



# Ophthalmological Symptom Presentations in Ear, Nose and Throat Diseases - A Cross-sectional Study from South India

<https://doi.org/10.47210/bjohns.2022.v30i1.626>

S Manjumol,<sup>1</sup> C S Asha,<sup>1</sup> M Sadarudheen Ahmed<sup>1</sup>

## ABSTRACT

### Introduction

Ophthalmological symptoms are common in ear, nose and throat (ENT) conditions. Orbital involvement and ophthalmological presentations may be indicative of the extensive and aggressive nature of the pathology. This study evaluated the causes of various ophthalmological presentations in relation to primary ENT diseases in patients attending the ENT Department of a government tertiary referral teaching hospital.

### Materials and Methods

Sixty patients with ophthalmological presentations arising out of primary ENT diseases were assessed in detail. Comprehensive physical, ophthalmological and ENT examinations were done. Ophthalmological and ENT diagnoses, treatment details, outcome and complications if any were also noted.

### Results

Most number of patients were in the age group 51 to 60 years (14; 23.4%). Most common ophthalmological symptom was periorbital oedema (51.6%) followed by epiphora (48.3%); the most common ENT symptom was headache (50%) followed by nasal discharge (48.3%). Most common diagnosis among patients was sinusitis (46.7%) followed by mucocele (21.7%). Most common (47%) otorhinological diagnosis associated with proptosis in this study was infections in the form of orbital cellulitis or abscess associated with sinusitis. Majority (43, 71.7%) of the study sample had surgical management.

### Conclusion

This study reiterates the need for a high index of suspicion from the part of the ophthalmologist to look beyond eye diseases as causes for ophthalmological presentations and from the part of otorhinolaryngologist to be aware of various non-ENT symptoms secondary to ear, throat and nose diseases. A close collaboration between the ophthalmology and ENT departments is essential in successful management of such patients.

### Keywords

Diseases; ENT; Ophthalmological; Presentations; Sinusitis

Ophthalmological presentations are common in the practice of otorhinolaryngology. The proximity of the eye to the nose, paranasal sinuses and skull base makes it vulnerable to be involved in the diseases

of this area.<sup>1</sup> Orbital complications may also arise from infections of dangerous area of face, by direct extension of the pathology of nose, paranasal sinuses and nasopharynx into orbit. Venous drainage through valveless communication can cause cavernous sinus thrombosis. Fissures and foramina of the bony orbit are also natural pathways for spread of pathology of nose, paranasal sinuses and nasopharynx to the orbit.<sup>2</sup> Causes of orbital complications from diseases of the nose and paranasal sinuses include direct spread from the sinuses

1 - Department of ENT, Government Medical College, Kottayam

### Corresponding author:

Dr C S Asha

email: ashamangal44322@gmail.com

into the orbit; involvement of the nerves supplying the orbit and involvement of nasolacrimal apparatus.<sup>3</sup>

Orbital involvement in sinonasal diseases can present as proptosis, ophthalmoplegia or even as blindness due to optic nerve damage. Orbital involvement in most of the sinonasal diseases indicate extensive and aggressive nature of the pathology and many of these, even if they are not malignancies are difficult to treat.<sup>4</sup> Though there has been some reduction in inflammatory complications of nasal and paranasal sinus diseases due to the availability of potent wide spectrum antibiotics, pre septal orbital cellulitis (orbital cellulitis that it is confined to the soft tissues anterior to the orbital septum) still remains a major concern in clinical practice. Orbital cellulitis is an emergency condition which needs to be diagnosed early and managed aggressively. Late treatment makes orbital cellulitis difficult to cure and may potentially cause blindness due to optic nerve compression. Orbital abscess and cavernous sinus thrombosis can lead to meningitis or cerebral abscess with high morbidity and possible mortality. Early treatment of nasal furunculosis has also been suggested to prevent orbital cellulitis.<sup>5</sup> Diseases of the paranasal sinuses can present solely with ophthalmological symptoms.<sup>6</sup> If left untreated, rhinosinusitis can rarely cause serious complications like irreversible blindness and delayed admission after onset of orbital symptoms have a higher risk of poor outcome. Hence these patients deserve prompt evaluation and early surgical intervention to prevent blindness.<sup>7</sup>

