A CLINICAL STUDY ON ORBITAL COMPLICATIONS OF NASAL AND PARANASAL SINUS DISEASES IN A TERTIARY GOVERNMENT HOSPITAL

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ABSTRACT

BACKGROUND

The orbit is an area of considerable interest to the otolaryngologist because of its close anatomical relationship to the Paranasal Sinuses (PNS). PNS may be involved in various types of pathology arising in the nose and paranasal sinuses. Surgical procedures of the nose and PNS may sometimes involve the orbit or its contents. Infections of the paranasal sinuses may spread to the orbit through suture lines, congenital or acquired bony dehiscence and retrograde thrombophlebitis and by bone necrosis or bony erosion. Neoplasms of the PNS also can involve the orbit. Hence, knowledge of the anatomy of the orbit is very important. The several of diseases of PNS in a tertiary hospital were included in the study and the data analysed.

The aim of the study is to determine the type of orbital complications of nasal and paranasal sinus diseases and to evaluate the management protocol in orbital complications of nasal and paranasal sinus diseases.

MATERIALS AND METHODS

The study included forty patients (40) with orbital complaints of diseases of nose and PNS. These patients had CT scan evidence of invasion of the orbit. After laboratory, radiological study and wherever necessary HPE is done. The entire patient's data was analysed. The orbital complications were classified and analysed.

RESULTS

Among the 40 patients, the age range was 10 to 80 years. 14 patients were females and 26 were males. 36 patients had symptoms pertaining to the orbit while 4 patients without. 26 patients underwent surgical management. 4 patients underwent medical treatment. 6 patients were treated with radiotherapy and chemotherapy. Among the 40 patients, 8 patients were diagnosed to have frontal mucocele, 8 patients with carcinoma of maxilla, 4 patients with inverted papilloma, 6 patients with lymphoma, 4 patients with osteomyelitis of the maxilla, 2 patients with osteomyelitis of the frontal bone, 4 patients with orbital cellulitis, 2 patients with mucormycosis and 2 patients with aspergillosis. Among the 18 patients presenting with neoplasia, 8 patients (44.44%) showed HPE of squamous.

CONCLUSION

The orbital complications of PNS diseases include chronic sinusitis, benign and malignant neoplasia and invasive and noninvasive fungal involvement of PNS. Vision was more affected in patients with fungal infection of the sinuses with orbital extension. CT scan is the mainstay in diagnosis of orbital involvement. In malignancies of the paranasal sinuses involving the orbit, an intraoperative assessment of involvement of the orbital periosteum and orbital contents is important in determining whether orbital exenteration should be added to total maxillectomy.

KEYWORDS

Ethmoid, Orbital, Complications, Sinus, Disease, Fungal, Tumour.

HOW TO CITE THIS ARTICLE: George BR, Oommen B. A clinical study on orbital complications of nasal and paranasal sinus diseases in a tertiary government hospital. J. Evid. Based Med. Healthc. 2017; 4(31), 1806-1813. DOI: 10.18410/jebmh/2017/352

BACKGROUND

The orbit having an intimate anatomic relation with the PNS is always at risk to get affected by the diseases of the later. Lamina papyracea separates the ethmoid from the orbit being a thin bone as the name suggests bears the brunt of diseases of the sinuses. Orbital complications are not very uncommon in ENT practice. The more usual orbital complications in sinus disease are mucocele, osteoperiostitis (osteomyelitis), diffuse orbital swelling, abscess, involvement of the optic nerve, uveitis and functional disturbances, especially in the intraocular and extraocular muscles. More or less constant ocular signs of sinus disease are lacrimation, oedema of the lids, episcleritis fugax and proptosis. In 1921, Lynch in the United States and Howarth in England simultaneously reported their experience with the transorbital frontal sinusotomy and ethmoidectomy. In his 15 cases, Lynch

Financial or Other, Competing Interest: None.
Submission 08-03-2017, Peer Review 14-03-2017,
Acceptance 01-04-2017, Published 14-04-2017.
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DOI: 10.18410/jebmh/2017/352

