Original Research Article

Evaluation of Unilateral Sinonasal Lesions

Abstract

Background: Sinonasal lesions are a common finding in all age groups. The lesions of nose and paranasal sinuses are very deceptive, so the presenting features, clinical examination, nasal endoscopy, radiological finding, and histopathology are employed conjointly to reach a diagnosis. The aim of this study was to observe a much of higher percentage of unilateral sinus pathology. Comprehensive evaluation of patient age, sex, presenting symptoms, nasoendoscopic examination and computed tomography (CT) or magnetic resonance imaging (MRI) findings help in the diagnosis of unilateral sinus disease with finding the same result in patient who had endoscopic sinus surgery performed in ear, nose, and throat (ENT) department of Tanta University Hospital.

Methods: This prospective randomized controlled study was carried out on 100 adult and pediatric patients who were suffering from nasal obstruction, epistaxis, proptosis, headache and space occupying lesions in one side of nose including inflammatory, benign and malignant lesions. All patients were subjected to complete history taking, endoscopic examination, otorhinogological examination, CT, MRI for evaluation of unilateral opacification of paranasal sinuses and other routine preoperative laboratory investigation.

Results: Of all affected sinuses, right maxillary sinus and nasal cavity were the most significantly affected sinuses in malignant tumor group than both inflammatory disease group and benign tumor group (P = 0.002, 0.001 respectively) while left maxillary, right ethmoid, left ethmoid, right sphenoid, left sphenoid, right frontal and left frontal showed insignificant differences in affection among the three groups. All performed radiology to the patients was insignificantly different among the three groups (P = 0.211). The main symptoms were significantly different among the three groups (P <0.001). Preoperative biopsy taking was significantly increased in malignant tumor group than both inflammatory disease and benign tumor group (P = 0.001). Diseases in the patients were significantly different among the three groups (P <0.001). Patients with excellent results of the operation was significantly decreased in malignant tumor group than benign tumor group (P = 0.001). The type of surgery was significantly different among the three groups (P <0.001).

Conclusions: Unilateral nasal polyps have high rates of malignancies and should be check carefully by endoscopy and histopathology.
Keywords: Evaluation, Unilateral, Sinonasal lesions.

Introduction:

A variety of non- neoplastic and neoplastic conditions involve nasal cavity and paranasal sinus are a common presentation in clinical practice [1].

Sinonasal lesions are a common finding in all age groups. The lesions of nose and paranasal sinuses are very deceptive so the presenting features, clinical examination, nasal endoscopy, radiological finding and histopathology are employed conjointly to reach a diagnosis [1].

Unilateral nasal masses are common clinical conditions in ENT clinics, which may be difficult to diagnose due to their symptomatic similarities with rhinosinusitis. The diagnosis and management of these masses are important because of their relationship with cerebrospinal fluid or cerebral parenchyma and because they are more likely to be premalignant or malignant than bilaterally observed inflammatory masses and may have originated from vascular structures [2].

Neoplastic lesions of the nose and paranasal sinus are one of the most challenging conditions that otolaryngologist have to diagnose and treat due to their hidden nature and late presentations so the clinician should have ahigh index of suspicion to rule out the neoplastic aetiology in all cases of unilateral nasal mass [1].

A proper work up including histopathological and radiological categorization is essential in the management of the sinonasal lesions.

Nowadays, Endoscopic nasal facilities have a great role in management of most non neoplastic and neoplastic lesions with minimal post-surgical complications [2].

The aim of this study was to observe a much of higher percentage of unilateral sinus pathology. Comprehensive evaluation of patient age, sex, presenting symptoms, nasoendoscopic examination and CT or MRI findings help in the diagnosis of unilateral sinus disease with finding the same result in patient who had endoscopic sinus surgery performed in ENT department of Tanta University Hospital.

Patients and Methods:

This prospective randomized controlled study was carried out on 100 Adult and pediatric patients who are suffering from nasal obstruction, epistaxis, proptosis, headache and space occupying lesions in one side of nose including inflammatory, benign and malignant lesions at Tanta University Hospital, otorhinolaryngology Department, hospitals from April 2019 to December 2020. The study was done after being approved from Tanta University research ethical committee. An informed written consent was obtained from all patients were enrolled in the study.