Around seven percent of orbital tumours have been found to be of paranasal in origin.<sup>8</sup> Involvement of the orbit has been found to be the initial presentation in a large majority of paranasal sinus tumours. Ophthalmological manifestations associated with primary ENT diseases are common presentations which can lead to serious complications. Importance of clinical examination in preventing complications including permanent blindness following orbital complications resulting from sinusitis has been recognised across the world.<sup>9,10</sup>

This study aimed to evaluate the causes of various ophthalmological presentations in relation to primary

ENT diseases in patients attending the ENT Department of a tertiary referral centre which is also a teaching hospital in the government sector.

### **Material and Methods**

This cross-sectional, descriptive study conducted at the Department of ENT, Government Medical College, Kottayam in the state of Kerala and was approved by the ethics committee of the institution. Patients belonging to all age groups of both genders with ophthalmological presentations consenting to the study were included in the study. Patients with primary ophthalmological disease presenting with ENT complaints were excluded. The sample size of the study was sixty patients. All consecutive consenting patients attending the ENT department with various ophthalmological symptoms in relation to suspected primary ENT diseases were included in the study. They either were self-referred or referred from other hospitals.

Proforma specifically designed for this study was used to document all the information. Patients with ophthalmological presentations arising out of primary ENT diseases from the ENT outpatient and inpatient departments were assessed in detail. A written informed consent was obtained from the patients. A detailed socio-demographic and clinical history was taken. Special focus was given to presenting ophthalmological and ENT symptoms. Predisposing factors and antibiotics prior to admission were noted. Comprehensive physical, ophthalmological and ENT examinations were done. Appropriate investigations were completed and results documented including that of imaging studies and culture results. Ophthalmological and ENT diagnoses were documented. Treatment details, outcome and complications if any were also noted. The treatment and course of illness were monitored closely in the outpatient or inpatient unit as appropriate. Orbital complications of sinusitis were categorised according to Chandler's classification of orbital infections.<sup>11</sup> Descriptive statistical analysis was done using Microsoft Excel version 16.

## Results

Most number of patients were in the age group 51 to 60 years (14; 23.4%) followed by 41 to 50 years (20%) closely followed by the age group 11 to 20 (18.3%). The youngest patient was 2 years old and the oldest patient was 80 years old. There were 29 (48.3%) males and 31 (51.7%) females.

Most common ophthalmological symptom among the study population was periorbital oedema (51.6%) followed by epiphora (48.3%). 28.3% had proptosis, 23.4% had blurring of vision, 21.6% had pain and redness around eyes suggestive of cellulitis and 11.7% had diplopia (Table I).

**Table I: Distribution of total study population according to presenting ophthalmological symptoms**

OPHTHALMOLOGICAL SYMPTOM	NUMBER OF PATIENTS	PERCENTAGE
Periorbital Oedema	31	51.6%
Epiphora	29	48.3%
Proptosis	17	28.3%
Blurring of vision	14	23.4%
Pain and redness around eyes/ orbital infection	13	21.6%
Diplopia	7	11.7%

Among this patient group the most common ENT symptom was headache (50%) followed by nasal discharge (48.3%). Facial pain was reported by 10%, 6.7% had nasal mass, 5% each had nasal block and epistaxis.

Most common diagnosis among patients in this study was sinusitis (46.7%) which mostly presented as either orbital cellulitis or abscess. This was followed by mucocele (21.7%) 15% of patients had Allergic Fungal Rhinosinusitis (AFRS). 5 (8.2%) patients had carcinoma. The detailed distribution of diagnosis of patients

presenting with ophthalmological symptoms are given in Table II.

