

Original Research Article

Histopathological Study of Lesions in Nasal Cavity and Paranasal Sinuses

Aman Jain¹, Prachi Mehta^{2*}

¹Second Year PG Student, ²Third Year PG Student, Department of Pathology, SBKSMI & RC, Sumandeep Vidyapeeth, Vadodara, Gujarat, India

*Corresponding author email: Prachimehta08021996@gmail.com

	International Archives of Integrated Medicine, Vol. 12, Issue 4, April, 2025.	
	Available online at http://iaimjournal.com/	
	ISSN: 2394-0026 (P)	ISSN: 2394-0034 (O)
	Received on: 2-4-2025	Accepted on: 17-4-2025
Source of support: Nil		
Conflict of interest: None declared.		
Article is under Creative Common Attribution 4.0 International		
DOI: 10.5281/zenodo.15262253		
How to cite this article: Aman Jain, Prachi Mehta. Histopathological Study of Lesions in Nasal Cavity and Paranasal Sinuses. Int. Arch. Integr. Med., 2025; 12(4): 8-14.		

Abstract

Background: Lesions of the nasal cavity and paranasal sinuses (PNS) encompass a broad spectrum of pathological entities ranging from non-neoplastic inflammatory conditions to benign and malignant neoplasms. Despite their anatomical proximity, the diversity in tissue types and exposures contributes to the wide histological variation. Histopathological examination remains the definitive method for diagnosis. To evaluate the histopathological spectrum of lesions in the nasal cavity and paranasal sinuses, determine the incidence of various neoplastic and non-neoplastic conditions, and compare findings with those reported in previous studies.

Materials and methods: A retrospective study was conducted on 727 cases received in the Department of Pathology, SBKS MI & RC, Sumandeep Vidyapeeth, Vadodara, between August 2018 and August 2021. Specimens were subjected to gross and microscopic evaluation using hematoxylin and eosin staining. Special stains were applied as required. Lesions were categorized as non-neoplastic, benign neoplastic, premalignant, or malignant based on histopathological features and classified according to the WHO classification system.

Results: Out of 727 cases, 649 (89.27%) were non-neoplastic, and 78 (10.73%) were neoplastic. Among neoplastic lesions, benign lesions (n=40; 5.5%) were more common than malignant (n=28; 3.86%). The most frequently encountered non-neoplastic lesion was inflammatory nasal polyp. Among malignant tumors, squamous cell carcinoma and nasopharyngeal carcinoma were the predominant types. A male preponderance was observed, with the highest incidence in the second and sixth decades of life.

Conclusion: Non-neoplastic lesions form the majority of sinonasal lesions; however, early diagnosis of neoplastic lesions - especially malignant - remains critical due to their potential morbidity.

Histopathological examination continues to be the gold standard in accurately diagnosing these diverse lesions.

Key words

Nasal cavity, Paranasal sinuses, Histopathology, Inflammatory polyps, Benign tumors, Squamous cell carcinoma, Nasopharyngeal carcinoma.

Introduction

The nasal cavity and paranasal sinuses (PNS) together constitute a complex anatomical and functional unit responsible for humidifying and filtering inhaled air, olfaction, and resonance of voice. These regions are lined by specialized epithelium and are exposed to a variety of environmental irritants, infectious agents, and allergens, making them susceptible to a wide array of pathological conditions [1]. Although occupying a relatively small anatomical space, the sinonasal tract gives rise to a diverse range of lesions, including inflammatory polyps, granulomatous diseases, benign tumors, and a variety of malignant neoplasms. Clinical presentations such as nasal obstruction, epistaxis, nasal discharge, or facial swelling often overlap, making definitive diagnosis reliant on histopathological examination [2, 3]. Non-neoplastic lesions are more commonly encountered in clinical practice and may mimic neoplastic processes both clinically and radiologically. Conversely, benign neoplasms like inverted papillomas and angiofibromas can recur or transform malignantly if inadequately treated. Malignant tumors, although relatively rare, often present late and are associated with significant morbidity [4]. Given the varied histopathological patterns and clinical implications, the accurate diagnosis and classification of sinonasal lesions is imperative. This study was undertaken to evaluate the histopathological spectrum of nasal cavity and PNS lesions, correlate them with demographic and clinical data, and compare the findings with existing literature.

