A STUDY OF FUNGAL DISEASES OF NOSE AND PARANASAL SINUSES

Dissertation submitted for

MASTER OF SURGERY

BRANCH IV

(OTO-RHINO-LARYNGOLOGY)

MARCH 2009

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

TAMIL NADU

CERTIFICATE

This is to certify that the thesis titled **"A STUDY OF FUNGAL DISEASES OF NOSE AND PARANASAL SINUSES"** Submitted By **DR.RAMASUNDAR.P** under my supervision & guidance in partial fulfillment for the award of the degree of **Master of Surgery in Otorhnolaryngology** by the Tamil Nadu Dr. M.G.R. Medical University, Chennai, is a bonafide record of the work done by him doing the academic period 2006-2009.

He has evinced keen interest in collecting the cases from the ward and analysing them. I have great pleasure in forwarding it.

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DECLARATION

I hereby declare that this dissertation entitled **"A STUDY OF FUNGAL DISEASES OF NOSE AND PARANASAL SINUSES"** has been prepared by me under the guidance and supervision of **DR.KR. KANNAPPAN MS, DLO, M.CH,** Prof. HOD Department of ENT Diseases, Govt Rajaji Hospital, Madurai.

This dissertation is submitted to the Tamil Nadu Dr.M.G.R. Medical University in partial fulfillment of the university regulations for the award of "The Master of Surgery" in Otorhinolaryngology.

This work has not formed the basis of the award of any Degree/ Diploma to me previously by any other university.

PLACE: Madurai

DATE : SIGNATURE.

ACKNOWLEDGEMENT

I profoundly thank **Dr.KR.Kannappan M.S., D.L.O., MCh.,** Professor and Head of the Department of E.N.T. Diseases, Madurai Medical College, Madurai, for his able guidance and encouragement in preparing this dissertation.

My sincere thanks to **Dr.K.R.Jyothikumar, M.S., D.L.O.,** Rtd., Professor, Department of E.N.T., Diseases, Madurai Medical College, Madurai, for his guidance, encouragement and help for executing this study.

I am extremely indebted to **Dr.A.Uma M.D.,** Director in charge of Dept. of Microbiology Madurai Medical College, Madurai for permitting me to utilize their facilities for the fungal culture study.

My thanks to **Dr.S.M.Sivakumar,M.S. Dean**, Madurai Medical College & Govt. Rajaji Hospital, Madurai, for permitting me to utilise the clinical materials of the hospital.

I profoundly thank the Assistant Professors & Post Graduate Colleagues of Department of E.N.T. Diseases, Madurai Medical College for their co-operation in completing this dissertation.

I gratefully acknowledge the **patients** who co-operated to submit themselves for this study.

CONTENTS

INTRODUCTION

Fungi are ubiquitous in nature and we are showered with their spores daily. Fungi infections of the nose and paranasal sinuses are not common in man in industralised countries. However in the recent past the fungal infections has been increasing both as 'imported ills' due to the greatly enhanced international traffic and as opportunistic infections in consequence of the use of powerful cytotoxic drugs (as applied to the treatment of neoplasms) and also steroid and antibiotic therapy.

The most common site of fungal infections in man is the lung with or without haematogenous spread to other organs. But localised fungal infections can also occur in the upper respiratory tract and is more common than was previously suspected.

Most fungal species which are pathogenic to humans, cause opportunistic infections and only dermatophytes are transmissible from host to host. The incidence of infections and deaths due to fungi has been grossly underestimated. Moreover the list of fungal species capable of producing diseases in immuno-compromised persons is increasing rapidly.

In an era with AIDS, broad spectrum antibiotics, cytotoxic drugs and the organ transplantations, fungal infections are becoming increasingly common and very diverse. The common fungal infection which affect the nose and sinuses are Candidiasis, Rhinosporidiosis, Aspergillosis, Phycomycosis, Actinomycosis, Coccidioidomycosis, Histoplasmosis, Cryptococcosis, Blastomycosis, Sporotrichosis and Nocardiosis.

Martin and Berson (1973) noted a high incidence in South Africa which they attributed particularly to malnutrition. The largest series of cases involving the nose and sinuses particularly to malnutrition. The largest series of cases involving the nose and sinuses have emanated from Sudan (Milosev B, Margoub ES, Abdel A, Hassan AM – 1969, Rudwan MA and Sheikh HA – 1976). Reports of nasal or sinus involvement in the United Kingdom are not very common. .

In our study, the fungal infections mainly presented with nasal polyps, nasal block, nasal discharge, headache, and proptosis mimicking benign or malignant tumors of the nose and paranasal sinuses.

The warm moist climate in Kerala, coastal regions of Tamil Nadu and Andhra Pradesh with its attendant high rate of allergic, hypertrophic,

vasomotor rhinitis and rhinosinusitis provides one of the pre-requisites for fungal infections of the upper respiratory tract. The agricultural economy of these three states also accounts for the high prevalence of the fungal infections.

Of the fungal infections of nose and para-nasal sinuses, Aspergillosis tops the list in terms of occurrence.

Here, the ENT Department, Government Rajaji Hospital, Madurai with its advanced facilities serves as a referral centre provides various possibilities for carrying out a study in fungal infections focusing mainly on opportunistic infections of the nose and para-nasal sinuses. The lack of recognition of this disease and the scarcity of the reports prompted us to undertake the study.

AIM OF THE STUDY

- To study the epidemiology of fungal infections of the nose and para-nasal sinuses in our region.
- To study the clinical and pathological manifestations of fungal infections of the nose and paranasal sinuses.
- To evaluate the role of CT scan in diagnosing the fungal diseases of nose and para-nasal sinuses.

