

## Original Research Article

# Role of histopathological and microbiological investigations for a definitive diagnosis of benign sinonasal masses: a tertiary care institute study

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## ABSTRACT

**Background:** This research aimed to study the clinical presentation of various sino nasal masses (SNM), to study the importance of Histopathological and microbiological investigations in making diagnosis of SNM and to study the correlation between clinical, radiological, histopathological, and microbiological findings of SNM.

**Methods:** In the present study 50 patients attending the ENT outpatient department with clinical evidence of nasal mass were selected based on inclusion and exclusion criteria. Patients were examined clinically and radiologically followed by surgical intervention. Histopathological and microbiological examination was done to make a definitive diagnosis.

**Results:** Majority of cases were from 21-40 years age group (66%) with male preponderance. Nasal obstruction was most common symptom 45 (90%) followed by nasal discharge 43(86%). On histopathology highest incidence was of inflammatory polyps 22 (44%) followed by allergic polyps 14(28%) and non-invasive fungal sinusitis (NIFS) 11 (22%) respectively. Microscopically in KOH, fungal elements, yeast and hyphae were seen in total 11 (22%) cases and with SDA, *Aspergillus niger* was seen in 7 (14%) cases, *Candida albicans* in 3 (6%) and both in 1 (2%) case. Correlation of provisional diagnosis with HPE was found to be highly significant.

**Conclusions:** It was observed that histopathological and microbiological examination is irreplaceable as both are the “GOLD STANDARD” for making a definitive diagnosis.

**Keywords:** Computed tomography, Contrast enhanced computed tomography, Diagnostic nasal endoscopy, Histopathological examination, Non-invasive fungal sinusitis, Sino-nasal masses

## INTRODUCTION

Sino-nasal masses (SNM) are the space occupying lesions of nasal cavity and paranasal sinuses. Nasal masses are abnormal growth that may arise from the nasal ala, mucosa of the nasal cavity/paranasal sinuses, the osseous or cartilaginous part of the nasal septum, the turbinate's, or the nasal bones or lesions may be a direct extension from neighbouring structures such as

nasopharynx and secondarily involving the sinonasal area.

A variety of non-neoplastic and neoplastic SNM involving the nasal cavity and paranasal sinuses form large portion of cases in ENT practice owing to spectrum of troublesome symptoms causing significant compromise in life quality. They can present with symptoms like nasal obstruction, rhinorrhoea, blood

stained nasal discharge, epistaxis, oral symptoms, facial swelling, orbital symptoms, ear symptoms etc.<sup>1</sup>

The prevalence of non-neoplastic growths outweigh the neoplasms, with inflammatory nasal polyposis being most common i.e. 4%. Burden of neoplasms of the sinuses and nasal cavity is 0.2%-0.8% of all carcinomas and account for 3% of all head and neck cancers.<sup>2</sup> The disproportion leads to delayed diagnosis and mismanagement in cases of neoplasms.

A substantial number of studies have been done to illustrate role of various investigations to help make a prompt definitive diagnosis of these wide variety of SNM so as to manage them accordingly which still remains a diagnostic dilemma.

In this modern era the focus has shifted more towards advance imaging however, history and examination unquestionably still remain the foundation of clinical practice.<sup>3</sup> The CT images evidently show fine structural architecture of bony anatomy thereby determining various extent of disease and characterization of various inflammatory, benign and malignant sinonasal diseases. The surgeon needs a clear understanding of the patency of the intercommunicating passages in the osteomeatal complex and how inflammatory disease impact on the patency of these channels. Furthermore, the surgeon requires a radiographic display that correlates with the imaging provided by the endoscopes used to guide functional endoscopic sinus surgery. CT imaging is viewed as a blueprint to provide information with equal resolution but beyond the boundaries displayed with endoscopes.<sup>4</sup>

In addition, histopathology is crucial for tissue diagnosis but microscopically KOH solution completely dissolves the non-fungal components whilst enhancing the fungal elements and yeast cells, increasing the sensitivity for fungal diagnosis. SDA culture can supplement in ascertaining the genus, species and antifungal susceptibility. The excellence of these in affirming a diagnosis makes them the gold standard in early detection of malignancies and fungal strains.