Bilateral sinonasal pathologies were excluded.

All patients in this study were subjected to the following: Preoperative (complete history taking, endoscopic examination, otorhinogological examination, CT, MRI for evaluation of unilateral opacification of paranasal sinuses, routine preoperative laboratory investigation, biopsy if needed, each patient is discussed by the team for planning of appropriate approaches, each approach will be evaluated as regards, its accessibility, values, limitation, difficulties, and risks, maintaining the privacy of the patients in the form of: A) results are allowed for research purpose only and not for the media, B) Images and videos will expose only the field of the procedure without exposing the face of the patient, C) All the procedures used in the research have no conflict with religion or low or social rules)

Due to multiplicity of the causes of unilateral sinonasal lesions we had categorized the lesions and procedures for 3 groups; group A: Inflammatory lesions, group B: Benign lesions and group C: Malignant lesions.

According to radiological and histopathological examination approaches were either:

Endoscopic endonasal, external osteoplastic, endoscopic with reconstruction, endoscopic with craniotomy, intra operative frozen section and histopathological examination of the excised tumor was done to ensure complete excision by examining margins in the case of malignant tumors, postoperative follow up was done every three months for inflammatory cases for six months, and every three months for 6 months for benign cases and after 6 months for a year, and in malignant cases was every month for 6 months then every 3 months for one year.

Follow up protocol was: Clinical examination, endoscopic examination, imaging in cases suspected to have recurrence and biopsy and histopathological examination of the site the tumor in cases of suspected recurrence.

Assessment of clinical examination, biopsy result, tumor sites and extensions, imaging and different approaches.

Major complications were defined in the study to be: Neurological like CSF leak, orbital like visual loss and intra or post-operative mortality.

Minor complications include mainly scars, residual lesions were defined as lesions detected immediately post-operative or was recognized intraoperative but can't be managed due to difficult manipulation or emerging of complication and recurrences were reappearance of the lesion after period of cure.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS version 19 (Statistical Package for Social Studies) created by IBM, Illinois, Chicago, USA. For numerical values the range mean and standard deviations were calculated. The differences between mean values among studied groups were used using Kruskal-Wallis, as the data were not normally distributed. For categorical variable the number and percentage were calculated and differences between subcategories were tested by chi square test or Monte Carlo exact test when chi square was found not appropriate. The level of significant was adopted at $p<0.05$.

Results:

Age of the patients was insignificantly different among the three groups (P = 0.097). Sex of the patients was insignificantly different among the three groups (P = 0.594). **Table 1**

Table 1: Age and sex in all studied groups

Age in years	Inflammatory disease (n=67)		Benign tumor (n=27)		Malignant tumor (n=8)	
	N	%	N	%	N	%
<20	8	11.9	4	14.8	1	12.5
20-29	19	28.4	1	3.7	1	12.5
30-39	18	26.9	4	14.8	0	0.0
40-49	8	11.9	10	37.0	3	37.5
50-59	5	7.5	5	18.5	1	12.5
60-69	8	11.9	2	7.4	2	25.0
70-79	1	1.5	1	3.7	0	0.0
Range	7-70		10-76		16-66	

Mean± SD	35.91 ± 15.34		41.89±16.16		44.25±17.32	
Kruskal-Wallis test	4.673					
p	0.097					
Males	35	52.2	16	59.3	3	37.5
Females	32	47.8	11	40.7	5	62.5
p	0.594					

Of all affected sinuses, right maxillary sinus and nasal cavity were the most significantly affected sinuses in malignant tumor group than both inflammatory disease group and benign tumor group (P = 0.002, 0.001 respectively) while left maxillary, right ethmoid, left ethmoid, right sphenoid, left sphenoid, right frontal and left frontal showed insignificant differences in affection among the three groups. **Table 2**

