Original Article

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Pathology Section

Histopathological Spectrum of Lesions of the Nasal Cavity and Paranasal Sinuses: A Five-year Cross-sectional Study from a Tertiary Care Centre, Lucknow, India

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ABSTRACT

Introduction: Polyps or masses arising in the sinonasal area can disturb local anatomy and physiology with similar kinds of symptoms, including sneezing, epistaxis, respiratory obstruction and destruction of local structures. These lesions can be categorised as non-neoplastic or neoplastic. Advanced radiological techniques enable presumptive diagnosis; however, histopathological examination confirms the exact nature of the lesion (benign, malignant, or inflammatory).

Aim: To investigate the histopathological spectrum of lesions arising in the nasal cavity, paranasal sinuses, nasopharynx and external nose and also to compare histopathological diagnosis in relation to age, sex and site of distribution.

Materials and Methods: The present observational cross-sectional study was conducted for one year (July 2018- June 2019), and data collection was done both prospectively (July 2018-June 2019) for one year and retrospectively (July 2014-June 2018) for four years was conducted at a Tertiary Care Centre, King George Medical University, Lucknow, Uttar Pradesh, India. A total of 967 cases of tissue samples were selected for study from the nasal cavity, paranasal sinuses, nasopharynx and external nose. All the relevant data like age, sex, complaints, site of lesion, diagnosis, immunohistochemical markers like Leukocyte Common Antigen (LCA) Pancytokeratin, S100 protein, Vimentin, Desmin, Cluster of Differentiation 99 (CD99) and special staining (periodic acid Schiff, Ziehl-Neelsen and Giemsa) were entered into an Excel sheet. Cases were categorised into non-neoplastic and neoplastic. Neoplastic was further divided into benign and malignant and compared in relation to age, sex and site of distribution. Statistical analysis was done using Statistical Package for Social Sciences (SPSS) Statistics (version 21.0). Mean, standard deviation, Chi-square test, Analysis of Variance (ANOVA) and level of significance (p-value) were done.

Results: A total of 967 sinonasal lesions were studied in patients aged eight months-85 years. The incidence was 11.1 cases/year with a male-to-female ratio of 2.37:1. Non-neoplastic lesions formed 57.3% (558), benign 22.9% (223), and malignant 19.1% (186). The mean age for malignant cases (46.1 years) was higher than for benign ones (29.2 years). Inflammatory polyps 60.4% (337) were the commonest non-neoplastic lesion, angiofibroma 46.2% (103) he commonest benign, and squamous cell carcinoma 36% (67) the predominant malignant lesion. The nasal cavity was the most frequent site involved.

Conclusion: The present study demonstrated a diverse range of histopathological lesions, from simple inflammatory to aggressive malignant lesions in the sinonasal area. It is very difficult to differentiate these lesions based on clinical and radiological parameters. Hence, histopathological examination is essential to categorise these lesions for the appropriate management of patients.

Keywords: Non-neoplastic, Neoplastic polyp, Sinonasal

INTRODUCTION

The nasal cavity is a roughly cylindrical, midline airway passage that extends from the nasal ala anteriorly to the choana posteriorly. It is divided in the midline by the nasal septum. Each side is flanked by the maxillary sinuses, and the roof is formed by frontal, ethmoidal and sphenoid sinuses in an anterior to posterior fashion. While seemingly simple, its anatomy is composed of intricate and subdivided air passages and drainage pathways that connect the hollow compartments [1]. Pathology in these areas produces similar kinds of symptoms, including sneezing, epistaxis, respiratory obstruction and destruction of local structures. The proximity of the area non-neoplastic to the eyes and brain warrants early definitive diagnosis so that the lesion is treated before it can involve important and vital centers. Nasal polyps are the most common lesion with 4% prevalence rate and present with nasal obstruction and have an association with allergy, asthma, and infections [2,3]. Advanced radiological techniques enable presumptive diagnosis only. However, it is only histopathological examination that confirms the nature of the lesion and makes it possible to implement correct and timely interventions, which is a major deciding factor for case management and better prognosis [4].

Masses in the sinonasal cavity, paranasal sinuses, and nasopharynx may be categorised into neoplastic or non-neoplastic lesions. In a neoplastic lesion, it may be benign or malignant. Benign lesions of the sinonasal region are common, and a lack of awareness about these lesions can lead to radical surgeries. Often, they present with frequent local recurrence and thus relatively significant morbidity [5].

Malignant tumours involving sinonasal tract account for 0.2 to 0.8 % of total malignancies and only 3% of all head and neck malignancies [6]. The clinicohistopathological study also gives valuable information about the possibility of changing a benign lesion into a malignant lesion. This five-year study was conducted in a tertiary-level hospital to explore the relation with age, sex and the variety of non-neoplastic and neoplastic lesions of the nasal cavity, paranasal sinuses, and nasopharynx. The objective of the present study was categorise the lesions occurring in the nasal cavity, paranasal sinuses, nasopharynx, and external nose and to

analyse the distribution of these lesions with respect to age and sex and also to correlate the histopathological findings with the site of origin of the lesions.

