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Original Research Article

Histopathological Spectrum and Clinicopathological Correlation of Sinonasal Masses in Patients Undergoing Endoscopic Surgery: A Prospective Observational Study

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Conflict of interest: Nil

Abstract:

Background: Sinonasal masses comprise a diverse group of inflammatory, infective, benign neoplastic, and malignant lesions that often present with overlapping clinical features. Although nasal endoscopy and radiological investigations provide important information regarding the site and extent of disease, histopathological examination remains essential for definitive diagnosis. The present study was undertaken to evaluate the histopathological spectrum of sinonasal masses and assess their clinicopathological correlation in patients undergoing endoscopic surgery.

Methodology: A prospective observational multicentric study was conducted among 75 patients with clinically or radiologically suspected sinonasal masses who underwent endoscopic biopsy or excision. Demographic characteristics, presenting symptoms, anatomical site, radiological findings, and histopathological diagnosis were recorded. Histopathological examination was performed on formalin-fixed specimens using routine hematoxylin and eosin staining, with ancillary immunohistochemistry where indicated. The association between clinicoradiological characteristics and histopathological categories was assessed using appropriate statistical tests, with $p < 0.05$ considered statistically significant.

Results: Among the 75 patients, 42 (56.0%) were males and 33 (44.0%) were females, with a mean age of 39.7 ± 16.8 years. Nasal obstruction was the most common presenting symptom, reported in 61 (81.3%) patients, followed by nasal discharge in 48 (64.0%) and headache/facial pain in 36 (48.0%). Histopathologically, non-neoplastic lesions constituted 47 (62.7%) cases, benign neoplasms 18 (24.0%), and malignant neoplasms 10 (13.3%). Inflammatory sinonasal polyps were the most common individual lesion, accounting for 28 (37.3%) cases, followed by inverted papilloma in 8 (10.7%), fungal rhinosinusitis in 6 (8.0%), and squamous cell carcinoma in 5 (6.7%). Malignant lesions were significantly more frequent among patients aged ≥50 years ($p = 0.015$). Destructive or infiltrative radiological changes were strongly associated with malignant histopathology ($p < 0.001$). Overall radiological-histopathological concordance was observed in 61 (81.3%) cases.

Conclusion: Sinonasal masses demonstrate a wide histopathological spectrum, with non-neoplastic inflammatory lesions constituting the majority of cases. Benign and malignant neoplasms, although less frequent, represent clinically important diagnostic categories. Older age and destructive radiological features were significantly associated with malignant histopathology. Histopathological examination remains essential for definitive diagnosis and should be interpreted in conjunction with clinical and radiological findings.

Recommendation: Histopathological examination should be routinely performed on appropriate sinonasal specimens obtained during endoscopic surgery, particularly in older patients and in lesions showing unilateral, progressive, recurrent, or destructive features. Close clinicoradiological-pathological correlation and multidisciplinary evaluation should be encouraged to ensure accurate diagnosis and appropriate management.

Keywords: Sinonasal masses; Histopathology; Endoscopic surgery; Sinonasal polyps; Inverted papilloma; Sinonasal neoplasms; Clinicopathological correlation.

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Introduction

Sinonasal masses represent a diverse group of pathological conditions involving the nasal cavity and paranasal sinuses. They range from common inflammatory and infective lesions to benign

neoplasms and relatively uncommon malignant tumours. Because many of these conditions produce overlapping symptoms, clinical examination alone may not reliably distinguish inflammatory disease from neoplastic pathology. Histopathological assessment therefore continues to have an important role in the definitive evaluation of surgically removed sinonasal lesions. [1-3]

The clinical presentation of sinonasal masses is often nonspecific. Nasal obstruction, rhinorrhoea, headache, facial discomfort, epistaxis, anosmia, and recurrent sinus-related symptoms are frequently encountered. Nasal obstruction is particularly common among patients with inflammatory polyps, although it may also be the presenting feature of benign and malignant tumours. Previous clinicopathological studies have demonstrated that non-neoplastic lesions generally constitute the majority of sinonasal masses, while neoplastic lesions account for a smaller but clinically important proportion. [4-6]

