**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCES**

**SCHOOL OF GRADUATE STUDIES**

**DEPARTMENT OF RADIOLOGY**

# COMPUTED TOMOGRAPHY PATTERNS OF SINONASAL DISEASES AT TIKUR ANBESSA SPECIALIDED HOSPITAL, ADDIS ABABA UNIVERSITY, ADDIS ABABA, ETHIOPIA.

**(INSTITUTIONAL BASED RETROSPECTIVE DESCRIPTIVE CROSS-SECTIONAL STUDY FROM NOVEMBER 2019 – JULY 2021)**

**MISGANAW JEGNIE (MD, RADIOLOGY RESIDENT)**

**A THESIS REPORT SUBMITTED TO DEPARTMENT OF RADIOLOGY, COLLEGE OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILMENT OF SPECIALTY IN RADIOLOGY**

**OCTOBER, 2021**

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**BY MISGANAW JEGNIE (MD, RADIOLOGY RESIDENT)**

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# ABSTRACT

**Background:** Sinonasal disease affects a wide range of population including broad spectrum of diseases both inflammatory conditions, congenital and neoplastic. Since their clinical assessment is fraught by the surrounding bony structures; diagnostic radiology is of paramount importance. This study is aimed at assessing the CT patterns of sinonasal pathologies which is the first study to the best of our knowledge at Tikur Anbessa Specialized Hospital and in Ethiopia.

**Objective:** To assess computerized tomography patterns of sinonasal pathologies and patterns of histopathologic findings at Tikur Anbessa Specialized Hospital.

**Methods:** Institutional based retrospective cross-sectional study was carried out at Tikur Anbessa Specialized Hospital department of radiology. A non-probability convenience sampling technique was employed to include all patients imaged at radiology department for sinonasal diseases during the study period. Data was collected from medical record books and imaging archive system to see the imaging reports of patients' images from November 2019 – July 2021, using structured data extraction template. The date was collected from June to August 2021. Data was entered and analyzed using SPSS 26 statistical software. Ethical clearance was obtained from Ethical Review Committee of the Department of Radiology at Addis Ababa University.

**Result**: A total of 102 patients were included during the study period of which 64(62.7% were males and 38(37.3%) were females with age range of 1 day up to 83 yrs. The mean age was 30.7 $\pm$ 20.9 years and median age 27.5 years. The most common presentations were nasal discharge 52(50.9 %), and nasal blockage accounting 42(41.2%) Inflammatory etiology is the most common finding accounting 47.1% (N=48) of the cases and malignant masses is the second most common category which accounted 28(27.4 %) of the cases. From those having histology the majority are malignant 25(71.4% N=35).

**Conclusion**: In this study malignant sinonasal pathologies are common next to inflammatory causes. All choanal atresia cases were bilateral. Further prospective study with large number of participants is recommended as this institutional based retrospective study in tertiary center may not represent the general population.

# Acknowledgement

My deepest gratitude goes to my advisors Prof Getachew Assefa and Dr. Tewodros Endale for their detailed advice and guidance starting from selecting the topic to preparation of the final research report. I would also like to thank the department of radiology for giving the opportunity to do this research. Last but not least I would like to thank the OPD medical record room work team for their support and cooperation during reviewing medical record books.

# Table of Contents

# LIST OF TABLES

# LIST OF FIGURES

# ABBREVIATIONS AND ACRONYMS

CT: Computerized Tomography

ENT: Ear, Nose, and Throat

FESS: Functional Endoscopic Sinus Surgery

HRCT: High-resolution Computed Tomography

JNA: Juvenal nasopharyngeal angiofibroma

MDCT: Multi-detector Computed Tomography

MRI: Magnetic Resonance Imaging

PET: Positron Emission Tomography

PNS: Paranasal Sinus

RMS: Rhabdomyosarcoma

SCC: Squamous cell carcinoma

TASH: Tikur Anbessa specialized hospital

SPSS: Statistical Software Package for Social Sciences

# 1. INTRODUCTION

## 1.1 Background

Sinonasal disease affects millions of people in United States and all over the world. The presence of nasal symptoms has a significant adverse impact on quality of life, emotional, function, productivity, and ability to perform daily activities. Symptoms related to sinonasal disease are the leading causes for seeking medical care in the United States costing tremendous amount (1).

The sinonasal region is comprised of the nasal cavity and surrounding paranasal sinuses. The nasal cavity is centrally located and is divided in midline by nasal septum. The body superior, middle and inferior turbinates project into the nasal cavity and divide the nasal cavity in to superior, middle and inferior meatuses. Paranasal sinuses are pneumatised spaces within the maxillary, frontal, sphenoid and ethmoid bones each connected to the nasal cavity by small openings (2).

Sinonasal disease is a pathological process involving the nasal cavity and the paranasal sinuses. These could be congenital, inflammatory, and or neoplastic. These diseases have nonspecific clinical presentation. After patients with sinonasal symptoms are evaluated with history and physical examination and if they have no warning signs they could be managed with inhaled intranasal corticosteroids. Those who present with severe headache, unilateral otitis media with effusion, facial numbness, dental swelling, unilateral watery drainage, high fever, peri-orbital swelling, and interference with extra ocular movement, bloody discharge, and decreased sense of smell, unilateral nasal obstruction and wheezing should be evaluated with endoscopy and imaging (1–3).

There are several congenital lesions of the sinonasal cavity, including pyriform aperture stenosis, choanal atresia, congenital encephaloceles, dermoid/epidermoid cysts, sinus tracts, and nasal gliomas (2,3).

Infectious and inflammatory causes are the most common pathologies and neoplastic causes are relatively rare. Sinusitis ranks as one of the most common afflictions in the United States. It is estimated that more than 31 million people in the United States are affected by sinus inflammatory disease each year and that 16 million visits to primary care physicians annually are

for sinusitis and its complications. The diagnosis of acute sinusitis is a clinical, and imaging can be performed to evaluate for recurrent sinus infections or atypical sinus infections, often with the intention of surgical intervention (2,3).

Sinus inflammatory disease is a common medical problem. Sinusitis may be secondary to infection, allergy, altered immunity, or a combination of these factors. Sinusitis may be classified as acute, subacute, and chronic. The imaging findings are nonspecific and should be correlated with the clinical history and physical examination. Air-fluid levels in a sinus usually correlate with acute sinusitis if there is no history of antral lavage, trauma, or reason for spontaneous hemorrhage (4).

Mucosal thickening up to 2 to 3 mm in the nasal cavity and anterior ethmoid sinus along with turbinate swelling is seen normally as part of the nasal cycle. In children under the age of 3 years, sinuses are usually opaque and thought to result from redundancy of mucosa. Thus, both should not be considered pathologic unless clinical findings support (4).

Chronic sinusitis usually results from repeated episodes of acute or subacute sinusitis. Though imaging findings cannot differentiate acute, subacute and chronic sinusitis long-standing inflammation may cause reactive sclerosis of the adjacent bones which may be used to suggest the diagnosis of chronic sinus disease (4).

Mucous retention cysts result from inflammatory obstruction of seromucinous glands. Serous retention cysts form secondary to submucosal accumulation of serous fluid. Both appear as smooth, dome-shaped structures frequently along the inferior aspect of the maxillary sinus which cannot be differentiated from a solitary polyp by imaging. Sinus polyps form as a result of folding and hypertrophy of the mucosa with submucosal accumulation of fluid. An association of allergy, inflammation, infection, vasomotor rhinitis, and cystic fibrosis with polyp formation is described (4).

Antrochoanal polyp refers to a solitary polypoid lesion that arises in the maxillary sinus and grows until it causes complete opacification of the antrum. It subsequently expands the maxillary ostium as it extends through it into the nasal cavity. Sphenochoanal polyp can also be seen. Edematous redundant mucosa in acute sinusitis may also prolapse through the ostiomeatal complex and mimic an antrochoanal polyp. Fungal sinusitis may resemble sinonasal polyposis as

in case of allergic fungal sinusitis, aspergilloma or invasive which may also mimic malignancy (4).

Mucocele which commonly occurs in the frontal sinus may have thin peripheral enhancement with central non enhancing component that aids to differentiate from malignant lesions (3,4).

From benign neoplasms that affect the sinonasal cavity osteomas, papillomas, schwannomas, and juvenile angiofibroma are most commonly seen. The stereotypical benign neoplasm expands and remodels the bone as a result of its slow, nonaggressive growth. Although juvenile nasal angiofibroma is a benign lesion, its marked vascularity lends it to be locally destructive and invasive (3,5). Papilloma's come in many different varieties (the fungiform, inverted, and cylindrical cell papilloma), the most common of which (around 75%) is the inverted papilloma. Inverted papilloma is frequently multicentric, and there is a 3% to 24% (average, 13%) incidence of coexisting carcinoma, mostly squamous cell (3,4).

Although malignant neoplasms comprise only 3% of all head and neck malignancies and 1% of all malignancies, they are important entities to be considered as they present with non-specific clinical presentation and detected in advanced stage involving vital structures like the orbit, skull base and cranial nerves (2,3,5). Approximately 50% to 65% of sinonasal malignancies arise within the maxillary sinuses, 10% to 25% in the ethmoid sinuses, and 15% to 30% in the nasal cavity (2–4).