In this prospective study we use clinical, radiological, histopathological, and microbiological evaluations to untangle the various diseases with overlapping symptoms.

## METHODS

A Prospective study was carried out on 50 patients of either sex, who reported in the Department of ENT Govt. Medical College Amritsar from August 2017- January 2020 with clinical presentation of nasal mass. The patients were selected at random basis on a pre-defined inclusion and exclusion criteria. They were first examined clinically followed by radiological examination and surgical intervention during which biopsy was taken

and sent for histopathological and microbiological examination, and the results were correlated.

### Inclusion criteria

All adult ( $\geq 14$  years old) of either sex, patients presenting with mass in nasal cavity or PNS (unilateral or bilateral) and patient with clinical symptoms suggestive of a Sino-nasal mass were included.

### Exclusion criteria

Patients less than 14 years of age, patient suffering from acute viral infection, patient not consenting evaluation as per proforma, patient not fit for surgery, patients with history of hypertension and trauma, patient with bleeding disorder and suspected cases of malignancy were excluded.

### Pre-operative evaluation

Clinical symptoms like: nasal obstruction, excessive sneezing, nasal discharge, post nasal discharge, sensation of smell or facial pain.

Anterior rhinoscopy findings: condition of nasal mucosa, nasal discharge, nature of discharge (if present), nasal septum deviation, condition of turbinate, other findings like polyp.

Radiological evaluation: In all the patients CT scan with or without contrast (as per requirement) of Nose and paranasal sinuses was done with 3mm cut sections.

Diagnostic nasal endoscopic evaluation: Using 4 mm 0° or 30° endoscope.

### Post-operative evaluation

Post-operative evaluation based on microbiological Culture for the identification of fungi, microscopy by KOH (potassium hydroxide) preparation, culture on SDA (Sabouraud Dextrose Agar), and histopathological examination (hematoxylin and eosin staining).

## RESULTS

In present study the most affected age group was 21-40 years with 66% cases and the mean age was 34.48 years (Table 1).

**Table 1: Age distribution.**

Age group	No. of cases	Percentage
$\leq 20$	6	12.0
21-40	33	66.0
41-60	7	14.0
>60	4	8.0
<b>Total</b>	<b>50</b>	<b>100.0</b>

As per socio-demographic profile, prevalence of SNM was more in urban 26 (52%) than rural population 24 (48%) and male to female ratio was 1.27:1.

The most common presenting symptom was nasal obstruction in 45 (90%) cases out of which 15 (30%) cases presented with left sided nasal obstruction, 8 (16%) with right sided nasal obstruction and 22 (44%) cases presented with bilateral nasal obstruction. 5 (10%) cases were without any complaint of nasal obstruction.

Nasal discharge was present in 43 (86%) patients which was mucoid in 22 (44%) cases, mucopurulent in 5 (10%) cases and watery in 16 (32%) cases. Complaint of post nasal discharge was present in 37 (74%) cases. History of headache was seen in 27 (54%) cases and facial fullness in 30 (60%) cases. Hyposmia was present in 28 (56%) cases. Epistaxis was the least common complaint with only 5 (10%) cases. Symptom of allergy was seen in 30 (60%) cases with excessive sneezing, and 24 (48%) cases presented with excessive watering from eyes. Detailed history showed that 10 (20%) patients had associated bronchial asthma.