partially removed the sinus floor and curetted out all the mucosa and stressed drainage of the sphenoid sinus.[1] In 1908, Knapp reported removal of the orbital wall in conjunction with an extensive external ethmoidectomy. Lynch[2] and Howrath[3] popularised this approach. The transorbital approach, which is employed to prevent disfigurement had numerous modifications later on. Conclusions, which have been reached on the basis of studies on the limitations of the external frontoethmoidectomy operation conducted by Coates, Eraner,[4] Hilding, Walsh[5] and Neel[6] are as follows. First, the total removal of the mucosa often results in fibrous tissue proliferation; however, complete obliteration of the sinus cavity does not consistently occur. Second, there is a tendency toward the epithelialisation of the sinus cavity following its denudation, form the mucosa of the nasofrontal duct or by retained microscopic tissue tags within the sinus itself. The finding by Walsh that instrumentation of the duct led to chronic infection of the sinus has caused some workers to advocate transorbital frontal sinusotomy without duct manipulation or enlargement. Boodale[7] and Williams and Holman[8] respectively described a variety of methods has hence been devised to maintain the patency of the nasofrontal duct. Tubes constructed of various materials like rubber, tantalum foil, Portex and acrylic have been tried. The lateral rhinotomy was first described by Michaux[9] in 1848 in France and by Bruns in 1872 in Germany. Numerous reports cited the versatility of the rhinotomy approach in the management of nasal, paranasal sinuses and nasopharyngeal lesions. In 1973, Neel[10] described the use of lateral rhinotomy in 56 cases of nasopharyngeal angiofibroma. Vravec[11] and Suh[12] cited the superiority of external rhinotomy over intranasal surgery in accomplishing complete extirpation of inverted papillomas. In 1977, Djalilan et al[13] described a method for the removal of olfactory neuroblastoma in which exposure of superior portion of the nasal cavity was gained through a lateral rhinotomy incision. In 1978, Pope[14] modified the procedure to include removal of the posterior wall of maxillary and ligation of internal maxillary artery. Sessions and Larson[15] coined the term "medial maxillectomy" to describe the en bloc removal of the ethmoid labyrinth along with the medial aspect of the maxilla and portions of lacrimal and palatine bones. Surgery of the ethmoid labyrinth dates to Hippocrates who avulsed nasal polyps and probably adjacent ethmoid cells by using sponge attached to fraction strings. He utilised cautery and employed a polyp snare similar to instruments in use today. Jansen in 1884 probably performed the first transantral ethmoidectomy. This procedure was further popularised by Horgan[16] in 1926 and by Langenbrunner and Nigri[17] in 1976. External ethmoidectomy was originally described by Ferris Smith[18] in 1933 and has been continuously modified by many surgeons since that time. In 1912, Mosher[19] described the anatomy and intranasal surgery of the ethmoid labyrinth. Yankauer demonstrated a complete exenteration of the ethmoid and removal of the anterior wall of sphenoid, which he termed sphenoethmoidectomy.

MATERIALS AND METHODS

This study included forty patients (40) who were admitted with complaints pertaining to the nose and paranasal sinuses. These patients had symptoms related to the orbit or CT scan evidence of invasion of the orbit.

Inclusion Criteria

1. Patients with paranasal sinus diseases presenting with orbital symptoms were included.
2. Patient's age 10 to 80 years were included.
3. Patients with history of previous sinus surgery were included.

Exclusion Criteria

1. Patients aged below 18 and above 60 years were excluded. 2. Patients with diseases other than infections and tumours of the PNS were excluded. In all the patients, detailed clinical history was taken and the following symptoms were studied- epistaxis, nasal obstruction, nasal discharge, headache, ear blockage, proptosis, double vision, decrease in vision, increased watering from eye and persistently discharging sinus on face. Clinical examination of the patients included general examination and local examination. Examination of the ENT included external appearance of the nose, anterior and posterior rhinoscopy examination. Anaesthesia of the infraorbital region was looked for. Ear and throat examination was followed by examination of the eye. Examination of the eye and orbit included looking for proptosis and direction and displacement of the eyeball, chemosis, visual acuity, extraocular movements and palpation of the orbital margins. Perimetry was done in all the patients to identify pressure on the optic nerve. All the laboratory investigations required as a surgical profile were performed. PNS radiography with Caldwell and Waters view were taken. CT scan of PNS was done. Biopsy of the nasal mass was performed and subjected to Histopathological Examination (HPE). All the data was analysed using standard statistical methods.

OBSERVATIONS AND RESULTS

40 patients attending the Department of ENT, Government Teaching Hospital at Kozhikode during the period of January 2013 to December 2014 were included in the present study. The age of the patients ranged from 10 to 80 years. 14 patients were females and 26 were males. 36 patients had symptoms pertaining to the orbit while 4 patients without orbital symptoms were found to have involvement of the orbit only on CT scan. 26 patients underwent surgical management. 4 patients underwent medical treatment. 6 patients were treated with radiotherapy and chemotherapy. 40 patients were divided into age groups with a class interval of 10 and 10/40 (35%) of them were belonged to the age group of 41-50 years followed by 25% in 21-30 years (Table 1).