## 1.2 Statement of the problem

Sinonasal diseases are some of the most common cases encountered by clinicians with 25 million medical visits and costing $2 billion annually in the United States. In a study done at Department of radio diagnosis of Acharya Vinoba Bhave Rural Hospital in India with 175 patients undergone CT were categorised according to aetiology as congenital, inflammatory, and neoplastic. Based on CT findings the maxillary sinus was the most common affected sinus. Deviated nasal septum and concha bullosa were found to be the most common anatomic variations. In this study, most of the cases were inflammatory sinusitis followed by polyps. Out of the 38 neoplastic lesions, 21 of them were benign. Nasopharyngeal angiofibroma and inverted papilloma were the commonest lesions. From the 17 malignant cases identified, squamous cell carcinoma of the maxillary sinus was the commonest (6).

CT for rhinosinusitis symptoms is a common clinical practice that can be ordered by primary care physicians who don't have instruments to perform thorough endoscopic nasal examinations. The radiologist could be the first physician to suggest the presence of sinonasal lesion and it is imperative that the radiologists be aware of the imaging findings of both benign and malignant masses and mass like lesions and also able to recommend the next appropriate steps in patient management (5).

Sinonasal imaging has progressed as generations of imaging modalities have advanced gradually. Previously plain film radiography was the modality of choice for sinonasal cavity as it allows quick, non-invasive evaluation of the lower nasal cavity, maxillary and frontal sinuses. But this standard view provides limited display of the anterior ethmoid cells, osteomeatal complex, middle turbinates and upper two third of the nasal cavity as well as the frontal recess that plays key roles in the pathogenesis of sinusitis. Currently high-resolution CT (HRCT) replaced radiography in the evaluation of sinonasal disease. HRCT provides excellent bone detail and accurate soft tissue mapping. The extents of inflammatory diseases and important anatomic landmarks as well as normal variants are assessed before endoscopic surgery (3,4,6,7)

For sinonasal tumours, CT and magnetic resonance imaging (MRI) have complementary role; the CT providing bone detail and anatomic landmarks and MR providing soft tissue character and extent (6,7). In a prospective study done in Egypt in 2013, both CT and MRI were taken for 30 patients with CT and MR having equal sensitivity in identifying the lesions. But in three

patients MRI was superior to CT to identify the origin of the mass. In all the 30 cases, MRI was better in identifying tissue from secretions (8). In a study involving 50 patients that correlated CT findings with histopathological findings, 47 (94%) of CT findings were similar to pathologic findings whereas 3 (6%) were different (9).

This study was aimed at assessing the patterns of sinonasal pathologies evaluated with CT. As to my knowledge and extensive search of literatures, the pattern of sinonasal pathology is not studied in Black Lion Hospital and in Ethiopia in general.

## 1.3 Justification of the Study

The nasal cavity and paranasal sinuses host wide spectrum of pathologies. Most of infectious sinonasal diseases can be treated medically. But when there is failure of medical management, to see complications or when faced with sinonasal mass lesions imaging plays crucial role. CT has become the main investigation modality of the sinonasal region pathologies and for surgeon's plan for functional endoscopic sinus surgery. In Africa there are no much researches done on sinonasal pathologies.

This study was the first study done on CT patterns of sinonasal pathologies in our institution and our country. This will be an entry point for researchers to conduct further studies that can be undertaken on this region. It may also have role in developing local protocol for sinonasal imaging.

# 2. LITERATURE REVIEW

The nasal cavity and paranasal sinuses host a wide spectrum of diseases and conditions that can be collectively termed as sinonasal diseases. These pathologies include congenital, inflammatory and neoplastic conditions. As these diseases have nonspecific clinical presentation radiological evaluation is very essential. The available imaging techniques include plain radiograph, CT, MRI, and positron emission tomography (PET). These modalities have their own advantages and disadvantages related to the sensitivity, specificity, availability, cost and radiation exposure (6).

Computed tomography has become the investigation of choice for radiological diagnosis of nasal and sinus diseases as CT images clearly show air spaces, opacified sinuses, soft tissue masses, and fine structural bony anatomy. Multi-detector CT (MDCT) allows assessment of the patency of sinonasal passages, shows the effect of anatomic variants, anatomic structures that are not visualized by physical examination or diagnostic nasal endoscopy, and is thus the investigation of choice for the surgeon who considers functional endoscopic sinus surgery (FESS). FESS allows restoration of sinus drainage and ventilation by opening the natural ostium and preserving the mucosa (6,7).

Patients with sinonasal pathologies present with nonspecific presentations. Evaluation of 50 patients who presented with sinonasal complaints in India in 2016 revealed nasal obstruction (82%) and nasal discharge (66%) to be the most common symptoms. Nasal mass was found in 56% of the cases whereas headache and allergic symptoms were found in 52% of the cases. Other symptoms were hyposmia, epistaxis, mouth breathing. There were 22 (44%) cases of chronic rhinosinusitis, 19(38%) cases of nasal polyps, 4(8%) cases of inverted papilloma, and 1(2%) case of rhinosporidiosis, rhinoscleroma, nasal septum angioma, sinonasal adenocarcinoma, and squamous cell carcinoma. From the 19 cases of nasal polyps included in the study, 13 (68.42%) were antrochoanal polyps and 6 (31.58%) were ethmoidal polyps. This shows that the most common type of disease involving nose and paranasal sinuses was inflammatory disease 43 (86%), followed by benign disease 5 (10%), and malignant disease were found in 2 (4%) of cases. The most common benign masses is papilloma accounting 80% followed by angioma of the nasal septum (7).

Sinonasal anatomical variants can cause anatomic compromise of the normal drainage of paranasal sinus secretion (4). A study in Spain at virgin Macarena University Hospital with 110 cases included showed 74 (67%) has some anatomical variant and in many more than one variant was seen in the same subject. In this study the highest degree of variability was for the nasal septum most common septal deviation (55%), followed by the middle nasal concha (25%), the ethmoidal air cells (10%), the ethmoidal uncinate process (4%), and other sites (6%) (10).

In another study conducted in India to see the relationship between anatomical variants of sinonasal region and chronic rhinosinusitis there was no statistically significant correlation (11). But in a study conducted in Italy in 2012 with patients who were medically treated for chronic rhinosinusitis and failed to respond with medical treatment statistically significant association was found between the presence of common anatomic variations: septal deviation, bilateral concha bullosa, medial deviation of uncinate process, Haller cell, ethmoidal bulla hypertrophic, agger nasi cell and the presence of sinus mucosal disease. But there was no significant correlation between other common and uncommon anatomic variations and mucosal pathologies (12).

A recent study on anatomographic variants of sphenoid sinus in Ethiopian population showed 2% conchal, 25.5% presellar, 50% sellar, and 22.5 post sellar pneumatisation (13).
Thirty-two histologically proved malignant disease involving the paranasal sinuses were studied using CT in England. The radiological features of tumor were sinus opacification, a soft-tissue mass, bone erosion and/or displacement, sclerosis, and new-bone formation. Measurements of tissue densities were not helpful in distinguishing tumor from benign masses**.** Significantly greater tumor extent was demonstrated by CT than by conventional radiography in 15 patients; the additional tumor most commonly involved the pterygoid region or orbit. In this study, 11 of the 32 malignancies were squamous cell carcinoma which is also the most common head and neck malignancy (14).

Sinonasal malignancies accounted 9% of primary head and neck malignancies in a study done at Black Lion Hospital Oncology Centre from 2010 - 2015 (15). Squamous cell carcinoma was the most common histological subtypes seen in 50.36% of the sinonasal malignancies in Nigeria (16), 56.6% in Poland (17), and 51.6% in United States (18). Similarly, the commonest tumor site was found to be the maxillary sinus in three of the aforementioned studies.

# 3. OBJECTIVES

## 3.1 General objectives

To assess computerized tomography patterns of sinonasal pathologies, patterns of histopathology, clinical-imaging and imaging-pathologic correlation at Tikur Anbessa Specialized Hospital

## 3.2 Specific objectives

- To determine the pattern of different sinonasal pathologies based on CT
- To assess CT patterns of sinusitis based on the level of obstruction
- To assess the patterns of histopathology of those who have histopathologic diagnosis
- To assess correlation of clinical and imaging diagnosis based on CT
- To assess imaging and histopathology correlation for those having histologic diagnosis

# 4. METHODOLOGY

## 4.1 Study design

Institutional based retrospective cross-sectional study was conducted

## 4.2 Study area and period

The study was conducted in Tikur Anbessa Specialized Hospital, the largest tertiary level referral and teaching hospital in the Ethiopia. It is one of the centers of excellence in Ethiopia in undergraduate, post graduate and subspecialty programs in health science. It is the only oncology center with radiotherapy service in the country. The radiology department is one of the many departments in the institution with experienced radiologists. It gives radiologic medical service and undertakes academic activities in training of general radiologists, medical radiology technologists, as well as medical students. The department also gives fellowship training. Digital X-ray, CT, U/S and Mammography are the imaging services available in the hospital. The study data collection was conducted from June to August 2021.