**Table II: Distribution of total study population according to diagnosis**

DIAGNOSIS	NUMBER OF PATIENTS	PERCENTAGE
Paranasal Sinusitis	28	46.7%
Mucocele	13	21.7%
Allergic Fungal Rhinosinusitis	9	15%
CA Maxilla	3	5%
CA Ethmoid	1	1.6%
Adenocystic Carcinoma	1	1.6%
Fibrous Dysplasia	1	1.6%
Inflammatory Reaction to Worm	1	1.6%
Cavernous Sinus thrombosis	1	1.6%
Dacryocystitis	1	1.6%
Lacrimal Sac Tumour	1	1.6%
<b>TOTAL</b>	<b>60</b>	<b>100%</b>

Chandler's classification was used to categorise orbital infections. 13 (65%) patients were categorised as Stage 1 (periorbital cellulitis/ preseptal cellulitis) or stage II (orbital cellulitis/post septal cellulitis); 6 (30%) patients came under stage III (sub periosteal abscess) or stage IV (orbital abscess) and 1 (5%) came under stage V (cavernous sinus thrombosis).

In patients who presented with epiphora, mucocele was the most common (34.5%) diagnosis, followed by infections (orbital cellulitis or abscess) due to sinusitis (17.2%).

Most common (47%) otorhinological diagnosis associated with proptosis in this study was infections in the form of orbital cellulitis or abscess associated with sinusitis. 23.5% had mucocele and 17.7% had malignancy (Table III).

**Table III: Diagnosis among patients who presented with proptosis**

DIAGNOSIS	NUMBER OF PATIENTS	PER-CENTAGE
Infections (Orbital cellulitis or abscess associated with sinusitis)	8	47%
Mucocele	4	23.5%
Allergic Fungal Rhinosinusitis	2	11.8%
CA Maxilla	2	11.8%
CA Ethmoid	1	5.9%
<b>TOTAL</b>	<b>17</b>	<b>100%</b>

Regarding the types of treatment, the patients received, majority (43, 71.7%) of the study sample had surgical management, 14 (23.3%) had medical management and 3 (5%) defaulted after diagnostic nasal endoscopy and biopsy.

Among those who underwent surgical management, 25.6% each were in the age groups, 41 to 50 years and 51 to 60 years. 20.9% were between 11 and 20 years. Youngest patient was 4 years old and the oldest patient was 64 years old. Among the patients who underwent surgery there was a slight female (n=23, 53.5%) preponderance; 20 (46.5%) were men. Among patients who underwent surgery the most common diagnosis was sinusitis (34.9%) followed by mucocele (30.2%). 9 (21%) patients had AFRS (Table IV).

**Table IV: Distribution of patients who underwent surgery according to diagnosis**

DIAGNOSIS	NUMBER OF PATIENTS	PER-CENTAGE
Sinusitis	15	34.9%
Mucocele	13	30.2%
Allergic Fungal Rhino Sinusitis	9	21%
CA Ethmoid	1	2.3%
Adenocystic Carcinoma	1	2.3%
Fibrous Dysplasia	1	2.3%
Cavernous Sinus thrombosis	1	2.3%
Inflammatory Reaction to Worm	1	2.3%
Dacryocystitis	1	2.3%
<b>TOTAL</b>	<b>43</b>	<b>100%</b>

The most common surgery performed was Functional endoscopic sinus surgery (FESS), 22 (51.2%) followed by Lynch Howarth operation, 10 (23.3%) (Table V).

Multiple sinuses were involved in 24 patients (56%) among those who had surgery, single sinus was involved in 15 patients (35%) and pansinusitis in 2 (4.5%) patients. 2 (4.5%) patients who underwent surgery had no sinus involvement. Among those with single sinus involvement who had surgery, maxillary sinus was involved in 6 (40%) patients. Ethmoid sinus was involved in 5 (33.3%) patients, frontal sinus in 3 (20%) and sphenoid sinus in 1 (6.7%) patient. Among 24 patients who had multiple sinus involvement, 23 (96%) had ethmoid sinus involvement followed by 15 (62.5%) who had maxillary sinus involvement.