Materials and Methods

A retrospective study was conducted on 727 cases received in the Department of Pathology,

SBKS MI & RC, Sumandeep Vidyapeeth, Vadodara, between August 2018 and August 2021 with analyses of nasal cavity and paranasal sinus (PNS) lesions. Ethical clearance was obtained prior to the commencement of the study. All biopsy and resection specimens from the nasal cavity and PNS received during the study period. All biopsy and resection specimens which were inadequately preserved and Non-diagnostic or inconclusive histological material were excluded from the study. A total of 727 cases were included. All specimens were fixed in 10% neutral buffered formalin. Gross examination was followed by routine tissue processing, paraffin embedding, sectioning at 4–5 µm thickness, and staining with hematoxylin and eosin (H&E). Special stains, such as Periodic Acid-Schiff (PAS) and Ziehl-Neelsen (ZN), were employed as necessary. Lesions were classified into non-neoplastic and neoplastic categories, with further subclassification into inflammatory, benign, premalignant, and malignant groups. Tumors were classified according to the World Health Organization (WHO) histological classification of tumors of the nasal cavity and paranasal sinuses. Demographic data including age, sex, and clinical presentation were recorded. The incidence of various lesion types and their histomorphological patterns were analyzed and compared with findings from previous studies.

Results

This study included a total of 727 cases of lesions originating from the nasal cavity and paranasal sinuses (PNS), received over a two-year period between August 2018 and August 2021 at the Department of Pathology, B.J. Medical College, Ahmedabad. The cases were evaluated histopathologically and categorized into non-neoplastic and neoplastic lesions (**Table**

– 1). Of the total cases, non-neoplastic lesions were predominant, accounting for 649 cases (89.27%), while neoplastic lesions constituted 78 cases (10.73%). Among the neoplastic lesions, benign tumors comprised 40 cases (5.5%), premalignant/suspicious lesions 10 cases (1.37%), and malignant tumors 28 cases (3.86%). A marked male predominance was observed, with 496 (68.23%) males and 231 (31.77%) females, giving a male-to-female ratio of approximately 2.1:1 (**Table – 2**). The age distribution ranged from 1 year to 85 years. Non-neoplastic lesions were commonly observed in the second (11–20 years) and fourth (31–40 years) decades, while malignant lesions were more frequently diagnosed in the sixth and seventh decades. The most frequently encountered non-neoplastic lesion was inflammatory nasal polyp, seen in a majority of cases. These lesions were characterized microscopically by a loose myxoid stroma infiltrated with lymphocytes, plasma cells, eosinophils, and neutrophils, lined by respiratory epithelium. Other non-neoplastic conditions included granulomatous lesions such as rhinoscleroma, sarcoidosis, and tuberculosis, as well as fungal infections like mucormycosis and aspergillosis. Fungal sinusitis cases were confirmed by identification of broad aseptate or septate fungal hyphae on special stains (PAS/GMS). Among the benign neoplastic lesions, the most common entities were inverted papilloma and nasopharyngeal angiofibroma. Inverted papillomas were seen predominantly in males and displayed histological features of invaginating nests of respiratory or squamous epithelium with underlying inflammation. Nasopharyngeal angiofibroma was exclusively seen in adolescent males and showed a vascular stroma composed of dilated vessels and fibrous tissue. Of the 28 malignant tumors, squamous cell carcinoma (SCC) was the most frequently diagnosed, comprising the majority of cases. SCCs typically presented as fungating masses with histology revealing sheets and nests of atypical squamous cells, keratin pearls, and high mitotic activity. Nasopharyngeal carcinoma (NPC) was the second most common

malignancy, seen in both keratinizing and non-keratinizing forms. Olfactory neuroblastoma, adenoid cystic carcinoma, rhabdomyosarcoma, and NUT carcinoma were among the rarer malignancies identified. NPCs often presented with cervical lymphadenopathy and were histologically associated with a lymphoid-rich background (**Table – 3**). Site-wise, the nasal cavity was the most commonly involved anatomical region across all types of lesions (**Table – 4**). Extension into the paranasal sinuses, particularly the maxillary sinus, was observed in several neoplastic and fungal cases (**Figure - 1, 2, 3, 4, 5**). In conclusion, inflammatory polyps represented the most frequent lesion in the sinonasal tract, while squamous cell carcinoma was the predominant malignancy. Benign neoplasms outnumbered malignant ones, emphasizing the need for careful histopathological evaluation in all excised lesions to guide appropriate management.