## 4.3 Source and study population

The source population were patients evaluated by ENT department and sent for imaging to radiology department of Tikur Anbessa Specialized Hospital from November 2019 to July 2021. The study population were those patients with medical records, CT done at TASH with imaging reports available, and evaluated by ENT Department.

## 4.4 Inclusion and Exclusion Criteria

### 4.4.1 Inclusion criteria

Patients presenting with history of headache, nasal obstruction, nasal discharge, anosmia, postnasal discharge, epistaxis, and swelling who are sent for sinonasal CT and imaged at the Radiology department

### 4.4.2 Exclusion criteria

- Patients with recent maxillofacial / head trauma,
- Patients who have undergone recent head and neck surgery and
- Patients who do not have CT report or incomplete medical records were excluded from the study.

## 4.5Sample size

Sample size was determined by using single population proportion formula at 95% confidence level and 10 % margin of error. According to a cross-sectional study conducted to determine the epidemiology of primary head and neck cancer in Tikur Anbessa Specialized Hospital Oncology Center, the prevalence of nasal and paranasal sinuses malignancies was 9% (11).

$n=\frac{Z^2\alpha/2\ p\ (1-p)}{d^2}$, where, n= sample size, Z=1.96, p=proportion & d=precision (0.05)

$n=\frac{1.96^2 * 0.09\ (1-0.09)}{0.05^2}$

$n=\frac{3.84 * 0.09 * 0.91}{0.0025}$

n=126

By adding 10 % nonresponse rate, the final sample size will be 139.

## 4.6Sampling technique

A non-probability convenience sampling technique was employed to include all sinonasal CT imaged patients at radiology department during the study period.

## 4.7Study variables

**Dependent variables**

- Congenital Sinonasal Pathgologies
    - Deviated Nasal Septum
    - Concha Bullosa

    - Pyriform Aperture Stenosis,
    - Choanal Atresia,
    - Congenital Encephaloceles,
    - Dermoid/Epidermoid Cysts,
    - Nasal Gliomas
- Inflammatory Sinonasal Pathgologies
    - Inflammatory Sinusitis
        - Acute Sinusitis
        - Chronic Sinusitis
        - Allergic Rhinosinusitis
    - Sinonasal Polyps/Polyposis
        - Antrochoanal Polyp
        - Sphenochoanal Polyp
        - Ethmoidal Polyp
- Neoplastic Conditions-Sinonasal Tumors
    - Juvenile nasopharyngeal angiofibrom
    - Papilloma's- Fungiform, Inverted, and Cylindrical Cell Papilloma
    - Sinonasal Adenocarcinoma,
    - Sinonasal undifferentiated carcinoma
    - Osteoma
    - Ossifying fibroma
    - Squamous Cell Carcinoma
    - Melanoma
    - Lymphoma
    - Mucoepidermoid carcinoma

**Independent variables**

- Age, sex, place of residence

## 4.8 Operational definition

**Sinonasal pathologies:** a pathological process involving the mucosa of the nasal cavity, paranasal sinuses or both (1).

**Acute rhinosinusitis:** acute inflammation of the nasal cavity and paranasal sinus mucosa that lasts less than four weeks which causes headache, facial pain, nasal congestion, runny nose. On imaging an air fluid level, bubbly or frothy-appearing secretions and enhancing mucosal thickening are suggestive (2,19,20).

**Chronic rhinosinusitis:** sinonasal infection lasting more than 12 weeks. On imaging sinus mucosal thickening & opacification with thickening and sclerosis of bony walls, intra-sinus hyperdensity or calcifications, and volume loss are suggestive(2, 19,20).

**Sphenoethmoidal recess**: a small space that drains the sphenoid sinus and the posterior ethmoid air cells into the superior meatus of the nasal cavity (19,21).

**Sphenoethmoidal recess pattern:** the sphenoid and ipsilateral posterior ethmoidal sinuses are involved (19,21).

**Osteomeatal complex/unit:** a common channel that links the frontal sinus, anterior ethmoid air cells and the maxillary sinus to the middle meatus allowing airflow and mucociliary drainage (19,21).

**Osteomeatal pattern:** the middle meatus of the nasal cavity, adjacent anterior and middle ethmoidal cells, maxillary and frontal sinuses are involved which could be caused by swollen mucosa, polypoid lesion, concha bullosa, septal deviation and nasal tumor (19,21).

**Infundibular Pattern**: Disease limited to the infundibulum and adjacent maxillary sinus (19,21).

**Sinonasal Polyposis:** polypoid sinonasal masses caused by non-neoplastic inflammatory swelling of the sinonasal mucosa that buckles to form polyps (19,21).

**Sinonasal Polyposis pattern:** polypoid lesions fill the nasal cavity and the sinuses bilaterally (19,21).

**Sporadic/unclassifiable pattern:** extent of disease does not appear to be related to the known mucus drainage patterns (19,21).

## 4.9Data collection

Paranasal sinus (PNS) CT was acquired using GE Medical Systems 64 slice CT which is a non-contrast low dose CT with KVP of 120 KV and maximum X-ray Tube current of 90 MA. Images are taken in axial section and reconstructed to coronal and axial planes, with soft tissue and bone window. The slice thickness for soft tissue windows are 2.5 or 5 mm and bone window is reconstructed with a slice thickness of 0.6 mm. No pre-procedure antibiotics, antihistamines given or no nose blowing to clear secretions is performed. Also post contrast head and neck CT and non-contrast/post contrast brain CT scans with sinonasal pathologies of patients that are evaluated at ENT department was included. The CT scans were reported by neuroradiology sub-specialists with more than three years of experience, and fellows in neuroradiology.

Data was retrieved from the CT reports in the imaging archive system, I-care system and medical record books of patients who undergone sinonasal CT, head or head and neck CT at radiology department from November 2019 to July 2021, after structured data extraction template was prepared. The data collection template has four parts: Sociodemographic characteristics, clinical data, CT findings, and pathologic findings.

## 4.10 Data quality control

Standardized data collection template was prepared by reviewing different related literatures. Frequent and timely supervision of data collectors was undertaken by the principal investigator. Appropriate measures and corrections were taken on time for completeness and accuracy.

## 4.11 Data processing and analysis

Data completeness was checked on each data collection day. Data was cleaned, entered and analyzed using Statistical Software Package for Social Sciences (SPSS) Version 26. Descriptive statistics such as frequency distribution, mean, standard deviation and percentages were calculated. Data was presented using tables, graphs and charts.

## 5. ETHICAL CONSIDERATIONS

Data collection was undertaken after getting permission from the ethical review committee of the department of radiology at Addis Ababa University. Patient confidentiality was maintained by omitting patients' name and hospital identification number from data collecting format and selected representative images.

## 6. DISSEMINATION OF RESULTS

The result of the study will be presented during thesis defense. It will also be submitted to the Department of Radiology, AAU. Moreover, the findings of the study will be disseminated through publications and presentation in scientific conferences and workshops.

# 7. RESULT

## 7.1 Socio-demographic data

A total of 102 patients were included in the study and from these 64(62.7% were males and 38(37.3%) were females. The participant's age ranged as young as 1 day up to 83 years of age with a mean age of 30.7 ± 20.9 years and median age of 27.5 years. The commonest age group was those in the range of 21 to 30 years accounting 23(22.55%) followed by those less than or equal to 10 years accounting 19(18.6 %). The majority came from Addis Ababa accounting 53(52%) of the participants.

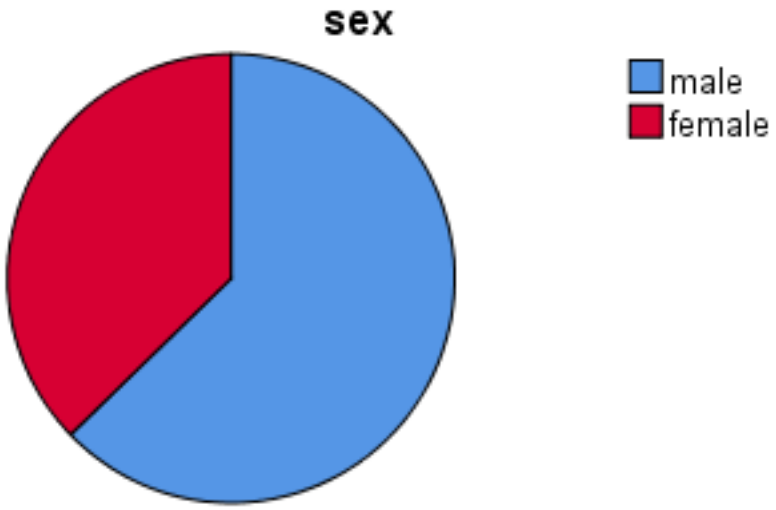


*Figure 1: sex distribution of patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

*Table 1: Age group distribution of patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| Age group | ≤ 10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | >70 |
|---|---|---|---|---|---|---|---|---|
| frequency | 19 | 18 | 23 | 12 | 8 | 13 | 7 | 2 |
| % | 18.6 | 17.64 | 22.54 | 11.76 | 7.84 | 12.74 | 6.86 | 1.96 |