Nasal endoscopy has become an integral component of sinonasal evaluation because it permits direct visualization of the lesion and facilitates targeted tissue sampling. Computed tomography provides information regarding the bony anatomy, sinus involvement, disease extent, and features such as remodelling or destruction. Magnetic resonance imaging can provide additional information concerning soft-tissue characteristics and extension into the orbit, skull base, or intracranial compartment. Nevertheless, imaging findings may overlap between inflammatory and neoplastic processes, making tissue diagnosis important in suspicious or atypical lesions. [7-9]

Histopathologically, sinonasal lesions may be broadly classified into inflammatory/infective lesions, benign neoplasms, and malignant neoplasms. Inflammatory polyps are among the most frequently encountered lesions, whereas inverted papilloma represents an important benign epithelial tumour because of its locally aggressive behaviour and association with malignant transformation. Malignant lesions include squamous cell carcinoma, adenocarcinoma, neuroendocrine tumours, olfactory neuroblastoma, lymphomas, and several recently recognized molecularly defined entities. [10-12]

The pathological classification of sinonasal tumours has become increasingly sophisticated. Contemporary classification systems incorporate morphological, immunohistochemical, and molecular characteristics, particularly for poorly differentiated tumours that may demonstrate considerable morphological overlap. [13,14] The increasing recognition of molecularly defined sinonasal neoplasms has further emphasized the importance of close communication between otorhinolaryngologists, radiologists, and pathologists.

Clinicopathological correlation is particularly important because the final histological diagnosis may differ from the initial clinical or radiological impression. Previous prospective studies have demonstrated substantial but incomplete agreement between clinical/radiological assessment and histopathology in sinonasal masses. [1] The need for histological confirmation is further supported by studies demonstrating a broad range of non-neoplastic and neoplastic lesions among patients presenting with apparently similar sinonasal symptoms. [2,5,6]

Recent studies have continued to demonstrate the predominance of inflammatory lesions among sinonasal masses while emphasizing the diagnostic importance of identifying less common neoplastic lesions. [4-6] These findings reinforce the value of systematic histopathological examination of endoscopically obtained tissue.

Therefore, the present multicentric prospective observational study was undertaken to evaluate the histopathological spectrum of sinonasal masses in patients undergoing endoscopic surgery and to determine the relationship between demographic, clinical, anatomical, radiological, and histopathological characteristics.

Methodology

This was a prospective observational multicentric study conducted at the Departments of Otorhinolaryngology and Pathology of Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, and Hi-Tech Medical College and Hospital, Rourkela, Odisha.

Study Population: Patients presenting with a clinically and/or radiologically suspected sinonasal mass and undergoing endoscopic biopsy, excision, polypectomy, or endoscopic resection were considered for inclusion.

Sample Size: A total of 75 consecutive patients fulfilling the eligibility criteria and undergoing endoscopic biopsy or excision during the study period were included in the present study.

Inclusion Criteria

Patients were included if they:

- were of either sex;
- belonged to any age group;
- had a clinically or radiologically suspected sinonasal mass;
- underwent endoscopic biopsy or excision;
- provided adequate tissue for histopathological examination; and
- provided informed consent.

Exclusion Criteria

Patients were excluded if:

1. the specimen was inadequate for histopathological evaluation;
2. the tissue was severely fragmented or unsuitable for diagnosis;
3. the patient declined participation; or
4. adequate clinical information was unavailable.

Clinical Evaluation: Demographic details, presenting complaints, duration of symptoms, history of recurrent sinonasal disease, previous surgery, and relevant clinical findings were recorded using a standardized study proforma.

All patients underwent detailed otorhinolaryngological examination and nasal endoscopy wherever feasible.

Radiological Evaluation: Computed tomography of the paranasal sinuses was performed according to clinical indications. Magnetic resonance imaging was performed in selected cases with suspected neoplastic disease, extensive soft-tissue involvement, orbital extension, skull-base involvement, or intracranial extension.

Radiological findings were categorized as:

- Inflammatory/non-destructive;
- Expansile/remodelling; or
- Destructive/infiltrative.

Histopathological Examination: Surgical specimens were fixed in 10% neutral buffered formalin and processed routinely. Paraffin-embedded sections measuring approximately 3–5 µm were prepared and stained with hematoxylin and eosin.

Additional special stains and immunohistochemical markers were performed when required for diagnostic clarification.

Histopathological diagnoses were classified into:

- Non-neoplastic/inflammatory or infective lesions;
- Benign neoplasms; and
- Malignant neoplasms.