Table - 1: Incidence of Neoplastic and Non-Neoplastic Lesions.

Type	No.
Neoplastic Lesions- Malignant	28 (3.86%)
Premalignant/ Suspicious Lesions	10 (1.37%)
Neoplastic Lesions- Benign	40 (5.5%)
Non-Neoplastic Lesions- Inflammatory	649 (89.27%)
Total	727

Figure - 1: H & E stained (10X view): Loose myxoid stroma infiltrated with lymphocytes, plasma cell, mast cell, neutrophils and eosinophils covered by respiratory epithelium - Inflammatory polyp.

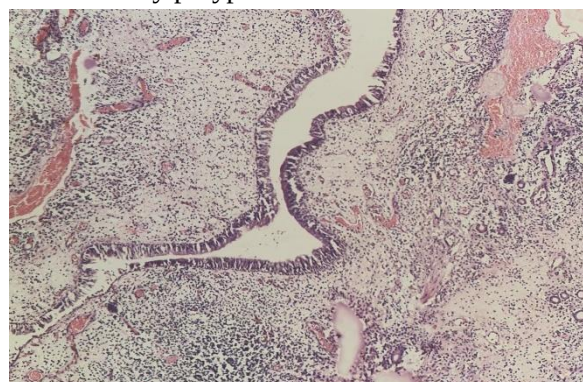


Table - 2: Sex Wise Distribution of Lesions Of Nasal Cavity and Paranasal Sinuses And Its Percentage.

Nature of Lesions	Male	%	Female	%	Total
Inflammatory	434	59.7	215	29.57	649
Benign	33	4.54	7	0.96	40
Premalignat	7	0.96	3	0.41	10
Malignat	22	3.03	6	0.83	28
Total	496	68.23	231	31.77	727

Table - 3: Site Wise Distribution of Neoplastic and Non-Neoplastic Lesion.

Site	No.
Nasal Cavity	719 (98.9 %)
Paranasal Sinuses	04 (0.55%)
Nasopharynx	04 (0.55%)
Total	727

Table - 4: Morphological Classification of Inflammatory Lesions Of Nasal Cavity And Paranasal Sinuses.

Morphological Type	Total Cases	Percentage
Abscess	3	0.46
Non - Specific Inflammation	50	7.7
Fungal Inflammation	517	79.6
TB Inflammation	3	0.46
Polyp	71	10.94
Chronic Sinusitis	1	0.15
Rhinolith	1	0.15
Rhinoscleroma	1	0.15
Rhinosclerosis	1	0.15
Adenoids	1	0.15

Figure - 2: H & E stained (10X view): Plenty of broad ribbon like, non-septate fungal hyphae with wide angle branching and spores- Mucormycosis.

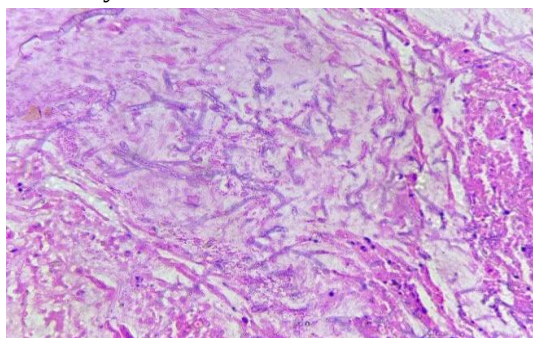


Figure - 3: H & E stained (10X view): Invaginating nests covered by non-keratinizing squamous epithelium underneath abundant and edematous connective tissue contains macrophages and neutrophils- Inverted Papilloma.