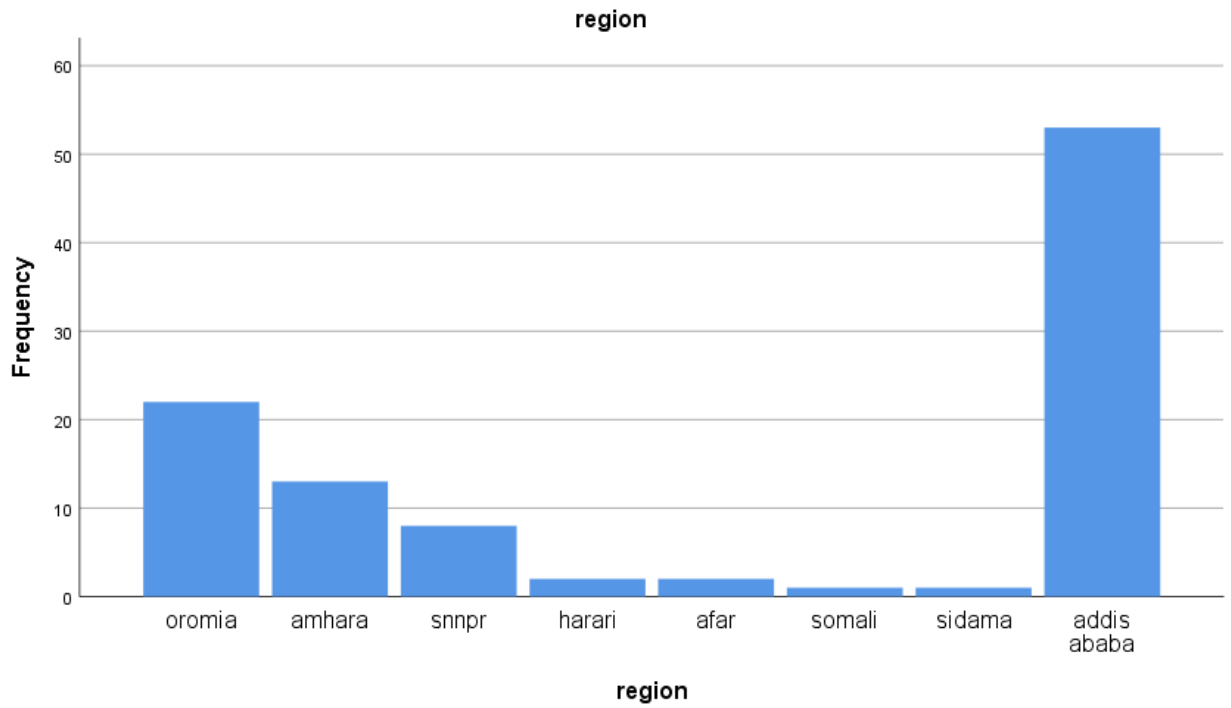


*Figure 2: Residence area of study participants who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

## 7.2 Clinical data

The most common presentation is nasal discharge (including rhinorrhea, post nasal drip, foul smelling nasal discharge and mucoid nasal discharge) 52(50.9%), rhinorrhea being the most common 29(55.7%, N=52) of nasal discharge complaints. The second most common complaint is nasal blockage accounting 42(41.2%) and the other common presentations are nasal congestion, and headache present in 32 (3.14%), and 23(22.5) of the patients respectively.

On anterior rhinoscopic/endoscopic evaluation 35 (34.3%, N=102) nasal cavity masses were seen from which 19(54.3%, N=35) appear malignant, 5(14.3%, N=35) appear benign and 11(31.4%, N=35) appear non neoplastic. There were also 12 (11.7%, N=102) cases with deviated nasal septum and 8 (7.8%, N=102) cases with inferior turbinate hypertrophy.

*Table 2: Frequency distribution of clinical presentation of study participants who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| SNO | Clinical presentation | Frequency | Percentage |
|---|---|---|---|
| 1. | Nasal blockage | 42 | 41.2 |
| 2. | Nasal congestion | 32 | 31.4 |
| 3. | Rhinorrhoea | 29 | 28.4 |
| 4. | Post nasal drip | 9 | 8.8 |
| 5. | Foul smelling nasal discharge | 9 | 8.8 |
| 6. | Mucoid nasal discharge | 5 | 4.9 |
| 7. | Headache | 23 | 22.5 |
| 8. | Nasal cavity swelling | 19 | 18.6 |
| 9. | Sneezing | 17 | 16.7 |
| 10. | Swelling over the maxillary region | 18 | 17.6% |
| 11. | Epistaxis | 14 | 11.8 |
| 12. | Difficulty in breast feeding and breathing since birth | 11 | 10.8 |
| 13. | Facial pain | 4 | 3.9 |
| 14. | Facial swelling | 4 | 3.9 |
| 15. | Fever | 4 | 3.9 |
| 16. | Hyposmia | 4 | 3.9 |
| 17. | Periorbital swelling | 3 | 2.9 |
| 18. | Others (wheezing, facial numbness, dental swelling, proptosis, unilateral watery nasal discharge, tinnitus, Ear pain, itching, neck swelling, dental swelling, nasal itching...) | 18 | 17.6% |

## 7.3 Imaging findings

From the 102 patients in the study 101 of them were categorized according to the etiology into congenital/developmental, inflammatory, benign and malignant diseases based on CT findings. One case was a case of CSF leak.

*Table 3: Frequency distribution of categories various sinonasal diseases based on CT in patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| | Imaging diagnosis | Frequency | Percentage (N=102) |
|---|---|---|---|
| 1. | Congenital/developmental | 19 | 18.6 |
| 2. | Inflammatory | 48 | 47.1 |
| 3. | Benign masses | 9 | 8.8 |
| 4. | Malignant masses | 28 | 27.4 |
| 5. | CSF leak | 1 | 1 |

### 7.3.1 Congenital/developmental

There are 19 congenital conditions accounting 18.6 % from 102 patients. From these the most common congenital abnormality is choanal atresia accounting 10 (52.6 %, N=19) of the cases and 5 are males and 5 are females.

*Table 4: Frequency distribution of congenital/developmental sinonasal diseases in patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| Congenital/developmental | Frequency | Percentage (N=19) |
|---|---|---|
| Choanal atresia (all bilateral) | 10 | 52.6 |
| Pyriform aperture stenosis | 2 | 10.5 |
| Right nostril hypoplasia | 1 | 5.3 |
| Hypoplastic frontal sinus | 2 | 10.5 |
| Hypoplastic sphenoid sinus | 2 | 10.5 |
| Nasal meningocele | 1 | 5.3 |
| Dermoid cyst | 1 | 5.3 |

| | | |
|---|---|---|
| Total | 19 | 100 |

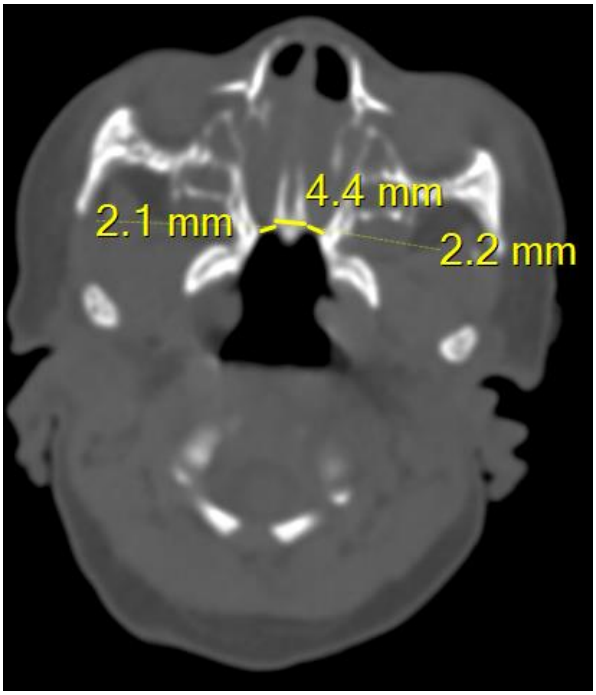


*Figure 3: Axial CT bone window in a 1 day neonate who presented with difficulty of breast feeding and fast breathing since birth showing narrow posterior choanal aperture, thickening of the vomer, medial deviation of the bilateral medial maxillary sinus wall and the bilateral nasal cavity is filled by hypoattenuating content with air fluid level suggesting bilateral bony choanal atresia.*

### 7.3.2 Inflammatory conditions

Inflammatory etiology is the most common finding accounting 47.1% (N=102) of the cases 25 males and 23 females, with sinusitis with or without sinonasal polyposis accounting 85.4 %( N=48) of the inflammatory condition. Among those diagnosed as sinusitis, chronic rhinosinusitis accounts 29 (70.7% N=41) of the cases. The maxillary sinus is involved in 36 (87.8%, N=41) of those diagnosed as sinusitis followed by ethmoid sinus involved in 28 (68.3%, N=41) of the cases. The most common radiological pattern of obstruction in patients with sinusitis is unclassified sporadic pattern 17(41.5) followed by osteomeatal unit and sinonasal polyposis pattern. Other inflammatory conditions include turbinate hypertrophy found in 11(10.8%), nasal/sinonasal polyposis in 9 (8.8%), antrochoanal polyp 6 (5.9 %) and mucocele 3(2.9 %) of the total cases.