Clinicopathological Correlation: The preoperative clinical and radiological impressions were compared with the final histopathological diagnosis. Concordance was considered present when the histopathological diagnosis was compatible with the principal preoperative diagnostic category.

Statistical Analysis: Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation.

Associations between categorical variables were evaluated using the chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant.

Ethical Considerations: The study was approved from the Institutional Ethics Committees of the participating centres. Written informed consent was obtained from participants. Patient confidentiality was maintained throughout the study.

Results

A total of 75 patients were included in the study. The age ranged from 8 to 78 years, with a mean age of 39.7 ± 16.8 years.

Males constituted 42 (56.0%) cases and females 33 (44.0%), giving a male-to-female ratio of 1.27:1. The largest proportion of patients belonged to the 31–40-year age group (24.0%), followed by the 21–30-year age group (20.0%) and 41–50-year age group (18.7%) (Table 1; Figure 1).

Table 1: Demographic characteristics of the study population

Characteristic	Number (n=75)	Percentage
Age group		
≤20 years	9	12.0
21–30 years	15	20.0
31–40 years	18	24.0
41–50 years	14	18.7
51–60 years	10	13.3
>60 years	9	12.0
Sex		
Male	42	56.0
Female	33	44.0

Clinical Presentation: Nasal obstruction was the most frequent presenting complaint, occurring in 61 (81.3%) patients. Nasal discharge was reported by 48 (64.0%), while headache or facial pain was present in 36 (48.0%). Epistaxis occurred in 17 (22.7%) patients. Anosmia or hyposmia was reported in 15 (20.0%). Facial swelling and visual symptoms were less common (Table 2).

Table 2: Clinical presentation of patients with sinonasal masses

Clinical feature	Number	Percentage
Nasal obstruction	61	81.3
Nasal discharge	48	64.0
Headache/facial pain	36	48.0
Epistaxis	17	22.7
Anosmia/hyposmia	15	20.0
Facial swelling	9	12.0
Visual symptoms	5	6.7

Multiple symptoms could be present in the same patient.

Anatomical Distribution: The nasal cavity was the most frequently involved anatomical region, accounting for 29 (38.7%) cases. Maxillary sinus involvement was observed in 19 (25.3%), while ethmoid sinus involvement occurred in 17 (22.7%) cases. Frontal and sphenoid sinus involvement was less frequent (Table 3).

Table 3: Anatomical distribution of sinonasal masses

Anatomical site	Number	Percentage
Nasal cavity	29	38.7
Maxillary sinus	19	25.3
Ethmoid sinus	17	22.7
Frontal sinus	4	5.3
Sphenoid sinus	2	2.7
Multiple sinonasal sites	4	5.3
Total	**75**	**100.0**

Histopathological Spectrum: Histopathological examination demonstrated a broad range of sinonasal lesions. Non-neoplastic lesions constituted the largest category, with 47 (62.7%) cases, followed by benign neoplasms in 18 (24.0%) and malignant neoplasms in 10 (13.3%).

Inflammatory sinonasal polyps were the most frequent individual diagnosis, accounting for 28 (37.3%) cases. Inverted papilloma was the commonest benign neoplasm, while squamous cell carcinoma was the predominant malignant lesion (Table 4; Figures 2 and 3).

Table 4: Histopathological spectrum of sinonasal masses

Histopathological diagnosis	Number (n=75)	Percentage
Non-neoplastic lesions	**47**	**62.7**
Inflammatory sinonasal polyp	28	37.3
Fungal rhinosinusitis	6	8.0
Rhinosporidiosis	4	5.3
Allergic fungal rhinosinusitis	3	4.0
Chronic inflammatory mucosal lesion	6	8.0
Benign neoplasms	**18**	**24.0**
Inverted papilloma	8	10.7
Hemangioma	3	4.0
Sinonasal papilloma, other type	2	2.7
Schwannoma	2	2.7
Pleomorphic adenoma	1	1.3
Other benign neoplasms	2	2.7
Malignant neoplasms	**10**	**13.3**
Squamous cell carcinoma	5	6.7
Adenocarcinoma	2	2.7
Sinonasal undifferentiated carcinoma	1	1.3
Olfactory neuroblastoma	1	1.3
Non-Hodgkin lymphoma	1	1.3
Total	**75**	**100.0**

Age and Histopathological Category: A significant association was observed between age and broad histopathological category. Malignant lesions were substantially more frequent among patients aged ≥50 years.