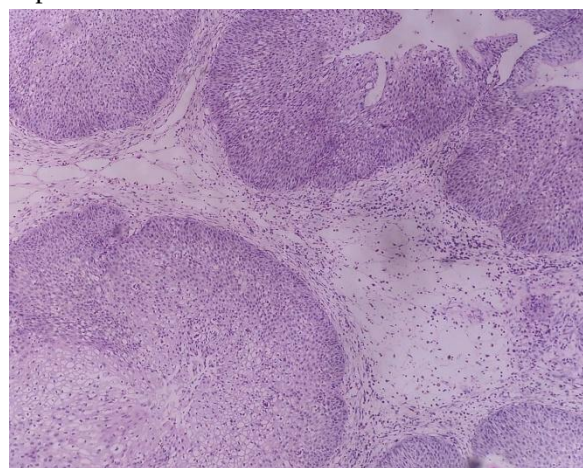
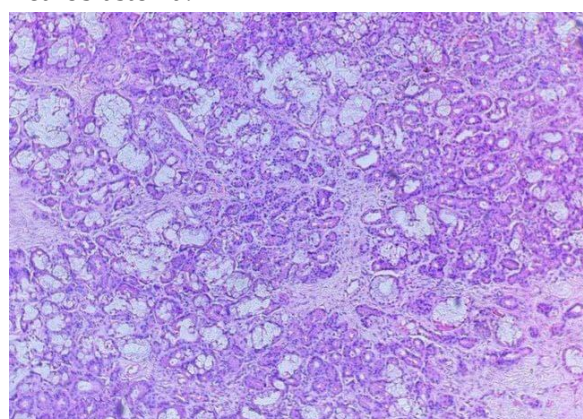


Figure - 4: H & E stained (10X view): Flexner-Winter Steiner Rosettes- Tumor cells surrounding true lumen - Olfactory Neuroblastoma.

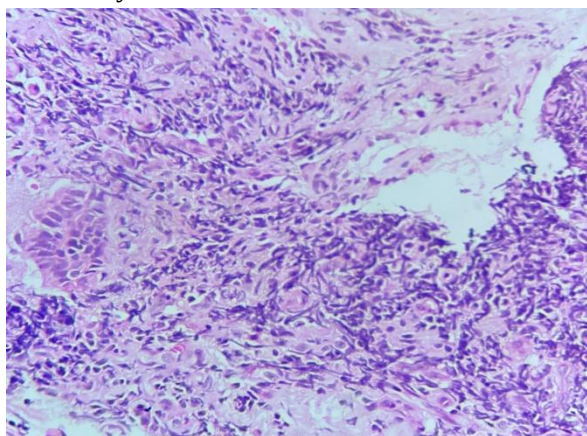


Discussion

The nasal cavity and paranasal sinuses (PNS) present a diverse array of lesions, ranging from

simple inflammatory polyps to aggressive malignancies. Although these structures occupy a relatively small anatomical area, the histological spectrum of their lesions is remarkably broad due to the variety of epithelial and mesenchymal elements present and their exposure to environmental agents. In the present study comprising 727 cases over a two-year period, non-neoplastic lesions accounted for the majority (89.27%), with neoplastic lesions constituting only 10.73%. This finding aligns with earlier studies by Dasgupta, et al. [1] and Vaidya, et al. [2], which also reported a higher incidence of non-neoplastic lesions in sinonasal pathology. Among non-neoplastic lesions, inflammatory polyps were the most common, which is consistent with other reports in the literature [3, 4].

Figure - 5: H & E stained (40X view) primitive round to spindle cells, with scant cytoplasm and hyperchromatic nuclei, scattered rhabdomyoblasts with brightly eosinophilic eccentric cytoplasm- Embryonal Rhabdomyosarcoma.



The male predominance in our study (male to female ratio ~2.1:1) is corroborated by similar observations by Deka, et al. [5] and Shaheen, et al. [6], who reported male predominance in both non-neoplastic and neoplastic conditions. This could be attributed to higher exposure of males to environmental irritants and occupational hazards. Fungal sinusitis represented a significant portion of the non-neoplastic spectrum, especially in immunocompromized