#### **Clinical examination**

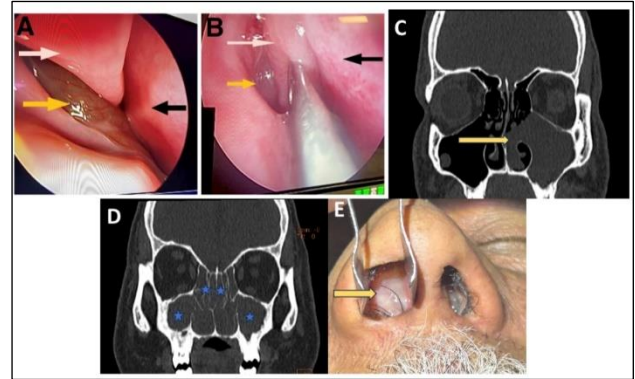
External deformity of nose was seen in 4 (8%) cases with crooked nose and widened nasal bridge. Anterior rhinoscopy showed mass/polyp in 17 (34%) cases on left and 14 (28%) cases on right side. On examining the left side mass in 17 cases, 1 (2%) was grey oedematous, 2 (4%) were grey smooth polypoidal and 1 (2%) was greyish irregular, 6 (12%) were pale polypoidal, 6 (12%) were pinkish smooth globular and 1 (2%) was soft red globular mass. On right side 4 (8%) were grey smooth polypoidal, 1 (2%) was greyish irregular, 5 (10%) were pale polypoidal and 4 (8%) were pinkish smooth globular mass.

#### **On diagnostic nasal endoscopy**

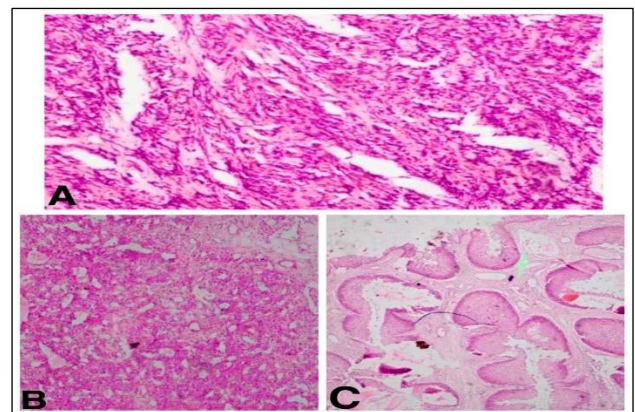
Septum deviation was found in 14 (28%) cases on left and in 13 (26%) cases on right side. Nasal spur was found in 4 (8%) cases (Figure 1). On left side hypertrophied middle turbinate was seen in 6 (12%) cases and middle turbinate polyp was seen in 4 (8%) cases. On right side hypertrophied middle turbinate was present in 10 (20%) cases and middle turbinate polyp was seen in 4 (8%) cases. Inferior turbinate was hypertrophied in 13 (26%) cases on left side and in 21 (42%) cases on right side.

Discharge in middle meatus was seen in 14 (28%) cases on left and in 8 (16%) cases on right side, polyp was present in 5 (10%) cases in both right and left, middle meatus was edematous in 3 (6%) in left. Accessory ostia was seen in 5 (10%) cases on both left and right side and not seen in 90% cases on both sides. Eustachian tube opening orifice was seen in 30 (60%) cases in left and 25 (50%) cases in right whereas Eustachian tube opening was not visualized in 8 (16%) cases in left side because

of mass or DNS or spur obstructing the view for endoscope to pass whereas its opening was not visible in 9 (18%) in right side. Eustachian tube mucosal oedema was seen in 3 (6%) cases in left and 6 (12%) in right side. Discharge at eustachian tube opening was seen in 9 (18%) in left and 10 (20%) in right side.



**Figure 1: Diagnostic nasal endoscopic findings. (A) Mass extending from middle meatus into nasal cavity right side (yellow arrow), middle turbinate (white arrow), nasal septum (black arrow), (B) Mass in middle meatus right side (yellow arrow), middle turbinate (white arrow) being retracted to reveal the mass, nasal septum (black arrow), (C) Computed tomography (CT) scan showing Left maxillary polyposis with polyp extending in middle meatus and left nasal cavity, (D) CT scan showing extensive polyps (blue asterisk) occupying the nasal cavity and paranasal sinuses & (E) Anterior rhinoscopy showing Sino nasal mass (yellow arrow).**



**Figure 2: (A) Histopathology study showing schwannoma obtained by biopsy, (B) Histopathology study showing image of nasal haemangioma obtained by biopsy & (C) Histopathology study showing image of nasal inverted papilloma obtained by biopsy.**

CECT findings depicted in Figure 2. Table 2 shows status of paranasal sinuses. Nasal polyp/mass was present in 17 (34%) cases on left and 14 (28%) on right side. Osteomeatal complex was blocked in 33 (66%) cases on the left and 27 (54%) on the right side.