REVIEW OF LITERATURE

1. HISTORICAL ASPECTS:

Aspergillosis

Aspergillosis derives its name from – "aspergillum" – A perforated globe for sprinkling holy water, due to its similarity of it's fruiting heads with aspergillum (Fetter, B, Klintworth, G.K. & Hendery, W.A. (1967). Nasal infection with aspergillus was first described by Schubert (1885). This was followed by Zarinko (1891), who described a patient with an aspergillus maxillary sinusitis.

By 1972, Ketch had assembled from the world literature a total no of 98 cases of aspergillosis of the ear, nose and throat. The incidence of mycotic infection of the paranasal sinuses has increased over the past decade. At the ENT clinic of Graz University, between 1976 and 1989 more than 340 patients, most of whom has severe mycotic infections of the nose and paranasal sinuses were treated. More than 90% of these mycotic infections were caused by Aspergillus (Primarily A. Fumigatus).

Fungal diseases of the nose and paranasal sinuses are not common (Romette, J.L. and Newman, R.K. 1982). Aspergillus is the most common

fungal pathogen in sinus disease (McGuirt, W. and Harrill, J.1979) and is the most common primary fungal agent infecting the maxillary antrum (Wader F.R., and chikes P.G. 1975).

The number of reported cases of aspergillosis in the nose and paranasal sinuses is increasing. Since 1968, the number of reported cases has increased threefold. A localised aspergillus infection can occur in the upper respiratory tract and is more common than previously suspected (Iwamoto H. 1972, Gregoriu D. 1977). Only 3 patients with sinusitis caused by aspergillus have been reported from Scandinavia (Rohrt 1954, Anderson and Stenderup 1956, Mikaelson 1975). Since the first report of aspergillus sinsusitis by Zarinko in 1891 reported cases of this disease have been very rare (Warder and Chickes 1975).

In 1972 a review of world literature by Zinneman revealed only 37 cases, of which 17 were reported by Milosev and Margoub, Sudan. In 1979, Jahrsoerfer et al reviewed world literature and found 103 cases most of which were solitary case reports. In Sudan 63 more cases were reported by Milosev et al on antral aspergillosis. Iwamoto et al in 1972 reported 5 cases of mycotic maxillary sinusitis and identified one case of candida and one of Mucoracea.

In the Nineteenth century, aspergillus was described as an occupational hazard. As medicine advanced, allowing patients with previously fatal conditions to survive in an immuno-compromised state, this ubiquitous fungus became a significant pathogen. Aspergillus is by far the most common cause of all forms of mycotic sinonasal disease (Brantdwein M). Aspergillus fumigatus is the major pathogen. In a recent study from India by chakrabarti A. and Sharma S.C. et al., of 119 patients of sinus complaints, 42% had positive fungal cultures, Aspergillus flavus was the responsible agent in 80% of the cases.

Mucormycosis

Mucormycosis is a saprophytic fungal disease which almost invariably occurs in immuno compromised hosts with suppressive resistance or immuno deficiency. The term phycomycosis and mucormycosis have been used interchangeably in the literature. The etiological agent is a fungus of the genus Mucor, Absidia, or Rhizopus of the Mucorales order. The disease was first described by Paultauf in 1884.

In 1967, Abramson, et al., reviewed 12 cases and added 2 of their own, reporting a survival rate of 50%. Abramson et al reported its occurrence in uncontrolled diabetes.

2. ANATOMY OF NOSE AND PARA-NASAL SINUSES

Nasal Cavity

The nasal cavity extends from the external nares or nostrils to the choanae, where it becomes continuous with the nasopharynx and is narrower anteriorly than posteriorly. Vertically it extends from the palate to the cribriform plate, being broader at its base than superiorly where it narrows to the olfactory cleft. The nasal cavity is divided in to two by a septum. Each half has a floor, a roof, a lateral wall and a medial (septal) wall. The floor is concave from side to side, antero-posteriorly flat and almost horizontal. Its anterior three-quarters are composed of the palatine process of the maxilla, and posterior one-quarter by the horizontal process of the palatine bone.

The roof is narrow from side to side, except posteriorly and may be divided into frontonasal, ethmoidal and sphenoidal parts, related to the respective bones. As both the frontonasal and sphenoidal parts of the roof slope downwards, the highest part of the nasal cavity relates to the cribriform plate of the ethmoid which is horizontal.

Nasal Septum

The nasal septum is composed of a small anterior membranous portion, cartilage and several bones: the perpendicular plate of the ethmoid, vomer and two bony crests of the maxilla and palatine. The cartilaginous portion is composed of a quadrilateral cartilage with a contribution from the lower and upper lateral alar cartilages forming the anterior nasal septum.

The perpendicular plate forms the superior and anterior bony septum, is continuous above with the cribriform plate and crista galli and abuts a variable amount of the nasal bones (Lang, 1989e). The vomer forms the posterior and inferior nasal septum and articulates by its two alae with rostrum of the sphenoid, thereby creating the vomerovaginal canals which transmit the pharyngeal branches of the maxillary artery. Occasionally the sphenoid sinus may pneumatize the vomer. The inferior border of the vomer articulates with the nasal crest formed by the maxillae and palatine bones. The anterior border articulates with the perpendicular plate above and the quadrilateral cartilage inferiorly. The posterior edge of the vomer forms the posterior free edge of the septum.