**Table V: Types of surgical management**

<b>SURGERY</b>	<b>NUMBER OF PATIENTS</b>	<b>PER-CENTAGE</b>
<b>Functional Endoscopic Sinus Surgery (FESS)</b>	<b>22</b>	<b>51.2%</b>
<b>Lynch Howarth</b>	<b>10</b>	<b>23.3%</b>
<b>Extended Sinus Surgery (ESS) with optic nerve decompression</b>	<b>5</b>	<b>11.5%</b>
<b>Extended Lateral Rhinotomy, Excision of tumour</b>	<b>2</b>	<b>4.7%</b>
<b>Caldwell-Luc</b>	<b>2</b>	<b>4.7%</b>
<b>Ophthalmologic excision</b>	<b>1</b>	<b>2.3%</b>
<b>Dacryocystorhinostomy</b>	<b>1</b>	<b>2.3%</b>
<b>TOTAL</b>	<b>43</b>	<b>100%</b>

## Discussion

The study included 60 patients with ophthalmological presentations who had primary ENT diagnosis. Most number of patients were in the age group 51 to 60 years (14; 23.4%) followed by 41 to 50 years (20%). This age distribution is quite similar to the findings reported by other Indian studies.<sup>2,12</sup> There was a slight female preponderance among this patient group; 31 (51.7%). There has been no consistency in gender distribution across studies of this nature.

As far as ophthalmological symptoms associated with ENT disorders are concerned, patients in this study presented with multiple complaints. General symptoms like periorbital oedema (51.6%) and epiphora (48.3%) were the commonest. Similar prevalence of watering from the eyes was reported by others as well.<sup>13</sup>

Most frequent diagnosis among patients with epiphora was mucocele (34.5%) in this clinic population. 28.3% patients had proptosis as the presenting ophthalmological symptom in this study. Another study, which was done in Telangana also reported that proptosis had a prevalence rate of 31% though it was the commonest ophthalmological symptoms among their patients.<sup>14</sup> The prevalence of proptosis was somewhat comparable to that of a similar Indian study which reported that among 62 patients, 30.64% patients had lagophthalmos and 20.96% had proptosis.<sup>2</sup>

In many studies which looked into ophthalmological symptoms associated specifically with sinonasal disorders, proptosis was reported as the most common symptom. A large majority (81%) had proptosis followed by diplopia (23%) when 100 patients who had orbital involvement following sinonasal diseases were evaluated.<sup>4</sup> In a study, which looked at orbital complications specifically of diseases of paranasal sinuses, most (67.7%) common ophthalmological presentation was proptosis.<sup>6</sup> Among fifty-four cases of nasal and paranasal sinus diseases invading the orbit, initial clinical presentation was proptosis in 66.66%, of patients<sup>15</sup> while another study reported a rate of 44.73%.<sup>16</sup> Primary ENT disorders especially of sinonasal origin presenting as proptosis has been studied in detail by several researchers. Proptosis reflects encroachment of disease into the orbit. This causes an increase the orbital volume. Early treatment can often result in complete recovery. Evaluation of proptosis by otorhinolaryngologists is important as it could be an early and sometimes the only manifestation of nasal or paranasal sinus pathology. Proptosis is commonly secondary to inflammatory disease in nose and paranasal sinuses.<sup>17</sup>

Most common (47%) cause for proptosis in this study was infections mostly in the form of orbital cellulitis or abscess associated with sinusitis. 23.5% had mucocele and 17.6% had malignancy. Infective causes such as orbital cellulitis associated with sinusitis is reported in studies assessing proptosis of otorhinological origin, though malignancy seems to be the most common cause in many studies. After assessing a series of 50 patients with proptosis due to ENT disorders in a study from



Ahmedabad, it was concluded that most lesions are neoplastic in origin. Nasopharyngeal angiofibroma (22%), followed by carcinoma of nasopharynx (14%) and carcinoma of maxilla (12%) were the commonest causative lesions. Around 6% of proptosis was of infective origin.<sup>18</sup> A study which conducted detailed assessment of 53 patients who had proptosis, reported the most common aetiology found was neoplastic (60%) of which sinonasal squamous cell carcinoma followed by juvenile nasopharyngeal angiofibroma were the most common causes<sup>14</sup> with similar findings reported from another study in the same region as well.<sup>19</sup> In a prospective study commonest cause of proptosis was malignancy of nose and paranasal sinuses (27.3%) of which squamous cell carcinoma was common. Frontoethmoid mucocele (22.7%) was the second common cause followed by fungal sinusitis.<sup>13</sup>

Most common diagnosis among the study population was paranasal sinusitis (46.7%) which mostly presented either as orbital cellulitis or abscess. This was followed by mucocele (21.7%) 15% of patients had AFRS and five (7.2%) patients had carcinoma. The prevalence of various conditions varies between studies and the study settings.