**Table 2: CECT findings.**

CECT	Left		Right	
	No.	%	No.	%
<b>Nasal cavity</b>				
Normal	33	66.0	36	72.0
Opacity	16	32.0	14	28.0
Any mass	1	2.0	-	-
<b>Osteomeatal complex</b>				
Normal	17	34.0	23	46.0
Blocked	33	66.0	27	54.0
<b>Frontal sinus</b>				
Normal	42	84.0	41	82.0
Partially opacified	5	10.0	6	12.0
Opacified	2	4.0	2	4.0
Hyperattenuation	1	2.0	1	2.0
<b>Maxillary sinus</b>				
Normal	14	28.0	23	46.0
Partially opacified	8	16.0	3	6.0
Opacified	24	48.0	19	38.0
Hyperattenuation	4	8.0	5	10.0
<b>Anterior ethmoid sinus</b>				
Normal	19	38.0	29	58.0
Partially opacified	14	28.0	7	14.0
Opacified	14	28.0	10	20.0
Hyperattenuation	3	6.0	4	8.0
<b>Posterior ethmoid sinus</b>				
Normal	38	76.0	43	86.0
Partially opacified	7	14.0	2	4.0
Opacified	4	8.0	4	8.0
Hyperattenuation	1	2.0	1	2.0
<b>Sphenoid sinus</b>				
Normal	45	90.0	47	94.0
Partially opacified	4	8.0	1	2.0
Opacified	1	2.0	1	2.0
Hyperattenuation	-	-	1	2.0

**Routine blood investigation**

Abnormal serum IgE (>150 IU/ml) were highest in inflammatory polyp and second highest in allergic polyposis 21 (44.7%) and 14 (29.8%) respectively. Whereas abnormal values were also found in 10 cases out of total 11 cases of non-invasive fungal sinusitis with p value of p=0.005. Abnormal absolute eosinophil count i.e. >300 mm<sup>3</sup> were recorded highest in allergic polyposis in 11 (37.9%) patients and second highest in non-invasive fungal sinusitis in 10 (34.5%) patients. Abnormal values were also found in 8 (27.6%) cases of inflammatory polyp.

As per histopathological examination it was found that inflammatory polyps were present in 22 (44 %) cases and allergic polyps in 14 (28%). Non-invasive fungal sinusitis was seen in 11(22%) cases. HPE also showed one case each of haemangioma, inverted papilloma and schwannoma (Table 3).

**Table 3: Frequency of histopathological diagnosis among cases.**

Histopathological diagnosis	No. of cases	Percentage
Allergic polyp	14	28.0
Hemangioma	1	2.0
Inverted papilloma	1	2.0
Inflammatory polyp	22	44.0
Non invasive fungus sinusitis	11	22.0
Schwannoma	1	2.0
<b>Total</b>	<b>50</b>	<b>100.0</b>

**Table 4: Correlation between provisional clinical diagnosis and histopathological diagnosis.**

Provisional clinical diagnosis	Histopathological diagnosis						Total
	Allergic polyposis	Hemangioma	Inverted papilloma	Inflammatory polyp	Non-invasive fungal sinusitis	Schwannoma	
Allergic polyposis	14	0	0	3	1	0	18
Hemangioma	0	1	0	0	0	0	1
Invasive fungal sinusitis	0	0	0	0	0	1	1
Inflammatory polyp	0	0	1	19	1	0	21
Non-invasive fungal sinusitis	0	0	0	0	9	0	9
<b>Total</b>	<b>14</b>	<b>1</b>	<b>1</b>	<b>22</b>	<b>11</b>	<b>1</b>	<b>50</b>



Correlation of provisional diagnosis with histopathological diagnosis was seen in 43 (86%) cases  $p < 0.001$  (0.881; highly significant) (Table 4). On the microscopic evaluation of masses with KOH budding yeast thin hyphae were seen in 3(6%) cases, fungal element was present in 8 (16%) cases and no growth was seen in 39 (78%) cases. On examination with SDA we observed *Aspergillus niger* in 7 (14%) cases, *Candida albicans* in 3 (6%) and both *Candida* with *Aspergillus niger* in 1 (2%) case (Table 5).