Age in Years	Number of Patients
10-20	2
21-30	10
31-40	4
41-50	14
51-60	6
61-70	0
71-80	4

Table 1. Age of Patients Studied

26/40 patients (65%) were males and 35% were females (Table 2).

1.	Number of males included in the study	26
2.	Number of females included in the study	14

Table 2. Gender Incidence in the Study Group

In this study, 36 patients (90%) presented with orbital complaints and without orbital complaints were (10%).

1.	Patients with obvious involvement of orbit	36
2.	Patients with orbital involvement only on CT scan	4

Table 3. Orbital Involvement Clinically Vs. on CT Scan in the Study

Surgical profile of patients for blood and urine investigations revealed the presence of diabetes mellitus in one patient with mucormycosis. In all the other patients, investigate were normal. Culture and sensitivity studies of pus in the nasal cavity in four patients revealed the presence of organisms like staphylococcus aureus, Haemophilus influenza and beta-haemolytic streptococcus, which were sensitive to penicillin and gentamicin.

Among the 40 patients, 8 patients were diagnosed to have frontal mucocele, 8 patients with carcinoma of maxilla, 4 patients with inverted papilloma, 6 patients with lymphoma, 4 patients with osteomyelitis of the maxilla, 2 patients with osteomyelitis of the frontal bone, 4 patients with orbital cellulitis, 2 patients with mucormycosis and 2 patients with Aspergillosis. Among the 18 patients presenting with neoplasias, 8 patients (44.44%) showed HPE of squamous cell carcinoma of the maxillary antrum, 4 (22.22%) with inverted papilloma, 6 patients (33.33%) with lymphoma and 2 patients with retro-orbital epidermal cyst (Table 4).

Diagnosis	Number of Patients
Frontal mucocele	8
Carcinoma of maxilla	8
Inverted papilloma	4
Lymphoma	6
Osteomyelitis of maxilla	4
Osteomyelitis of frontal bone	2
Aspergillosis	2
Mucormycosis	2
Orbital cellulitis	4
Retro-orbital epidermal cyst	2

Table 4. Cases Included in Our Study

Nasal obstruction was present in 36 patients and history of epistaxis in 18 patients (45%). 16 patients (40%) complained of recurrent nasal discharge and 28 patients (70%) with headache. On examination of the patients, 8 patients had multiple polypoidal masses in the nasal cavity and 8 had purulent nasal discharge from the middle meatus. 2 patients had persistent discharge from the upper eyelid while 2 had discharge from a sinus on the right infraorbital area. All patients except 4 had symptoms pertaining to the orbit (Table 5). 30 patients (75%) gave history of watering from the eye. 2 patients with osteomyelitis gave history of persistent discharge from the upper eyelid. The same patients had an incision and drainage of an abscess in the upper eyelid in the past. The second patient with osteomyelitis was admitted with history of persistent discharge from the right side of face. Extraocular muscle movement was totally absent in one patient with mucormycosis and restricted in two patients with orbital cellulitis.

Symptoms	Number of Patients
Decrease in vision	38
Nasal obstruction	36
Swelling of eyeball	36
Double vision	24
Increased watering from eye	30
Recurrent nasal discharge	28
Epistaxis	18
Discharge from upper eyelid	2
Discharge from infraorbital area	2
No orbital symptoms	4

Table 5. Orbital Symptoms in the Patients Included in Our Study

14 patients (35%) had reddish irregular mass in the nasal cavity and 4 patients had a firm, pink smooth surfaced mass in the nose. No nasal findings were present in 2 patients with retro-orbital cyst. Proptosis was present in 34 patients. 4 patients with malignancy of the maxillary sinus had no obvious proptosis, but had narrowing of the palpebral fissure due to upward displacement of the eyeball. The direction of displacement of the eyeball gave a clue as to the aetiology of the proptosis. In all patients with frontal mucocele, the eyeball was displaced downwards and laterally (Table 6).

Observation	Number of Patients
Reddish irregular mass	14
Pink smooth surfaced mass	4
Proptosis	34
Swelling above the medial canthus	2
Displacement of eye ball	4
Discharging sinus on the eye lid	

Table 6. Showing the Signs in the Patients (n=40)

Visual acuity was assessed with the help of Snellen's charts. Visual acuity was 6/12 in 12 patients, 6/18 in 16 patients and 6/36 in 4 patients. 4 patients had only perception of light and 2 patients had only finger counting present. 4 patients had no visual perception. The decrease in vision was insidious in onset and gradually progressing in

all patients. Vision was found to be maximally affected in patients with fungal infection of the sinus involving the orbit. The patient with mucormycosis had no vision in his affected eye, while the patient with Aspergillosis had only perception of light present (Table 7).

