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Histopathological Study of Lesions of Sino-Nasal Tract and Nasopharynx

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Abstract: ***Background: Nose is the most prominent part of the face with substantial aesthetic and functional significance. It is one of the few organs of body invested with an aura of emotional and cultural importance. Paranasal sinuses are the air-containing cavities in the skull. Nasopharynx is the uppermost part of the pharynx which lies behind the nasal cavities and acts as a conduit for air and is important during swallowing, vomiting, gagging and speech. A variety of non-neoplastic and neoplastic conditions involving the nasal cavity, paranasal sinuses and nasopharynx, are common in clinical practice and their incidence increased with COVID-19 pandemic. Head and neck neoplasia (HNN) is a major form of neoplasia in India, accounting for 23% of all cancers in males and 6% in females. Tobacco and alcohol play an important role in the pathogenesis of HNN. The five-year survival varies from 20–90% depending upon the sub-site of origin and the clinical extent of disease. India has the dubious distinction of having the world's highest reported incidence of HNN in women. (1) Trends and tradition of a clinical entity change from time to time. Till date an analysis of the sino-nasal masses in India population has been lacking. In order to understand this entity better the present study, histopathological study of lesions of sino-nasal tract and nasopharynx was undertaken. Aim: To study the incidence and the histopathological spectrum of various non-neoplastic and neoplastic lesions encountered in the sino-nasal tract and nasopharynx. Materials and Methods: Type of Study: In this Retrospective study a total of 88 Specimens of sino-nasal tract and nasopharynx sent for histopathological examination to Department of Pathology Santhiram medical college and general hospital were considered in the two year study period (December 2018 – November 2020). All infectious, inflammatory, allergic and neoplastic lesions of sino-nasal tract and nasopharynx were included in the study. The lesions from areas other than sino-nasal tract and nasopharynx and other inadequate biopsy specimens were excluded. Results: The mean age of non-neoplastic lesions was 29.43 years. Most of the lesions showed a male preponderance with overall male: female ratio of 1.7:1. Sino-nasal polyps were the most common non-neoplastic lesions. Mean age of benign was 29.68 years with a male: female ratio of 2:8:1. Hemangioma was the most common benign. All the malignant neoplasms were reported in 5th, 6th, and 7th decades. Mean age s was 62.08 years and lesions were predominant in male sex with overall male: female ratio of 5. Squamous cell carcinoma was the most common malignant lesion followed by nasopharyngeal carcinoma, basal cell carcinoma, adenocarcinoma and undifferentiated carcinoma respectively. Conclusion: Definitive diagnosis requires histopathological examination, as most lesions are either inaccessible for fine needle aspiration cytology. The histologic type and grade of the tumor is representative of the biological behaviour, chemosenstivity and radiosensitivity of the mass and hence has an impeccable impact on its management. Therefore it is important that all lesions should be submitted for histopathological examination. The present study helps to know the prevalence and the distribution of the polypoidal lesions in the nasal cavity and it emphasises that subjecting nasal polyps to histopathological examination remains the mainstay of final definitive diagnosis.***

Keywords: Sino-nasal tract, Nasopharynx, Histopathological study, Non-neoplastic and Neoplastic

1. Introduction

A variety of non-neoplastic and neoplastic conditions involving the nasal cavity, paranasal sinuses and nasopharynx, have inflicted mankind from time immemorial and are often encountered in clinical practice these days. The nasal cavity and paranasal sinuses including the maxillary, ethmoid, sphenoid and frontal sinuses are collectively referred to as the sino-nasal tract.(2) The sino-nasal tract and the nasopharynx can be represented as a single functional unit which is lined by stratified squamous, respiratory type, pseudo-stratified columnar, and transitional epithelium and comprising of a wide variety of glandular, lymphoid, connective tissue and bony elements.(3) These structures frequently encounter allergens, air pollution, smoking, industrial carcinogens, viruses (HPV and EBV), and occupational exposure to heavy metal particles (such as nickel and chromium), that are potentially infectious, allergic or carcinogenic and predispose the development of malignancies. Hence, it is not surprising that sino-nasal tract and nasopharynx is the site of origin of some of the more complex histologically diverse group of tumors of the entire human body. Patients with sino-nasal tumors present with vague complaints like nasal obstruction, nasal congestion associated with discharge, headache, swelling and facial pain. These symptoms often masquerade as chronic inflammatory condition. Clinically it becomes quite impossible to distinguish between inflammatory conditions presenting as simple polyps and benign polypoidal neoplasms with a resultant delay of diagnosis. The clinical and radiological features of masses of sino-nasal tract and the nasopharynx are overlapping and often only a provisional diagnosis is possible. Hence, definite diagnosis requires histopathological examination as most of the lesions are inaccessible.

Need for Study

- The clinical and radiological features of masses of sino-nasal tract and the nasopharynx are overlapping and often only a provisional diagnosis may be possible. [3] Hence, definite diagnosis requires histopathological examination as most of the lesions are inaccessible for fine needle aspiration. Also FNAC is not recommended because of fear of hemorrhage. [4]
- Tondon et al [5] and Dasgupta et al [6] devoted considerable effort in the study of sino-nasal masses in the Indian population. However, to date a histopathological analysis of the sino-nasal masses in India population has been lacking. There is also a recent surge of diseases related to sino-nasal region in the post covid patients. In order to understand this entity better the present study was undertaken.

Aim:

- To study the incidence and the histopathological spectrum of various non-neoplastic and neoplastic lesions encountered in the sino-nasal tract and nasopharynx.

Objectives:

1) To study the incidence of inflammatory, benign and malignant lesions of sino-nasal tract and nasopharynx.
2) To study the age and sex distribution of various lesions of sino-nasal tract and nasopharynx.
3) To differentiate infectious and neoplastic lesions of sino-nasal tract and nasopharynx based on their histopathological aspects and compare with other similar studies.

2. Material and Methods

Type of study: Retrospective study

Study location: This is a tertiary care teaching hospital based study done in Department of pathology, at Santhiram medical college and general hospital.

Study duration: December 2018 – November 2020. (Two years study)

Sample size: A total of 88 Specimens of sino-nasal tract and nasopharynx were sent for histopathological examination to Department of Pathology during the study period

Methods of data collection: Relevant clinical data was collected from patients through questionnaire, requisition forms and case sheets. All biopsies in the area of sino-nasal tract and nasopharynx received at the Department of Pathology were subjected to histopathological examination. These cases were classified into neoplastic and non-neoplastic lesions. The neoplastic lesions were further classified according to WHO classification 2004. The specimens were measured, weighed at the time of grossing and after recording the external and cut section findings, bits were given from representative areas. In small biopsies total material was processed. Sections were processed stepwise and embedded in paraffin. Haematoxylin and Eosin staining was done for all cases. Special stains and Immunohistochemistry were done wherever needed, particularly in grey zone diagnoses.

Sampling criteria (Inclusion criteria):

- All the cases irrespective of age and sex who presented to the Department of Otorhinolaryngology with various upper respiratory tract symptoms and subjected to biopsies were included in the study.
- All infectious, inflammatory, allergic and neoplastic lesions in the area of sino-nasal tract and nasopharynx were biopsied and sent for histopathological examination to the Department of Pathology, Santhiram Medical College, Nandyal were included in the study.