**Table 5: Microbiological examination of masses.**

	No. of cases	Percentage
<b>KOH</b>		
Budding yeast thin hyphae	3	6.0
Fungal element	8	16.0
No fungal elements seen	39	78.0
Total	50	100.0
<b>SDA</b>		
<i>Aspergillus niger</i>	7	14.0
<i>Candida albicans</i>	3	6.0
<i>Candida</i> with <i>Aspergillus niger</i>	1	2.0
No growth	39	78.0
Total	50	100.0

## DISCUSSION

There are heterogenous group of SNM macroscopically it becomes quite difficult to differentiate them on clinical evaluation and are frequently misdiagnosed as simple nasal polyp causing delay in proper management. These masses can be classified as congenital or acquired. Congenital masses such as dermoid cysts, glioma and encephaloceles primarily present as midline swellings extending intracranial or extracranially. Acquired SNM can be inflammatory (infection, trauma or allergy), rhinoscleroma, rhinosporodiosis, inverted papilloma, schwannoma, aesthesioneuroblastoma, benign or malignant neoplasms etc.<sup>5</sup> We included 50 cases of SNM in our study and the most affected age group was between 21-40 years. In a study done by Sharma et al, mean age of presentation was 31.5 years.<sup>6</sup> Bakari et al had reported a peak incidence of 33 years, while for Zafar et al, the mean age of presentation was 22.5 years.<sup>7,8</sup>

Present study showed male preponderance with male to female ratio of 1.27:1. In a study by Aggarwal and Panigrahi R, the male to female ratio for non-neoplastic tumours was 1:1.1 and that for benign tumours was 1.8:1.<sup>9</sup> The overall male to female ratio was similar to the studies (1.2:1) by Bakari et al and (1.3:1) by Dafale et al.<sup>7,10</sup>

In present study rural to urban ratio was 1:1.08 which was similar to the rural to urban ratio of 1:1 in the study by Bist et al.<sup>11</sup>

Socio-economic status was assessed according to modified B.G. Prasad classification based on monthly per capita income in rupees (2019 January). Lower class people constituted 16%, Lower middle class in 26%, Middle class 24%, and upper middle class 30% and upper class 4%.

Though different parameters were taken according to different scales for socioeconomic status, Gupta et al found that as per socioeconomic status, SNM were more prevalent among lower class 61.96% followed by lower middle 26.09%, upper middle 9.78% and upper class 2.17%.<sup>12</sup>

In our study among presenting symptoms history of nasal obstruction was most common complaint in 45 (90%) cases followed by nasal discharge which was present in 43 (86%) cases, PND in 37 (74%) cases, headache in 27 (54%) cases and history of facial fullness in 30 (60%) cases. Epistaxis was least common complaint in only 5 (10%) cases. Also in a study done by Bakari et al the main presenting symptoms were nasal blockage and rhinorrhoea.<sup>7</sup>

In another study done by Bist et al the most common presenting symptom was nasal obstruction in 96 (87.27%) patients, followed by nasal discharge in 76 (69.09%) patients.<sup>11</sup>

In our study hyposmia was present in 28 (56%) patients which according to a study by Gupta et al was 70% while Lathi A et al documented hyposmia in 31.3% cases.<sup>12,13</sup>

In our study allergic symptom were found in 60% patients with all of them having excessive sneezing and 48% had excessive watering from eyes. According to a study by Bakari et al allergic symptoms were seen in 52.6% patients.<sup>7</sup> Concomitant asthma was noted in 20% patients in the present study which was seen in 21.4% patients of a study by Rehman et al.<sup>14</sup>

AEC was recorded highest in patients with NIFS i.e. in 9 (64.3%) out of total 14 NIFS patients and also in 37.5% patients of allergic polyposis. In study done by Budhiraja et al significant peripheral eosinophilia was seen in 72.4% (21 cases) of allergic polyps.<sup>15</sup>