MATERIALS AND METHODS

The present observational study was conducted in the Department of Pathology, King George University, Lucknow, Uttar Pradesh, India. The duration of study was one year (July 2018- June 2019), and data collection was done both prospectively for one year (June 2018-July 2019) and retrospectively for four years (July 2014-June 2018). A total of 974 cases of tissue samples were obtained from the nasal cavity, paranasal sinuses, nasopharynx and external nose. Seven cases were non-diagnostic; hence, excluded from statistical analysis. Before start of the study approval was taken from Institutional Ethics Committee King George Medical University, Lucknow, Uttar Pradesh, India (IEC no. 644/Ethics/19 and Reference code: 95th ECM IIB-Thesis/P14).

Inclusion and Exclusion criteria: Inclusion criteria for the study were all samples from biopsy/excision of mass in the nasal cavity/paranasal sinuses/nasopharynx, and the external nose. Patients of all age groups and both sexes were included. All traumatic cases, or cases from other sites that were mentioned above, were excluded.

Study Procedure

Tissue samples of biopsy/excisional masses were collected and selected throughout the year from the prospective group), from the patients attending the Outpatient Department (OPD) with complaints of mass in the nose, nasal blockage, and/or nasal discharge or mass lesions detected on Computed Tomography (CT)/Magnetic Resonance Imaging (MRI), in the nasopharynx and paranasal sinuses. After receiving the sample, it was confirmed that the sample was properly fixed in 10% formalin. Then, after the tissue was processed, it was processed according to standard protocol in the automated Leica tissue processor. A 3-4-micron thick section were cut and stained with haematoxylin and eosin. Special stains like periodic acid Schiff, Ziehl-Neelsen and Giemsa were done wherever necessary. In a difficult case, immunohistochemistry (LCA, PanCK,S100, Vimentin, Desmin, CD99, Ki67 antigen, Chromagranin, Non-specific enolase, Cluster of differentiation (CD)- 20, CD3, CD5, B-cell lymphoma 2 (BCL2), CD10, CK7, CD117, Epithelial Membrane Antigen (EMA), Ber-EP4) was also done to reach the appropriate diagnosis. As per the requirement, The authors also consulted with clinicians to correlate the X-ray/CT/MRI findings/biochemical findings Complete Blood Count (CBC), Erythocyte Sedimentation Rate (ESR), blood sugar, and IgE (to exclude allergic rhinitis) of the patient. For retrospective collection, The authors retrieved the cases of the nasal cavity, paranasal sinuses, nasopharynx and external nose from the archives of pathology, which were reported during the last four years in the department of Pathology.

All the relevant data (like age, sex, complaints, site of lesion, diagnosis, immunohistochemistry and special staining) were entered into an Excel sheet. Cases were categorised into non-neoplastic and neoplastic. Neoplastic was further divided into benign and malignant, compared in relation to age, sex and site of distribution.

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS Statistics (version 21.0), including mean, SD, Chi-square test and ANOVA test, and the p-value was calculated.

RESULTS

In the present study, a total of 967 cases of sinonasal lesions were detected over a five-year period. Out of which 558 cases (57.7%) were non-neoplastic, 223 cases (23.1%) were benign and 186 (19.2%) were malignant. According to the site of distribution, the most common site was the nasal cavity, 78.9% (767), followed by the nasopharynx, 9.2% (87) and the paranasal sinus, 6.8% (65) and the least common at the external nose 4.9%(48). Non-neoplastic lesions are common at the nasal cavity, 62.5% (480) while neoplastic lesions are common in the nasopharynx including benign 60.9% (53) and malignant 23% (20) [Table/Fig-1].

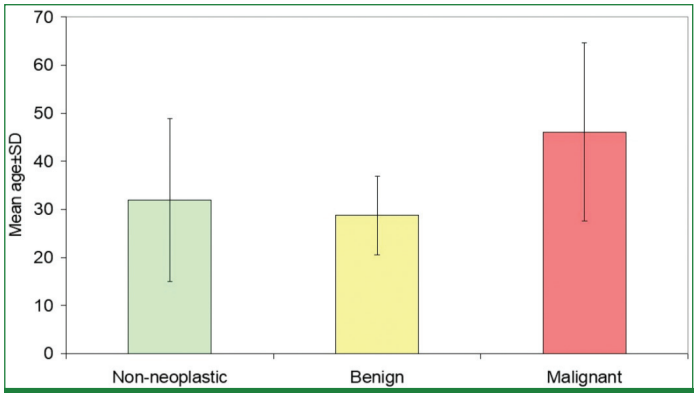
Sl. no.	Type of lesion	Nasal cavity (n=767)	Paranasal sinuses (n=65)	Nasopharynx (n=87)	External nose (n=48)	Total no. of specimens/ percentage%
1	Non neoplastic	480 (62.5)	37(55.9)	14 (16.1)	27 (56.2)	558 (57.7)
2	Benign	148 (19.3)	14 (21.5)	53 (60.9)	8 (16.7)	223 (23.1)
3	Malignant	139 (18.2)	14 (21.5)	20 (23.0)	13 (27.1)	186 (19.2)

[Table/Fig-1]: Type of lesions and their distribution according to site of origin.

An increase in the proportion of malignant cases was observed with an increase in age. The mean age of malignant cases (46.11±18.51 years) was found to be significantly higher (p<0.001) than that of non-neoplastic (31.80±16.81 years) and benign cases (29.23±18.44 years) [Table/Fig-2,3].