Table 2: Sinus affected in all studied groups

Sinus affected	**Inflammatory disease (n=67)**		**Benign tumor (n=27)**		**Malignant tumor (n=8)**		**P value**
	N	%	N	%	N	%	
Right maxillary	25	37.3	9	33.3	8	100.0	**0.002***
Left maxillary	22	32.8	7	25.9	0	0.0	0.140
Right ethmoid	6	9.0	4	14.8	1	12.5	0.509
Left ethmoid	14	20.9	4	14.8	0	0.0	0.371
Right sphenoid	5	7.5	4	14.8	1	12.5	0.664
Left sphenoid	4	6.0	2	7.4	1	12.5	0.550
Right frontal	10	14.9	7	25.9	1	12.5	0.412
Left frontal	14	20.9	2	7.4	0	0.0	0.152
Nasal cavity	17	25.4	10	37.0	8	100.0	**0.001***

* Significant as P value <0.05.

All performed radiology (CT, MRI, and PET) to the patients was insignificantly different among the three groups (P = 0.211). **Table 3**

Table 3: Performed radiology in all studied groups

Radiology	**Inflammatory disease (n=67)**	**Benign tumor (n=27)**	**Malignant tumor (n=8)**

	N	%	N	%	n	%
CT	42	63.0	13	50.0	2	37.2
MRI and CT	23	33.3	12	47.5	4	57.2
MRI	2	3.7	0	0.0	1	2.9
CT, MRI, and PET CT	0	0.0	1	2.5	1	2.9
p	0.211					

The main symptoms were significantly different among the three groups (P <0.001) as follow: asymptomatic patients and nasal obstruction were significantly decreased in malignant tumor group than both inflammatory disease group and benign tumor group while proptosis and oral swelling were significantly increased in malignant tumor group than both inflammatory disease group and benign tumor group but epistaxis was insignificantly different among the three groups.

Preoperative biopsy taking was significantly increased in malignant tumor group than both inflammatory disease and benign tumor group (P = 0.001). Table 4

Table 4: Main symptoms and Pre-operative biopsy in all studied groups

Main symptoms	**Inflammatory disease (n=67)**		**Benign tumor (n=27)**		**Malignant tumor (n=8)**	
	N	%	N	%	N	%
Nasal obstruction	60	82.1	18	66.7	0	0.0
Epistaxis	7	1.5	9	33.3	1	12.5
Proptosis	0	0.0	0	0.0	3	37.5
Oral swelling	0	0.0	0	0.0	4	50.0
P value	**<0.001***					
Preoperative biopsy						
None	55	82.1	20	74.1	0	0.0
Done	12	17.9	7	25.9	8	100.0
X^2	27.749					
p	**0.001***					

* Significant as P value <0.05

Diseases in the patients were significantly different among the three groups (P <0.001). **Table 5**

Table 5: Diseases in all studied groups

Disease	Inflammatory disease (n=67)		Benign tumor (n=27)		Malignant tumor (n=8)	
	N	%	n	%	N	%
Inflammatory sinusitis	25	37.3	0	0.0	0	0.0
Antero-choanal polyp	18	26.9	0	0.0	0	0.0
Fungal sinusitis	13	19.4	0	0.0	0	0.0
Mucocele	5	7.5	0	0.0	0	0.0
Acute invasive fungal sinusitis	4	6.0	0	0.0	0	0.0
Silent sinus syndrome	2	3.0	0	0.0	0	0.0
Angiofibroma	0	0.0	4	14.8	0	0.0
Inverted papilloma	0	0.0	14	51.9	0	0.0
Ossified fibroma	0	0.0	3	11.1	0	0.0
Osteoma	0	0.0	4	14.8	0	0.0
Monostatic fibrous dysplasia	0	0.0	2	7.4	0	0.0
Adenocystic carcinoma	0	0.0	0	0.0	2	25.0
Fibrous histocytoma	0	0.0	0	0.0	1	12.5
Mucoepidermoidcarcinoma low grade	0	0.0	0	0.0	2	25.0
Mucoepidermoid carcinoma high grade	0	0.0	0	0.0	2	25.0
Adenocarcinoma	0	0.0	0	0.0	1	12.5
P value	**<0.001***					

* Significant as P value <0.05

Patients with excellent results of the operation was significantly decreased in malignant tumor group than benign tumor group (P = 0.001).