Visual Activity	Number of Patients
6/12	12
6/18	16
6/36	4
Finger counting	2
Perception of light	2
No vision	4

Table 7. Visual Activity in Patients Included in Our Study

X-ray of the paranasal sinuses showed haziness of ethmoid and frontal sinuses with loss of scalloping of the frontal sinus in all patients with frontal mucocele. Haziness of the maxillary antrum and nasal cavity with destruction of the anterolateral wall of the maxilla was seen in 4 patients with carcinoma of the maxillary sinus. Destruction of the infraorbital margin was detected on the x-ray in 4 patients with carcinoma of the maxillary sinus. All patients with fungal infection of the nose and paranasal sinuses showed haziness of the nasal cavity, frontal, ethmoid and maxillary sinuses on x-rays.

X-ray of the paranasal sinuses was normal in patients with retro-orbital epidermal cyst. Patients with osteomyelitis showed destruction and sclerosis of the involved bone. X-ray in patients with inverted papilloma and lymphoma showed haziness of the involved sinuses. CT scan of PNS and orbit in patients with frontal mucocele showed erosion of the anterior wall and floor of the frontal sinus with involvement of the orbit and proptosis, while the other patients had involvement with erosion of the frontal sinus alone. All patients with carcinoma of the maxillary antrum showed mass in the nasal cavity, ethmoid sinus and maxillary antrum with erosion of the medial wall, anterolateral wall and floor of the orbit with invasion of the orbit. Patients also have involvement of the oral cavity due to erosion of the hard palate. Patients with inverted papilloma had pathology involving the frontal, maxillary and ethmoid sinuses with destruction of the roof and medial wall of the orbit and ethmoid sinuses. The patient with osteomyelitis of the frontal bone had a CT scan, which showed a non-homogenous enhancing mass in the frontal and ethmoid sinuses and superior portion of the orbit displacing the eyeball downwards and outwards. This scan also showed destruction of the orbital plate of the frontal bone, ethmoid sinus and roof of the orbit. CT scan of the patient with osteomyelitis of the maxillary antrum showed enhancement of maxillary and ethmoid lesions suggestive of thick purulent material. Maxillary sinus walls were thickened. Anterior wall and the roof of the maxillary antrum showed breakdown. CT scan of patients with orbital cellulitis showed haziness of ethmoid air cells with evidence of orbital cellulitis. CT scan of the same patient after one week of antibiotic treatment showed clearance of disease in the ethmoid sinus and return of orbit to normal. The CT scan of patients with lymphoma showed the presence of a mass in the nasal cavity and ethmoid with erosion of the lamina papyracea and extension of the disease to the orbit. Biopsy was done in all patients who presented with nasal mass and the treatment was started accordingly (Table 8).

Disease	Route of Spread
Frontal mucocele	Erosion of roof of orbit
Malignancy of maxillary sinus	Erosion of floor of orbit
Inverted papilloma	Erosion of lamina papyracea
Lymphoma	Erosion of lamina papyracea and floor of orbit
Osteomyelitis of frontal bone	Erosion of roof of orbit
Osteomyelitis of maxilla	Erosion of orbital floor
Fungal infection	Spread through medial wall of orbit
Orbital cellulitis	Spread through medial wall of orbit