Age group (Years)	Total (N=967)	Non-neoplastic (n=558)		Benign (n=223)		Malignant (n=186)	
		No.	%	No.	%	No.	%
0-10	66	44	66.7	19	28.8	3	4.5
11-20	246	138	56.1	90	36.6	18	7.3
21-30	161	108	67.1	34	21.1	19	11.8
31-40	156	100	64.1	21	13.5	35	22.4
41-50	134	78	58.2	23	17.2	33	24.6
51-60	112	52	46.4	20	17.9	40	35.7
61-70	73	35	47.9	13	17.8	25	34.2
>70	19	3	15.8	3	15.8	13	68.4
Mean age±SD	33.93±18.53	31.95±16.91		28.78±18.21		46.11±18.51	
Range (Months-years)	6 m-85 yr	1-72 yr		6 m-80 yr		2-85 yr	

[Table/Fig-2]: Association of histopathological diagnosis with age.
Row-wise % χ^2=126.958; p <0.001 (Significant); F=58.068; p<0.001(Chi-square and ANOVA test)



[Table/Fig-3]: Relation of histopathological diagnosis with age.

Overall, the male-to-female ratio was 2.37. The proportion of males among benign 184 (82.5%) and malignant cases 142 (76.3%) was found to be significantly higher than that of non-neoplastic cases 356 (63.8%) [Table/Fig-4] which was statistically significant (p<0.001).

Gender	Total (N=967)	Non-neoplastic (n=558)		Benign (n=223)		Malignant (n=186)	
		n	%	n	%	n	%
Female	287	202	36.2	39	17.5	44	23.7
Male	680	356	63.8	184	82.5	142	76.3
Male: Female ratio	2.37	1.76		4.72		3.23	

[Table/Fig-4]: Association of histopathological diagnosis with gender.
Row-wise % χ^2=30.586; p<0.001 Significant (Chi-square test)

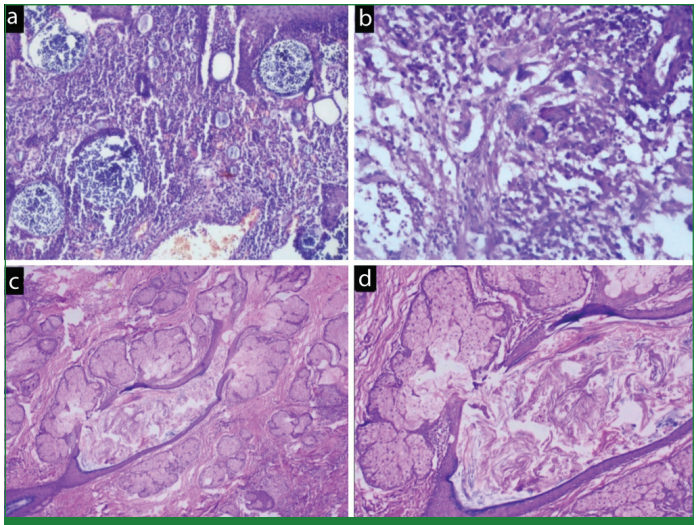
On comparing age, the authors noticed that non-neoplastic and benign lesions are more prevalent during the adolescent and young age groups, 11-20 and 21-30 years. Malignant lesions are common after 50 years of age.

Non-neoplastic lesions: The most common lesion was inflammatory nasal polyp 337 (60.4%), followed by chronic non-specific inflammation 172 (30.8%). Less common were epidermal inclusion cyst 20 (3.6%), fungal infection 12 (2.2%), rhinosporidiosis 4 (0.7%) and tubercular inflammation 3 (0.5%) [Table/Fig-5]. Fungal inflammation was observed equally among males and females. Preponderance of males was observed for inflammatory polyps and chronic non-specific inflammation; however, difference in the gender of non-neoplastic cases with different clinical diagnoses was not found to be statistically significant (p=0.131).

Source of sample	Histopathological diagnosis	Total	Female		Male	
			n	%	n	%
External nose n=27	Epidermal inclusion cyst	12	1	8.3	11	91.7
	Chronic non-specific inflammation	7	3	42.9	4	57.1
	Nevus	4	3	75.0	1	25.0
	Cysticercosis	1	1	100.0	0	0.0
	Fungal inflammation (mucormycosis)	1	0	0.0	1	100.0
	Rhinophyma	1	1	100.0	0	0.0
	Tubercular inflammation	1	1	100.0	0	0.0
	Total	27	10	37.0	17	63.0
	χ^2=12.502; p=0.052					
Nasal cavity N=480	Polyp	322	114	35.4	208	64.6
	Chronic non-specific inflammation	130	55	42.3	75	57.7
	Fungal inflammation (mucormycosis)	11	6	54.5	5	45.5
	Epidermal inclusion cyst	8	3	37.5	5	62.5
	Rhinosporiodosis	4	0	0.0	4	100.0
	Tubercular inflammation	2	1	50.0	1	50.0
	Atrophic rhinitis	1	0	0.0	1	100.0
	Chronic osteomyelitis	1	0	0.0	1	100.0
	Rhinoscleroma	1	0	0.0	1	100.0
	Total	480	179	37.3	301	62.7
	χ^2=7.591; p=0.474					
Paranasal sinus n=37	Chronic non-specific inflammation	23	7	30.4	16	69.6
	Inflam. Polyp	13	3	23.1	10	76.9
	Rhinoscleroma	1	0	0.0	1	100.0
	Total	37	10	27.0	27	73.0
	χ^2=0.609; p=0.738					
Nasopharynx n=14	Chronic non-specific inflammation	12	3	25.0	9	75.0
	Polyp	2	0	0.0	2	100.0
	Total	14	3	21.4	11	78.6
	χ^2=0.636; p=0.425					