Pre- and post-operative follow up of the patients by NOSE score, most patients with nasal obstruction due to inflammatory and benign lesions improved after surgical procedure and post-operative follow up and care and totally improved after 6 months, while cases with malignant lesions were mostly satisfactory just long follow up and post-operative scars or radiotherapy treatment.

The type of surgery was significantly different among the three groups (P <0.001) as follow: endoscopic intervention only was significantly decreased in malignant tumor group

than both inflammatory disease group and benign tumor group while endoscopic intervention with craniotomy was significantly increased in malignant tumor than both inflammatory disease group and benign tumor group but endoscopic intervention with reconstruction and external osteoplastic intervention were insignificantly different among the three groups. **Table 6**

Table 6: Results of operation and type of surgery in all studied groups

Results	Benign tumor (n=27)		Malignant tumor (n=8)	
	N	%	N	%
Excellent	18	66.7	18	66.7
Satisfactory	9	33.3	9	33.3
P	**0.001***			
Type of surgery	**Inflammatory disease (n=67)**		**Benign tumor (n=27)**		**Malignant tumor (n=8)**	
	N	%	N	%	N	%
Endoscopic	67	100.0	24	88.9	6	75.0
Endoscopic with craniotomy	0	0.0	0	0.0	2	25.0
Endoscopic with reconstruction	0	0.0	1	3.7	0	0.0
External osteoplastic	0	0.0	2	7.4	0	0.0
P value	**<0.001***					

* Significant as P value <0.05

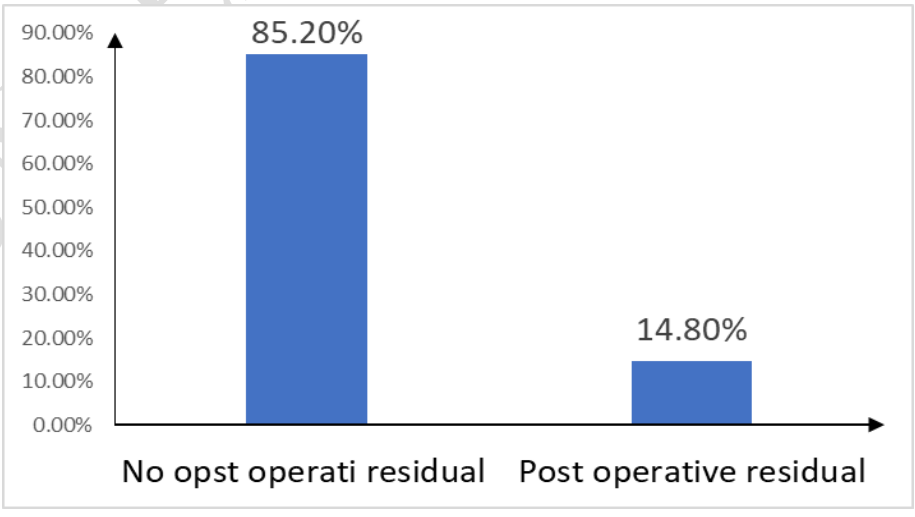

Figure 1: Distribution of cases with benign tumor in relation to post-operative residual

Discussion

Patients with Sinonasal masses may present to the otorhinolaryngologist with rhinorrhea and nasal obstruction. Unilateral persistent nasal obstruction may indicate the presence of sinonasal lesion which could be inflammatory or neoplastic. Although most cases of sinonasal masses are inflammatory polyp, neoplastic lesions do also occur, especially in unilateral pathologies. It is a common practice to assume that unilateral sinonasal mass in adults is either inverted papilloma or a malignant lesion. However, some workers reported simple nasal polyp and squamous cell carcinoma as the most frequent sinonasal lesion [3].

Our results were supported by study of Alshoabi et al. [4] as they reported that among 82 patients with CRS involved in this study, the ages ranged from 4 to 90 years (mean: 34.48±17.74 years), and 45 (54.88%) were females. Most of the patients were in the second to the fifth decades and peaking at the third decade ($p<0.001$). The most common lesion was inflammatory polyps (31.4%), and allergic polyps (30.5%). Nasopharyngeal carcinoma (NPC) was 9.8% of the lesions.