In a fifteen-year retrospective review sinogenic orbital cellulitis constituted 57% of the study population.<sup>10</sup> Among 28 patients who had sinonasal disease with secondary orbital involvement around 60% was reported to have sinusitis while around 15% had carcinomas.<sup>20</sup> Similar figure was observed in another study where the majority of had an infective or granulomatous (59, 34%) aetiology followed by traumatic (45, 26%) and neoplastic (44, 26%) causes.<sup>14</sup> Much higher prevalence rate of 79.63% of an inflammatory aetiology was also reported in the literature with 20.4% having neoplastic lesions in the nasal and paranasal sinuses extending into the orbit.<sup>15</sup>

It was suggested that orbital involvement associated with sinonasal diseases usually indicate extensive and aggressive nature of the pathology and often difficult to treat which is very evident in conditions like acute fulminant and chronic invasive fungal rhinosinusitis.<sup>4</sup> In their study the authors report the prevalence of allergic fungal rhinosinusitis as 37%. They also found

mucormycosis in 17% and chronic invasive fungal sinusitis in 16% of patients.

Sinonasal tumours as the commonest (78.2%) cause for orbital involvement subsequent to diseases of the paranasal sinuses has been reported as well where they found 17.7% had sinus infection.<sup>6</sup> A study from Uttar Pradesh had 47.37% patients with sinonasal neoplasms and 23.68% with infections.<sup>16</sup> Although benign cystic lesions, mucoceles can be locally destructive as they expand with a risk of around 20% of patients losing their vision. Mucocele was the diagnosis of 21.7% patients in this study and other studies have also reported it as a cause of ophthalmological manifestations in sinonasal disorders.<sup>6,20</sup>

In this study, 24 (56%) patients who underwent surgery had multiple sinus involvement and 15 (35%) had only one sinus involved. Most common sinus involved among patients who had single sinus involvement and underwent surgery was maxillary sinus, (40%) followed by ethmoid sinus (33.3%). Among those who had multiple sinus involvement, 96% had ethmoid sinus involvement followed by 62.5% who had maxillary sinus involvement. Frequent involvement of ethmoid and maxillary sinuses has been reported in several other studies as well.<sup>21,22</sup> Maxillary sinus had the highest incidence of sinusitis either singly (18%) or combined (65%).<sup>10</sup> Common (58.1%) involvement of maxillary sinus was noted by others as well.<sup>6</sup> Ethmoidal sinus was the most common sinus affected followed by maxillary sinus in another study.<sup>23</sup>

As far as clinical management is concerned, except for two patients (one patient with a diagnosis of inflammatory reaction to worm and another patient with dacryocystitis) who were managed at ophthalmology department all other patients were treated in the ENT Department. Chandler's classification was used to categorise orbital infections. 65% with orbital infection was categorised as stage I or stage II, 30% percent came under stage III or stage IV and 5% came under stage V. Majority (69%) of patients in stages I and II responded well to medical management. Similar finding of good response to medical management of patients in early stages were reported by other researchers as well.<sup>2</sup>

Majority (71.7%) of patients had surgical interventions. The principles of and indications for treatment follow recognised treatment practices.<sup>24,25</sup> Among those who had surgery, 34.9% had a diagnosis of paranasal sinusitis and 30.2% had mucocele. Two patients had a diagnosis of maxillary mucocele; which is a rare lesion which develops due to retained secretions and presents as an expansile cystic lesion. It is postulated that the aetiology may be the obstruction of the ostium by inflammation or previous surgical procedures.<sup>26</sup> All patients who had mucocele were managed either by FESS or Lynch Howarth operation. A patient with ethmoid malignancy diagnosed as chondrosarcoma underwent extended lateral rhinotomy and tumour excision who was further treated with radiotherapy. There were two patients with maxillary carcinoma who defaulted later during the study period.