[Table/Fig-5]: Association of gender and histopathological diagnosis in patients with non-neoplastic lesions (n=558) from different site.
Chi-square test

Histopathologically, these polyps comprised loose mucoid stroma and mucous glands lined by respiratory epithelium. Inflammatory infiltrate of lymphocytes, plasma cells, neutrophils and a few eosinophils was observed in this loose stroma. Allergic polyps show an increased number of eosinophils. Fungal infections were seen in the third decade, and on microscopy, exhibited inflammation of neutrophils and histiocytes in the granulation tissue along with fungal hyphae. Mucormycosis was the commonest fungal infection. Rhinosporidiosis



[Table/Fig-6]: a) Rhinosporidiosis: mixed inflammatory exudate with multiple thick walled sporangia (arrow) containing numerous endospores H&E x 100X; b) Fungal granuloma: mixed inflammatory exudate with collection of multinucleated giant cells and histiocytes plasma cells, and embedded fungal hyphae H&E x 100X; c) Rhinophyma: hyperplasia of sebaceous gland with follicular plug and inflammation in stroma H&E x 40X; d) sebaceous gland hyperplasia in left-side and keratin plug in centre H&E x 100X.

Source of sample	Histopathological diagnosis	Total	Female		Male	
			n	%	n	%
External nose n=8	Lipoma	5	1	20.0	4	80.0
	Bony lesions	1	0	0.0	1	100.0
	Capillary haemangioma	1	0	0.0	1	100.0
	Seborrheic keratosis	1	0	0.0	1	100.0
	Total	8	1	12.5	7	87.5
	χ^2=0.686; p=0.877					
Nasal cavity n=148	Angiofibroma	56	2	3.6	54	96.4
	Capillary haemangioma	34	17	50.0	17	50.0
	Inverted papilloma	31	5	16.1	26	83.9
	Bony lesions	14	4	28.6	10	71.4
	Lipoma	6	0	0.0	6	100.0
	Schwannoma	4	2	50.0	2	50.0
	Olfactory neuroblastoma	2	1	50.0	1	50.0
	Nasoencephalocele	1	0	0.0	1	100.0
	Total	148	31	20.9	117	79.1
	χ^2=33.381; p=0.001					
Paranasal sinus n=14	Bony lesions	12	5	41.7	7	58.3
	Ameloblastoma	1	0	0.0	1	100.0
	Capillary haemangioma	1	1	100.0	0	0.0
	Total	14	6	42.9	8	57.1
	χ^2=2.090; p=0.352					
Nasopharynx n=53	Angiofibroma	47	0	0.0	47	100.0
	Capillary haemangioma	3	1	33.3	2	66.7
	Bony lesions	1	0	0.0	1	100.0
	Lipoma	1	0	0.0	1	100.0
	Pleomorphic adenoma	1	0	0.0	1	100.0
	Total	53	1	1.9	52	98.1
	χ^2=16.987; p=0.002					

[Table/Fig-7]: Association of gender and histopathological diagnosis in patients with benign lesions (n= 223) from different source.
Chi-square test

showed many diagnostic globular sporangia containing numerous spores [Table/Fig-6a,b]. Rhynophyma was found on the external nose and showed hyperplasia of the sebaceous gland and chronic inflammatory cells with stromal fibrosis [Table/Fig-6 c,d].

Benign lesions: Angiofibroma was the most common lesion, 103 (46.2%), followed by capillary haemangioma, 39 (17%), inverted

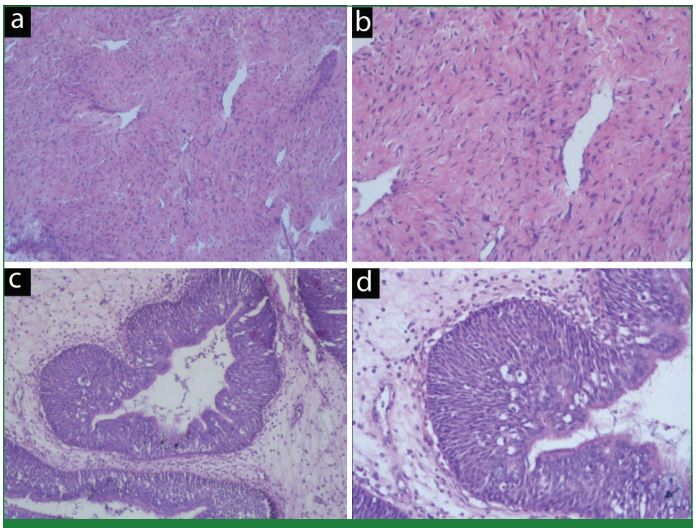
Clinical diagnosis	Number of cases	≤10 yr %	11-20 yr %	21-30 yr %	31-40 yr %	41-50 yr %	51-60 yr %	61-70 yr %	>70 yr %
Angiofibroma	103	6.8	68.9	14.6	1.9	4.9	1.9	0.0	1.0
Capillary haemangioma	39	12.8	20.5	15.4	17.9	10.3	5.1	15.4	2.6
Invered papilloma	31	0.0	0.0	9.7	16.1	25.8	29.0	16.1	3.2
Bony lesions	28	17.9	28.6	14.3	17.9	10.7	10.7	0.0	0.0
Lipoma	12	0.0	16.7	33.3	8.3	16.7	16.7	8.3	0.0
Schwannoma	4	25.0	0.0	25.0	0.0	25.0	25.0	0.0	0.0
Olfactory neuroblastoma	2	0.0	50.0	0.0	0.0	0.0	50.0	0.0	0.0
Ameloblastoma	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Nasoencephalocele	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleomorphic adenoma	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Seborric keratosis	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0