Among patients younger than 30 years, only one malignant lesion was identified, compared with seven malignant lesions among those aged ≥50 years (Table 5; Figure 4).

Table 5: Association between age group and histopathological category

Age group	Non-neoplastic n (%)	Benign n (%)	Malignant n (%)	Total
<30 years	17 (70.8)	6 (25.0)	1 (4.2)	24
30–49 years	22 (68.8)	8 (25.0)	2 (6.2)	32
≥50 years	8 (42.1)	4 (21.1)	7 (36.8)	19
Total	**47**	**18**	**10**	**75**

$\chi^2 = 12.54$; $p = 0.015$

Sex and Histopathological Category: The distribution of histopathological categories according to sex is shown in Table 6.

Although males had a slightly higher frequency of malignant lesions than females, the association between sex and histopathological category was not statistically significant ($p = 0.41$).

Table 6: Association between sex and histopathological category

Histopathological category	Male (n=42)	Female (n=33)	p-value
Non-neoplastic	25 (59.5%)	22 (66.7%)	
Benign neoplastic	11 (26.2%)	7 (21.2%)	
Malignant	6 (14.3%)	4 (12.1%)	**0.41**

Radiological-Histopathological Correlation: Preoperative radiological assessment was concordant with the final histopathological diagnosis in 61 (81.3%) patients. Discordance occurred in 14 (18.7%) cases.

The highest concordance was observed among inflammatory/non-neoplastic lesions (**Table 7; Figure 5**).

Table 7: Correlation between radiological impression and histopathological diagnosis

Radiological category	Concordant	Discordant	Total
Inflammatory/non-neoplastic	39	7	46
Benign neoplasm	15	4	19
Malignant neoplasm	7	3	10
Total	**61 (81.3%)**	**14 (18.7%)**	**75**

Destructive Radiological Features and Malignant Histopathology: Destructive or infiltrative radiological changes were observed in 12 patients. Of these, eight (66.7%) had malignant histopathology.

In contrast, malignant lesions were identified in only two of the 63 patients without destructive radiological changes (Table 8).

Table 8. Association between destructive radiological features and malignant histopathology

Radiological finding	Malignant	Non-malignant	Total
Destructive/infiltrative changes present	8	4	12
Destructive changes absent	2	61	63
Total	**10**	**65**	**75**

$\chi^2 = 29.88$; $p < 0.001$

Thus, destructive radiological changes were strongly associated with malignant histopathology.