*Table 5: Frequency distribution of cases of sinusitis and involved sinuses among patients in the study based on CT findings in patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| **Sinusitis** | **Frequency** | **Percentage** |
|---|---|---|
| Acute rhinosinusitis | 2 | 4.9 |
| Chronic rhinosinusitis | 29 | 70.7 |
| Allergic rhinosinusitis | 7 | 17.5 |
| Fungal sinusitis | 3 | 7.3 |
| Total | 41 | 100 |
| **Sinuses involved** | | |
| Maxillary sinus | 36 | 87.8 |
| Ethmoid sinus | 28 | 68.3 |
| Sphenoid sinus | 21 | 51.2 |
| Frontal sinus | 19 | 46.3 |

*Table 6: CT patterns of sinusitis based on the level of obstruction among patients with sinusitis in patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| **Pattern of involvement** | Frequency | Percentage |
|---|---|---|
| Sinonasal polyp | 8 | 19.5 |
| Infundibular | 3 | 7.3 |
| Osteomeatal unit | 8 | 19.5 |
| Sphenoethmoidal recess | 5 | 12.2 |
| Unclassified | 17 | 41.5 |

Most of those with inflammatory conditions are from Addis Ababa accounting 27(56.25%, N=48).

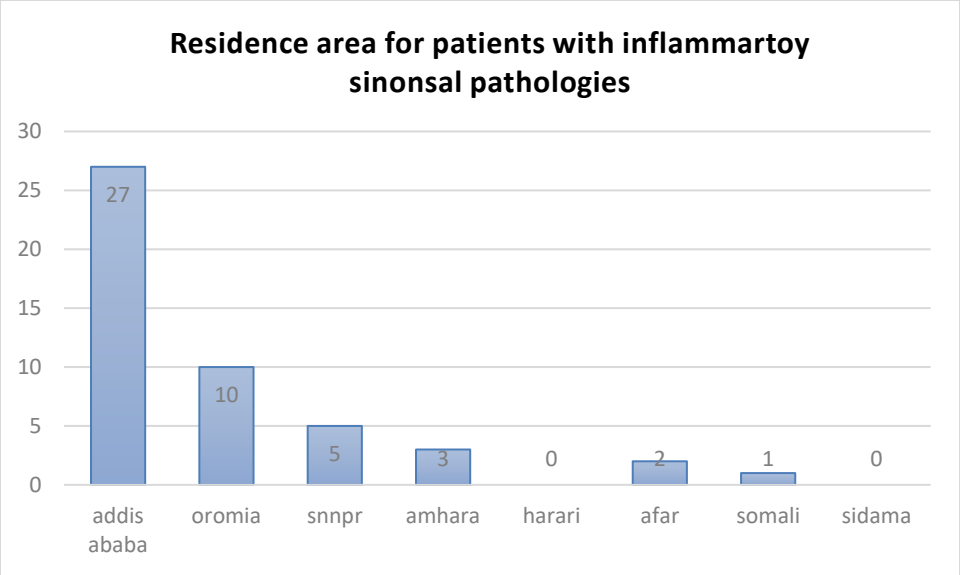


*Figure 4: Residence area of patients with inflammatory sinonasal pathologies in patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

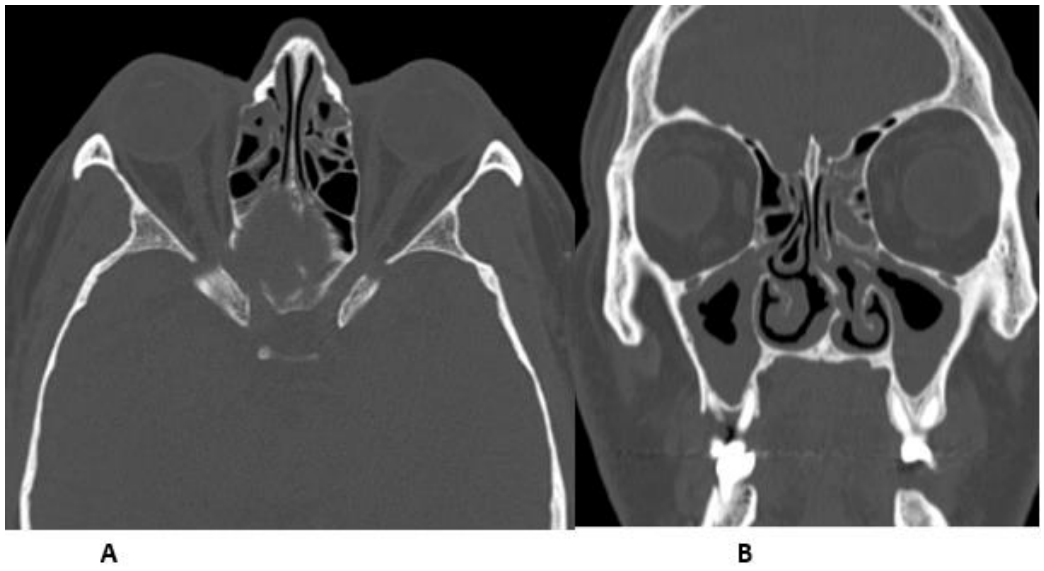


*Figure 5: Axial (A) and coronal(B) CT of a 66 years old male patient, showing opacification of the anterior ethmoid air cells, thickening of the bilateral maxillary sinus mucosa, opacification of the bilateral osteomeatal units, pneumatized right middle turbinate, and leftward nasal septal deviation (Chronic rhinosinusitis, osteomeatal unit type)*

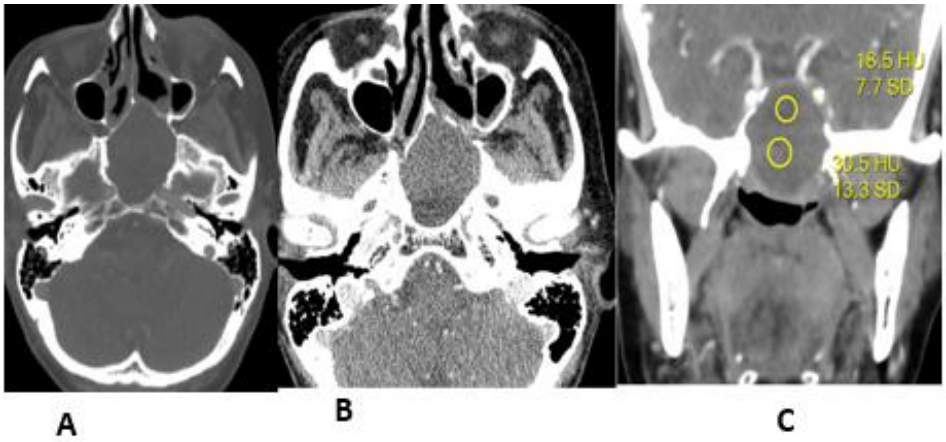


*Figure 6: Axial bone window (A), axial soft tissue window (B) and coronal Soft tissue window (C) CT of a 56 years old female showing heterogeneous soft tissue and fluid density opacification of the sphenoid sinus with marked expansion and bone remodeling with areas of bony wall discontinuity suggesting sphenoid sinus mucocele.*

### 7.3.3 Benign masses

Among the 9 benign sinonasal pathologies juvenile nasal angiofibroma was the most common imaging diagnosis accounting 3(33.3 %, N=9) of the cases. The other benign mass were 2 frontal osteomas, 2 fibrous dysplasia, 1 rosai dorfman disease and 1 inverted papilloma.

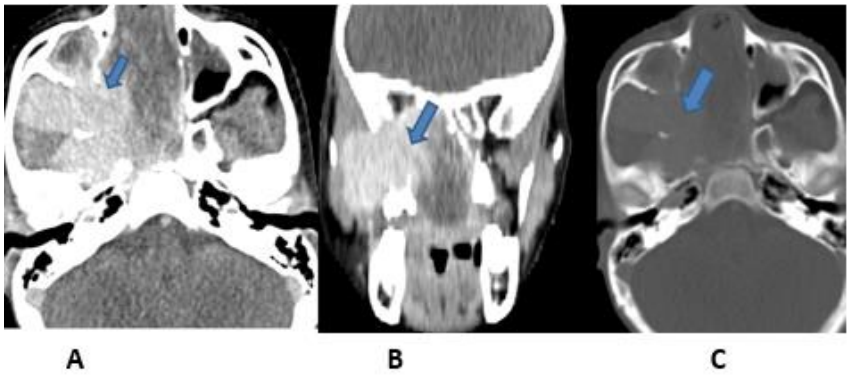


*Figure 7: Post contrast Axial & coronal soft tissue (A&B) and axial bone window (C) CT of a 12 years old male who presented with epistaxis showing a large lobulated markedly enhancing mass lesion involving the region of the right sphenopalatine foramen expanding the right prerygopalatine fossa and extending along the pterygomaxillary fissure to the right infratemporal masticator space, filling the nasal cavity with nasal septal deviation to the left with obliterated bilateral nasal cavity, to the nasopharynx with obliteration of the nasopharyngeal airway. The mass also extends to the right maxillary, ethmoid and sphenoid sinuses. There is also intracranial extension (not shown).*

### 7.3.4 Malignant masses

Malignant mass is the second most common category accounting 28(27.4 %). 24 of these cases are males. From these the epicenter was in the maxillary sinus in 15(53.6%) of the cases and the nasal cavity in 9(32.1 %) of the cases.