Sampling criteria (Exclusion criteria):

- Lesions from areas other than sino-nasal tract and nasopharynx.
- Inadequate biopsy specimens.

3. Observations and Results

The present study was conducted from December 2018 to November 2020 in the Department of Pathology, Santhiram Medical College, Nandyal. Out of 256 biopsies received from Otorhinolaryngology department, 88 were from sino-nasal tract and nasopharynx accounting for 34.4% of ENT biopsies and 1.9% of the biopsies received from other departments, of which 18 cases presented with bilateral involvement, while remaining 62 cases showed unilateral involvement. In the present study, the symptoms associated with lesions of sino-nasal tract and nasopharynx was observed in the following order of frequency.

Table 1: Clinical presentation in all lesions of sino-nasal tract and nasopharynx

S.no	Clinical features	Number of cases	Percentage
1	Nasal obstruction	82	93.18%
2	Rhinorrhoea	46	52.27%
3	Hyposmia	27	30.68%
4	Headache	14	15.91%
5	Intermittent epistaxis	11	12.5%
6	Facial swelling	9	10.23%
7	Eye-related symptoms	5	5.68%

In the present study biopsies were taken from patients of age ranging from 6 year old male child to 72 year old male. Maximum numbers of cases were observed in the age group of 21-30 years (23.86%), followed by other age groups. The mean age of all the lesions in the study was 33.94 years.

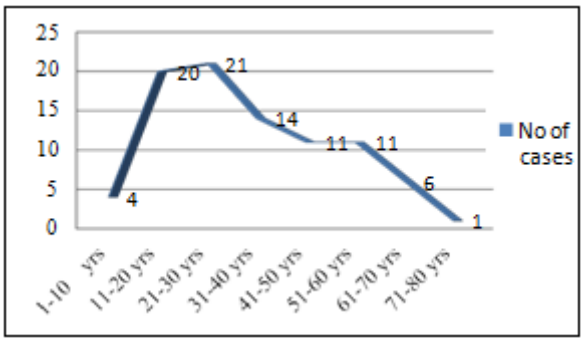

Figure 1: Age distribution of lesions of sino-nasal tract and

nasopharynx

In the present study among the 88 biopsies, majority of cases (60 cases) were seen in males constituting 68.2% when compared to females (28 cases) who showed a percentage of 31.8%.

Table 2: Sex distribution of lesions of sino-nasal tract and nasopharynx

Sex	Number of cases	Percentage
Male	60	68.2%
Female	28	31.8%
Total	88	100%

Out of 88 biopsies of sino-nasal tract and nasopharynx, 57 cases were diagnosed as non-neoplastic and constituted 64.73%, while the remaining 31 neoplastic cases constituted 35.27%. Among the 31 neoplastic cases in the present study, 19 cases were diagnosed as benign neoplasms (21.61% of all the lesions) and remaining 12 cases as malignant neoplasms (3.66% of the total lesions).

Table 3: Distribution of all lesions of sino-nasal tract and nasopharynx

S. No.	Diagnosis	Number of cases	Percentage
1	Non-neoplastic	57	64.73%
2	Neoplastic-Benign	19	21.61%
3	Neoplastic-Malignant	12	13.66%
	Total	88	100%

In the present study out of 57 non-neoplastic lesions, sino-nasal polyps were the most common non- neoplastic lesions with 39 cases (68.42%), followed by 7 cases of Rhinosporidiosis, 4 cases of Fungal infections, 2 cases each of Tuberculous granuloma, Foreign body granuloma and nonspecific inflammation and 1 case of Rhinoscleroma.

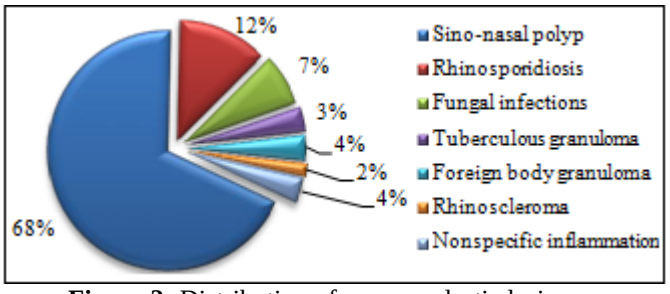

Figure 2: Distribution of non-neoplastic lesions

In the present study, age distribution of all 57 non-neoplastic lesions was from 6 years to 63 years. There was clustering of cases between 11-30 years, with maximum cases seen in 2nd decade (17cases). Mean age of non- neoplastic lesions was 29.43 years.

Table 4: Age distribution of non-neoplastic lesions

S.no.	Diagnosis	1-10	11-20	21-30	31-40	41-50	51-60	61-70
1	Sino-nasal polyp	1	17	11	4	4	2	-
2	Rhinosporidiosis	-	-	-	2	2	2	1
3	Fungal infections	-	-	1	2	1	-	-
4	Tuberculous granuloma	-	-	-	-	1	1	-
5	Foreign body granuloma	2	-	-	-	-	-	-
6	Rhinoscleroma	-	-	1	-	-	-	-
7	Nonspecific inflammation	-	-	1	1	-	-	-
	Total	3	17	14	9	8	5	1

In the present study out of 57 non-neoplastic lesions reported, 36 cases were seen in males (62.5%) and 21 cases were seen in females (37.5%). Most of the lesions showed male preponderance with overall male: female ratio of 1.7:1.

Table 5: Sex distribution of non-neoplastic lesions

S. no.	Diagnosis	Male	Female	No of cases	Ratio
1	Sino-nasal polyp	25	14	39	1.8:1
2	Rhinosporidiosis	4	3	7	1.3:1
3	Fungal infections	2	2	4	1:1
4	Tuberculous granuloma	1	1	2	1:1
5	Foreign body granuloma	2	-	2	-
6	Rhinoscleroma	1	-	1	-
7	Nonspecific inflammation	1	1	2	1:1
	Total	36	21	57	1.7:1

In the present study out of 19 benign lesions reported, Hemangioma was most common benign lesion accounting for 7 cases (36.85%) followed by 4 cases of Squamous papilloma (21.04%), 3 cases of Inverted papilloma (15.76%), 2 cases each of Angiofibroma and Benign adnexal tumours (10.54%). Pleomorphic adenoma accounted for a case.

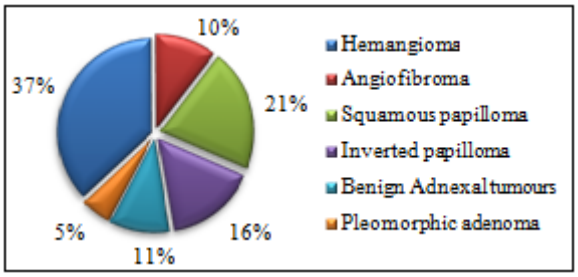

Figure 3: Distribution of benign neoplasms.

In the present study, the age distribution of all 19 benign neoplasms was from 7 years to 49 years. There was clustering of cases between 11-30 years, with maximum cases seen in 21-30 years (7 cases). Mean age of benign neoplasms was 29.68 years.