[Table/Fig-8]: Association of age and clinical diagnosis in patients with benign lesions.
χ^2=169.370; p<0.001 (Chi-square test)

papilloma, 31 (13.9%) and bony lesions, 28 (12.61%). Preponderance of males was observed among angiofibroma (98.1% vs 1.9%), and inverted papilloma (83.9%vs 16.1%). It was statistically significant [Table/Fig-7]. A statistically significant association of age and clinical diagnosis was also observed [Table/Fig-8].

Angiofibromas were commonly seen in the nasal cavity (56) and nasopharynx (47) with the microscopy of an intricate mixture of blood vessels and fibrous stroma [Table/Fig-9a,b]. Capillary haemangioma was seen equally in males and females (51.3% vs 487%), mostly seen in the nasal cavity (34) and nasopharynx (3), with lobular proliferation of small to medium-sized blood vessels and supporting stroma.

Inverted papilloma was mostly found in the nasal cavity, which is 5.2 times higher in males, and most commonly in the 5th and 6th decades of life and was composed of invaginations of squamous epithelium into the underlying stroma [Table/Fig-9c,d].



[Table/Fig-9]: a) Angiofibroma: Stellate/staghorn blood vessels mixed with irregular fibrous stroma H&E x 100X; b) Stroma showing fibroblasts with dense collagen x H&E x200X; c) Inverted papilloma: Inverted nests of respiratory epithelium in loose mucoid stroma with no atypia, H&E x 100X; d) Smooth invaginating basal layerx H&E x 200X.

Bony lesions were more common in the nasal cavity 14 (50%) and paranasal sinuses 12 (42.9%) and it is two times higher in males. It was seen in the early 1st decade and a 2nd peak in the 3rd and 4th decades. The most common benign bony lesions were ossifying fibroma, fibrous dysplasia, central giant cell granuloma and osteoma. Histology was classical as other sites. Rare cases found in the present study were lipoma (7), schwannoma (4), olfactory neuroblastoma (2), pleomorphic adenoma (1) and naso-encephalocele (1), which presented with a characteristic microscopic picture.

Malignant lesions: Out of total 186 cases the most common clinical diagnosis of patients with malignant lesions was SCC (36.0%) followed by nasopharyngeal carcinoma (26.3%) and non-Hodgkin's lymphoma (13.4%) while less common clinical diagnosis was Adenoid cysticcarcinoma (9.1%), Basal cell carcinoma (4.8%), Adenocarcinoma (4.3%), Ewing's sarcoma/tumour (2.2%), malignant melanoma (1.6%). The association of age and clinical diagnosis of cases with malignant lesions was found to be statistically significant [Table/Fig-10].

Clinical diagnosis	Number of cases	≤10 yr %	11-20 yr %	21-30 yr %	31-40 yr %	41-50 yr %	51-60 yr %	61-70 yr %	>70 yr %
SCC	67	0.0	1.5	9.0	16.4	25.4	32.8	11.9	3.0
Nasopharygeal carcinoma	49	2.0	28.6	10.2	20.4	14.3	12.2	6.1	6.1
Non-hodgkin lymphoma	25	8.0	0.0	12.0	24.0	16.0	12.0	12.0	16.0
Adenoid cystic carcinoma	17	0.0	5.9	11.8	29.4	11.8	23.5	17.6	0.0
Basal cell carcinoma	9	0.0	0.0	0.0	0.0	0.0	33.3	44.4	22.2
Adenocarcinoma	8	0.0	0.0	12.5	25.0	25.0	12.5	12.5	12.5
Ewing sarcoma/ tumour	4	0.0	50.0	25.0	0.0	0.0	25.0	0.0	0.0
Malignant melanoma	3	0.0	0.0	0.0	0.0	33.3	0.0	33.3	33.3
Verrucous carcinoma	3	0.0	0.0	0.0	33.3	0.0	0.0	66.7	0.0
Osteosarcoma	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Total	186	1.6	9.7	10.2	18.8	17.7	21.5	13.4	7.0

[Table/Fig-10]: Association of age and clinical diagnosis in patients with malignant lesions.
χ^2=103.730; p=0.001 (Chi-square test)

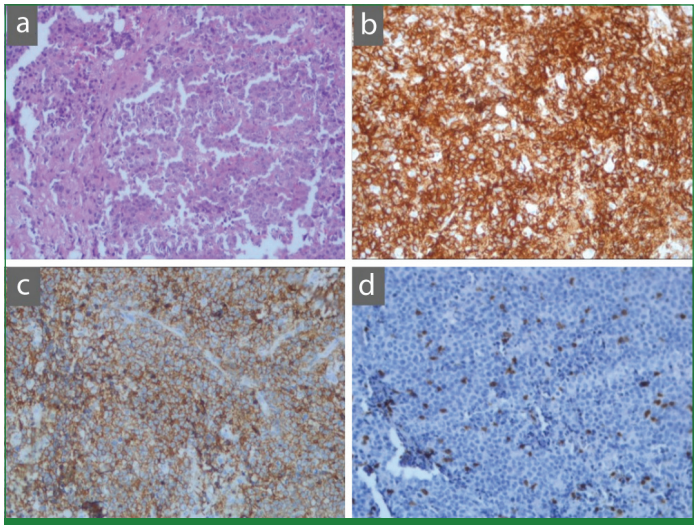
Male preponderance was observed for almost all malignant cases with the above clinical types. However, it was not found to be statistically significant [Table/Fig-11].