Histology

The mucoperichondrium of the septum is separate from the mucoperiosteum that overlying the maxillary crest, reflecting its embryological development. The mucous membrane is predominantly respiratory with a small area of olfactory epithelium superiorly adjacent to the cribriform plate. Respiratory epithelium is composed of ciliated and non-ciliated pseudostratified columnar cells, basal pluripotent stem cells and goblet cells.

Seromucinous glands are found in the submucosa and are more important in mucus production in the nasal cavity than the goblet cells which are more numerous in the sinuses. The olfactory epithelium spreads down from the cribriform plate onto the upper septum.

Blood Supply

The external and internal carotid arteries are responsible for the rich blood supply to the nose. The sphenopalatine artery (branch of the maxillary artery and thus external carotid artery) supplies the posteroinferior septum. The greater palatine artery (also a branch of the maxillary) supplies the anteroinferior portion entering the nasal cavity via the incisive canal. The superior labial branch of the facial artery

contributes anteriorly, in particular to Kiesselbach's plexus, which is composed of unusually long capillary loops and is situated in little's area on the anterior septum-a common source of epistaxis. The internal carotid artery supplies the septum superiorly via the anterior and posterior ethmoidal arteries and also contributes to Kiesselbach's plexus.

The cavernous venous system drains via the sphenopalatine vessels into the pterygoid plexus posteriorly and into the facial veins anteriorly. Superiorly the ethmoidal veins communicate with the superior ophthalmic system and there may be direct intracranial connections through the foramen caecum into the superior sagittal sinus.

Never Supply

The maxillary division of the trigeminal nerve provides sensory supply to the nasal septum. The nasopalatine nerve supplies the bulk of the bony septum, entering the nasal cavity via the spheno-palatine foramen. The anterosuperior part of the septum is supplied by the anterior ethmoidal branch of the nasociliary nerve and a smaller anterioinferior portion receives a branch from the anterior superior alveolar nerve. The posteroinferior septum also receives a small supply from the nerve to the

pterygoid canal and a posterior inferior nasal branch of the anterior palatine nerve.

The sensory nerves are accompanied by postganglionic sympathetic fibres to blood vessels and parasympathetic secretomotor fibres pass to glands with the branches from the pterygopalatine ganglion.

The olfactory epithelium covers the inferior surface of the cribriform plate spreading down to cover a variable area on the upper septum and adjacent lateral wall, over the medial surface of the superior concha.

Lymphatic Drainage

The anterior septum drains with the external nose to the submandibular nodes while the posterior septum drains into the retropharyngeal and anterior deep cervical nodes posteriorly.

The Lateral Nasal Wall

The inferior meatus is that part of the lateral wall of the nose lateral to the inferior turbinate. It is the largest meatus, extending almost the entire length of the nasal cavity. The meatus is highest at the junction of the anterior and middle third. The naso-lacrimal duct opens into the inferior meatus the opening being covered by small folds of mucosa

(Hasner's valve). It can be identified in life by gentle massage of the lacrimal sac at the medial canthus.

Inferior Turbinate

This structure is composed of a separate bone, the inferior concha which has an irregular surface, perforated and grooved by vascular channels to whch the mucoperiosteum is firmly attached. The bone has a maxillary process which articulates with the inferior margin of the maxillary hiatus. It also articulates with the ethmoid, palatine and lacrimal bones, completing the medial wall of the nasolacrimal duct. The inferior concha has its own ossification center which appears around the fifth intrauterine month.

The turbinate possesses an impressive submucosal cavernous plexus with large sinusoids under autonomic control which provides the major contribution to nasal resistance. The turbinate is covered by respiratory epithelium, with a high number of goblet cells which decrease in density towards the posterior end (Tos and Morgensen, 1979).

Middle Meatus

The middle meatus is that portion of the lateral nasal wall lying lateral to the middle turbinate. It receives drainage from the frontal,

maxillary and anterior ethmoidal sinuses. In the past when radical surgery was predominantly used for most pathology this was of less significance. The advent of endoscopic sinus surgery has led to an increased interest in the detailed anatomy of the region and a need for consensus in terminology.

The endoscopist's interest is mainly in the middle meatus since the frontal sinus, anterior and middle ethmoidal cells and the maxillary sinus drain here. The region of the middle meatus with the anterior and middle ethmoids has been termed as the osteo-meatal complex by Naumann. On removing the middle turbinate one can clearly see certain structures in the middle meatus, i.e. anteriorly, there is a hook shaped uncinate process behind which lies a semilunar groove called the hiatus semilunaris. This groove separates the uncinate process from the bulla ethmoidalis which is just behind. The hiatus semilunaris is really a deep groove and its deepest part is called the infundibulum. Anterior to the frontal recess is the prominence of the agger cells. This area is easily identified on the lateral nasal wall, just in front of the middle turbinate. Exenteration of these cells is often necessary to expose the frontal recess.

The maxillary ostium lies just superior to the inferior turbinate. The part of the lateral nasal wall just above the inferior turbinate, anterior and posterior to the maxillary ostium consists only a double layer of mucosa with no intervening bone. These are termed as the anterior and posterior fontanelles. The bulla ethmoidal cell is the most constant ethmoial cell, and along with its surrounding cells constitutes the middle ethmoidal cells which opens either in to the infundibulum or on the medial wall of the bulla itself. The middle ethmoidal cells are bounded superiorly by the ethmoidal roof. The anterior and posterior ethmoidal arteries traverse the ethmoidal roof in the coronal plane from the orbit to the nose. They are important landmarks as they denote the upper limit of dissection. The lateral part of the roof of the ethmoid is fairly thick and at a higher level, whereas the medial part of the roof is thin and slopes downwards to join the cribriform plate. The cribriform plate is also very thin and may be easily perforated.