In this study, unilateral mass was present in 74% cases out of which in 44% on the left side and bilateral involvement was seen in 26% while Bakari et al, observed unilateral SNM in 55.3% of cases and bilateral lesions in 44.7% of patients.<sup>7</sup>

On radiological evaluation preoperatively we found that in CT scan maxillary sinus was most commonly affected sinus with mass or polyp present in 36 (72%) cases on left side and in 27 (54%) on right side. Anterior ethmoids were reportedly to be the second most affected with opacification/polyp/mass seen in 31 (62%) and 21 (42%) case on left and right side respectively. Posterior ethmoid

and frontal sinus were less affected with sphenoid sinus being least affected also OMC was blocked in 33 (66%) on left side and 27 (54%) on right side.

A study by Varshney et al also showed maxillary sinus as most commonly and most severely affected sinus, while sphenoid sinus was the least involved sinus.<sup>16</sup>

Also in a study done by Shahizon et al they concluded that on CT scan; maxillary sinus was commonest sinus involved in 34 patients out of 40, followed by anterior and posterior ethmoid, frontal and sphenoid sinuses.<sup>17</sup>

On microbiological examination in our study we found that out of 50 total cases, fungal isolates were obtained in 11 cases (22%). Most common fungus isolated was *Aspergillus niger* in 7 (14%) cases, followed by *Candida albicans* in 3 (6%) and in 1 (2%) case both *Candida* with *Aspergillus niger* was seen.

This is concordant with study by Fadda et al in which 77.5% of the patients were identified with *Aspergillus* species, followed by *Candida* species.<sup>18</sup>

Also in study done by Rehman et al, allergic fungal sinusitis was found in more than one fifth of cases with nasal polyp, *Aspergillus* was the commonest organism responsible for NIFS.<sup>14</sup>

In the present study on histopathological examination highest incidence was that of inflammatory polyps in 22 (44%) patients, second was allergic polyps followed by non-invasive fungal sinusitis in 11 (22%) cases including fungal ring, one case (2%) of haemangioma, 1 (2%) inverted papilloma and 1 (2%) schwannoma each.

In a study done by Lathi et al subdivided nasal polyps into allergic and inflammatory type further each into ethmoidal and antrochoanal, it was observed that 62.5% of the polyps were allergic in nature and 25% were inflammatory.<sup>13</sup> Among benign neoplastic lesions, haemangioma (47.3%) was the most common in their study followed by inverted papilloma (36.8%), mucocele and angiofibroma.

Clinico-histopathological correlation by Bist et al was 96.37% of total cases.<sup>11</sup> In the study conducted by Gupta et al it was 96%.<sup>12</sup> Kale et al studied 344 cases and found clinic-histopathological correlation in 99.7% cases.<sup>19</sup>

Diamantopoulus et al found clinico-histopathological correlation in 98.9% cases among 2021 patients.<sup>20</sup> In this study clinico-histopathological correlation was present in 86% cases with variation in 14%.

## CONCLUSION

This study concluded on a note that armamentarium involved in the approach to sinonasal mass includes a step-wise scheme comprising of clinic-radiological

evaluation in conjunction with Histopathology. A thorough and detailed clinical evaluation with advanced imaging techniques portrays a gross picture of the underlying disease. In terms of correlation, in our study we observed that presumptive diagnosis framed by clinico-radiological evaluation deduces the differentials significantly. The supremacy of histopathology in classification of these multitude of lesions is unparalleled as it shows tissue invasion and tissue reaction. However, when it comes to fungal organisms, direct microscopy sample in KOH mount and SDA culture gives us their accurate morphology, steering us towards the species of fungi involved. Both Microbiology and histopathology are our final milestones which ends our journey for a definitive diagnosis and subsequent management options.