Many instances were encountered in this study which exemplified the importance of appropriate and timely investigations in effective management of the patients. Histopathological results led to a change of diagnosis in two patients. These patients who had blurring of vision and diplopia were considered to have neoplasms due to the aggressiveness of the lesions, with a plan for FESS. However, the histopathological results and fungal culture proved to be AFRS with granuloma. Aggressive AFRS with complications can safely be managed with appropriate investigations and treatment.<sup>27</sup>

Imaging plays a crucial role in management of patients with ophthalmological presentations associated with ENT disorders. CT was an integral diagnostic tool prior to surgery for many patients. There were instances where patients with orbital invasion when taken up for FESS also undergoing optic nerve decompression with marked improvements in outcome. It is clinically important for the ophthalmologist and the ENT surgeon to be sensitive about the possibility of lesions in the paranasal sinuses resulting in ophthalmic complications like blindness and be ready to intervene. Another classic example of how timely diagnosis and intervention could lead to significant improvement in ophthalmological symptom was, when a patient with cavernous sinus thrombosis who complained of decreased vision posted for FESS, was found to have sphenoid sinus filled with pus. On drainage

of the pus by widening of sphenoid ostium and post-operative antibiotics, his vision improved remarkably.

Appropriate and timely investigations play a crucial role in the management of patients with ophthalmological symptoms following ENT diseases.<sup>2</sup> Diseases of the sinonasal tract with orbital extension must be considered whenever a patient presents with ophthalmological symptoms or signs of orbital disease. Cooperation between the ophthalmologist and the otolaryngologist is desirable for proper management of such patients.<sup>20</sup> A firmer knowledge of orbital anatomy with respect to sinonasal region is required and diagnosis and treatment are of utmost importance in preserving vision and life in these patients.<sup>28</sup> Early recognition and management can pave the path to prevention of mortality and morbidity associated with ocular involvement secondary to ear, nose, throat disorders.<sup>14</sup>

Some limitations of this study include a small sample size limited to a single centre which may not be representative of patients in the community.

## Conclusions

This study re-emphasises the need for a high index of suspicion from the part of the ophthalmologist to look beyond eye diseases as causes for ophthalmological presentations and from the part of otorhinolaryngologist to be aware of various non-ENT symptoms secondary to ear, throat and nose diseases. Early diagnosis, referral and good working relationships between specialists invariably save vision and life in many patients. A close collaboration between the ophthalmology and ENT departments is essential in successful management of such patients.

## References

1. Akinsola FB, Somefun AO, Oguntoyinbo OS. Ophthalmological complications of nasal, paranasal sinus diseases and head and neck tumours. *East Afr Med J.* 2006; 83(12):674-8. doi: 10.4314/eamj.v83i12.9499
2. Ghosh D, Khanna S, Baruah DK. Ophthalmological Manifestations of ENT Diseases: An Overview. *Indian Journal*