Laterally middle ethmoidal cells are related to the lacrimal bone and the lamina papyracea of the ethmoidal bone forming the medial orbital wall, which is very thin and delicate, and may also be accidentally perforated during dissection. Posteriorly the middle ethmoidal cells are

bounded by a bony partition, the basal or ground lamella which corresponds to the bony attachment of the posterior end of the middle turbinate. It should be noted that although the middle turbinate runs in the sagittal plane, its posterior bony attachment curves laterally so that the ground lamella lies in the coronal plane. Posterior to the ground lamella lie the posterior ethmoidal cells, which are related superiorly to the dura, postero-inferiorly to the sphenoid sinus and laterally to the orbital apex and the optic nerve. Sometimes the optic nerve canal may produce a bony convexity in the lateral wall of the posterior ethmoidal cells. Posterior ethmoidal cells vary from one to seven in number and usually open by one orifice in the superior meatus.

Two important points must be stressed here. First, the posterior part of the lateral wall of ethmoids curves medially. Hence, as the surgeon proceeds deeper in to the ethmoids the direction of his dissection should turn medially to guard against an accidental damage to the optic canal. Secondly, it must be clearly understood that the sphenoid sinus has a posteo-infero-medial relation to the posterior ethmoidal cells. When proceeding with the dissection from the posterior ethmoidal cells in to the

sphenoid sinus, the surgeon will have to angle his instruments in an inferomedial direction.

The sphenoid sinuses show variations in size and shape, as well as position and direction of the inter-sphenoidal septum. The anterior wall of the sphenoidal sinus is approximately 7 cm from the anterior nasal spine. The roof of the sphenoidal sinuses presents a convex bulge corresponding to the roof of the pituitary fossa. The lateral sphenoid wall in its upper parts is related to the optic nerve. Often, the bony canal of the optic nerve produces a bulge in the lateral wall. In about 4% of subjects, there may be a bony dehiscence in this canal marking the nerve more prone to injury during surgery. More posteriorly and inferiorly, the lateral wall of the sphenoid sinus is related to the internal carotid artery.

ANATOMICAL VARIATIONS

There is a considerable range of anatomical variation in this area which has been implicated in the aetiology of sinus infection (Zinrech, Kennady, and Gayler, 1988). This includes pneumatization of the middle turbinate, enlargement of the ethmoidal bulla, a paradoxically bent middle turbinate, everted uncinate process and the Haller cells or a septal deflection.

Blood Supply of Lateral Nasal Wall

The external and internal carotid arteries supplythe lateral nasal wall. The sphenopalatine artery (From the maxillary and thus external carotid artery) contributes the majority of the supply to the turbinates and meatus. An area anteriorly is supplied by a branch from the facial and part of the lateral wall adjacent to the palate receives blood from greater palatine artery. The internal carotid artery contribution via the ethmoidal arteries which supplies the superior lateral wall.

Nerve Supply of Lateral Wall

Apart from the olfactory supply on the superior concha, the lateral nasal wall receives ordinary sensation from the anterior ethmoidal nerve anterosuperiorly and from branches of the pterygopalatine ganglion and anterior palatine nerves posteriorly. There is small area innervated by the infraorbital nerve anteriorly and an area of overlap between the ethmoidal and maxillary nerves. Anterior superior alveolar never sends a small branch to the anterior inferior meatus.

Lymphatic Drainage

The lateral wall drains the external nose to the submandibular nodes anteriorly and to the lateral pharyngeal, retropharyngeal and upper deep cervical node posteriorly.

3. EPIDEMIOLOGY & ETIOPATHOGENESIS

Classification

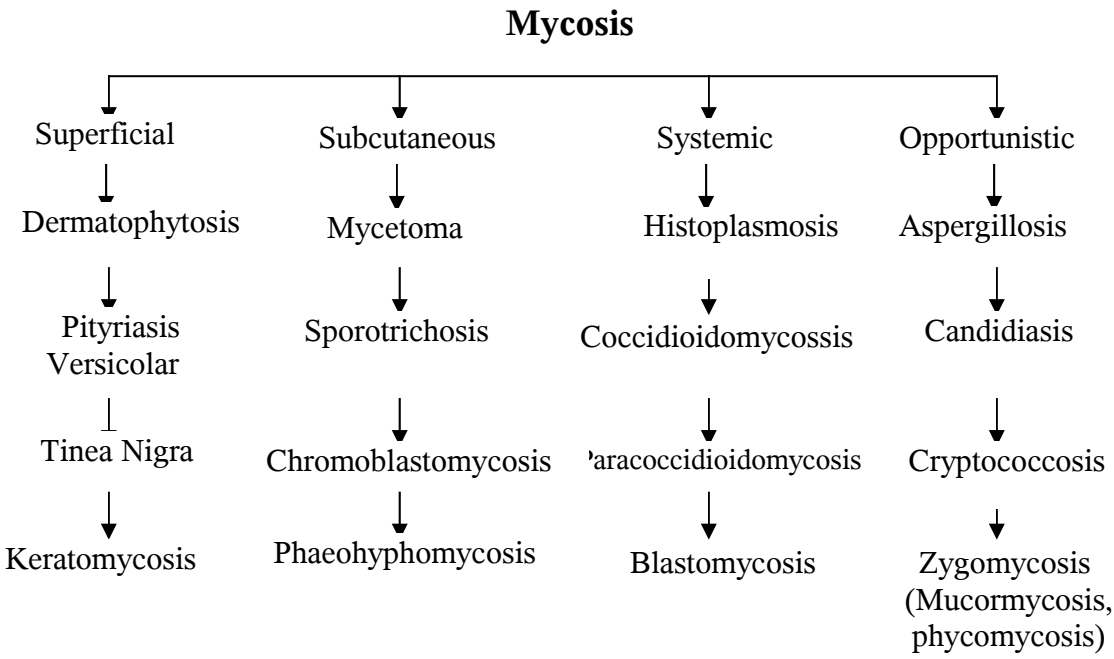
On the basis of the portal of entry and the major site of infection, mycosis are classified into four major categories.