individuals. Mucormycosis and aspergillosis were the most frequent fungal pathogens. The rise in mucormycosis cases during the COVID-19 pandemic has been highlighted in recent studies [7, 8], where poorly controlled diabetes and corticosteroid use were implicated as contributing factors. Histopathologically, mucormycosis showed broad, non-septate hyphae, while aspergillosis displayed septate hyphae with dichotomous branching, findings consistent with descriptions by Chandler, et al. [9]. Among benign neoplastic lesions, inverted papilloma was the most common. It is well recognized for its tendency for recurrence and potential for malignant transformation [10, 11]. Histologically, inverted papillomas show characteristic epithelial invaginations into the stroma, which can be misinterpreted as malignancy unless properly evaluated. Nasopharyngeal angiofibroma, although rare, was exclusively observed in adolescent males, a demographic feature well-documented in literature [12, 13]. The malignant neoplasms constituted 3.86% of the total cases. Squamous cell carcinoma (SCC) was the predominant malignancy, consistent with earlier studies [14, 15]. SCC typically arises from areas of squamous metaplasia and shows keratinization and intercellular bridges histologically. Occupational exposure to wood and leather dust, smoking, and chronic inflammation have been implicated in SCC etiology [16]. Nasopharyngeal carcinoma (NPC) was the second most frequent malignancy. Studies from Southeast Asia, including India, report higher prevalence of NPC compared to Western populations [17]. EBV (Epstein-Barr Virus) is a key etiological factor in non-keratinizing and undifferentiated NPCs [18]. Histological subtypes in our study corresponded with the WHO classification, including Regaud and Schmincke patterns, as described by Shanmugaratnam, et al. [19]. Olfactory neuroblastoma or esthesioneuroblastoma, though rare, was also identified in our study. These tumors are neuroectodermal in origin and have distinct histological features such as Homer Wright rosettes. Their diagnosis often requires immunohistochemical confirmation [20].

Similarly, adenoid cystic carcinoma, identified in a few cases, demonstrated the classical cribriform pattern described by Spiro, et al. [21]. Another noteworthy finding was the presence of NUT carcinoma, a rare and aggressive midline carcinoma defined by NUTM1 gene rearrangement. These tumors are often misdiagnosed due to their undifferentiated morphology and require molecular diagnostics for confirmation [22]. The age distribution showed inflammatory lesions to be more common in younger individuals, while malignant tumors were more prevalent in older age groups, echoing observations by Bhargava, et al. [23]. This reflects the chronic nature and cumulative risk associated with neoplastic transformation over time. Regarding fungal infections in our study, the results can be compared to Vartak, et al. [24]. (**Table – 5**) While histopathology remains the cornerstone of diagnosis in sinonasal pathology, the absence of ancillary techniques such as immunohistochemistry (IHC) and cytogenetics in our study is a limitation. IHC, in particular, is critical for the accurate classification of poorly differentiated tumors and lymphomas, and for confirming rare entities such as olfactory neuroblastoma or NUT carcinoma. Our study reinforces the importance of prompt biopsy and histopathological evaluation in all persistent or atypical nasal lesions. A large proportion of neoplastic lesions, particularly malignancies, were diagnosed at an advanced stage, underscoring the need for increased clinical vigilance and early referral for histological assessment.

Table - 5: Comparison of various Fungal Inflammation.

Various Fungal Lesions	Vartak, et al. [24] (No. of cases & %)	Present Study (No of cases & %)
Mucormycosis	18 (8.3%)	510 (78.58%)
Aspergillosis	3 (1.9%)	1 (0.15%)
Mixed Fungal Inflammation	-	5 (0.77%)
Candidiasis	-	1 (0.15%)

Conclusion

The present study provides a comprehensive overview of the histopathological spectrum of lesions in the nasal cavity and paranasal sinuses. Non-neoplastic lesions, particularly inflammatory nasal polyps, were found to be the most prevalent, followed by a smaller but significant proportion of neoplastic lesions. Among neoplasms, benign tumors outnumbered malignant ones, with inverted papilloma and nasopharyngeal angiofibroma being the most frequently encountered benign tumors. Squamous cell carcinoma emerged as the predominant malignant neoplasm. Histopathological examination continues to be the cornerstone for definitive diagnosis, given the overlapping clinical presentations of various sinonasal lesions. The use of special stains and, where possible, immunohistochemistry can aid in confirming unusual or rare pathologies. Early diagnosis and differentiation between benign and malignant processes are essential to guide appropriate clinical management and improve patient outcomes. Our findings underscore the importance of including histological evaluation in all cases of persistent or suspicious nasal symptoms, regardless of clinical or radiological impressions. Further studies incorporating molecular and immunohistochemical techniques would enhance diagnostic accuracy and facilitate a better understanding of rare sinonasal tumors.