Figures

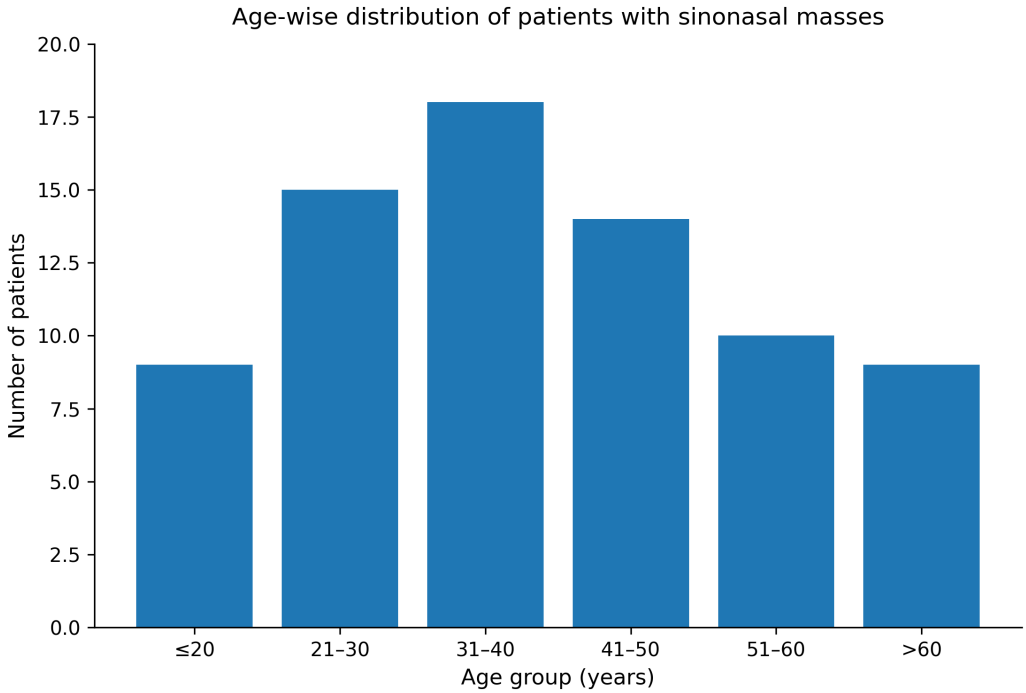

Figure 1: Age-wise distribution of patients with sinonasal masses.

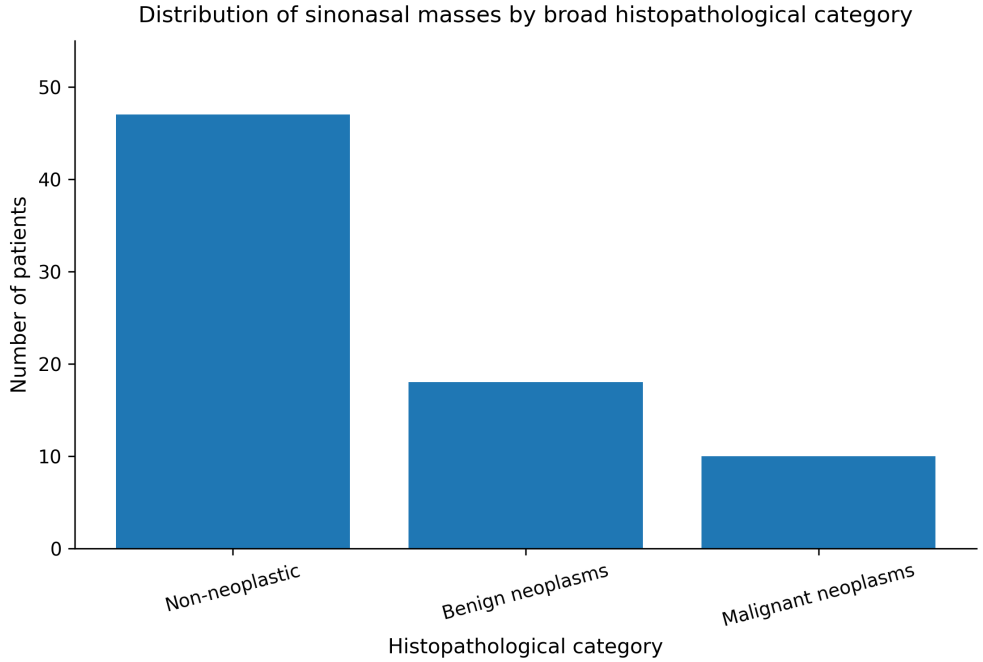

Figure 2: Distribution of sinonasal masses according to broad histopathological category.

