities are evaluated on thick section brain Ct protocol image further prospective study is recommended with quantitative analysis of abnormalities, The true magnitude of incidentalality of the findings should be correlated with prospective patient interview on symptoms of paranasal sinus abnormalities.

10. Annex

10.1 Data collection form

Age_____ Sex_____ MRN_____ Month CT scan taken **Code**_____

1. Indication for CT Scan

2. Paranasal sinus abnormality detected a) yes b) no

3. If yes to question number 3, which type of abnormality detected

S.NO		Right side		Left side	
		Yes	No	Yes	No
1.	Frontal sinus: • Mucoperiosteal thickening /Opacification • Fluid level • Retention cysts/polyp • Bone destruction				
2.	Ethmoid sinus: • Mucoperiosteal thickening /Opacification • Fluid level • Retention cysts/polyp • Bone destruction				
3.	Sphenoid sinus: • Mucoperiosteal thickening /Opacification • Fluid level • Retention cysts/polyp • Bone destruction				
4.	Maxillary sinus: • Mucoperiosteal thickening /Opacification • Fluid level • Retention cysts/polyp • Bone destruction				

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Declaration

I, the undersigned declare that this thesis is my original work in Partial fulfillment of the Requirements for the Certificate of Specialty in Radiology. I also declare that it has never been presented in this or any other university and that all resources and materials used in the thesis have been duly acknowledged.

Student Name: _____

Signature: _____

Place of submission: _____

Date of submission: _____

This thesis has been submitted with my approval as a College/university advisor.

Advisor Name: _____

Signature: _____

Date of submission: _____