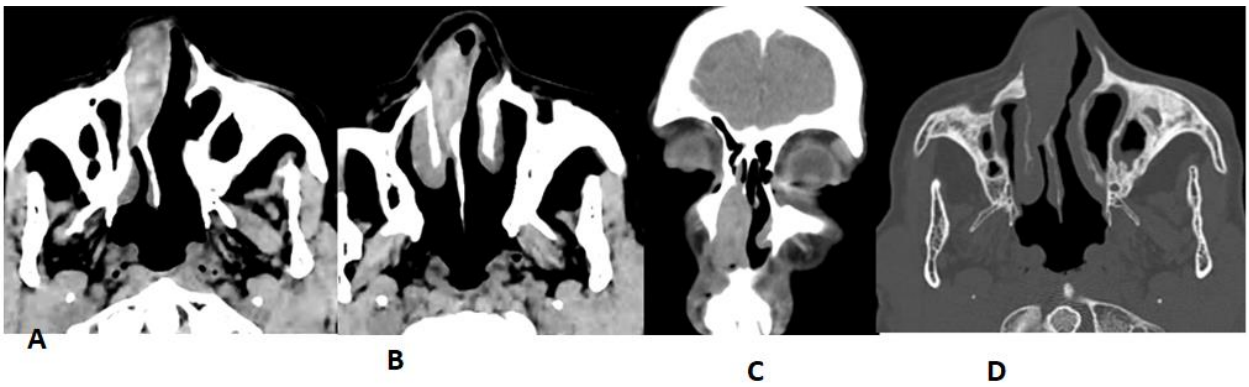


*Figure 8: Post contrast Axial and coronal soft tissue window (A, B&C) and axial bone window CT of a patient who presented with blackish right nasal cavity mass. There is hyper attenuating right nasal cavity soft tissue mass that has eroded the right nasal bone, the wall of right nasolacrimal duct, inferior turbinate and has soft tissue extension to the anterior nasal soft tissue with overlying skin infiltration. Biopsy shower malignant melanoma of the nasal cavity.*

### 7.3.5 Anatomical variants

Nasal septal deviation is the most common anatomical variant seen in 13 (12.7 %) of the cases from 102 patients. The second common anatomical variant found is concha bullosa counting 4 (3.9%).

*Table 7: Anatomical variants among study participants from patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| **Anatomical variants** | Frequency | Percentage (N=102) |
|---|---|---|
| Nasal septal deviation | 13 | 12.7 |
| Concha bullosa | 4 | 3.9 |
| Ager nasi cells | 2 | 2 |
| Haller cells | 2 | 2 |
| Total | 21 | 20.6 |

N.B: one patient could have one or more anatomical variants

## 7.4Histologic diagnosis

From 102 cases 35 (34.3%) of the cases have histologic diagnosis with the majority being malignant 25(71.4% N=35) and 10(28.6 % N=35) are inflammatory and benign. The most common histologic diagnosis is squamous cell carcinoma accounting 22.8 % followed by sinonasal undifferentiated carcinoma accounting 11.4%. Inflammatory polyposis account 3 (8.6%), and JNA& inverted papilloma account 2 (5.7%) each.

*Table 8: Histologic diagnosis among those who have histologic diagnosis from patients who came for CT for sinonasal pathologies at TASH from November 2019 to July 2021*

| Histologic diagnosis | Frequency | Percentage (N=35) |
|---|---|---|
| Squamous cell carcinoma | 8 | 22.85 |
| Sinonasal undifferentiated carcinoma | 4 | 11.45 |
| Inflammatory polyposis | 3 | 8.5 |
| Melanoma | 3 | 8.5 |
| RMS | 2 | 5.7 |
| Juvenile nasopharyngeal anjiofibroma | 2 | 5.7 |
| Lymphoma | 2 | 5.7 |
| Inverted papilloma | 2 | 5.7 |
| Mucoepidermoid ca | 1 | 2.8 |
| Hemangioma | 1 | 2.8 |
| Rosai dorfman disease | 1 | 2.8 |
| Myoepithelial l ca | 1 | 2.8 |
| sinonasal ossifying fibroma | 1 | 2.8 |
| Plasmacytoma | 1 | 2.8 |
| Adenoid cystic carcinoma | 1 | 2.8 |
| Adenocarcinoma | 1 | 2.8 |
| Esthesioneuroblastoma | 1 | 2.8 |
| Total | 35 | 100 |

## 7.5 Correlation of clinical-imaging diagnosis and imaging-pathologic diagnosis

There is 84.3 % concordance (86 out of 102) between the clinical and imaging diagnosis. A strong agreement between clinical and imaging diagnosis was demonstrated (kappa value = 0.92, p-value < 0.001, Phi=0.926). This is based on the category as inflammatory, congenital/developmental, benign and malignant diseases.

There is 88.7 % (31 out of 35 cases) concordance between imaging and histologic diagnosis. From 28 masses with imaging diagnosis of malignant lesions 25(89.3 %) were concordant with histologic diagnosis. The agreement between histologic and imaging diagnosis was strong (kappa value = 0.77, p-value < 0.001, Phi=0.791). From the rest three cases (10.7%, N=28) two were benign masses and one case was non-neoplastic inflammatory lesion. One right nasal cavity mass with imaging feature of malignant lesion turned to be capillary hemangioma, the other left maxillary sinus malignant appearing mass was inflammatory non-neoplastic mass on histology and the other bleeding left nasal cavity mass turned to be juvenile nasopharyngeal angiofibroma.

# 8. DISCUSSION

Recently CT has become the best diagnostic modality for the evaluation of the nasal cavity, paranasal sinuses for demonstrating various sinonasal diseases (6). This study was a retrospective descriptive cross-sectional study carried out on 102 patients.

**Age and sex distribution**

The age distribution ranged from 1 day to 83 years of age and the peak age distribution was among those between 21 – 30 years of age which was comparable with prospective study done by Rashmi Kandukuri & Suresh Phatak (6) with sample size of 175, and Kanwar et al (22) with sample size of 91. In this study, majority of the cases were males which is comparable with studies done by Bhumikaben P. Suthar with sample size of 63 and Kanwar et al (22). In a study by Verma J. et al (7) having a sample size of 50 the majority of the cases were females.

The age and sex distribution is comparable with majority of other studies.

**Clinical presentation**

The most common clinical presentation in this study was nasal discharge followed by nasal blockage. This study is consistent to the study done by Bhumikaben P. Suthar (23). A study by Verma et al (7) showed nasal blockage as the most common presentation (7). Headache was the predominant compliant followed by nasal discharge and nasal obstruction in the study done by Kanwar et al. (22) In this study maxillary sinus region swelling and nasal cavity swelling are also common complaints which were not common presentations in the other studies.

The clinical presentation is variable among the previous studies and in this study which could be due to the non-specific presentation of sinonasal pathologies. There are more patients with compliant of swelling which could be related to referral of more patients with malignancies as the hospital is the only oncology center with radiotherapy service.

On anterior rhinoscopic or nasal endoscopic evaluation malignant appearing nasal cavity masses were more common (54.3%, N=35) than benign and inflammatory non neoplastic masses. In a study by Dhillon et al (29) most of the masses found on nasal endoscopy were non neoplastic inflammatory masses. This could be related to the referral of more patients with malignancy to this our institution.

**Imaging**

In this study inflammatory conditions were the most common disease affecting the nose and paranasal sinuses, followed by sinonasal malignancies the two accounting 47.2 and 27.4 % respectively. The others are congenital diseases and benign masses. Inflammatory pathologies was also the most common pathology in studies done by Rashmi Kandukuri & Suresh Phatak (6), Verma *J et al.* (7),Bhumikaben P. Suthar (23), Kanwar, *et al* (22). However in this study the malignant pathologies were the second most common imaging diagnosis which is in contrary to these other studies which showed malignant lesions being the least common. This could be related to the referral based system in the evaluation of patients at TASH as it is one of the largest referral hospital in the country. So that more number of patients with masses will be referred.

**Congenital/developmental**

In this study congenital/developmental abnormalities accounted 18.6 %. Choanal atresia was the commonest congenital abnormality accounting 52.6% of the congenital abnormalities. In this study all choanal atresia are bilateral. This is in contrary to a case series study done by J Robert Newman (24) which was a review of 42 patients whose age ranged from 3 days to 15 years, in 15 years of period from 1996 to 2010 which showed unilateral choanal atresia accounts 59% of the cases. In a 20 year retrospective study by Samadi et al among 78 patients with choanal atresia aged from newborn to 18 years, 55% had bilateral choanal atresia and 45 % were unilateral (25).