- of Otolaryngology and Head & Neck Surgery 2011; 65:197-202
3. Jones HM. Some orbital complications of nose and throat conditions. *J R S Med.* 1981; 74:409-14
  4. Qazi ZU, Latif S, Awan SM. Orbital Involvement in Sinonasal Diseases. *J Ayub Med Coll Abbottabad.* 2016; 28(4):687-93
  5. Zeyad M, Muhammad S, Quick Cadric A. Multiple bilateral orbital abscesses secondary to nasal furunculosis. *International Journal of Pediatric Otorhinolaryngology* 2001; 58(2):167-71
  6. Rahman A. Orbital Complications of The Paranasal Sinuses Disease. *Transl Biomed.* 2015; 6:3. doi: 10.21767/2172-0479.100027
  7. Ismi O, Vayisođlu Y, Bal KK, Helvaci I, Görür K, Ozcan C. Surgical Treatment of Rhinosinusitis-Related Orbital Complications: Factors Affecting Irreversible Blindness. *J Craniofac Surg.* 2018; 29(5):1294-9. doi: 10.1097/SCS.00000000000004531
  8. Bier H, Ganzer U. Involvement of the orbit in diseases of the paranasal sinuses. *Neurosurgical Review* 1990; 13:109-12
  9. Patt BS, Manning SC. Blindness resulting from orbital complications of sinusitis. *Otolaryngology, Head and Neck Surgery* 1991; 104(6):789-95
  10. Nwaorgu OGB, Awobem FJ, Onakoya PA, Awobem AA. Orbital cellulitis complicating sinusitis: A 15 year review. *Nigerian Journal of Surgical Research* 2004; 6(1):14-6
  11. Chandler JC, Lagenbrunner DL, Stevens ER. The pathogenesis of orbital complications in acute sinusitis. *Laryngoscope* 1970; 80:1414-8
  12. Chavan SS, Deshmukh SD, Pawar VG, Vaibhav G, Kirpan VG, Khobragade SW. Orbital Complications of Sinogenic Origin: A Case Study of 20 Patients. *World Articles in Ear, Nose and Throat* 2010; 3(2). <http://www.waent.org/archives/2010/Vol3-2/20101110-orbital-complications/sinus-orbital-complications.htm>
  13. Venugopal M, Sagesh M. Proptosis: The ENT Surgeon's Perspective. *Indian Journal of Otolaryngology and Head & Neck Surgery* 2013; 65(Suppl 2)247-50
  14. Novshaba, Bhushan IP, Reddy LS, Divya J. A prospective study of ocular involvement secondary to ear, nose and throat disorders in a tertiary care centre, Telangana. *Int J Otorhinolaryngol Head Neck Surg.* 2019; 5:1593-600
  15. Malik TG, Farooq K, Rashid A. Paranasal Sinuses and Nasal Cavity; The Notorious Neighbours of Orbit. *Professional Med J.* 2011;18(1):154-9
  16. Kumar A, Chauhan JPS, Bhadouriya SKS, Bharti B, Narain P, Singh J. Orbital complications of ENT diseases. *Int J Otorhinolaryngol Head Neck Surg.* 2018; 4:210-6
  17. Williamson-Noble FA. Diseases of the orbit and its contents, secondary to pathological conditions of the nose and paranasal sinuses. *Ann R Coll Surg Engl.* 1954 Jul;15(1):46-64. PMID: 13189324
  18. Sinha V, Bhardwaj D, George A, Memon RA. Proptosis through eyes of E.N.T. surgeon. *Indian J Otolaryngol Head Neck Surg.* 2005; 57(3):207-9. doi: 10.1007/BF03008015
  19. Nazeer N, Ivaturi PB. Proptosis in Otorhinolaryngology: An Overview. *Int Arch Otorhinolaryngol.* 202;25(2):267-72. doi: 10.1055/s-0040-1709986
  20. El-Sayed Y. Orbital involvement in sinonasal disease. *Saudi Journal of Ophthalmology* 1995; 9:29-37
  21. Robin PE, Powell DJ, Stansbie JM. Carcinoma of the nasal cavity and paranasal sinuses: incidence and presentation of different histological types. *Clinical Otolaryngology and Allied Science* 1979; 4(6):431-56
  22. Bornholdt J, Hansen J, Steiniche T, Dictor M, Antonsen A, Wolff H et al. K-ras mutations in sinonasal cancers in relation to wood dust exposure. *BMC Cancer* 2008; 8:53. <https://doi.org/10.1186/1471-2407-8-53>
  23. Elango S, Reddy TNK. Orbital complications of acute sinusitis. *Singapore Medical Journal* 1990; 31:341-4
  24. Hopkins C, Browne JP, Slack R, Lund V, Brown P. The Lund-Mackay staging system for chronic rhinosinusitis: how is it used and what does it predict? *Otolaryngol Head Neck Surg.* 2007;137(4):555-61
  25. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, et al. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. *Rhinology* 2020; 58(Suppl S29):1-464
  26. Sadhoo A, Tuli IP, Sharma N. Idiopathic mucocele of maxillary sinus: A rare and frequently misdiagnosed entity. *J Oral Maxillofac Radiol.* 2016; 4:87-9
  27. Thakare S, Vaidya D, Chaudhary A, Hazirmis K, Bhondawe S. Aggressive allergic fungal sinusitis managed completely by endoscopy. *Journal of Evidence Based Medicine and Healthcare* 2014; 1:489-96
  28. Shukla A, Kumar B. A Study of Otorhinolaryngological Diseases with Ophthalmic Complications: At a Tertiary Care Center. *Indian J Otolaryngol Head Neck Surg.* 2020; 1-6. <https://doi.org/10.1007/s12070-020-01849-2>.