Table 6: Age distribution of benign neoplasms

S.no.	Diagnosis	1-10	11-20	21-30	31-40	41-50	51-60	61-70
1	Hemangioma	1	2	3	-	1	-	-
2	Angiofibroma	-	1	1	-	-	-	-
3	Squamous papilloma	-	-	2	1	1	-	-
4	Inverted papilloma	-	-	-	2	1	-	-
5	Benign adnexal tumours	-	-	1	1	-	-	-
6	Pleomorphic adenoma	-	-	-	1	-	-	-
	Total	1	3	7	5	3	-	-

In the present study out of 19 cases of benign neoplasms, 14 cases were seen in males and 5 cases were seen in females. Most of the lesions showed a male preponderance with over all male: female ratio of 2:8:1.

Table 7: Sex distribution of benign neoplasms

S. No	Type of Benign neoplasm	Male	Female	Total	Ratio
1	Hemangioma	5	2	7	2.5:1
2	Angiofibroma	2	-	2	-
3	Squamous papilloma	3	1	4	3:1
4	Inverted papilloma	2	1	3	2:1
5	Benign adnexal tumours	1	1	2	1:1
6	Pleomorphic adenoma	1	-	1	-
	Total	14	5	19	2.8:1

In the present study out of 12 malignant lesions, Squamous cell carcinoma was the most common malignant lesion accounting for 5 out of 12 cases. Three cases of nasopharyngeal carcinoma, two cases of Basal cell carcinoma and one case each of Adenocarcinoma and Undifferentiated carcinoma were reported.

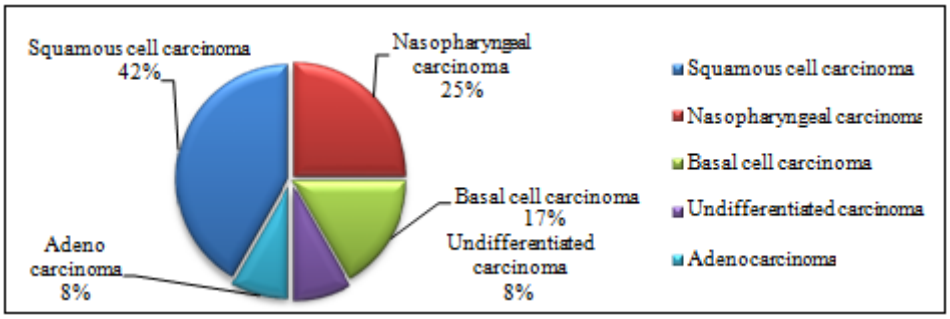

Figure 4: Distribution of malignant neoplasms

In the present study 12 malignant neoplasms were encountered, all of which were reported in the age range of 51-80 years. There was clustering of cases in sixth and seventh decades. Maximum number cases (6 cases) were seen in the age group of 51-60 years. Mean age of malignant lesions was 62.08 years.

Table 8: Age distribution of malignant neoplasms

S.no.	Diagnosis	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
1	Squamous cell carcinoma	-	-	-	-	-	2	2	1
2	Nasopharyngeal carcinoma	-	-	-	-	-	2	1	-
3	Basal cell carcinoma	-	-	-	-	-	1	1	-
4	Adenocarcinoma	-	-	-	-	-	-	1	-
5	Undifferentiated carcinoma	-	-	-	-	-	1	-	-
	Total	-	-	-	-	-	6	5	1

In the present study, out of 12 malignant lesions, 10 lesions were seen in males and 2 were seen in females. The lesions were predominant in male sex with overall male: female ratio of 5:1. Squamous cell carcinoma showed a male preponderance with M: F ratio of 4:1.

Table 9: Sex distribution of malignant neoplasms

S. No.	Diagnosis	Male	Female	Total	Ratio
1	Squamous cell carcinoma	4	1	5	4:1
2	Nasopharyngeal carcinoma	2	1	3	2:1
3	Basal cell carcinoma	2	-	2	-
4	Adenocarcinoma	1	-	1	-
5	Undifferentiated carcinoma	1	-	1	-
	Total	10	2	12	5:1

4. Discussion

The incidence rates of mass in sino-nasal tract and nasopharynx was 34.3 cases per year, non-neoplastic lesions constituted 60% of these cases with incidence of 20.7 cases per year. Carcinomas of the nasal cavity and paranasal sinuses account for 0.2-0.8% of all malignant neoplasms and 3% of those occurring in the head and neck.[7] The incidence of cancer of the nasal cavity and paranasal sinuses (sino-nasal cancer) is low in most populations (< 1.5/100,000 in men and < 1.0/100,000 in women). Higher rates are recorded in Japan and certain parts of China and India. Squamous cell carcinomas are the commonest in India. Basal cell carcinoma (BCC) is the most common non-melanoma skin cancer. [8]

Nasopharyngeal carcinoma (NPC) shows a distinct racial and geographical distribution. While rare in most parts of the world, incidence is considerably higher in native and foreign-born Chinese, South-East Asians, and North Africans. The prevalence of NPC in the population had been grossly estimated to be 1-4%,. Older reports have suggested a prevalence ranging from 0.2 to 2.2 %.[9]

Histopathological examination of sino-nasal and nasopharyngeal masses showed a spectrum of lesions ranging from non-neoplastic ones to neoplastic tumours. The present histopathological study included a total of 88 lesions of which, 57 (64.73%) were non-neoplastic and 31 (35.27%) were neoplastic forming a ratio of non- neoplastic to neoplastic as 1.84:1. The biopsies included patients of all age groups, ranging from a 6 year old male child to a 72 years old male patient. The lesions had a stronger predilection for males (60 cases - 68.2%) as compared to females (28 cases - 31.8%) with M: F ratio of 2.1:1. The explanation for male predominance in the present study can be provided on the basis of outdoor activities, jobs, occupational hazards to which males are exposed more often than females.

Table 10: Comparison of distribution and sex ratio of all lesions of sino-nasal tract and nasopharynx with other studies

Parameter	Dasgupta et al 1997[6]	Mysorekar et al 1999[10]	Zafar et al 2008[11]	Kalpana Kumari et al 2013[12]	Present study
Non-neoplastic (%)	50.7	70.3	58	66	64.7
Neoplastic (%)	49.3	29.7	42	34	35.3
Male : Female ratio	2:1	-	1.7:1	2.4:1	2.1:1

As shown in the distribution of non-neoplastic and neoplastic lesions correlated well with the studies done by Zafar et al[11] and Kalpana Kumari et al. [12] However the sex ratio of lesions in present study better correlated with Dasgupta et al [6] than with Zafar et al[11] and Kalpana Kumari et al. [12]

Presenting complaints: The frequent symptom recorded in the present study was nasal obstruction in 82 cases (93.2%) and nasal discharge in 46 cases (52.3%). Studies conducted by Zafar et al [11] and by Bakari A et al [13] at a Nigerian centre also showed nasal obstruction, nasal discharge and symptoms of nasal stuffiness as the commonest. The other symptoms like total and partial loss of smell, headache due to sinusitis, sneezing, and mucoid or watery discharge were less common presenting features. Site of presentation: In the present study maximum number of lesions was seen arising in nasal cavity (78.5%) followed by paranasal sinuses (12.5%) and nasopharynx (9%). Observations were similar to the study by Shashikala et al[14] where 82% of lesions were in nasal cavity, 12% in paranasal sinuses and 6% nasopharynx.