This study showed all cases of choanal atresia which could be explained by the age of the presentation as bilateral choanal atresia patients early after birth. In our study 9 of the 10 cases aged from 1 day to 6 days and 1 infant was 5 months old.

**Inflammatory pathologies**

In this study inflammatory pathologies are the most common sinonasal diseases accounting 47.2% of the cases. Chronic rhinosinusitis with or without sinonasal polyposis accounts the majority of the inflammatory pathologies and the maxillary sinus was the most commonly involved sinus. This is consistent with studies done by Verma et al (7), Rashmi Kandukuri & Suresh Phatak (6) and Kanwar et al (22). The involvement of the maxillary sinus more than other sinuses could be related to drainage pattern (3).

Sinonasal or nasal polyposis was found in 18.5 % of those with inflammatory sinonasal disease. This is found to be less prevalent compared to a study by Kanwar et al (22) which was 24% out of 91 cases and by Rashmi Kandukuri & Suresh Phatak (6) which was found 32% out of 134 patients. In this study antrochoanal polyp was found in 12.7 % of those with inflammatory diseases and 5.9 % out of the 102 cases which is comparable with the study done by Kanwar et al. (22).

In this study the most common pattern of sinusitis is sporadic/unclassified pattern followed by osteomeatal unit pattern. But in a study by Verma et al (7) the most common patterns were osteomeatal unit pattern and in study done by Kanwar et al (22) sinonasal polyposis pattern was the most common. The reason behind this could be due to the reporting system in our setup, the trend of pattern based reporting is not accustomed. The data related to the pattern of obstruction was collected from the body of the report in that if there is no mentioned site of obstruction it was taken as unclassified/sporadic pattern.

Inflammatory sinonasal disease is the most common sinonasal pathology as it was encountered from previous studies.

**Benign masses**

From the 9 benign mass masses juvenile nasal angiofibroma was the most common diagnosis accounting 3(33.3 %). The other benign mass 2 frontal osteomas, 2 fibrous dysplasia, 1 rosai dorfman disease and 1 inverted papilloma. This study is comparable with studies done by N. Khan (26) and Rashmi Kandukuri & Suresh Phatak (6) where juvenile nasopharyngeal angiofibroma was the most common benign mass, 42.85% and 33% respectively.

From this study, juvenile nasopharyngeal angiofibroma is the commonest benign mass which is comparable with previous studies.

**Malignant masses**

In In our study, malignant masses are second common after inflammatory sinonasal pathologies accounting 27.4 % of the cases. The maxillary sinus was the most common epicenter accounting 53.6 % (N=28) of the cases and nasal cavity is the 2$^{nd}$ most common accounting 31.1 % of the malignant cases based on the CT. The specific histologic diagnosis was not mentioned based on

the CT findings. The maxillary sinus was also the most common site involved in the study done by Rashmi Kandukuri & Suresh Phatak (6).

The reason for the high prevalence of malignant sinonasal diseases compared to other studies could be explained by the referral of many patients to this institution as it is the only oncologic center with radiotherapy service in the country. So patients with signs and symptoms suggestive of malignancy will be referred to this hospital.

**Anatomical variants**

In this study nasal septa deviation was seen in 12.7 % of the cases and concha bullosa was seen in 3.9 % of the cases. In study by Bora et al (27) who studied CT findings of 1532 patients nasal septal deviation was the most common anatomic variant followed by concha bullosa and ethmoid bulla which accounted 79.7%, 40.9%, and ethmoid bulla 21.0%, respectively. On the contrary in a study done by vandan Mendiratta (28) with sample size of 40 patients the most common anatomical variation was agger nasi cell (80%), followed by nasal septal deviation and concha bullosa.

In this study the prevalence of anatomical variants is lower compared to other studies which could be explained by the presence of cases with masses that resulted in bone destruction and anatomical distortion so the prevalence may be underestimated.

**Histologic diagnosis**

Out of 102 cases 35 had histologic diagnosis of which 71.4 % are malignant. From the malignant masses squamous cell carcinoma (SCC) is the most common histology accounting 8 (22.85 %, N=35) of the cases followed by sinonasal undifferentiated carcinoma (11.45%, N=35). From the 8 squamous cell carcinomas 5 (62.5 %, N=8) were maxillary sinus squamous cell carcinomas. Based on histology the SCC was also the most common diagnosis patients with malignant sinonasal disease in studies bone by Dhillon et al (29), N. Khan (26), and Rashmi Kandukuri & Suresh Phatak (6). But in all this studies the most common histologic diagnosis in patient for whom histology was done was inflammatory polyposis. In a retrospective study done in Nigeria by Ajiya, A., Abdullahi, H. and Shuaibu in 2020 among 245 patients malignant sinonasal

constituted 55.92%% of the sinonasal neoplasia. SCC was the most common histological subtypes seen in 50.36% of the patients (16).

Among non-malignant histologic diagnoses inflammatory polyposis, juvenile nasopharyngeal angiofibroma and inverted papilloma were the common diagnosed accounting 9 %, 6% and 6% respectively from the 35 cases. Also in studies done by Dhillon et al (29), N. Khan (26), and Rashmi Kandukuri & Suresh Phatak (6) inflammatory polyposis was the most common non neoplastic pathology based on histology. But the prevalence is low in our study compared to these studies.

In conclusion in our study malignant histologic diagnosis outnumbered inflammatory and benign sinonasal masses. This could be related to the referral based system in the evaluation of patients at TASH as it is one of the largest referral hospital in the country. So that more number of patients with signs and symptoms of malignancy will be referred.

On the other hand among malignant sinonasal masses SCC is the most common histologic diagnosis that is comparable with other studies.

**Correlation of clinical-imaging diagnosis and imaging-histologic diagnosis**

There is 84.3 % concordance between clinical and imaging diagnosis. A strong agreement between clinical and imaging diagnosis was demonstrated (kappa value = 0.92, p-value < 0.001, Phi=0.926). From those having histologic diagnosis 88.7 % of the cases have concordance between imaging and histologic diagnosis. The agreement between histologic and imaging diagnosis was strong (kappa value = 0.77, p-value < 0.001, Phi=0.791). Also from those with imaging diagnosis of malignant sinonasal pathology 25 (89.3 %) have imaging-histologic concordance but 2(7.4 %, N=28) were benign and 1(3.6 %, N=28) was inflammatory non neoplastic. The correlation of clinical and imaging diagnosis was less consistent compared to a study by Dhillon et al but the imaging and histopathologic correlation is comparable. (29)

# 9. CONCLUSION

Sinonasal region pathologies are common diseases that impose high burden and cost on the health care delivery system. Majority of the sinonasal complaints can be treated medically with primary care physicians without the need of imaging. But those with danger signs on history and physical examination needs further evaluation by ENT specialist and also may need imaging for diagnosis and assessment of extent as well as complications.

Inflammatory sinonasal pathologies are common with chronic rhinosinusitis accounting the most common inflammatory condition.

Choanal atresia is the commonest congenital abnormality and all patients have bilateral choanal atresia.

Malignant sinonasal masses are more common than benign masses.

Maxillary sinus is the most commonly involved site in rhinosinusitis and the most common epicenter for malignant sinonasal pathologies.

This study highlights the patterns of sinonasal pathologies bases on which is a subject matter that is not well studied. This institutional based retrospective study was undertaken with limited sample size that will not be generalized for the general population and cannot show the accuracy of CT in the diagnosis of sinonasal pathologies rather it will help as a baseline for further detailed study in the subject matter.

## 10. LIMITATION OF THE STUDY

CT report was done by different radiologists with different level of experience and there could also be inter-observer variation in reporting cases.

The study being retrospective in nature and includes patients only in a single institution with cases received in a referral system, it is subjected to bias.

Incomplete patient data documentation and inaccessibility of patient documents.

## 11. RECOMMENDATION

Further population based study is recommended to assess the prevalence and impact of sinonasal pathologies in Ethiopia.

Further institutional based prospective study with greater sample size and specific diseases category is recommended.

Patient preparation prior to performing CT by giving full course of antibiotics, antihistaminic and decongestant and nose blowing is recommended to have better assessment of the anatomy predisposing blockage of the normal drainage channels.

Pattern based reporting and documenting possible specific histologic diagnosis and differential diagnosis based on CT appearance is recommended.