Superficial

Subcutaneous

Systemic

Opportunistic



Aspergillosis

Aspergillus fumigatus is a true fungus with septate hyphea and is the usual infective organism in man, although cases due to A. niger, A.flavus, A.oryzae, A.nidulam have been reported, (Hora-1965, Mahgoub-1971, Milosem-1966, Rotherfeld-1972, Jahrsdoerfer, and Ejercito, 1979).

Two types of paranasal sinus aspergillosis can occur, the largest group being non-invasive (Hora-1965) or local form in immuno-competent persons, and more aggressive or invasive form occurring in immuno-suppressed individuals.

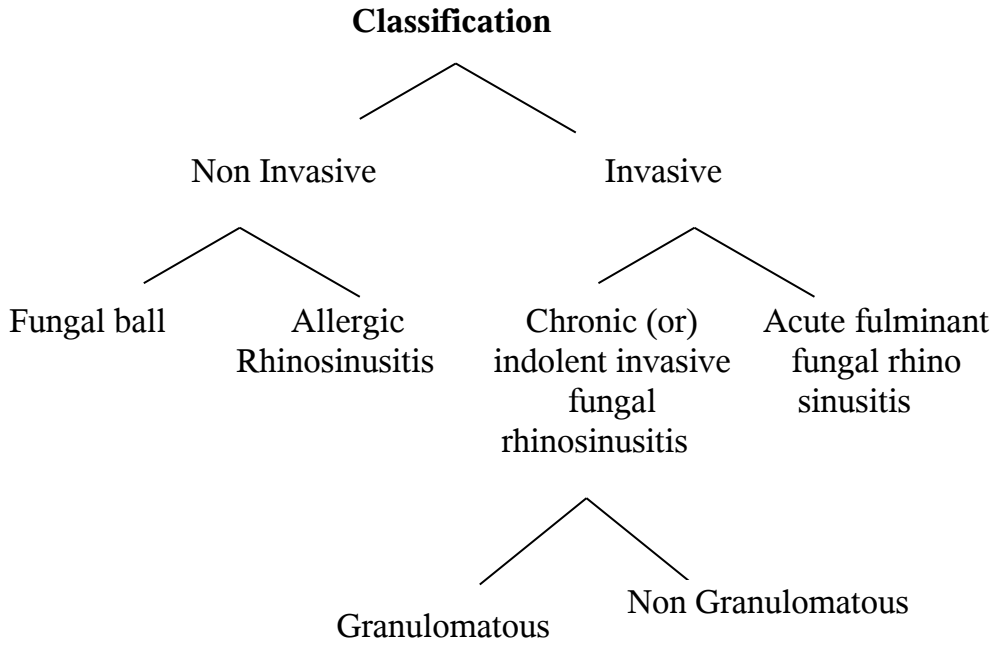
A hot humid, dusty climate and low hygiene standards are thought to predispose to mycotic infections of the paranasal sinuses (Yassin, Maher et al). Jahrsdoerfer et al, believe that the usual saprophytic fungi turn into pathogenic when the appropriate climatic change occurs and these opportunistic fungi grow in well aerated locations like the nose and paranasl sinuses, bronchi, ear, canal etc., Maher et al do not consider anaerobiosis to be essential for fungal growth while Milosev et al and Veress et al, believe that fungi become pathogenic only when a sinus cavity is obstructed and ventilation impeded. The extensive use of

antibiotics, antiallergics and immuno suppressants results in suppression of bacterial flora and predispose to mycotic overgrowth (Young et al), (Axelsson,). Mucosal thickening due to allergy may be among the factors which cause a sinus to be obstructed (Bassiouny). Although the pathogenesis of mycotic infections of the paranasal sinuses is not fully known Milosev and Mahgoub et al., believe that inhaled spores of aspergillus settle down in the sinus and become pathogenic when the conditions in the sinuses-become relatively anaerobic. This is concluded from the favourable results obtained by reaerating the sinus surgically by providing wide drainage into the nasal cavity. Romett and Newman, 1982 believe that aspergillus is frequently a contaminant in the paranasal sinuses and grows as an anaerobe, so bacterial infection with subsequent occlusion of the sinus ostium leads to conditions that favour fungal proliferation. Axelsson and Carlsoo, 1978 believe that recurrent bacterial infections, tooth extraction trauma or surgery may affect the drainage of the maxillary sinus predisposing it to infection. In Sudan, aspergillosis of all paranasal sinuses appears as a granuloma with giant cell reaction, fibrosis and involvement of the orbit (Milosev). The living habits and environmental conditions in parts of Sudan where, the bodily products of

cattle are widely used for house hold purposes could be the predisposing factors to infections (Milosev et al) aspergillus species could be isolated from the patients environment in these cases (Sandison et al).