In the study of Eid and Eissa [5], the nasal involvement had the highest prevalence, being noted in ten cases (n = 10), with different combination of nasal and sinus involvement in eight patients and only two strictly unilateral nasal disease; one is showing a nasal mass between the inferior and middle turbinates and another one is epicentered at the classic site of lateral nasal wall, seen opposite the middle meatus. A case of bilateral bi-nasal disease had predominant large nasal lesions with limited frontal sinus extension. Two cases had combined maxillary sinus and nasal disease. Three cases (n = 3) had nasal and ethmoidal involvement with limited frontal sinus extension in two of them and maxillary extension in one. Two cases (n = 2) had combined nasal and maxillary sinus involvement. Three cases (n = 3) had isolated maxillary sinus involvement. Two patients had spheno-ethmoidal sinus involvement.

In a study conducted by Sharma et al. [6], number of lesions of unilateral involvement were 68% and of bilateral involvement were 32% while Bakari et al., [7] observes that unilateral sinonasal masses were seen in 55.3% of cases and bilateral lesions in 44.7% of patients. According to Bist et al. [8] maximum number of sinonasal masses were of unilateral involvement (66.36%) and only 25.45% were bilaterally present. In the study by Lathi et al.[9] Unilateral presentation was seen in 48.2% of cases and bilateral presentation in 51.8% of

cases. Gupta et al. [10] found that 83.6% of their total cases were of unilateral presentation and 16.4% were of bilateral presentation.

Clinical diagnosis of a patient presented with single-sided sinonasal mass is an important clinically challenging issue because of multifactorial underlying etiologies. Comprehensive evaluation of the patient requires investigation of patient's age, symptoms, nasal endoscopic examination, and computed tomographic findings[11].

In the study of Nair et al. [11], the CT scan findings revealed sinus opacity, intrasinous densities and presence of high attenuation areas without bony erosions in the inflammatory conditions as compared to sinus opacity with bone expansion and thinning in mucoceles. Keratocyst maxilla and inverted papilloma presented with sinus opacity with erosion whereas sclerosis, erosion and extensive soft tissue invasion was observed in the neoplastic lesions. A few cases like mucormycosis, mucopyocele and keratocyst maxilla produced similar findings like bone thinning and erosion similar to neoplastic lesions on CT scan whereas inverted papilloma in the earlier stages were found to be easily mistaken for inflammatory condition on radiology.

According to Alshoabi et al. [4] the results revealed strong compatibility between the clinical diagnoses and the histopathology results, ($p<0.001$) and the measure of agreement kappa= 0.215. The results also revealed significant compatibility between CT diagnoses of the radiologist and the histopathology results ($p<0.001$). The results revealed strong compatibility between clinical and radiological diagnoses for bilateral sinonasal lesions. All cases diagnosed as sinonasal polyposis were inflammatory and allergic but no one was malignant. This result is consistent with Wong et al. [12] who reported that discrepancies between clinical and histopathological diagnoses of bilateral nasal polyps is very low.

Also, Hameed et al. [13] revealed that 200 patients were included in the retrospective study attending the Department of ENT with the signs and symptoms of sinonasal diseases between 2018 and 2019. The sinonasal pathologies presenting as masses in the nasal cavity, para nasal sinus, and nasopharynx and with symptoms of nasal obstruction discharge, headache, hyposmia, recurrent epistaxis was included. Clinical evidence of sinonasal diseases were diagnosed using nasal endoscopy and CT prior to endoscopic surgery and malignant cases excluded. Nasal Endoscopic procedures were performed using 0°, 30° and 70, 4 mm Hopkins's rod endoscopes.

In a study performed by Lee, [14], and Rudralingam et al., [15], the authors asserted that CT is a helpful method in demonstrating bone erosion, and determination of the etiology of fungal diseases. In patients with inverted papilloma bone erosion may be seen. In the study of Kandukuri and Phatak [16], in a patient with inverted papilloma we observed defect on anterior wall of maxillary sinus in one, and also a defect on lamina papyracea of another patient.