Non-Neoplastic Lesions:
In the present study more than 50 % (31 out of 57) of non-neoplastic cases were in the 2nd and 3rd decade of life which was comparable to the study conducted by Ghosh and Bhattacharya. [15] Although adolescence or early childhood is stated to be the commonest age of occurrence, there are reports of non-neoplastic lesions occurring in all age groups. There was male preponderance among non-neoplastic lesions with male to female ratio of 1.7:1 which was similar to that observed by Zafar et al, Ghosh and Bhattacharya, and Dasgupta et al.

Sino-nasal polyps: In the present study out of 57 non-neoplastic lesions, sino-nasal polyp was the most common lesion constituting 39 cases. The incidence of nasal polyps among all the non-neoplastic lesions in the present study was 68.42%. Among the 39 sino-nasal polyps 32 were reported as inflammatory polyps and remaining 7 were reported as allergic polyps.

Table 11: Comparison of incidence of sino-nasal polyps with other studies

Parameter	Tondon et al 1971[5]	Dasgupta et al 1997[6]	Kulkarni et al 2012[17]	Modh et al 2013[16]	Present study
Inflammatory polyp	-	20.5%	55.7%	70.5%	56.1%
Allergic polyp	-	42.3%	13.6%	13.1%	12.3%
Sino-nasal polyps (total)	64%	62.8%	69.3%	83.6%	68.4%

On observation lower incidence of nasal polyps was reported by Tondon et al i.e. 64%. The incidence of nasal polyps was slightly higher in the present study (68.4%) similar to the observations made by Kulkarni et al [17] (69.3%). Zafar et al and Modh et al [16]. Among all the sino-nasal polyps in the present study, a higher incidence of inflammatory polyps (56.1%) compared to allergic polyps was noted similar to Modh et al (70.5%) and Kulkarni et al (55.7%).

Table- 12: Comparison of sex ratio of sino-nasal polyps with other studies.

Parameters	Dasgupta et al (1997) [6]	Zafar et al (2008) [11]	Modh et al (2013) [16]	Present study
No of cases	110	119	92	39
Male	64	79	50	25
Female	46	40	42	14
M:F ratio	1.4:1	2:1	1.7:1	1.8:1

In present study out of 39 sino-nasal polyps reported 25 were seen in males and 14 in females with a M: F ratio of 1.8:1. The sex ratio in the present study is very much similar to that of study by Modh et al[16] and also correlated well with Dasgupta et al, [8] Zafar et al. [11] In the present study, sino-nasal polyps (17 cases) were common in the age group of 11–20 years constituting 43.58% followed by 11 cases (28.20%) in age group of 21- 30 years. Age incidence of sino-nasal polyps in the present study had been compared to other similar studies by Majumdar et al, [18] Busuttil et al, [19] Dandapath et al[20] and Kalpana Kumari et al. [12]

Table 13: Age distribution of sino-nasal polyps in comparison to other studies

Age Group	Majumdar et al (1982) [18]	Busuttil et al (1992) [19]	Dandapath et al (1993) [20]	Kalpana Kumari et al (2013) [12]	Present study
1-10	-	-	4 (3.54%)	4 (9.09%)	1 (2.57%)
11-20	2 (1.74%)	-	36 (31.86%)	8 (18.18%)	17 (43.59%)
21-30	8 (6.96%)	16 (21.62%)	44 (38.94%)	10 (22.73%)	11 (28.21%)
31-40	13 (11.31%)	19 (25.67%)	13 (11.51%)	4 (9.09%)	4 (10.25%)
41-50	27 (23.47%)	19 (25.67%)	9 (7.96%)	7 (15.91%)	4 (10.25%)
51-60	34 (29.56%)	6 (8.11%)	7 (6.19%)	6 (13.64%)	2 (5.13%)
61-70	23 (20%)	6 (8.11%)	-	5 (11.36%)	-
71-80	8 (6.96%)	8 (10.82%)	-	-	-
Total	115	74	113	44	39

In the present study the incidence of nasal polyps was common in 2nd and 3rd decades and correlated well with the study of Dandapath et al [20] and Kalpana kumari et al [12] where 70.8% of cases and 40.9% of the cases presented in 2nd and 3rd decades respectively. In a study by Majumdar, [18] commonest age group affected was from 5th to 7th decades. In the study by Busuttil et al, [19] maximum patients were seen in 4th and 5th decades. Both studies differed with the present study. Friedman et al mentioned histopathologists often face difficulty in subgrouping the nasal polyp as allergic and non-allergic or as inflammatory polyp and allergic polyp.[21] Mygind classified polyps into two groups, those containing large number of eosinophils and those containing large number of neutrophils. [22] The present study, (82% of all sino-nasal polyps reported as inflammatory polyps) correlated well with the studies of Modh et al, Dandapath et al, and Drake Lee(23) in the aspects of incidence of inflammatory and allergic polyps. The commonest site of involvement of nasal polyps in the present study was ethmoidal sinus whereas maxillary sinus, turbinates and posterior nasal cavity were also involved less frequently in the same order mentioned. With regard to site of presentation, similar site involvement has been reported in majority of the studies by various authors like Friedmann and Osborn (1976), [21] Shifu and Perzin (1997), [24] Ozcan et al (2005), [25] and Larsen and Tos (2004) [26]. Microscopically, the sino-nasal polyps were composed of loose mucoid stroma and mucus secreting glands which were covered by respiratory epithelium (ciliated columnar epithelium). The epithelium in some cases showed areas of squamous metaplasia. Some polyps showed presence of cystic areas filled with eosinophilic secretions. The stroma was infiltrated by lymphocytes, plasma cells, neutrophils, and eosinophils. Sometimes necrosis was seen indicating infarction. The basement membrane underlying the surface mucosa was markedly thickened in most, but not in all inflammatory polyps.

Rhinosporidiosis: In the present study, rhinosporidiosis was reported as the second most common non-neoplastic lesion after sino-nasal polyps (12.28%) with predominant incidence in 4th and 5th decades. In a study by Tondon et al, [5] rhinosporidiosis constituted 66.7% (24 cases) of all infectious polypoidal lesions, males were predominantly affected than females and maximum incidence was seen in 3rd decade of life. According to Iqbal MS et al also, males were commonly affected. [27] Various parameters in the present study were compared with studies done by Dasgupta et al, Modh et al and Kalpana Kumari et al.)

Table 14: Comparison of sex ratio and age at presentation of rhinosporidiosis with other studies

Parameters	Dasgupta et al (1997)	Modh et al (2013)	Kalpana et al (2013)	Present study
No of cases	55	2	2	7
Male	43	1	2	4
Female	12	1	0	3
M:F ratio	3.6:1	1:1	-	1.3:1
Age at	4th	-	2nd	4th &5th

In study by Dasgupta et al, rhinosporidiosis was reported in 55 cases (31.4%), ranging from first to seventh decade, with males (43 cases) more commonly affected than females (12 cases). However, Modh et al and Kalpana Kumari et al reported very less number of cases (2 cases each) of rhinosporidiosis in their studies. The present study when compared to the study by Dasgupta et al showed similarity in age at presentation. On contrary, sex incidence in the present study showed only a slight male preponderance (4 cases in males to that of 3 in females) compared to study by Dasgupta et al. Microscopically these lesions were lined by ciliated columnar to transitional epithelium with areas of squamous metaplasia. Sporangia in various stages of development containing endospores were seen as many cystic spaces with thick walls filled with numerous eosiniophilic granules.