Table 8. Route of Spread of Paranasal Sinus Diseases to the Orbit

26 patients were managed by surgical treatment alone. Frontoethmoidectomy was done in 10 patients (8 with frontal mucocele and 2 patients with osteomyelitis of frontal bone). Total maxillectomy with orbital exenteration was done in 8 patients with malignancy of maxillary sinus. Caldwell-Luc operation with transantral ethmoidectomy was done in 2 patients with osteomyelitis of the maxillary sinus. External ethmoidectomy was done in 2 patients with retro-orbital epidermal cyst and medial maxillectomy in 4 patients with inverted papilloma (Table 9). 4 patients had combined medical and surgical treatment, which included external ethmoidectomy with intravenous amphotericin in 2 patients with Aspergillosis and intranasal ethmoidectomy with evisceration of eyeball and intravenous amphotericin in the other 2 patients with mucormycosis (Table 10). 4 patients with orbital cellulitis were treated with intravenous antibiotics, while 6 patients with lymphoma were treated with radiotherapy and chemotherapy (Table 11). Follow-up of patients with orbital cellulitis showed improvement of vision in both patients with return of eyeball to normal. The patient with Aspergillosis had no improvement of vision after surgery and intravenous amphotericin, but periodic followup has not revealed any recurrence of the disease. In the patient with mucormycosis, evisceration of the eyeball prevented the intracranial extension of the disease. All patients with osteomyelitis showed excellent improvement of vision and healing of the sinus postoperatively. In all patients with frontal mucocele, proptosis and ocular mobility improved postoperatively. Of patients with malignancy of the maxillary sinus who underwent total maxillectomy and orbital exenteration, 2 patients showed evidence of recurrence on follow-up. Patients who underwent medial maxillectomy for inverted papilloma showed no evidence of tumour on follow-up (Table 12).

Surgery	Number of Patients
Frontoethmoidectomy	10
Total maxillectomy with orbital exenteration	8
Caldwell-Luc operation with transantral ethmoidectomy	2
External ethmoidectomy	2
Medial maxillectomy	4

Table 9. Patients Treated by Surgical Management Alone (26)

Type of Management	Number of Patients
External ethmoidectomy + IV amphotericin	2
Intranasal ethmoidectomy + IV amphotericin + control of diabetes mellitus	2

Table 10. Patients Treated by Combined Medical and Surgical Management

6 patients with lymphoma were treated with radiotherapy and chemotherapy.

Type of Treatment	Number of Patients
Intravenous antibiotics	4
Radiotherapy + chemotherapy	6

Table 11. Patients Treated by Non-Surgical Management

Disease	Management
Frontal mucocele	Frontoethmoidectomy
Carcinoma of maxilla	Total maxillectomy with orbital exenteration
Inverted papilloma	Medial maxillectomy
Lymphoma	Radiotherapy + chemotherapy
Osteomyelitis of maxilla	Caldwell-Luc operation + transantral ethmoidectomy
Osteomyelitis of frontal bone	Frontoethmoidectomy
Aspergillosis	External ethmoidectomy + IV amphotericin
Mucormycosis	Intranasal ethmoidectomy + evisceration of orbit + IV amphotericin
Orbital cellulitis	IV antibiotics + nasal decongestants
Retro-orbital epidermal cyst	External ethmoidectomy

Table 12. Management of Patients Included in Our Study

DISCUSSION

40 patients included in the present study included different diseases with a potential to invade the orbit to produce orbital complication. Infections and inflammations spread to the orbit from the maxillary and ethmoid sinus in children and from the frontal sinus in adults. Spread to the orbit is an ominous physical sign, which requires urgent diagnosis, aggressive treatment and close follow up. Orbital extension of infection in paranasal sinuses may occur through a variety of avenues, which include- Open suture lines (e.g. ethmoid-maxillary suture line), congenital bony dehiscence in the orbital portion of the maxilla or lamina papyracea of the ethmoid, natural pathways along the anterior and posterior ethmoid blood vessels within the frontoethmoid suture line, necrosis of bone by acute infection or bone erosion from chronic disease, retrograde thrombophlebitis or paraphlebitis or lymphatic spread. The ophthalmic veins are valve free and course through the orbit emptying into the cavernous sinus. The superior ophthalmic vein is continuous with the nasofrontal vein and the inferior ophthalmic vein receives tributaries from the eyelids, lacrimal sac and orbital muscles. Although, the complications of sinusitis have been reduced by antibiotics, they continue to occur, because of inadequate antibiotic therapy, impaired host resistance, infection with resistant organisms and delay or lack of surgical intervention. Sinusitis is a frequent cause of periorbital and orbital cellulitis; however, trauma, retained foreign bodies and cutaneous, lacrimal, dental and postsurgical infections are also aetiologic factors. The classification of orbital infections introduced by Chandler[20] in 1970 is as follows-

Stage-I- Preseptal cellulitis or inflammatory oedema.

Stage-II- True orbital cellulitis.

Stage-III- Subperiosteal abscess.

Stage-IV- Orbital abscess.

Stage-V- Cavernous sinus thrombosis- In this stage, the patient has no vision, the eye is fixed and severely proptosis and contralateral vision is in imminent danger.