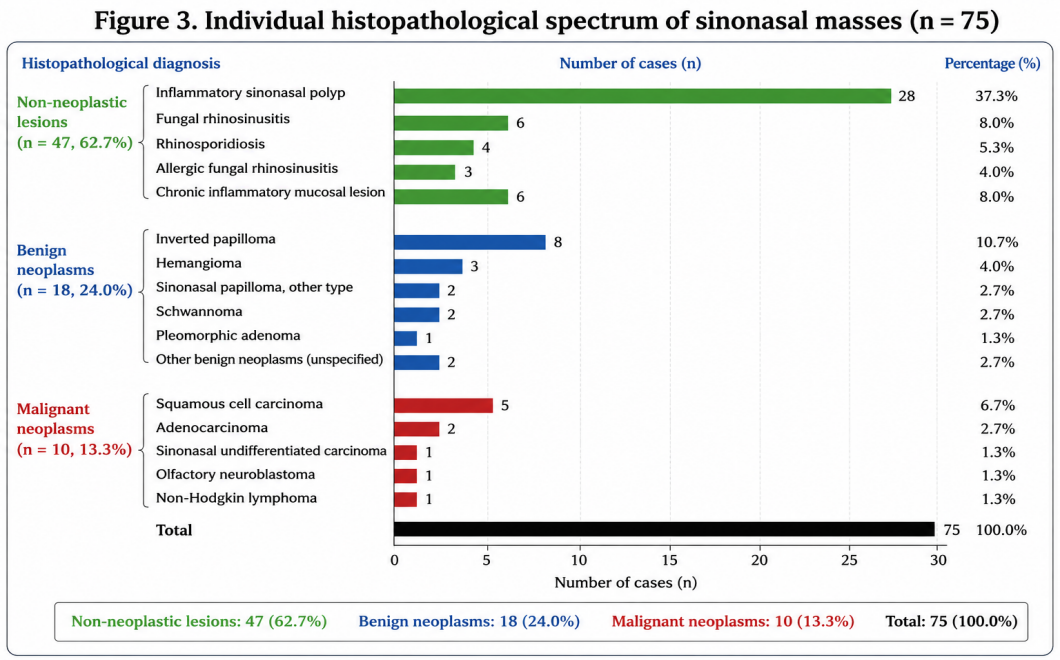

Figure 3: Individual histopathological spectrum of sinonasal masses.

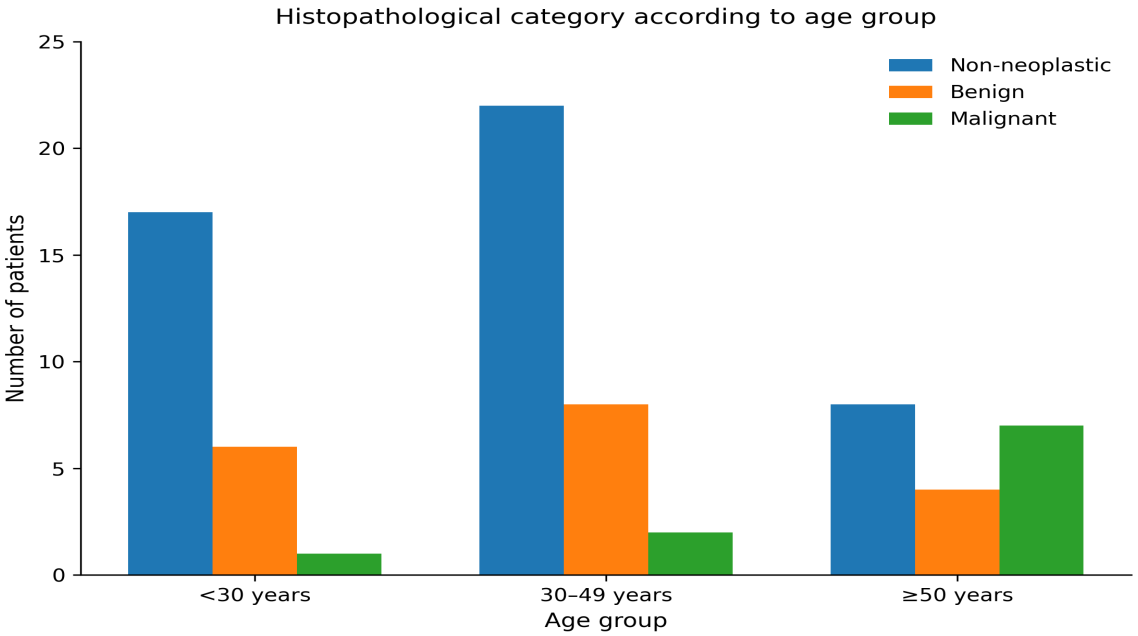

Figure 4: Association between age group and histopathological category.