Tuberculosis: In the present study two patients with tuberculous granulomatous lesions (3.51%) presented in 4th and 5th decade of their life. Male to female ratio was one with a case each in males and females. The presenting features were loss of appetite, low grade fever, weight loss, and cervical lymphadenopathy. Cough and rhinorrhoea were present in both the patients. Microscopically, the granulomas were well to poorly formed, non-necrotic and some with caseous necrosis. They were composed of langhan's giant cells, epitheliod cells, and lymphocytes arranged in follicular pattern. Zafar et al reported 6 cases (4.14%) in their study which included 4 males and 2 females with predominant incidence in male. The presentation was in 4th and 5th decades similar to the present study.

Fungal infections: In the present study the 4 patients (7.02%) with fungal infections were identified in 3rd to 5th decades of life with equal incidence in both males and females. 2 out of 4 cases were mucormycois which probably occurred due to steroid usage since both the patients recovered from covid -19 infection recently. They presented with foul smelling nasal discharge. Few parameters in the present study were compared with studies by Zafar et al, Modh et al and Kalpana Kumari et al.

Table 15: Comparison of sex ratio and age at presentation of fungal infections with other studies

Parameters	Zafar et al (2008) [11]	Modh et al (2013)[16]	Kalpana et al (2013)	Present study
No of cases	5	7	4	4
Male	3	4	3	2
Female	2	3	1	2
M:F ratio	1.5:1	1.3:1	3:1	1:1
Age at presentation	3rd -4th	3rd -4th	3rd	4th

All the studies compared with the present study showed a male predominance. In the study by Kalpana Kumari et al[12] M:F ratio was highest, and in the study by Modh et al it was 1.3:1 which correlated with the present study. Similar results were published in study by Ghosh and Bhattacharya.[15] The present study showed that cases were common in 4th decade similar to studies by Zafar et al Modh et al and Kalpana Kumari et al. In the present study Diabetes mellitus and COVID-19 infection were the commonest predisposing conditions and mucor mycosis as the commonest etiologic agent. Post covid status was found to be associated with fungal infection in 2 out of 4 cases (50%). Also there were recent surge in post covid fungal infections in our hospital after the study period was over which could not be included.

Rhinoscleroma: In the present study only 1 case of rhinoscleroma was observed in a 23 year old male which clinically resembled nasal polyp. Microscopically chronic inflammatory cell infiltrate with lymphocytes and plasma cells were seen. Plenty of Mikulicz cells (foamy macrophages with bacilli) and Russell bodies (inclusion bodies in plasma cells) were also seen. **Foreign body granuloma:** These were mostly seen in children. Pieces of paper, chalk, pledges of cotton or swabs may be accidentally left in the nose that elicits inflammatory reaction. The children presented with unilateral, foul-smelling nasal discharge. On examination, a grey brown or greenish- black mass with irregular surface and hard feel was seen in the nasal cavity between the septum and turbinate. Two such cases were reported in the present study. **Nonspecific inflammation:** In the present study. two cases of nonspecific inflammation were reported which showed histological characters that didn't fit into any diagnostic criteria. This was probably because non-representative biopsy or inadequate material.

Neoplastic Lesions:

In the present study out of 31 neoplastic lesions 19 were benign (61.29%) which were dominant over 12 malignant lesions (38.71%), forming a ratio of benign to malignant of 1.6:1. Tondon et al[5] observed 74.6% of benign lesions as compared to malignant lesions(25.4%). Modh et al[16] also observed that benign lesions (69.23%) predominated over malignant lesions (30.77%) in their study.

Table 16: Comparison of incidence of benign and malignant lesions with other studies

Neoplastic lesions	Tondon et al[5]	Modh et al[16]	Present study
Benign	74.62%	69.23%	61.29%
Malignant	25.38%	30.77%	38.71%
Total	100%	100%	100%

Benign Neoplastic Lesions: The peak incidence of benign neoplastic lesions was in 3rd decade (36.84%) followed by 4th decade (26.32%). Ghosh and Bhattacharya observed the peak incidence in 3rd decade that correlated well with the present study. **Hemangioma:** In the present study 7 cases (36.85%) of hemangiomas were reported out of all 19 benign neoplasms and were the most common benign neoplastic lesions. All the 7 were capillary hemangiomas and no cavernous type was encountered. The age of the cases ranged from 5-50 years. However, predominant occurrence was in 2nd and 3rd decades. Five cases of capillary hemangiomas were reported in male sex and two in female sex, with a male: female ratio of 2.5:1. Hemangiomas were common in fifth decade and there is no sex difference according to Friedmann.[21]

Table 17: Comparison of sex ratio and age at presentation of hemangiomas with other studies

Parameters	Dasgupta et al (1997) [6]	Modh et al (2013)[16]	Kalpana et al (2013) [12]	Present study
No of cases	59	7	1	7
Male	39	3	1	5
Female	20	4	0	2
M:F ratio	2:1	1:1.3		2.5:1
Age at presentation	4th	3rd-4th	4th	2nd -3rd

In a study by Dasgupta et al, hemangioma was the commonest benign lesion with 59 cases (45.7%) with male predominance (2:1). Clinically, they presented as smooth, lobulated, polypoidal red masses. In most cases, the complaint was epistaxis with or without nasal obstruction. The incidence (6.81%) and age at presentation (2nd, 3rd decades) in the present study correlates well with study done by Dasgupta et al, Tondon et al and Modh et al where the incidence of hemangioma was reported as 7%, 5.88% and 4.32% respectively and age at presentation was in 4th decade. Also there was male predominance in all the compared studies similar to the present study. Microscopically all capillary hemangiomas were composed of lobules of proliferating capillaries, lined by plump endothelial cells. **Angiofibroma:** In the present study, 2 cases (10.54%) of angiofibromas were encountered, in a 28 year old and 19 year old, both being males. Presenting complaint was unilateral nasal obstruction and bleeding. The sole occurrence of angiofibroma in male patient was amply supported and reported by Friedmann,[21] shifu and Perzin.[24] In a study by Dasgupta et al, 30 cases (23.2%) of angiofibroma were encountered, with a wide age range (10 – 55 years) and mainly in males (mean age 23.4 years) similar to present study.. Microscopy showed increased vascularity composed of intricate mixture of blood vessels and fibrous stroma. The stroma varied from loose and edematous with stellate fibroblasts and numerous mast cells to acellular and highly collagenized tissue. The vessels ranged from capillary size to venous size.

Sino-nasal papillomas: Papillomas in the nose and nasal sinuses are stated to be commonly occurring benign epithelial neoplasms. They includes squamous papillomas, inverted papillomas and oncocytic papillomas. These benign tumors were received in the present study in the form of multiple polypoidal, firm and white bits with undulant or

papillary surfaces. **Squamous papilloma:** They were exophytic with proliferating squamous epithelium growing outwards. Numerous micro-cysts containing nuclear debris and mucin were present, giving the epithelium a 'moth-eaten' appearance. Stroma was either edematous or fibro-collagenous, with chronic inflammatory cells in some. **Inverted papilloma:** These tumors are often multi-centric, with a marked tendency for aggressive behaviour, recurrence after surgical excision (5 - 20%), and transformation to an epithelial malignancy (5 - 9%), most commonly squamous cell carcinoma. Therefore, it would be of utmost importance to make an accurate pre-operative diagnosis. Most characteristic microscopic features of inverted papilloma were increase in thickness and proliferation of covering epithelium and downward inversion into stroma.