In the study of Sharma et al.[6], the common presentation of the sinonasal masses were nasal obstruction (56%), nasal discharge (34%) followed by post nasal discharge (22%). Bist et al., (11) shows the most common presenting symptom as nasal obstruction (87.27%) followed by nasal discharge (69.09%) and headache (60.90%).

Gupta et al. [10] reported that main presenting symptoms of sinonasal masses were nasal blockage (94.5%) and rhinorrhea (90.2%). According to Bakari et al. (73) the main presenting symptoms were nasal blockage (97.4%), rhinorrhea (94.7%), allergic symptoms (52.6%), anosmia (34.6%). Lathi et al., (75)found nasal obstruction (97.3%) to be most common presenting complaint followed by rhinorrhea (49.1%), hyposmia (31.3%), intermittent epistaxis (17.9%), headache (16.9%), swelling over face (11.6%) and eye related symptoms (10.7%).

Clinical presentations in association with sinonasal pathology include rhinorrhea, nasal blockage, hyposmia, epistaxis, cheek swelling, facial pain, shaky tooth, proptosis and diplopia. In previous study of Tritt et al. [1], epistaxis and pain were among predominant presenting complaint in association with neoplastic pathologies. This is also their observation as we noticed that epistaxis was one of the prominent presenting features in association with neoplastic lesion.

Our results were supported by study of Kandukuri and Phatak, [16] as they reported that the most common benign pathology was nasopharyngeal angiofibroma which was also seen in study done by Gomaa et al. [17]. The most common malignant pathology was squamous cell carcinoma of maxillary sinus which was also seen in studies done by in Azzam et al. study [18], Gomaa et al. [17] and Chow et al. [19]

However, in the study of Sharma et al. [6], among benign neoplastic sinonasal masses, inverted papilloma in 6.52% cases and nasopharyngeal angiofibroma in 5.43% cases. Malignant sinonasal mass were reported in 6.52% cases. Chavan et al.,[20] showed the most common benign sinonasal mass as the nasal polyp; 51.7% of the cases revealed ethmoidal

polyp and 20.4% revealed an antrochoanal polyp with nasopharyngeal angiofibroma in 12.24% cases. Bakari et al. [7] showed that there is high incidence of benign non neoplastic lesions in their study, constituting about 77.6% of cases while 2.6% were malignant and 19.7% had no pathologic diagnosis.

According to Belli et al. [21], among all lesions, and also benign lesions most frequently nasal polyp was seen. Nasal polyps were seen more frequently in adults rather than children, and men rather than women. Nasal polyp was diagnosed in 158 patients (81.03%). Schnederian papilloma was the second most frequently seen tumor. Schnederian papilloma has inverted, fungiform, and oncocytic types. In this study they detected inverted (92.31%), fungiform (3.85%), and oncocytic (3.85%) types in respective percentages of patients with schnederian papillomas. As malignant lesions we encountered high-grade dysplasia, squamous cell carcinoma developed on the background of inverted papilloma, squamous cell carcinoma, adenoid cystic carcinoma, malignant melanoma, β-cell non-Hodgkin lymphoma. They detected malignant lesions in 5 male, and 3 female patients. Most frequently seen malignant lesion was squamous cell carcinoma (SCC).

Tanna et al. [22] has reported the minimally invasive endoscopic technique for this with decreased morbidity and comparable efficacy. Most of the patients were treated surgically under FESS (transnasal endoscopic sinus surgery) with medial maxillectomy. In their study there were no perioperative complications were encountered. Following analysis of results in this study the clinical implications noted were: Patients experienced minimized hospital stay. It was also reported by Sautter et al.[23]. Endoscopic approach was a chosen surgical option for sinonasal inverted papillomas and was confirmed by the global recommendations. It was the gold standard in the treatment of such lesions giving a lower recurrence rate compared to external approaches. Similarly, other indications for pure endoscopic approach to sinonasal pathologies in this study also have been described in the literature. The advantages noted were avoiding facial incision so in turn minimizing scar formation, minimal pain and swelling. Patients did not have dysesthesia as compared to open surgery..