References

1. Dasgupta A, Ghosh RN, Mukherjee C. Histopathological study of nasal and paranasal sinus lesions. *Indian J Otolaryngol Head Neck Surg.*, 1999; 51(1): 25–29.
2. Vaidya S, Dogra R, Bhake A. Histopathological spectrum of sinonasal lesions: A tertiary care study. *J Clin Diagn Res.*, 2017; 11(4): EC01–EC04.
3. Pradhananga RB, Shrestha BL, Sinha BK, Amatya RC. Nasal polyposis: Histopathological spectrum. *Nepal Med Coll J.*, 2007; 9(2): 109–111.

4. Yorgancilar E, Yildirim M, Gun R, et al. Clinical, radiological, and histopathological evaluation of nasal polyps. *Eur Arch Otorhinolaryngol.*, 2013; 270(12): 3045–3050.
5. Deka RC, Bhuyan SK, Barman D. Clinicopathological study of sinonasal tumors. *Indian J Otolaryngol.*, 1992; 44(1): 31–35.
6. Shaheen OH. Histopathology of nasal polyps. *J Laryngol Otol.*, 1994; 108(11): 965–967.
7. Mohapatra S, Sahoo AK, Das A. Rhino-orbito-cerebral mucormycosis in COVID-19 patients. *J Fungi.*, 2021; 7(8): 654.
8. Mehta S, Pandey A. Rhino-orbital mucormycosis associated with COVID-19. *Cureus.*, 2020; 12(9): e10726.
9. Chandler JR, Langenbrunner DJ, Stevens ER. The pathogenesis of chronic sinusitis. *Laryngoscope*, 1977; 87(6): 936–948.
10. Ringertz N. Pathology of malignant tumors of the nasal cavity and paranasal sinuses. *Acta Otolaryngol.*, 1938; 27(Suppl 27): 1–85.
11. Hellquist H, Lundgren J, Olofsson J. Inverted papilloma of the nasal cavity: A study of 87 cases. *Histopathology*, 1985; 9(6): 681–689.
12. Radkowski D, McGill T, Healy GB, et al. Juvenile nasopharyngeal angiofibroma: Case series and literature review. *Laryngoscope*, 1996; 106(1 Pt 1): 49–55.
13. Fisch U. The infratemporal fossa approach for nasopharyngeal tumors. *Laryngoscope*, 1984; 94(3): 313–316.
14. Barnes L, Eveson JW, Reichart P, Sidransky D. WHO Classification of Tumours: Pathology and Genetics of Head and Neck Tumours. Lyon: IARC Press; 2005.
15. Som PM, Curtin HD. Sinonasal squamous cell carcinoma: CT and MR imaging features. *Radiographics*, 2000; 20(5): 1477–1486.
16. Luce D, Leclerc A, Begin D, et al. Sinonasal cancer and occupational exposure to formaldehyde and wood dust. *Am J Epidemiol.*, 1993; 138(11): 947–960.
17. Wei WI, Sham JST. Nasopharyngeal carcinoma. *Lancet*, 2005; 365(9476): 2041–2054.
18. Young LS, Rickinson AB. Epstein-Barr virus: 40 years on. *Nat Rev Cancer*, 2004; 4(10): 757–768.
19. Shanmugaratnam K, Sobin LH. Histological typing of nasopharyngeal carcinoma. *IARC Sci Publ.*, 1991; (117): 1–27.
20. Dulguerov P, Allal AS, Calcaterra TC. Esthesioneuroblastoma: A meta-analysis and review. *Lancet Oncol.*, 2001; 2(11): 683–690.
21. Spiro RH, Huvos AG, Strong EW. Adenoid cystic carcinoma: Factors influencing survival. *Am J Surg.*, 1974; 128(4): 512–520.
22. French CA. NUT midline carcinoma. *Cancer Genet Cytogenet.*, 2010; 203(1): 16–20.
23. Bhargava D, Nair S, Gadhvi K, Shah S. Histopathological spectrum of sinonasal lesions: A 3-year study. *Oman Med J.*, 2011; 26(1): 15–18.
24. Vartak UC, Sarnaik AG, Vartak S, Pathan F. Spectrum of histopathological lesions of nose and paranasal sinuses: A 5-year study. *J Med Soc.*, 2020; 34: 128–38.