The term orbital apex syndrome refers to the complex of clinical features, those resulting from involvement of the neurovascular structures that traverse the superior orbital fissure, namely sub-ophthalmic vein, III, IV and VI cranial nerves, ophthalmic nerves and the optic foramen through which the optic nerve, ophthalmic artery, sympathetic plexus pass through. Clinically, there are multiple ocular signs and symptoms, which include impaired mobility of the eye, anaesthesia of the eyelid, cornea and conjunctiva, optic neuritis as well as swelling and congestion of the eyelid and conjunctiva and protrusion of the globe. The increased intraocular pressure accompanying orbital suppuration may manifest itself in retinal oedema and haemorrhage or evidence of optic neuritis and atrophy. However, blindness can occur without any fundus abnormality. Hence, monitoring of the visual acuity is more important than fundoscopy in following the clinical course of the disease. Visual loss secondary to optic neuritis may also result from acute or chronic sinusitis in the absence of orbital cellulitis. Visual loss secondary to optic neuritis may also result from acute or chronic sinusitis in the absence of orbital cellulitis. Visual loss maybe due to ischaemia or optic neuritis and blood flow to the nerve should be restored within 90 minutes or the loss is permanent.[21] Pus from the middle meatus should be Gram stained and cultured prior to treatment. The common organisms are Haemophilus influenza in children and Streptococcus pneumonia and Staphylococcus aureus in adults. Anaerobes are also seen in culture. Diagnosis of orbital involvement is made from high spiking temperature, elevated WBC count, inflamed nasal mucosa and pus in the

middle meatus, proptosis, limitation of external ocular mobility and reduction in visual acuity. CT scan is a sensitive indicator to demonstrate involvement of the orbit. A "muddy" soft tissue swelling of lids is seen in stage-I of preseptal cellulitis. True orbital cellulitis is seen in cases with proptosis. A well-defined enhancing ring like mass is seen in stage - III of subperiosteal abscess.[22] Gas maybe present within an abscess due to gas forming organisms or communication with an adjacent sinus. CT scanning may also demonstrate the loss of the normal soft tissue planes between the optic nerve, retrobulbar fat and rectus muscles as well as scleral thickening. Based on CT scan, orbit can be divided anatomically into- (1) Intraconic - centrally within the muscle cone; (2) Extraconic- peripherally between periosteum and recti and (3) Subperiosteal- between orbital wall and its periosteum. Medical treatment includes high doses of intravenous broad-spectrum antibiotics. Drugs which cross the blood brain barrier like ampicillin and chloramphenicol should be given in children. Sympathomimetic nasal decongestants should be administered. Intravenous antibiotics should be continued till all signs of inflammation resolve and then oral antibiotics should be continued for two weeks. Complete external ethmoidectomy is done for wide drainage. Floor of the frontal sinus is removed up to the supraorbital nerve and adequate drainage. Floor of the frontal sinus is removed up to the supraorbital nerve and adequate drainage obtained through the nose. A loose pack with antibiotic ointment placed in the cavity is removed after 72 hours. 4 patients with orbital cellulitis were included in our study. Infectious involvement of the cranial vault is a potentially serious complication. In 1913, Guibert N[23] reviewed 43 cases and showed the significance of osteomyelitis as a complication of sinusitis. Staphylococcus is the most common causative organism followed by aerobic and anaerobic streptococci.[24] Radiographs are initially not diagnostic as bone changes occur slowly. Eventually, a characteristic "moth eaten" pattern or avascular necrosis appears owing to decalcification of bone along with sequestration and areas of osteoblastic response. Treatment consists of adequate intravenous antibiotic therapy and debridement of osteomyelitis bone. Because of the avascular nature of the bone and sequestration of the nidus antibiotics do not penetrate the infected area very well. Bone must be removed to a healthy margin.