In the present study a total of 7 sino-nasal papillomas (36.83%) were reported among the 19 benign neoplasms. Out of which four cases (21.05%) were of fungiform or squamous papilloma type in the present study. Three papillomas (15.78%) of the inverted type in the present study were characterized by infolding of the metaplastic stratified squamous epithelium with focal areas of ciliated columnar cells. The age range of the three cases of inverted papillomas was from 31-50 years and showed a male predominance with M: F ratio of 2:1. Commonest complaint was unilateral nasal obstruction with epistaxis. Out of 3 cases, 2 cases were on left side, while 1 case presented on right side of nasal cavity.

Table 18: Comparison of incidence rate of sino-nasal papillomas with other studies

S. No	Authors	Percentage of sino-nasal papillomas
1	Ghosh and Bhattacharya [15] (1966)	13.46%
2	Tondon et al[5] (1971)	23.53%
3	Butchanan & Slavin[28] (1972)	20.00%
4	Bjerregaard et al[29] (1992)	16.67%
5	Panchal et al[30] (2007)	34.80%
6	Present study (2016)	36.83%

The incidence rate of sino-nasal papillomas in the present study was 36.83%. Similar incidence rates were found in studies by Panchal et al[30] (34.80%) and Tondon et al (23.53%). Studies by Butchanan & Slavin[28] and Bjerregaard et al[29] showed a lower incidence of papillomas compared to the present study.

Table 19: Comparison of age of presentation of inverted papillomas with other studies

S. No	Study	Age at presentation (decade) of inverted papillomas
1	Thorp et al[31]	5^{th} -7^{th}
2	Dasgupta et al[6]	3^{rd} -6^{th}
3	Ghosh and Bhattacharya[15]	3^{rd}
4	Panchal et al[30]	4^{th}-5^{th}
5	Present study	4^{th} -5^{th}

Tondon et al quoted 8 cases as inverted papilloma among 64 benign lesions (12.5%) with a male preponderance.[7] In his study inverted papillomas occurred most commonly in 5^{th} to 7^{th} decade[96] and a male predominance was noted. In a study by Thorp et al, inverted papillomas occur most commonly in fifth to seventh decade. A male predominance noted with male to female ratio of 2:1. In a study by Dasgupta et al, inverted papilloma was reported in 5 cases (3.9%) and commonly seen in 3^{rd} to 6^{th} decade, with mean age of 45 years and a male predominance with male to female ratio of 4:1.4. Ghosh and Bhattacharya also observed the peak incidence in 3^{rd} decade. Panchal et al observed peak age incidence in 4^{th} and 5^{th} decade. Hence it appears that the age incidence of inverted papilloma is widely variable. The findings of present study correlated well with the studies of Tondon et al, Thorp et al in aspects of incidence and sex ratio. Maximum number of cases occurred in 4^{th} and 5^{th} decade comparable to studies by Panchal et al and Dasgupta et al.

Salivary gland tumours: Minor salivary gland tumors uncommonly arise in nasal cavity and sinuses. If encountered they are usually seen in nasal septum, turbinates or ostial regions. Adenoid cystic carcinoma is the most common malignant tumor followed by mucoepidermoid carcinoma. Pleomorphic adenoma (mixed tumor) is most common benign tumor. One such case of pleomorphic adenoma was reported in the present study.

Malignant Lesions:

The malignant tumours of sino-nasal tract and nasopharynx constitute an important and a varied group. In the present study 12 lesions were reported as malignant (38.71%) among all neoplastic lesions and squamous cell carcinoma (5 cases) was the most common malignancy encountered constituting 41.67% of malignant neoplasms. The following table compares various sites of incidence of malignant neoplasms in studies done by Lewis and Castro,[32] Jackson et al[33] and Hopkin et al[34] with the present study.

Table 20: Comparison of site incidence of malignant neoplasms with other studies

S. No	Site	Lewis and Castro [32] (1972)	Jackson et al [33] (1977)	Hopkin et al [34] (1984)	Present study
1	Ethmoid sinus	10%	13%	19%	8.3%
2	Maxillary sinus	58%	67%	53%	58.4%
3	Nasal cavity	31%	16%	26%	25%
4	Frontal sinus	0.6%	3%	1.2%	-
5	Sphenoid sinus	0.4%	1%	0.9%	-
6	Site not known	-	-	-	8.3%

In the present study the most common site of malignancies was maxillary sinus (58.4%) followed by nasal cavity (25%) which was consistent with the studies done by Lewis and Castro, (58%), Jackson et al (67%) and Hopkin et al (53%).In the present study it was evident that most common malignant lesion was squamous cell carcinoma. Lathi A et al[35] and Svane Knudsen et al[36] have reported squamous cell carcinoma to be the most commonly encountered

malignancy in the sino-nasal tract in India and Denmark respectively.

Table 21: Comparison of incidence of various malignant neoplasms with other studies

S.no	Type of malignancy	Lewis and Castro [32] (1972)	Jackson et al [33] (1977)	Hopkin et al [34] (1984)	Present study
1	Squamous cell carcinoma	496 (64%)	61 (53%)	201 (36%)	5 (42.67%)
2	Transitional cell carcinoma	-	2 (2%)	60 (11%)	-
3	Adenocarcinoma	129 (17%)	7 (6%)	40 (7%)	1 (8.33%)
4	Olfactory neuroblastoma	-	5 (4%)	3 (1%)	-
5	Undifferentiated carcinoma	-	11 (10%)	92 (16%)	1 (8.33%)
6	Adenoid cystic carcinoma	-	8 (7%)	30 (5%)	-
7	Malignant melanoma	34 (4%)	7 (6%)	39(7%)	-
8	Others	113(15%)	14(12%)	95(17%)	5 (42.67%)