To surgically treat sinonasal inverted papilloma (IP), a definite diagnosis is essential identifying its origin by CT scan, and MRI imaging. In the study of Hameed et al.[13], successful treatment of sinonasal IP with EMMM (endoscopic modified medial maxillectomy) was possible without much difficulty. EMMM gives a good visibility and

maneuverability. Hence EMMM was considered to be a very favorable approach for treatment of sinonasal IP. External incision and scaring and disfigurement are avoided by endoscopic approaches especially in Dacryo-Cysto-Rhinostomy, medial maxillectomy, fronto-ethmoidectomy. Rhinosporidiosis was seen mostly arising from nasal septum, inferior meatus and turbinate, posterior choana. All are resected and pedicle cauterized with better visualization, so residual lesion and recurrence are rare. Rhinosporidiosis is characterized by polypoid, papillomatous lesions of the mucosa with friable, bloody to the touch, painless and the septum implantation is the most common form with complaints of nasal obstruction, epistaxis, and mucopurulent rhinorrhea. It is a consensus that the surgical total resection of the lesion and cauterization of its peduncle is the treatment [24].

Gotlib et al. [25] from their 5-year study observed that disease-specific survival with Endoscopic endo nasal method of surgery was 91.4 % and seemed to indicate that endoscopic surgery was ideal. On the other hand, the prevalence of intra-orbital complications and invasion of sinonasal diseases was observed to be 3.7 to 47.6 % by Clayman et al.[26] Intra cranial invasion of sinonasal diseases and their neoplasia was observed in more than 5.8 % of their patients by Vairaktaris, Marilita et al. [27] In the study of Hameed et al., [13], the intra orbital complications was observed in the form of orbital cellulitis alone in 02 % of the patients. Similarly, the incidence of mucormycosis was not found in this study but review of literature shows its prevalence to be between 8.1 and 11.24 % as reported by Patel et al. [28]

Conclusions:

Inflammatory disease was found in 67 patients, benign tumor was found in 27 patients and malignant tumor in 8 patients. The most common disease in inflammatory group was inflammatory sinusitis (37.3%), the most common disease in benign group was Inverted papilloma (51.9%) & the most common disease in malignant group was adenocystic carcinoma (25%), mucoepidermoid carcinoma low grade (25%) and mucoepidermoid carcinoma high grade (25%). Further confirmation by histopathology should be reserved for doubtful cases only. Unilateral nasal polyps have high rates of malignancies and should be check carefully by endoscopy and histopathology.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

References

1. Tritt S, McMains KC, Kountakis SE. Unilateral nasal polyposis: clinical presentation and pathology. Am J Otolaryngol. 2008;29:230-2.
2. Calus L, Van Bruaene N, Bosteels C, Dejonckheere S, Van Zele T, Holtappels G, et al. Twelve-year follow-up study after endoscopic sinus surgery in patients with chronic rhinosinusitis with nasal polyposis. Clin Transl Allergy. 2019;9:30.
3. Uysal I, Misir M, Polat K, Altuntaş EE, Atalar MH, Tuncer E, et al. Primary malignant melanoma of the nasal cavity. J Craniofac Surg. 2012;23:e2-5.
4. Alshoabi SA, Binnuhaid AA, Gameraddin MB, Alsultan KD. Histopathological analysis of sinonasal lesions associated with chronic rhinosinusitis and comparison with computed tomography diagnoses. Pak J Med Sci. 2020;36:146-50.
5. Eid M, Eissa L. Imaging of sino-nasal inverted papilloma: How can we emphasize the usefulness of the “striated pattern” sign? Egyptian Journal of Radiology and Nuclear Medicine. 2020;51:1-16.
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;3:253-8.

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;3:186.

8. Bist SS, Varshney S, Baunthiyal V, Bhagat S, Kusum A. Clinico-pathological profile of sinonasal masses: An experience in tertiary care hospital of Uttarakhand. Natl J Maxillofac Surg. 2012;3:180-6.

9. 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;31:372-7.

10. Gupta R, Moupachi SS, Poorey VK. Sinonasal masses: a retrospective analysis. Indian J Otolaryngol Head Neck Surg. 2013;65:52-6.