Aspergillosis is a group of mycosis caused by several species of Aspergillus. The maxillary sinus is most commonly involved followed in descending order by the ethmoidal, sphenoidal and frontal sinuses. Orbital extension with proptosis occurs in 60% patients. When the disease becomes invasive, there is usually spread from the maxillary to the ethmoid sinus, often with nasal and orbital extension. On radiography, there is usually opacification or mucosal thickening of the involved sinus. In cases with bone destruction, there is usually erosion of the floor or medial wall of the orbit. On histopathological studies, there is ulceration of the epithelium with a dense inflammatory infiltrate of lymphocytes, plasma cells and neutrophils. With the noninvasive type of aspergillosis, a drainage procedure such as sinusotomy with curettage of diseased tissue is usually curative. But, with the invasive form, it may be difficult to eradicate the fungus and multiple recurrences are not unusual. In this study, patients with invasive type of aspergillosis presented with multiple polyps in the right nasal cavity and decreased vision. Right fronto ethmoidectomy was done and disease present in the ethmoid and frontal sinus was cleared. Fungal culture revealed the presence of Aspergillus and the patient was started on intravenous amphotericin. The patient was given an initial dose of 0.2 mg/kg/day followed by gradual increase in dose up to 0.8 mg/kg/day. The patient was also given fluconazole nasal washes. Serial evaluation of serum creatinine was done. Treatment was continued for 3 weeks, but had to be stopped as the patient developed increased levels of serum creatinine. Regular follow up of the patient has not revealed any recurrence of the lesion, but the vision has not improved. Mucormycosis refers to an infection by an organism of the family Mucoraceae, which belongs to the class phycomycetes. Tissue damage and endothelial venous damage ensue. Clinically, the most common presenting signs are cranial nerve defects, (especially blindness, ophthalmoplegia and facial paralysis) proptosis, facial swelling, palatal ulcer and coma or stupor. The most common radiologic presentation was the involvement of multiple sinuses with clouding/mucosal thickening or bone erosion. Radiological examination shows loss of translucency, loss of scalloping and definition of frontal sinus margins with supraorbital depression and/or erosion. The frontal mucocele occur due to obstruction of the frontonasal duct with associated inflammation. Bone resorbing substances produced by the mucosal lining include PGE_2 and collagenase. Therefore, it is important to remove all lining mucosa- the only exception being areas where erosion of posterior wall has occurred exposing the dura. Treatment of this condition is surgical. External frontoethmoidectomy (Lynch Howarth incision) creates a new channel by exenteration of anterior ethmoid and insertion of a 1 cm indwelling fenestrated silastic tube for 3 to 5 months. Frontoethmoidectomy was done in patients in this study. Proptosis and ocular mobility improved postoperatively. Diplopia was initially worse, but improved later. Neoplasms of the paranasal sinuses enlarge within the aerated sinus lumen before involving orbit. Symptoms develop only when the sinus wall is breached or sinus ostium occluded. The neoplasms extend to the orbit by- direct bony erosion, neural/vascular pathways, suture lines and bony dehiscence. The periosteal covering of the bony orbit is quite resistant to the spread of cancer, but once the cancer in the sinus has destroyed the adjacent bone, the orbit is at risk. The incidence of orbital exenteration for cancer of the sinuses ranges from 20% to 45%. The benign neoplasms of the paranasal sinuses include inverted papilloma, neuroectodermal tumours and osteoma. Malignant neoplasms include squamous cell carcinoma, adenocarcinoma, adenoid cystic carcinoma,

esthesioneuroblastoma and sarcoma. Clinical manifestations of orbital extension of paranasal sinus neoplasm include- proptosis, ocular pain, visual alteration, diplopia, epiphora, ptosis and photophobia. Physical findings include- orbital mass, chemosis, conjunctival injection, increased intraocular tension, ophthalmoplegia and optic atrophy. CT scanning in axial and coronal planes helps to detect early lesions and to observe bone destruction and adjacent orbital and intracranial extension. Biopsy is obtained transnasally except in tumours not invading the nasal cavity in which exploration of the involved sinus is required. A lateral rhinotomy- medial maxillectomy approach, which permits wide exposure is preferred in inverted papilloma tumours. Tumour is dissected from periorbital and if encroachment in orbital tissue is present, resection with a cuff of fat and if needed, rectus muscle is done. In malignant neoplasms, total maxillectomy and orbital exenteration in combination with radiotherapy was the treatment of choice in tumours with orbital extension, before the advent of craniofacial procedure. Lids were preserved as usually they were not involved. In the absence of orbital involvement with total maxillectomy, the globe is left supported by the suspensory ligament of Lockwood. There may be some prolapse several weeks later and might need reinforcement of the area with nylon mesh or silastic sheet. In this study, patients with malignancy of the maxillary sinus with extension into the orbit, all of whom were subjected to total maxillectomy with orbital exenteration. All these patients showed invasion of the orbital periosteum and hence the orbit could not be preserved. In patients with inverted papilloma, medial maxillectomy was done and in patient with retro-orbital epidermal cyst, tumour was removed by external ethmoidectomy. The patients with lymphoma were given combined radiotherapy and chemotherapy.