Squamous cell carcinoma was observed in the 5th and 6th decades. Histologically, tumour cells were arranged in nests and sheets with the evidence of squamous differentiation in the form of intracellular keratin, intercellular bridges and extracellular keratin pearls.

Non-Hodgkin lymphoma showed blue cells with round cell morphology. Immunohistochemistry showed diffuse LCA positivity, and further B and T cell markers and Ki67 were applied for further categorisation [Table/Fig-12]. The next common tumour was adenoid cystic carcinoma, which showed classical biphasic morphology composed of ductal and myoepithelial cells arranged in a tubular or cribriform pattern [Table/Fig-13a]. Myoepithelial cells have dark angulated nuclei and scanty cytoplasm, giving a basaloid appearance, and the tumour was positive for CK7 and CD117. Basal

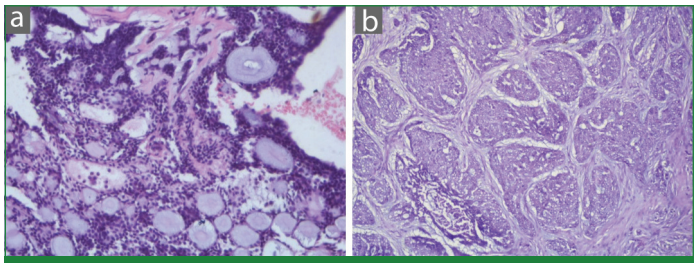
Source of sample	Histopathological diagnosis	Total	Female		Male	
			n	%	n	%
External nose	Basal cell carcinoma	8	4	50.0	4	50.0
	SCC	4	2	50.0	2	50.0
	Verrucuous carcinoma	1	0	0.0	1	100.0
	Total	13	6	46.2	7	53.8
	χ^2=0.929; p=0.629					
Nasal cavity	SCC	54	9	16.7	45	83.3
	Nasopharygeal carcinoma	32	7	21.9	25	78.1
	Non-hodgkin's lymphoma	23	9	39.1	14	60.9
	Adenoid cystic carcinoma	15	5	33.3	10	66.7
	Metastatic adenocarcinoma	7	0	0.0	7	100.0
	Malignant melanoma	3	0	0.0	3	100.0
	Verrucuous carcinoma	2	1	50.0	1	50.0
	Ewing sarcoma/tumour	2	1	50.0	1	50.0
	Basal cell carcinoma	1	0	0.0	1	100.0
	Total	139	32	23.0	107	77.0
	χ^2=10.455; p=0.235					
Paranasal sinus	Adenoid cystic carcinoma	2	2	100.0	0	0.0
	Ewing sarcoma/tumour	1	0	0.0	1	100.0
	Nasopharygeal carcinoma	1	0	0.0	1	100.0
	Non-hodgkins lymphoma	1	0	0.0	1	100.0
	Osteosarcoma	1	1	100.0	0	0.0
	SCC	8	1	12.5	7	87.5
	Total	14	4	28.6	10	71.4
	χ^2=9.712; p=0.084					
Nasopharynx	Nasopharygeal carcinoma	16	2	12.5	14	87.5
	Ewing sarcoma/tumour	1	0	0.0	1	100.0
	Metastaic adenocarcinoma	1	0	0.0	1	100.0
	Non-hodgkins lymphoma	1	0	0.0	1	100.0
	SCC	1	0	0.0	1	100.0
	Total	20	2	10.0	18	90.0
	χ^2=0.556; p=0.968					

[Table/Fig-11]: Association of gender and histopathological diagnosis in patients with malignant lesions (n=186) from different source.
Chi-square test; Amongst cases with malignant lesions association of gender and clinical diagnosis was not found to be significant irrespective of the site



[Table/Fig-12]: Non-Hodgkin's lymphoma: a) Sheets and cluster of atypical round cells, having coarse chromatin and inflammatory exudate H&E × 100X; b) Diffuse LCA positive in tumour cells, LCA x 100X; c) diffuse CD20 positive in tumour cells, CD20x 100X; d) CD3 negative in tumour cells, CD3 x 100X.

cell carcinoma was observed at the external nose in the 6th and 7th decades, and the histological appearance was characteristic of a lobular or nested pattern with peripheral palisading. Basaloid tumour cells with uniform hyperchromatic nuclei and scant cytoplasm were noted [Table/Fig-13b]. In the present study, adenocarcinoma was observed exclusively in males, 8/8 (100%), in the 3rd to 6th decade, and histological appearance was classical, as in other places, glandular and papillary patterns with and without mucin production.



[Table/Fig-13]: a) Adenoid cystic carcinoma: Nests and cords of epithelial cells showing cribriform pattern H&E × 100X; b) Basal cell carcinoma: Nests of epithelial cells with peripheral palisading H&E × 100X.