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## REFERENCES

1. Somani S, Kamble P, Khadkear S. Mischievous presentation of nasal masses in rural areas. Asian J Ear Nose Throat. 2004;2:9-17.
2. Bateman N, Fahy C, Woolford T. Nasal polyps: still more questions than answers. J Laryngol. 2003;117:1-9.
3. Summerton N. The medical history as a diagnostic technology. Brit J Gene Pract. 2008;58(549):273-6.
4. Bhagat R, Maan AS, Sharma KK, Chander R. Combined radiological and endoscopic evaluation of sino nasal anatomical variations in patients of chronic rhinosinusitis: a North Indian Study. Ind J Otolaryngol Head Neck Surg. 2023;1-8.
5. Maheshwari A, Bansal A. Clinico-pathological spectrum of sinonasal masses: a tertiary care hospital experience. Int J Otorhinolaryngol Head Neck Surg. 2017;3(4):1015-9.
6. Sharma R, Sahni D, Uppal K, Gupta R, Singla G. A clinicopathological study of masses of nasal cavity, paranasal sinuses and nasopharynx. Int J Otorhinolaryngol Head Neck Surg. 2017;3(2):253-8.
7. Bakari A, Afolabi OA, Adoga AA, Kodiya AM, Ahmad BM. Clinico-pathological profile of sinonasal masses: an experience in national ear care center Kaduna, Nigeria. BMC Res Notes. 2010;3(1):186.
8. Zafar U, Khan N, Afroz N, Hasan SA. Clinicopathological study of non-neoplastic lesions of nasal cavity and paranasal sinuses. Ind J Pathol Microbiol. 2008;51(1):26.
9. Agarwal P, Panigrahi R. Sinonasal mass-a recent study of its clinicopathological profile. Ind J Surg Oncol. 2017;8(2):123-7.
10. Dafale SR, Yenni VV, Bannur HB, Malur PR, Hundgund BR, Patil SY. Histopathological study of polypoidal lesions of the nasal cavity-A cross

- sectional study. *Al Ameen J Med Sci.* 2012;5(4):403-6.
11. Bist SS, Varshney S, Baunthiyal V, Bhagat S, Kusum A. Clinico-pathological profile of sinonasal masses: An experience in tertiary care hospital of Uttarakhand. *Nat J Maxillof Surg.* 2012;3(2):180.
  12. Gupta R, Moupachi SS, Poorey VK. Sinonasal masses: a retrospective analysis. *Ind J Otolaryngol Head Neck Surg.* 2013;65(1):52-6.
  13. Lathi A, Syed MM, Kalakoti P, Qutub D, Kishve SP. Clinico-pathological profile of sinonasal masses: a study from a tertiary care hospital of India. *Acta Otorhinolaryngol Ital.* 2011;31(6):372.
  14. Rehman AB, Rafiq FA, Uppal AA. Evaluation of allergic fungal sinusitis occurrence in patients with nasal polyps. *Pak J Med Health Sci.* 2015;9(3):875-8.
  15. Budhiraja G, Mittal S, Kaur A, Gill AK, Suri V. A study of non-neoplastic nasal polypoidal lesions and its relation with local and systemic eosinophilia, peripheral IgE levels and mast cell quantitation. *Sch J App Med Sci.* 2017;5(6B):2108-16.
  16. Varshney H, Varshney J, Biswas S, Ghosh SK. Importance of CT scan of paranasal sinuses in the evaluation of the anatomical findings in patients suffering from sinonasal polyposis. *Ind J Otolaryngo Head Neck Surg.* 2016;68(2):167-72.
  17. Shahizon AMM, Suraya A, Rozman Z, Aini AA, Gendeh BS. Correlation of computed tomography and nasal endoscopic findings in chronic rhinosinusitis. *Med J Malay* 2008;63(3):211-5
  18. Fadda GL, Succo G, Moretto P, Veltri A, Castelnuovo P, Bignami M, et al. Endoscopic endonasal surgery for sinus fungus balls: clinical, radiological, histopathological, and microbiological analysis of 40 cases and review of the literature. *Iran J Otorhinolaryngol.* 2019;31(102):35.
  19. Kale SU, Mohite U, Rowlands D, Drake-Lee AB. Clinical and histopathological correlation of nasal polyps: are there any surprises? *Clin Otolaryngol All Sci.* 2001;26(4):321-3.
  20. Diamantopoulos I, Jones N, Lowe J. All nasal polyps need histological examination: an audit-based appraisal of clinical practice. *J Laryngol Otol.* 2000;114(10):755-9.

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