Aspergillus infection of the sinuses can be found in patients in good health, in patients with an underlying debilitating illness and in nutritionally deprived persons (Emmons et al). Systemic diseases such as diabetes mellitus, immuno compromised states, malignant tumours and also treatment for it are associated with an increased incidence of fungal infections. In patients in general good health, there are probably some factors, systemic or local predisposing to the fungal infection of the paranasal sinuses (Chapnik and Bach). Although the fungus grows best anaerobically, paradoxically, the most serious infections involve the respiratory tract, the external auditory canal and the central nervous system (Romett and Newman). Fungal maxillary sinustitis is generally regarded as a nasological entity, although there is some debate about this (Grigoriu and Brambule). Schubert described the rapid onset of this condition as being sometimes within a few days, while Grigoriu and Brambule et al have observed chronic cases showing development over months or seven years.

Clinical Types



Two types of localised Diseases

I) Non-invasive

II) Invasive (Hora et al)

I (a). Fungal ball

- Defined as the presence of tangled mass of hyphae in one or more sinuses. Occur in immuno competent persons.
- Adults are affected with female preponderance. No paediatric cases reported, most common fungus isolated is aspergillus.

- Maxillary sinus followed by sphenoid sinus are the most affected

  clinical features: Post nasal discharge and cacosmia are the most common symptoms. Patient can be asymptomatic
- Fever, proptosis and blurred vision are rare.
- Endoscopy – non specific changes as actual fungal ball is rarely visualised

CT scan: Heterogenous opacification along with bony thickening or sclerosis of sinus wall. Calcification corresponding to dense hyphae. Bony erosion is also noted corresponding to inflammatory reaction of mucous membrane.

Diagnosis is confirmed by histopathology. It is an extramucosal disease, so no mucous membrane invasion. Fungal culture is positive 20-50% of cases due to lack of viability of fungus.

Treatment

Surgical removal of fungal ball under endoscopic guidance. No medical treatment.

Recurrence on relapse is due to residual debris.

I (b). Allergic fungal rhinosinusitis

Defined as an immunocompetent person with an allergy to fungus. Fungal hyphae are part of mucin and causes continued stimulation.

Most common fungus are dematiaceous species [Bipolaris, Curvalaria Alternaria] and rarely Aspergillus.

Pathophysiology: Atopic individuals, inhalation of fungi causes inflammatory reactions. Resulting edema is associated with production of **"allergic mucin".**

Allergic mucin is defined as a black green to grey lamellate of dense inflammatory cells, mainly mast cells in various stages of degranulation, charcot leyden crystals and fungal hyphae.

Clinical features

Younger age group (around 30 yrs)

Male and females are equally affected

Bilateral / Unilateral polyps are usually, present

CT scan: complete opacification, bone expansion, focal hyperdense lesion with surrounding hypodense mucoid material.

Culture – Usually no growth is observed.

RAST is the minimum allergy test needed to confirm diagnosis. Other tests like. Total eosinophil count, total serum specific Ig E or Ig G are suggested to reinforce diagnosis.

Treatment is controversial:

Removal of all allergic mucin is recommended. Oral prednisolone and topical steroids are recommended. But dosage and duration are still under evaluation.

II. Invasive fungal rhinosinusitis:

II (a). Chronic or indolent invasive fungal rhinosinusitis

- One of the less frequent form of rhinosinusitis
- Mainly reported from northern Africa and Asia.

2 types - Granulomatous and Non-granulomatous

Clinical features – healthy, immunocompetent individuals are affected. Previous history of chronic rhinosinusitis is present.

Pain is the main symptom. Asymptomatic period occurs frequently. Symptom appears when skull base or orbit are affected. Chronic headache, proptosis and cranial nerve palsies have been reported.

Maxillary sinus in the most common affected sinus

Endoscopy - Nasal congestion or polypoid mucosa and sometimes a soft tissue mass covered by a normal or ulcerated mucosa.

CT scan – opacification with bone erosion

MRI helps to confirm extension of soft tissue lesion.

Diagnostic biopsy usually reveals – fungal invasion of bone, mucous membrane or blood vessels.

Treatment

Combination of surgery and antifungal chemotherapy.

No one surgical procedure is recommended. Technique range from biopsy to total exenteration of diseased tissue.

II (b). Acute fulminant fungal rhinosinusitis

Characterised by mycotic infiltration of mucous membrane of nasal cavity or paranasal sinuses.

Affects immunocompromised patients [AIDS, hematological diseases, type I diabetes mellitus with a fatal outcome in the absence of treatment.

Symptoms

Fever of unknown origin or rhinorrhoea are the common symptoms.

Proptosis, ophthalmoplegia and focal neurological signs.

Endoscopy: Discoloration due to black necrotic turbinate, granulation, ulceration, or crusts in nose.

Most common sites affected – Middle turbinate, septum or inferior turbinate.

Histology

Vascular invasion with direct invasion of walls of large and small arteries and sometimes veins causing thrombosis.

Mucoraceae and aspergillus are most commonly isolated.

CT is most commonly used but MRI is superior for delineating intracranial extension.

Treatment

Combination of antifungal agents, aggressive surgical debridement and if possible reversal of underlying immunocompromising disease.

Amphotericin is the most commonly used drug.

Two Histological Patterns are seen (Verses, 1973)

i. A proliferative type accounts for 66% of cases and is characterised by pseudotubercles in a fibrous tissue stroma. There is often thickening of the arterial walls secondary to proliferation of the intima and swelling of the media.

ii. Exudative type account for 10% of the cases and is characterised by large areas of edematous necrosis.

In Sudan aspergilloma of the paranasal sinuses is found to be the commonest lesion causing secondary unilateral proptosis (Milosev and Meghoub, 1969). Proptosis was associated with a swelling to medial canthal region corresponding to the ethmoid or a swelling over the maxilla or both. The swelling was usually firm with an irregular surface and was differentiated from malignancy by its slow growth, lack of metastasis and absence of nasal bleeding. Because of this painless nature patients do not seek early medical advice. The duration of symptoms was 3 months to fifteen years.