Less common tumours were ewing's sarcoma and melanoma. Ewing's sarcoma was observed commonly in the 2nd decade with male predominance (3:1). Histological picture showed uniform small round cells with finely stippled chromatin and clear to scant eosinophilic cytoplasm. Immunohistochemistry was positive for CD99, vimentin and NSE and negative for Pan CK, EMA, LCA, desmin and chromogranin, which confirmed the diagnosis of PNET/Ewing's sarcoma. Next were three cases of verrucous carcinoma, one on the external nose, two in the nasal cavity, mostly in the 6th decade and male predominance. Histology showed hyperplastic proliferation of epithelium with broad and bulbous rete ridges and pushing encroachment on stroma and bland cytology. Then, one case of osteogenic sarcoma was noticed in a female patient within the paranasal sinus in the 3rd decade with typical histology.

DISCUSSION

Malignant tumours involving sinonasal tract account for 0.2 to 0.8 % of total malignancies [6]. Lesions in the sinonasal area and nasopharynx form a heterogeneous group of lesions with a broad spectrum of histopathological features. They clinically present with similar symptoms, as nasal polyps or masses. These lesions may be non-neoplastic or neoplastic and are often very difficult to differentiate clinically. This lack of distinction can lead to misdiagnosis and delayed treatment. Hence, accurate recognition and differentiation are essential for proper management and to reduce the patient's emotional burden.

In the study, a total of 967 specimens were found in the external nose, nasal cavity, paranasal sinus naxopharynx region, out of which 558 (57.7%) cases were non-neoplastic, 223 (23.1%) cases benign and 186 (19.2%) cases were malignant [Table/Fig-1]. In the present study, the age range of the patients varied from six months to 85 years. The majority of the patients were in the adolescents age group of 11-20 years 246 (25.43%), followed by 21-30 years 161(16.64%) which was consistent with studies done by Mysorekar VV et al., 11-20 years 41 (28.27%), 21-30 years 27(18.62%), Banerjee A et al., 11-20 years 30 (20.13%), 21-30 years 25 (16.77%) and Parmar NJ et al., 11-20 years 24 (24.00%), 21-30 years 20 (20.00%) [7-9].

A male predominance was observed in the present study with an overall male to female ratio of 2.4:1 which is closer to study done by Singh SG et al., [10] (1.08:1) Defale SR et al., [11], Banerjee A et al., [8] (1.08:1) & higher than study of Mysorekar VV [7] and Dinesh Singh T et al., [12] 1.03:1 and 1.42:1, respectively. In the present study, among the non-neoplastic lesions (558), Inflammatory polyp was the most common lesion, comprising 337 (60.4%) cases, followed by chronic non-specific inflammatory lesions (172), 30.82% and fungal infection 12 (2.15%). The commonest age of presentation of polyps was the 2nd and 3rd decades, with male preponderance. Rare lesions were tuberculosis (3), cysticercosis (1), osteomyelitis

Study, Author and Year	Total no. of cases	Inflammatory polyup	Fungal infection (Mucormycosis)	Tuberculosis	Rhino-sporiodosis	Rhino-scleroma	Other /remaining cases
Parmar NJ et al., [9] (2018)	80	74 (92.50%)	03 (3.75%)	02 (2.5%)	0 (0.0%)	0 (0.0%)	1 (1.25%)
Banerjee A et al., [8] (2017)	93	87 (93.55%)	0	0	5 (5.38%)	0 (0.0%)	1(1.07%)
Kulkarni AM et al., [13] (2012)	101	70 (69.30%)	1 (0.99%)	0	14 (13.86%)	16 (15.84%)	-
Khan N et al., [4] (2006)	144	120 (83.33%)	5 (3.47%)	6 (4.17%)	0 (0.0%)	8 (5.55%)	5 (3.47%)
Agarwal P et al., [14] (2017)	81	20 (24.7%)	8 (9.9%)	0 (0.0%)	17 (20.9%)	5 (6.2%)	31 (38.27%)
Present study	558	337 (60.4%)	12 (2.2%)	3 (0.5%)	4 (0.7%)	2 (0.4%)	200 (35.8%)

[Table/Fig-14]: Comparison of types of non-neoplastic lesions in the present study with other studies [4,8,9,13,14].

Study, Author, Year	Total no. of cases	Angiofibroma	Capillary haemangioma	Inverted papilloma	Pleomorphic adenoma	Other/remaining cases
Khan N et al., [4] (2006)	56	24 (42.85%)	11 (19.6%)	15 (26.78%)	4 (7.14)	2 (3.57%)
Kulkarni AM et al., [13] (2012)	13	4 (30.76%)	5 (38.46%)	2 (15.38%)	0 (0.0%)	2 (15.38)
Banerjee A et al., [8] (2017)	42	6 (14.29%)	24 (57.14%)	7 (16.67%)	1 (2.38%)	5 (11.90%)
Agarwal P et al., [14] (2017)	39	3 (7.7%)	17 (43.6%)	12 (30.7%)	0 (0.0%)	7 (17.94%)
Present study	223	103 (46.2%)	39 (17.5%)	31 (13.09%)	1 (1.4%)	49 (21.97%)

[Table/Fig-15]: Comparison of types of neoplastic (benign) lesions in the present study with other studies [4,8,13,14].

(1), atrophic rhinitis (1) and rhinophyma (1), and these can be differentiated only on histopathological examination. Findings are similar to other studies [Table/Fig-14] [4,8,9,13,14]. The variation in the percentage of inflammatory disease in different studies might be due to geographic variation, population density, socioeconomic status and hygienic culture among different populations.