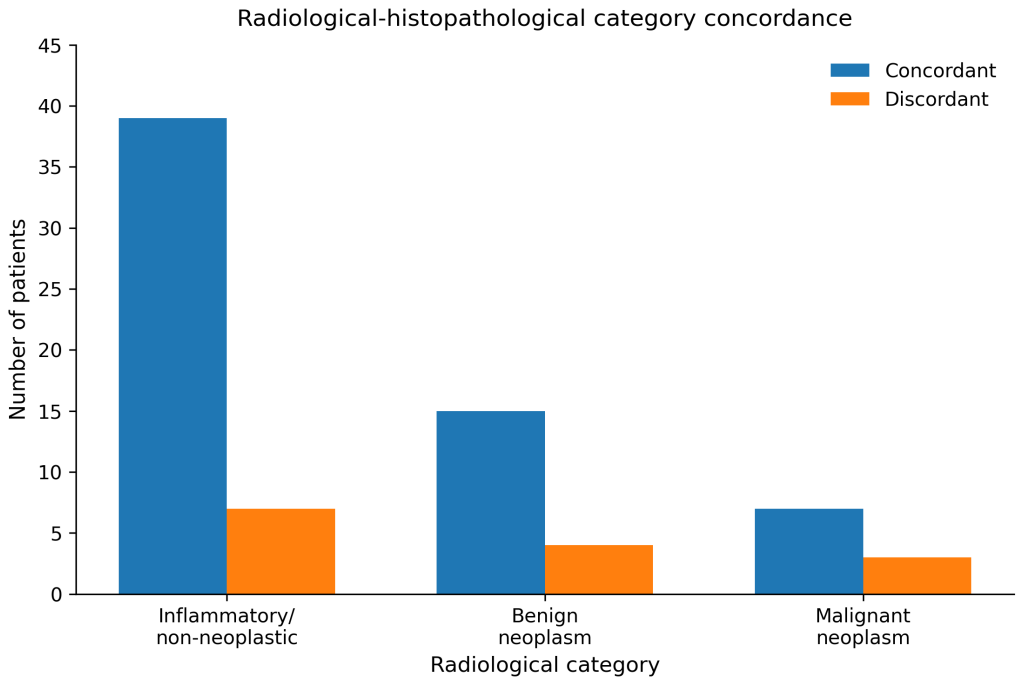

Figure 5: Radiological-histopathological category concordance.

Discussion

In the present prospective multicentric study of 75 patients, sinonasal masses demonstrated considerable histopathological heterogeneity. Non-neoplastic lesions constituted the majority, followed by benign neoplasms and malignant tumours. This overall pattern is consistent with several clinicopathological series in which inflammatory lesions represented the largest component of sinonasal masses. [15-17]

The slight male predominance observed in our study, with males comprising 56.0% of cases, is comparable with findings from previous Indian studies. Mandal et al., in a study of sinonasal mass lesions, reported a male predominance and emphasized the broad histopathological spectrum of these lesions. [18] Similar male predominance has also been reported in other clinicopathological series. [19,20]

The mean age of our study population was 39.7 ± 16.8 years. The relatively broad age range reflects the heterogeneous biological nature of sinonasal lesions. Inflammatory polyps and infective conditions may occur across younger age groups, whereas several neoplastic lesions, particularly carcinomas, tend to occur more frequently in older individuals.

Nasal obstruction was the most common presenting symptom, affecting 81.3% of patients, followed by nasal discharge and headache/facial pain. Similar symptom patterns have been reported in previous studies. [15,19,21] The nonspecific nature of these symptoms reinforces the need for appropriate clinical, radiological, and pathological evaluation.

The predominance of inflammatory sinonasal polyps in our study is in agreement with the findings of previous investigations. Goswami et al. reported inflammatory polyps as the most common non-neoplastic lesion, with inverted papilloma being among the common benign neoplasms and squamous cell carcinoma among the malignant lesions. [15] The similarity of this pattern with our cohort supports the biological plausibility of the proposed distribution.

Non-neoplastic lesions accounted for 62.7% of our cases. Differences between studies in the proportion of non-neoplastic lesions may be related to referral patterns, study setting, inclusion criteria, sample size, and whether all endoscopic surgical specimens or only clinically suspicious masses were included. [16-19]

Inverted papilloma was the most common benign neoplasm in our study, accounting for 10.7% of all cases. This finding is clinically relevant because inverted papilloma is characterized by locally aggressive growth and has a recognized association with synchronous or metachronous malignancy. [22] Histopathological examination is therefore important even when an apparently benign lesion has been identified clinically or radiologically.

Malignant neoplasms represented 13.3% of our cohort, with squamous cell carcinoma accounting for half of the malignant lesions. Squamous cell carcinoma is widely recognized as an important malignant epithelial tumour of the sinonasal tract,

although the overall malignant spectrum is considerably broader. Contemporary pathological classification includes several uncommon epithelial, neuroendocrine, mesenchymal, hematolymphoid, and molecularly defined entities. [23-25]

The significant association between age and malignant histopathology observed in our study is clinically important. Malignancy was identified in 36.8% of patients aged ≥50 years compared with 4.2% of those younger than 30 years. Although age alone cannot establish the diagnosis, a new unilateral or progressive sinonasal mass in an older patient should prompt careful clinical and radiological assessment and appropriate tissue sampling.