Complete medical recording

# 12. REFERENCES


1. Clark JH, Baroody FM, Naclerio RM. A Pragmatic Approach Towards Sinonasal Diseases. J Allergy Clin Immunol Pract [Internet]. 2020;8(5):1556–8. Available from: https://doi.org/10.1016/j.jaip.2020.02.003
2. Koch BL, Hamilton BE, Hudgins PA HH. Diagnostic Imaging: Head and Neck.
3. Nadgir R, Jousem D. Neuroradiology: The Requisites. 4th ed. Philadelphia: ELSEVIER; 2017.
4. Rao VM, El-Noueam KI. Sinonasal imaging: anatomy and pathology. Radiol Clin North Am. 1998;36(5):921–39.
5. Keir G, Jay AK. What the Radiologist Needs to Know About Sinonasal Masses. Contemp Diagnostic Radiol. 2019;42(12):1–7.
6. Kandukuri R, Phatak S. Evaluation of sinonasal diseases by computed tomography. J Clin Diagnostic Res. 2016;10(11):TC09-TC12.
7. Verma J, Rathaur SK, Mishra S, Mishra AK. The role of diagnostic imaging in evaluation of nasal and paranasal sinus pathologies. Int J Otorhinolaryngol Head Neck Surg. 2016;2(3):140.
8. Gomaa MA, Hammad MS, Abdelmoghny A, Elsherif AM, Tawfik HM. Magnetic Resonance Imaging versus Computed Tomography and Different Imaging Modalities in Evaluation of Sinonasal Neoplasms Diagnosed by Histopathology. Clin Med Insights Ear, Nose Throat. 2013;6:CMENT.S10678.
9. Kushwah DAPS, Bhalse DR, Pande DS. CT evaluation of diseases of Paranasal sinuses & histopathological studies. Int J Med Res Rev. 2015;3(11):1306–10.
10. Pérez-Piñas I, Sabaté J, Carmona A, Catalina-Herrera CJ, Jiménez-Castellanos J. Anatomical variations in the human paranasal sinus region studied by CT. J Anat. 2000;197(2):221–7.
11. Kaygusuz A, Haksever M, Akduman D, Aslan S, Sayar Z. Sinonasal Anatomical Variations: Their Relationship with Chronic Rhinosinusitis and Effect on the Severity of

Disease—A Computerized Tomography Assisted Anatomical and Clinical Study. Indian J Otolaryngol Head Neck Surg. 2014;66(3):260–6.

12. 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 [Internet]. 2012;32(4):244–51. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23093814%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3468938

13. Tizita K. Degaga, Abay M. Zenebe 2 ATW, Gemechu STDJM, Woldehawariat TD. Anatomographic Variants of Sphenoid Sinus in Ethiopian Population. Diagnostics. 2020;10(970):1–10.

14. Parsons C, Hodson N. Computed tomography of paranasal sinus tumors. Radiology. 1979;132(3):641–5.

15. Tefera AT, Bekele BG, Dejene D, Workicho A, Tigeneh W. The Epidemiology Of Primary Head And Neck Cancer In Black Lion Specialized Hospital Oncology Center, Ethiopia: A Hospital Based Retrospective Study. 2019;1–13.

16. Ajiya A, Abdullahi H, Shuaibu IY. Clinicopathologic profile of sinonasal neoplasia in Kano, Northwestern Nigeria: A 10-year single-institution experience. Vol. 19, Annals of African Medicine. 2020. p. 191–7.

17. Zyłka S, Bień S, Kamiński B, Postuła S, Ziółkowska M. Epidemiology and clinical characteristics of the sinonasal malignancies. Otolaryngol Pol. 2008;62(4):436–41.

18. Turner JH, Reh DD. Incidence and Survival In Patients with Sinonasal Cancer : A Historical Analysis of Population-Based Data. 2011;1–9.

19. Momeni AK, Roberts CC, Chew FS. Imaging of chronic and exotic sinonasal disease: Review. Am J Roentgenol. 2007;189(6 SUPPL.):35–45.

20. PL Dhingra, Dhingra S, Dhingra D. Diseases of Ear, Nose and Throat & Head and Neck Surgery. 7th ed. ELSEVIER; 2019.

21. Naimi M, Bakhshaei M. The major obstructive inflammatory patterns of the sinonasal

diseases in 200 candidates of functional endoscopic sinus surgery. Iran J Otorhinolaryngol. 2006;17(42).

22. Kanwar SS, Mital M, Gupta PK, Saran S, Parashar N, Singh A. Evaluation of paranasal sinus diseases by computed tomography and its histopathological correlation. 2019;46–52.

23. Bhumikaben P. Suthar, Divya Vaidya PPS. The Role of Computed Tomography in the Evaluation of Paranasal Sinuses Lesions. Int J Res Med. 2015;4(4):75–80.

24. Newman JR, Harmon P, Shirley WP, Hill JS, Woolley AL, Wiatrak BJ. Operative Management of Choanal Atresia. 2013;139(1):71–5.

25. Samadi DS, Shah UK, Handler SD. Choanal Atresia : A Twenty-Year Review of Medical Comorbidities and Surgical Outcomes. 2003;(February):254–8.

26. Khan N, Zafar U, Afroz N, Ahmad SS, Hasan SA. Main Article MASSES OF NASAL CAVITY , PARANASAL SINUSES AND NASOPHARYNX : A CLINICOPATHOLOGICAL STUDY. 2006;58(3).

27. Bora A, Koç M. Evaluating the frequency of anatomical variations of the sinonasal region in pediatric and adult age groups according to gender : computed tomography findings of 1532 cases. 2021;9.

28. Mendiratta V, Baisakhiya N, Singh D, Datta G. Sinonasal Anatomical Variants : CT and Endoscopy Study and Its Correlation with Extent of Disease. Indian J Otolaryngol Head Neck Surg. 2016;68(3):352–8.

29. Dhillon V, Dhingra R, Davessar J, Chaudhary A, Monga S, Kaur M, et al. Correlation of Clinical , Radiological and Histopathological Diagnosis among Patients with Sinonasal Masses. 2016;3(6):1612–5.

## 13. ANNEX II: DATA COLLECTION TEMPLATE

| Part I: Sociodemographic Data | | |
|---|---|---|
| Number | Questions | Response |
| 101 | Age (in years) | |
| 102 | Sex | 1. Male<br>2. Female |
| 103 | Residence area (Region) | 1. Tigray<br>2. Oromiya<br>3. Amhara<br>4. Binishangul-gumuz<br>5. Gambella<br>6. SNNP<br>7. Harari<br>8. Somali<br>9. Afar<br>10. Sidama<br>11. Addis ababa<br>12. Diredawa |

| Part II: Clinical Presentations | | |
|---|---|---|
| 201 | Clinicalpresentation | 1. Epistaxis<br>2. Rhinorrhea<br>3. Nasal congestion<br>4. Nasal blockage<br>5. Foul smelling nasal discharge<br>6. Unilateral watery nasal discharge<br>7. Headache<br>8. Facial pain<br>9. swelling over the maxilla<br>10. nasal cavity mass<br>11. peri orbital swelling<br>12. Interference with extra ocular movement<br>13. Hyposmia<br>14. unilateral otitis media with effusion,<br>15. facial numbness<br>16. dental swelling<br>17. high fever<br>18. difficulty in breast feeding and breathing since birth, unable to pass NGT<br>19. Others..specify |

| Part III: Nasal Rhinoscopic/Endoscopic Findings and clinical diagnosis | | |
|---|---|---|
| 301 | Anterior rhinoscopic/Endoscopic findings | |
| 302 | Clinical diagnosis | |

| Part IV: Imaging Findings | | |
|---|---|---|
| 401 | Disease entity identified on CT | a. Congenital<br>b. Anatomic variant<br>c. Inflammatory<br>d. Benign mass<br>e. Malignant mass |
| 401.1 | Congenital abnormality identified | f. Choanal atresia<br>g. Pyriform aperture stenosis<br>h. Nasal septal deviation |
| 401.1.1 | Type of choanal atresia identified | i. Bilateral bony<br>ii. Bilateral membraneous<br>iii. Bilateral mixed<br>iv. Unilateral bony<br>v. Unilateral membraneous<br>vi. Unilateral mixed |
| 401.2 | Anatomic variant | a. Choncha bullosa<br>b. Onodi cells<br>c. Haller cells<br>d. Aeger nasi cells<br>e. Hypoplastic fontal sinus |
| 401.3 | Inflammatory | a. Sinusitis<br>b. Turbinate hypertrophy<br>c. Mucus retention cyst<br>d. Sinonasal polyp<br>e. Mucocele<br>f. Antrochoanal polyp<br>g. Ethmoidal polyp |
| 401.3.1 | Sinusitis | a. Acute rhinosinusitis<br>b. Chronic rhinosinusitis (Infundibular, Osteomeatal unit, Sphenoethmoidal recess, Sinonasal polyposis, Unclassified)<br>c. Allergic sinusitis<br>d. Fungal sinusitis |
| 401.4 | Benign masses | a. JNA<br>b. Osteoma<br>c. Fibrous dysplasia<br>d. Papilloma |

| | | |
|---|---|---|
| | | e. Others |
| 401.5 | Malignant masses | a. Malignant mass unspecified histology<br>b. SCC<br>c. Minor salivary gland tumors<br>d. Adeno carcinoma<br>e. esthesioneuroblastoma<br>f. Melanoma<br>g. Lymphoma<br>h. Others |
| 402 | Anatomic site of involvement | a. Frontal sinus<br>b. Sphenoid sinus<br>c. Ethmoid sinus<br>d. Maxillary sinus<br>e. Nasal cavity |

| **Part V: Histologic Findings** | | |
|---|---|---|
| 501 | Histologic diagnosis | a. SCC<br>b. Adenocarcinoma<br>c. paranasal sinus undifferentiated carcinoma<br>d. lymphoma<br>e. osteosarcoma<br>f. pleomorphic adenoma<br>g. inflammatory polyposis<br>h. esthesioneuroblastoma<br>i. melanoma<br>j. RMS<br>k. Others |