Among the total 223 benign cases, the most common lesion was angiofibroma 103 (46.2%) followed by capillary haemangioma 39 (17.5%), and inverted papilloma 31 (13.9%), which was very similar to studies done by Khan N et al., Banerjee A et al., and Kulkarni AM et al., as given in [Table/Fig-15] [4,8,13,14].

Angiofibroma most originated from the nasal cavity 56 (54.36%) and nasopharynx 47 (45.63%), and was found exclusively in males 101 (98%). Capillary haemangioma was mostly seen in the nasal cavity, 34/39 (87.17%). It was equally found in males and females. Bony lesions were more common in the nasal cavity 14 (50%) and paranasal sinuses 12 (85.71%), and it is two times higher in males. It was seen in early Ist decade and 2nd peak in 3rd and 4th decades. The most common bony lesions were ossifying fibroma, fibrous dysplasia, central giant cell granuloma and osteoma. Inverted papilloma was mostly found in the nasal cavity 31, 100%), which is 5.2 times higher in males, and most commonly in the 5th and 6th decades of life. Rare cases found in our study were schwannoma (4), pleomorphic adenoma (1) and naso encephalocele (1). These entities were also reported in other studies like Dafale SR et al., [11], Chopra H et al., [15] and Mysorker VV et al., [7].

In present study, out of total 186 cases of malignant lesions, 67 (36.02%) cases of SCC and 49 (26.3%) of nasopharyngeal carcinoma which were very close to the findings of Khan N et al., [4]. In present study, there was 25 (13.44%) case of NHL found which was similar to the result of study done by Parmar NJ et al., [9]. In the present study, adenoid cystic carcinoma was 17 (9.1%) and basal cell carcinoma was 9 (4.8%) similar to the study of Banerjee A et al., [Table/Fig-16] [4,8,9,13].

Squamous cell carcinoma was most commonly found in the nasal cavity 54, 80.6%) and presented in the 5th and 6th decades, with male predominance (4.6 times). Nasopharyngeal carcinoma was mainly observed in the nasal cavity 32, (65.30%) and nasopharynx 16 (32.65%). This was common in the 2nd to 4th decades of life, and male predominance was noticed (4.4 times). Adenoid cystic carcinoma was also found commonly in the nasal cavity in the 4th and 5th decades. No sex predilection was noticed. BCC was most common at the external nose and was found equally in males and females. Adenocarcinoma was also common in the nasal cavity, and it showed an increasing trend after the 5th decade with male predominance [Table/Fig-10]. But different findings are noted by Garg D et al., who found one case each of plasmacytoma, hemangiopericytoma, PNET and olifactory neuroblastoma [16].

In the literature few authors had described the distribution of sinonasal lesion according to the site of origin. Parmar NJ et al., found that out of 100 cases and maximum cases were arising from nasal cavity (84) followed by paranasal sinuses (08) external nose (06) and least in nasal septum (02) [9]. These findings were similar to our study also. In the present study, the most common site was nasal cavity (767), followed by nasopharynx (87) and paranasal sinus (65) and least common at external nose (48) [Table/Fig-1].

We concluded that inflammatory and benign lesions were common in younger age group (2nd and 3rd decade), while malignant lesions are increasing with advanced age. Nasal cavity was the most predicted site and male predominance was noticed in most of the sinonasal lesions.

Limitation(s)

The present study is a tertiary care centre-based study, and most cases received were of referral and difficult types, which could not be treated at the primary level due to a lack of advanced facilities. So, the present study cannot represent the actual incidence of lesions in the population. There may be possibilities of enhanced detection of malignant, difficult, or rare lesions. In future, this type of study can be done in collaboration with their primary health care centers to find out the actual data in our population.

Study, Author and Year	Total no. of cases	Squamous cell carcinoma	Naso-pharyngeal carcinoma	Non-Hodgkin's lymphoma	Adenoid cystic carcinoma	Basal cell carcinoma	
Khan N et al., [4] (2006)	40	15 (37.5%)	10 (25.0%)	2 (5.0%)	2 (5.0%)	0 (0.0%)	11 (27.5%)
Banerjee A et al., [8] (2017)	14	2 (14.29%)	0 (0.0%)	0 (0.0%)	1 (7.14%)	1 (7.14%)	10 (71.42%
Parmar NJ et al., [9] (2018)	7	2 (28.57%)	0 (0.0%)	1 (14.29%)	0 (0.0%)	03 (42.86%)	1 (14.28%)
Kulkarni AM et al., [13] (2012)	3	2 (66.6%)	0 (0.0%)	0 (0.0%)	1 (33.33%)	0 (0.0%)	-
Present study	186	67 (36.00%)	49 (26.30%)	25 (13.44%)	17 (9.13%)	9 (4.84%)	19 (10.21%

[Table/Fig-16]: Comparison of types of neoplastic (malignant) lesions in the present study with other studies [4,8,9,13].

CONCLUSION(S)

The present study found that there were different varieties of histopathological lesions ranging from simple inflammatory lesions to aggressive malignant lesions, which can present as similar symptoms and mass lesions at nasal cavity, paranasal sinuses, and nasopharynx. It is very difficult to differentiate these lesions based on clinical and radiological parameters. Hence, histopathological examination is essential to categorise these lesions for the appropriate management of patients.

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