The present study thus reported squamous cell carcinoma as the most common malignant lesion similar to other studies. However, there are mixed opinions regarding second most common malignant lesion among various studies which happened to be nasopharyngeal carcinoma in the present study. **Squamous cell carcinoma:** Squamous cell carcinoma constituted 5 out of 12 malignant cases in the present study of which four were males (M: F ratio 4:1). SCC was more common in males with male to female ratio of 2: 1 as documented by Ghosh and Bhattacharya similar to present study. The incidence of squamous cell carcinoma was 36.60%, 48.99% and 72.70% in studies conducted by Panchal et al, Dasgupta et al and Ghosh & Bhattacharya respectively similar to that in present study. Maximum number of cases in the present study was seen in 6th and 7th decade. Microscopically, malignant squamous cells forming sheets and nests with occasional keratin pearls were seen. **Nasopharyngeal carcinoma:** In the present study 3 cases (25%) of Nasopharyngeal carcinoma (NPC) had been reported with an average age of onset of about 56 years. Two cases in males and one in female were noted. Studies based on NPC cases were registered in most of the cancer diagnosis and treatment centres in North-Eastern region of India during 1988–1989 and computed with the population structure of the region indicated that the incidence of NPC is quite high in Nagaland (about 4.3 per 100 000 people/year) and also in some other parts of India. It is very difficult to locate, and random biopsies are needed from fossa of Rosenmullar to obtain specimen. Schmincke type of NPC poses a diagnostic problem due to its microscopic similarity with large cell malignant lymphoma, where nuclear morphology and IHC play important role in distinguishing the two lesions. **Basal cell carcinoma:** Two cases of basal cell carcinoma were reported in the present study both being males in the age group of 51-70 years. It may present as a cyst or papulo-pearly nodule or an ulcer with rolled edges and a very slow growing tumor confined to the skin for a long time. Underlying cartilage or bone may get invaded. The biopsy exhibited an infiltrative proliferation of solid epithelial nests composed of basaloid cells with peripheral palisading. The surface epithelium was eroded. These basaloid cells had a high nuclear/cytoplasmic ratio, hyperchromatic nuclei without conspicuous nucleoli and scant cytoplasm. Mitotic figures were scattered and apoptotic bodies were frequently observed. No keratinization was observed in the tumor cells. **Adenocarcinoma:** Adenocarcinomas of the sino-nasal tract can be broadly classified into the non-salivary and salivary types. One set of such adenocarcinomas arises from the lining epithelium or from the sero-mucinous glands, termed as the 'non-enteric type', while the other set, 'enteric' type is usually secondary to epithelial metaplasia in response to wood dust or other occupational hazards. There was only one adenocarcinoma of the non-enteric type which came across, in the present study. **Sino-nasal undifferentiated carcinoma:** There was one case of sino-nasal undifferentiated carcinoma (SNUC) in the present study. The patient presented with headache, nasal obstruction, and epistaxis. These tumours were composed of pleomorphic cells in sheets and lobules with focal necrosis. The cells possessed scanty cytoplasm, bizarre hyperchromatic or vesicular nuclei and prominent nucleoli. They need to be distinguished from other poorly differentiated Sino-nasal tumours, since they require aggressive therapy that includes a combination of craniofacial resection, chemotherapy and radiotherapy and IHC may be helpful in this aspect.

Non-epithelial tumors like soft-tissue sarcoma, rhabdomyosarcoma, leiomyosarcoma, fibrosarcoma, liposarcoma, angiosarcoma, myxosarcoma, hemangiopericytoma, connective tissue sarcoma, chondrosarcoma, osteosarcoma and synovial sarcoma, lymphoreticular tumors like lymphoma, plasmacytoma, giant cell tumor and metastatic carcinoma which were reported in other studies were not encountered in the present study in the two year study period of the present study.

5. Conclusion

The majority of non-neoplastic cases were in males as compared to females. Maximum number of cases was observed in the 3rd decade. Sino-nasal polyps were the most common non-neoplastic lesions. Hemangioma was the most common benign lesion; maximum number of benign lesions was seen in 3rd decade. Most of the lesions were observed in males. All the malignant neoplasms were reported in 5th, 6th, and 7th decades. The lesions were predominant in male sex and Squamous cell carcinoma was the most common malignant lesion followed by nasopharyngeal carcinoma, basal cell carcinoma, adenocarcinoma and undifferentiated carcinoma respectively. Nasal polyps can result from a wide variety of pathologic entities. Clinically it is impossible to distinguish between these inflammatory polyps, polypoidal lesions & neoplasms of sino-nasal tract and paranasal sinuses. The complex regional anatomy, proximity to vital structures, and delayed presentation following nonspecific symptoms make an accurate diagnosis a mandatory prerequisite for planning effective management.

Definitive diagnosis requires histopathological examination, as most lesions are either inaccessible for fine needle aspiration cytology or is not recommended for fear of haemorrhage. The histologic type and grade of the tumor is representative of the biological behaviour, chemosenstivity and radiosensitivity of the mass and hence has an impeccable impact on its management. Therefore it is important that all lesions should be submitted for histopathological examination. The present study helps to know the prevalence and the distribution of the polypoidal lesions in the nasal cavity and it emphasises that subjecting nasal polyps to histopathological examination remains the mainstay of final definitive diagnosis.

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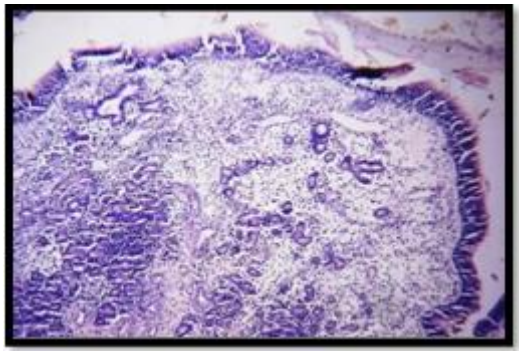

Figure 5: Inflammatory polyp showing edematous stroma with mucus glands and inflammatory infiltrate (H&E; 10x).

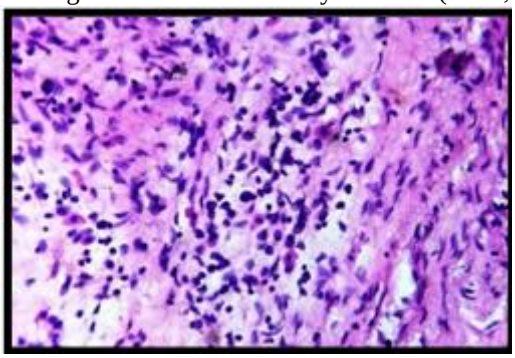

Figure 6: Inflammatory polyp showing lympho-plasmacytic infiltrate (H&E; 100x).

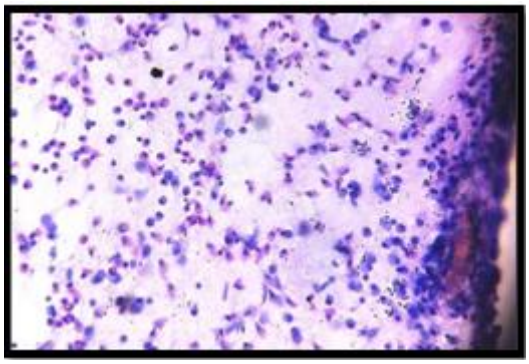

Figure 7: Allergic polyp showing flammatory infiltrate with predominant eosinophilis (H&E; 100x).

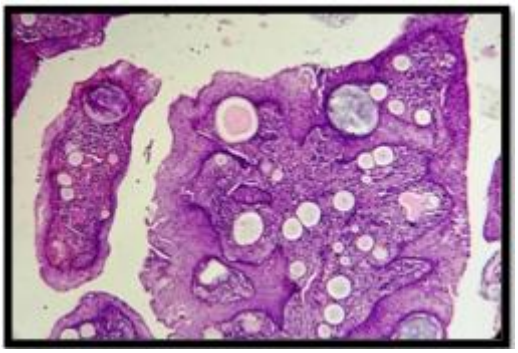

Figure 8: Rhinosporidiosis showing multiple large thick walled sporangia (H&E; 10x).