CONCLUSION

The type of orbital complications in nasal and paranasal sinus disease included proptosis, decrease in the visual acuity, increased watering from the eyes, diplopia and discharging sinus on the face. Noting the direction of displacement of the eyeball is helpful in determining the sinus involved. Vision was more affected in patients with fungal infection of the sinuses with orbital extension. The management protocol in all patients with orbital complications of nasal and paranasal sinuses included detailed history. ENT and eye examination apart from investigations are mandatory in the final diagnosis. CT scan is the mainstay in diagnosis of orbital involvement. In malignancies of the paranasal sinuses involving the orbit, an intraoperative assessment of involvement of the orbital periosteum and orbital contents is important in determining whether orbital exenteration should be added to total maxillectomy. In orbital infections complicating sinusitis, daily monitoring of visual acuity is very important in the management as surgical intervention maybe required.

REFERENCES

[1] Harrison DFN. Surgical approach to the medial orbital wall. Annals Otorhinolaryngology 1981;90(5):415-419.

[2] Lynch RC. The technique of a radical frontal sinus operation which has given me the best results. Larngoscope 1921;31(1):1-5.

[3] Howarth WB. Operations on the frontal sinus. J Laryngol 1921;36(9):417-421.

[4] Coates GM, Ersner MS. Regeneration of the mucous membrane of the frontal sinus after its surgical removal. Arch Otolaryngol 1930;12(5):642-648.

[5] Walsh TE. Experimental surgery of the frontal sinus. The role of the ostium and nasofrontal duct in postoperative healing. Laryngoscope 1943;53(2):75-92.

[6] Neel HB, Whicker JA, Lake CF. Thin rubber sheeting in frontal sinus surgery. Animal and clinical studies. Laryngoscope 1976;86(4):524-536.

[7] Goodale RL. Some causes for failure in fontal sinus surgery. Annals of Otology Rhinology Laryngology 1942;51(3):648-652.

[8] Williams HL, Holman CB. The causes and avoidance of failure in surgery for chronic suppuration of the fronto-ethmo-sphenoid complex of sinuses. Laryngoscope 1962;72(9):1179-1227.

[9] Mertz JS, Pearson BW, Kern EB. Lateral rhinotomy indications, technique and review of 226 cases. Arch Otolaryngol 1983:109(4):236-239.

[10] Neel HB, Whicker JH, Devine KD, et al. Juvenile angiofibroma: review of 120 cases. Am J Surg 1973;126(4):547.

[11] Vrabec DP. The inverted Schneiderian papilloma, a clinical and pathological study. Laryngoscope 1975;85(1):186-220.

[12] Suh KW, Facer GW, Devine KD, et al. Investing papilloma of the nose and PNS. Laryngoscope 1977;87(1):35-46.

[13] Djalilan M, Zujko RD, Weiland LH, et al. Olfactory neuroblastoma. Surg Clin N America 1977;57(4):751-762.

[14] Pope TH. Surgical approach to tumours of nasal cavity. Laryngoscope 1978;88(11):1743-1748.

[15] Sessions RB, Larson DL. En bloc ethmoidectomy and medial maxillectomy. Arch Otolaryngol 1977;103(4):195-202.

[16] Horgan JB. Surgical approach to the ethmoidal cell system. JLO 1926;41(8):510-521.

[17] Langenbrunner DJ, Negri P. Transantral ethmoidectomy: an overlooked procedure. Tran Sect Otolaryngolo Am Acad Ophthalmol Otolaryngol 1977;84(4 pt 1):ORL.744-749.

[18] Watkinson J, Gilbert RW. Pitutary tumors. Stell & Maran's text book of head and neck surgery and oncology. 5th edn. London: Hodder Arnold 2012:p. 538.

[19] Ohngren ZG. Malignant tumours of the maxilla ethmoid region. Acta Otolaryngol 1933;Suppl 19:1-476.
[20] Chandler JR, Langenbrunner DJ, Stevens SR. The pathogenesis of orbital complications in acute sinusitis. Laryngoscope 1970;80(9):1414-1428.
[21] Manigilia AJ, Kronberg FG, Culberston W. Visual loss associated with an orbital sinus disease. Laryngoscope 1984;94(8):1050-1059.
[22] Harr DL, Quencer RM, Abrams GW. Computed tomography and ultrasound in the evaluation of orbital infection and pseudo tumour. Radiology 1982;142(2):395-401.
[23] Guibert N, Avenard M, Rose X, et al. Major orbital complications of acute maxillary sinusitis of dental etiology. Rev Laryngol Otol (Bord) 2008:129(4-5):319-323.
[24] Bordley JE, Bischotberger W. Osteomyelitis of the frontal bone. Laryngoscope 1967;77(8):1234-1244.