11. Nair S, James E, Awasthi S, Nambiar S, Goyal S. A review of the clinicopathological and radiological features of unilateral nasal mass. Indian J Otolaryngol Head Neck Surg. 2013;65:199-204.

12. Wong JS, Hoffbauer S, Yeh DH, Rotenberg B, Gupta M, Sommer DD. The usefulness of routine histopathology of bilateral nasal polyps - a systematic review, meta-analysis, and cost evaluation. J Otolaryngol Head Neck Surg. 2015;44:46.

13. A S, R.T A, Dilna D. A Cross Sectional Study of Sinonasal Pathologies and Their Endoscopic Surgical Management. Journal of Evidence Based Medicine and Healthcare. 2020;7:2442-7.

14. Lee JY. Unilateral paranasal sinus diseases: analysis of the clinical characteristics, diagnosis, pathology, and computed tomography findings. Acta Otolaryngol. 2008;128:621-6.

15. Rudralingam M, Jones K, Woolford TJ. The unilateral opaque maxillary sinus on computed tomography. Br J Oral Maxillofac Surg. 2002;40:504-7.

16. Kandukuri R, Phatak S. Evaluation of Sinonasal Diseases by Computed Tomography. J Clin Diagn Res. 2016;10:Tc09-tc12.

17. Gomaa MA, Hammad MS, Abdelmoghny A, Elsherif AM, Tawfik HM. Magnetic resonance imaging versus computed tomography and different imaging modalities in evaluation of sinonasal neoplasms diagnosed by histopathology. Clin Med Insights Ear Nose Throat. 2013;6:9-15.

18. Salami AM. Unilateral Sinonasal Disease: analysis of the clinical, radiological and pathological features. Journal of the Faculty of Medicine Baghdad. 2009;51:372-5.

19. Chow JM, Leonetti JP, Mafee MF. Epithelial tumors of the paranasal sinuses and nasal cavity. Radiol Clin North Am. 1993;31:61-73.

20. Chavan SS, Deshmukh S, Pawar V, Sarvade K, Kirpan V, Kumbhakarna N, et al. Case study of clinicopathological correlation of benign sinonasal masses. World Articles Ear Nose Throat. 2012;5.

21. Belli S, Yildirim M, Eroglu S, Emre FK. Single-sided sinonasal mass: A retrospective study. North Clin Istanb. 2018;5:139-43.

22. Tanna N, Edwards JD, Aghdam H, Sadeghi N. Transnasal endoscopic medial maxillectomy as the initial oncologic approach to sinonasal neoplasms: the anatomic basis. Archives of Otolaryngology–Head & Neck Surgery. 2007;133:1139-42.

23. Sautter NB, Cannady SB, Citardi MJ, Roh HJ, Batra PS. Comparison of open versus endoscopic resection of inverted papilloma. Am J Rhinol. 2007;21:320-3.

24. Nicolai P, Berlucchi M, Tomenzoli D, Cappiello J, Trimarchi M, Maroldi R, et al. Endoscopic surgery for juvenile angiofibroma: when and how. Laryngoscope. 2003;113:775-82.

25. Gotlib T, Osuch-Wójcikiewicz E, Held-Ziółkowska M, Kużmińska M, Niemczyk K. Endoscopic transnasal management of sinonasal malignancies - our initial experience. Wideochir Inne Tech Maloinwazyjne. 2014;9:131-7.

26. Clayman GL, Adams GL, Paugh DR, Koopmann CF, Jr. Intracranial complications of paranasal sinusitis: a combined institutional review. Laryngoscope. 1991;101:234-9.

27. Vairaktaris E, Moschos MM, Vassiliou S, Baltatzis S, Kalimeras E, Avgoustidis D, et al. Orbital cellulitis, orbital subperiosteal and intraorbital abscess: report of three cases and review of the literature. J Craniomaxillofac Surg. 2009;37:132-6.

28. Patel A, Kaur H, Xess I, Michael JS, Savio J, Rudramurthy S, et al. A multicentre observational study on the epidemiology, risk factors, management and outcomes of mucormycosis in India. Clin Microbiol Infect. 2020;26:944.e9-.e15.