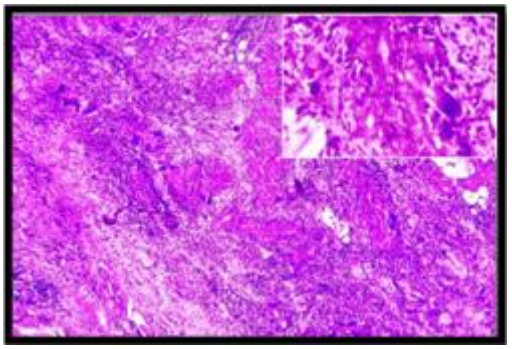

Figure 9: Foreign body granuloma showing non-caseating granulomas with lymphocyte predominant inflammatory infiltrate, inset showing foreign body type of giant cells.

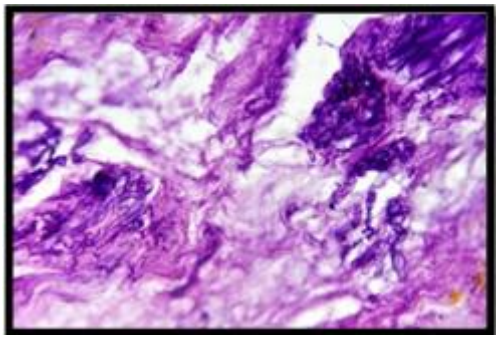

Figure 10: Fungal sinusitis showing broad branching septate hyphae (H&E; 100x).

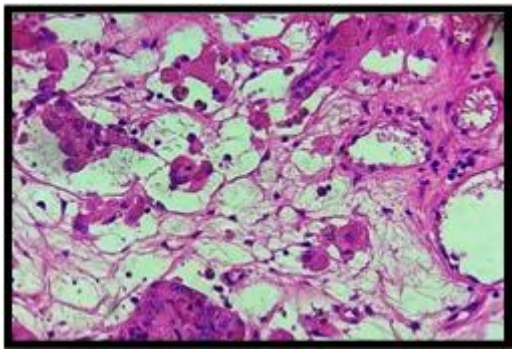

Figure 11: Rhinoscleroma showing Mikulicz cells (foamy macrophages) (H&E; 100x).

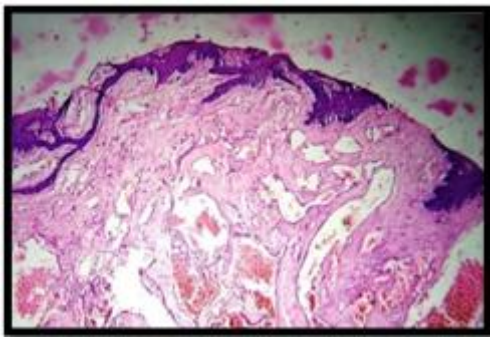

Figure 12: Hemangioma showing dilated vascular spaces lined by plump endothelial cells (H&E; 10x).

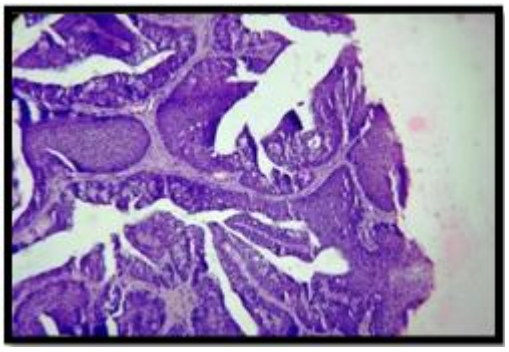

Figure 13: Squamous papilloma showing papillomatosis with thin fibro-vascular core (H&E; 40x).

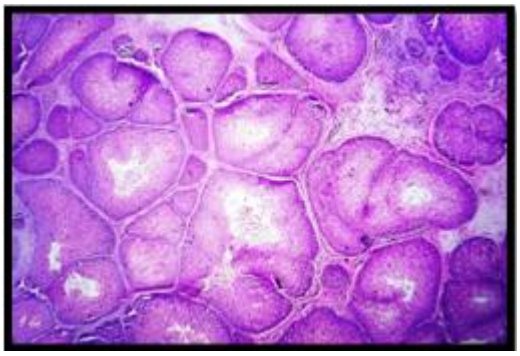

Figure 14: Inverted papilloma showing deeply invaginated nests of benign squamous epithelium (H&E; 10x).

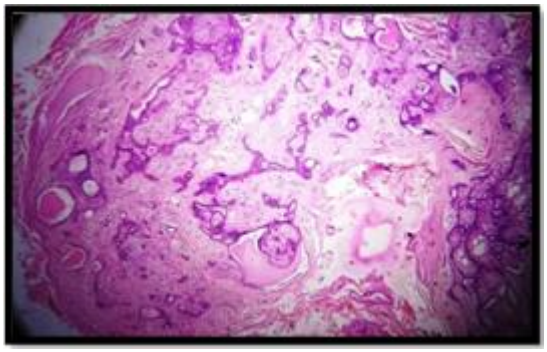

Figure 15: Benign adnexal tumor (Syringoma) showing well circumscribed proliferation of round to comma shaped ducts and cords lined by double layered epithelium (H&E; 10x).

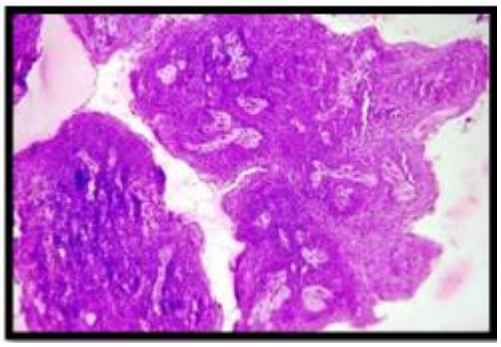

Figure 16: Squamous cell carcinoma showing regular nests with minimal pleomorphism, keratinization and stromal invasion (H&E; 40x).

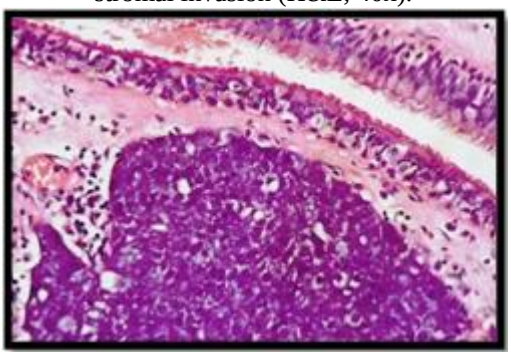

Figure 17: Nasopharyngeal carcinoma – Regaud type showing well defined tumor nests separated by fibrous stroma with inflammatory cells (H&E; 100x).

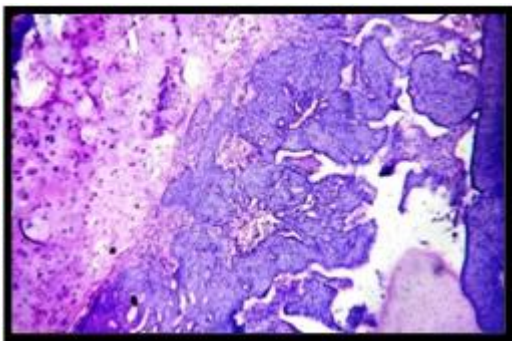

Figure 18: Basal cell carcinoma showing nests of basaloid cells with peripheral palisading, slit-like stromal retraction and adjacent native nasal cartilaginous tissue (H&E; 40x).