In the four patients reported by Axelsson and Carlsoo in 1978 all were in good health except for their ENT symptoms 3 had been treated with repeated antral lavages prior to their surgery without improvement of symptoms. Warder et al., noted unilateral vasomotor disturbances with unilateral obstruction and persistent edema of the nasal mucosa on the affected side despite vasoconstriction in the case. Differential diagnosis of the aggressive type of aspergillosis of the PNS should include

malignancy, chronic sinusitis with osteomyelitis, granulomatous disease, inverted papilloma (Glass and Hertzanu et al).

Less commonly, the mycotic process may extend to involve the posterior ethmoid, the sphenoid sinus, or even the frontal sinus. Isolated involvement of any one of the paranasal sinuses is also possible. Sinus tomography and CT usually show areas of high and low radioopacity although the bony or metallic density described for aspergillus is not found in the Mucormycosis (Stammberger).

Sinus endoscopy is very valuable in diagnosis of aspergillus sinusitis, as it may show fungal concretions of unusual color in the antrum (Bassiouny and Magher). A mycotic infection of the maxillary sinus can be diagnosed by maxillary sinuscopy through the canine fossa. The entire maxillary sinus may be filled or even tightly packed by a mass ranging in consistency from soft and buttery to friable and hard. There may be central, smaller mycotic concretion, surrounded by purulent secretions, or small distinct mycotic concretions. The latter are usually found in the maxillo-ethmoidal angle or on the ostium of the maxillary sinus. The mucus membrane lining may show massive polypoid changes or it may

appear unremarkable if there is no inflammation. The color of the fungal mass may vary from whitish-yellow to dirty-brown or greyish-black.

Immunodiffusion tests have proved quite specific and are recommended in the diagnosis of suspected aspergillosis (McGuirt and Harill). Mahgoub et al, had positive results from immunodiffusion tests in 11 out of 11 patients proved to have paranasal aspergillosis and negative results in twenty controls. All sera reacted with antigens made from A.flavs strains.

Definitive diagnosis is made from microscopic examination and special culture of the operative specimens. The tissue appearance of aspergillus is characteristics. The hyphae are thin regular and have frequent septae. Aspergillus hyphae appear more stiff than other hyphae, with less bending. Aspergillus reproduces as a sexual conidium and is recognized by septate hyphae and ischotomous branching at an angle of 45 degree (Milroy et al). pathological mucormycosis may be confused with aspergillosis, but slides of former will show vascular invasion in addition to tissue necrosis (Harill, 1979). The diagnosis of aspergillus infection can also be made on routine stained sections (Axelsson and Carlsoo, 1978).

Although A.fumigatus is the most common cause of all aspergillus infection. A flavus has been more common in cases of paranasal sinuses aspergilloma for which culture isolation and identification have been done (Savetsky and Waltner, Mahgoub et al). All these cases reported by Warder et al in 1975 were afebrile and had normal total white blood counts on admission.

Phycomycosis

This is classified into two major groups

1. Entomophthoromycosis (Rhinophycomycosis) caused by Basidiobolus coronata
2. Rhino cerebral mucormycosis caused by mucorales and so far it would appear that mucormycosis is more common than entomophthorosis.

Clinical Features

Mucormycosis is usually superimposed on some other disease such as uncontrolled diabetes mellitus or proloned treatment with cytotoxic drugs, steroids or antibiotics. On the other hand, Entomophthorosis is more likely to occur in otherwise healthy subjects.

In rhinomucormycosis the disease develops rapidly, the duration of symptoms being numbered in days. It may present with nasal discharge, loss of sensation in the cheek, proptosis and even blindness, x-ray may reveal destruction. Cerebral involvement may manifest itself with headache, pyrexia and lethargy.

Entomophthorosis develops more slowly and the clinical presentation is less dramatic than in mucormycosis. The general condition of the patient is usually good and the common form of presentation is nasal obstruction together with swelling of the nose and cheek, often of many months duration which contrasts sharply with the fulminant progress of mucormycosis.

Histopathology

The lesion in mucormycosis consists of inflammatory granulation tissue with haemorrhage and necrosis. There is infiltration by polymorphonuclear leucocytes, histiocytes, foam cells and multinucleated giant cells, some times of Langhans type thereby simulating tuberculoid tissue reactions (Symmers, 1968). Aseptate fungal hyphae with or without sporangia are found lying in the inflammatory tissue and portions of hyphae may be engulfed by giant cells. A particular characteristic of

mycormycosis is involvement of blood vessels. It is best seen with a Gomori silver methenamine stain.

Aetiology and Pathogenesis

The genera of Mucorales involved in mucormycosis are Rhizopus, Absida and Mucor. Rhizopus (oryae, arrhizius and corymbifer) appear to be the commonest cause of the disease (Baker, 1957). The hyphae which are characteristically aseptate range from 4 to 20 microns in width and upto 200 microns in length. Branching may be found both in culture and in the tissues. Although culture has not been carried out in many reported cases, these fungi are easily grown on artificial media. In culture aerial hyphae bear sporangia at their extremities, representing asexual reproduction but in tissue lesions sporangia may or may not be found. When seen, they appear as rounded, expanded ends of hyphae which in the mature state contain numerous spores of the order of 6 microns in diameter. The finding of these fungi in secretions does not necessarily have any significance since they are normally saprophytes. They are normally found in the soil and on decaying food material. However, in the presence of lowered body resistance, they may become pathogenic. Reports relating to predisposing causes are variable due to selection.