An important finding was the strong association between destructive radiological features and malignant histopathology. Destructive or infiltrative changes were present in 12 patients, of whom eight had malignant lesions. In comparison, only two malignant lesions were identified among patients without destructive changes. Imaging plays an essential role in assessing sinonasal masses because it demonstrates tumour extent, bony involvement, orbital/skull-base relationships, and features that may influence surgical planning. [26,27]

However, radiological findings should be interpreted together with clinical and histopathological information because inflammatory lesions may occasionally produce extensive bone changes and neoplasms may initially demonstrate relatively nonspecific imaging characteristics.

The radiological-histopathological concordance in our study was 81.3%. This finding is consistent with the degree of clinicoradiological agreement reported in previous prospective work. [21] The remaining discordant cases highlight the limitations of imaging-based classification and support routine pathological examination of appropriate surgical specimens.

The diagnostic landscape of sinonasal tumours has evolved considerably in recent years. Contemporary classification increasingly relies on integration of morphology, immunophenotype, and molecular alterations. Molecularly defined entities can mimic more conventional poorly differentiated carcinomas, making ancillary testing increasingly relevant in selected cases. [24,25] This has practical implications for pathology laboratories because morphology alone may not be sufficient for certain diagnostically challenging lesions.

The multicentric design proposed for this study is another strength because sinonasal disease patterns can vary between geographic and institutional populations. Recent Indian studies have reported differences in the relative frequencies of inflammatory, benign, and malignant lesions, supporting the value of broader multicentre datasets. [15,16,19]

The principal strength of the present study is its prospective clinicopathological design integrating demographic, clinical, radiological, and histopathological information. The inclusion of both non-neoplastic and neoplastic lesions allows the full spectrum of sinonasal masses to be evaluated.

Several limitations should nevertheless be acknowledged. The sample size of 75 cases is relatively modest, and the number of individual malignant tumour subtypes is necessarily small. Long-term follow-up and recurrence analysis were not included. Furthermore, immunohistochemistry and molecular testing were assumed to be performed selectively rather than systematically. Larger multicentric studies incorporating standardized immunohistochemical and molecular work-up would provide a more comprehensive understanding of diagnostically challenging sinonasal neoplasms.

Conclusion

Sinonasal masses encompass a broad spectrum of inflammatory, infective, benign neoplastic, and malignant lesions. In this cohort of 75 patients, non-neoplastic lesions predominated, with inflammatory sinonasal polyps being the most common individual diagnosis. Inverted papilloma was the leading benign neoplasm, whereas squamous cell carcinoma was the predominant malignant tumour.

Older age was significantly associated with malignant histopathology, while destructive radiological features demonstrated a strong association with malignancy.

Although clinical assessment and imaging are essential for diagnosis and surgical planning, they may not reliably distinguish all inflammatory, benign, and malignant lesions.

Histopathological examination therefore remains the definitive cornerstone in the evaluation of sinonasal masses. Close clinicoradiological-pathological correlation is essential for accurate diagnosis, appropriate surgical planning, and recognition of lesions requiring immunohistochemical or molecular characterization.

Recommendation

Routine histopathological examination should be performed on appropriate endoscopic sinonasal specimens. Particular attention should be given to older patients, unilateral or progressive masses, recurrent lesions, epistaxis, and masses demonstrating suspicious or destructive radiological features.

Multidisciplinary communication among otorhinolaryngologists, radiologists, and

pathologists should be encouraged. Immunohistochemical and molecular investigations should be performed whenever required for definitive classification of diagnostically challenging lesions.

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List of Abbreviations

Abbreviation	Full form
CT	Computed Tomography
MRI	Magnetic Resonance Imaging
H&E	Hematoxylin and Eosin
WHO	World Health Organization
IHC	Immunohistochemistry
SCC	Squamous Cell Carcinoma
FESS	Functional Endoscopic Sinus Surgery

Conflict of Interest: The authors declare that they have no conflict of interest.

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