Hutter (1959) reviewed mucormycosis as a complication of treatment cancer patients and emphasized the prolonged use of antibiotics, steroids, chemotherapeutic agents and altered metabolic states such as diabetes mellitus. He claimed that the later disease was present in 19 percent of cases of mucormycosis.

Behaviour

Many cases of cerebral involvement have had a fatal outcome but 11 out of the 13 cases reported by Pillsberg and Fischer survived which they attributed to aggressive surgery and use of Amphotericin B. the infection is liable to become systematized with involvement of internal organs, especially the lungs. The lowered body resistance that permits establishment of the infection clearly plays a part in the fatal progression.

By contrast, entomophthoramycosis affecting the nose and sinuses develops more slowly against higher resistance and tends to be limited in its extend. Spread from the nose to the paranasal sinuses often occurs but the infection is usually confined to these regions. Symmers (1972) reported a case of nasal infection which developed secondary involvement of both lower lobes of the lungs. One could reasonably assume that the

pulmonary infection was inhalatory rather than systematized. It is clear that rhinoentomophthorosis has a better prognosis than mucormycosis.

4. IMMUNOLOGY

It has been theorized that AFS evolves after inhalation and trapping of fungal spores allow mold antigens to react with IgE-sensitized mast cells. The cascade of immunologic events that results in chronic inflammation and subsequent tissue destruction follows. The marked influx of eosinophils and thick inspissated mucus traps fungal hyphae and provides continuous antigenic stimulation. Major basic protein is known to be tissue toxic and is thought to be partially responsible for the bony remodeling (expansive changes) which is present in long-standing disease.

Manning et al. demonstrated in their series that all allergic fungal sinusitis patients were modified radioallergosorbent (mRAST) positive to atleast one fungal antigen in the family of their cultured organism, while control patients were not mRAST positive to either dematiaceous or Aspergillus fungal antigens. It has been presumed that this disease is a combination of both Coombs type I (IgE) and type III (immune complex) response.

If this condition is truly allergic in its origin, then how can one readily explain the fairly high frequency of unilateral AFS. Moreover, some patients have fungus identified in eosinophilic mucin but do not have documented allergy to fungus. Therefore, the question is: “Can this allergic mucin exist without fungus being present?” In this light, researchers reported a condition they termed “allergic fungal sinusitis-like syndrome”. This condition behaves clinically just like AFS, but neither the fungus nor the allergy could be documented in all patients with AFS like syndrome. Subsequently, Ponikau et al. reported culture and tissue handling techniques which improve the yield of mycology and pathology in identifying fungi from the nose and sinuses. They believe that documented allergy is not necessary to properly diagnose AFS, and using this definitional change, they identified AFS in 94 of 101 (93%) consecutive patients undergoing surgery of CRS. They have suggested that some of these patients will have a tendency to develop an allergy to fungus, and that these patients will develop a more intense sinusitis than other patients with CRS. They suggest that nearly all patients with CRS have “eosinophilic fungal rhinosinusitis”.

It appears that the best explanation for the pathogenesis of AFS is that it is multifactorial, and that, as such, its treatment is aimed broadly at the inflammatory cascade.

The AFS patient can have abnormalities in

1. Peripheral blood eosinophilia,
2. Immediate skin test reactivity to offending fungal antigens,
3. Elevated total serum IgE,
4. Precipitating antibodies to offending fungal antigens,
5. Elevated fungal-specific IgE and IgG.

Patients with AFS are immunocompetent by humoral and cellular screening. Manning et al. have recommended mRAST testing as a routine clinical test for diagnosis of AFS. Comparing with the culture-specific fungal IgG antibody test, the IgE mRAST test is easily obtained and relatively inexpensive. Unfortunately, RAST antigens are not widely available for certain fungal organisms.

5. ENDOSCOPIC SINUS SURGERY

Introduction

The treatment of nasal and sinus diseases has been revolutionised by the introduction of the nasal endoscope. The pioneering work of

Meeserklinger has lead to an understanding of the physiology of the nose and sinuses and also recognizing the mucociliary transport mechanism of the nose and sinus mucosa. The mucociliary transport of mucus etc., occurs in a definite genetically predetermined pattern. The transport is always towards the natural ostium and a dependent opening like the intranasal antrostomy does not necessarily help in drainage. Mucosal contact between adjacent areas e.g., in the middle meatus arrests the mucociliary transport leading to stagnation and subsequent infection. This has shown that in most instances, the pathology is not primarily in the larger sinuses but is secondary to impaired drainage caused by disease in the ethmoidal infundibulum blocking their natural ostia in the middle meatus. According to Naumann, shows the vicious cycle that is initiated by an infundibular blockage. Interruption of ventilation and drainage caused by ostial obstruction leads to stagnation of the secretory product and damage to the ancillary function of the respiratory epithelium with consequent inflammation. The inflamed mucosa in turn contributes to the osital obstruction, thus completing the cycle.

There are numerous narrow clefts in the anterior ethmoidal cells and there are many anatomical variations that can easily narrow these

clefts thus predisposing to recurring infection, firstly in the ethmoids and eventually in the larger sinuses. The Messerklinger's concept for the treatment of diseases of the nose and sinus is based largely on the diagnosis of these areas of obstruction, by the use of a Diagnostic Nasal Endoscopy and C.T. Scans. Once the cause of the problem is identified clearly, treatment can be directed at these critical areas in the ethmoidal clefts and not at the larger sinuses.

With the Messerklinger's technique, the two advantages are (1) radical procedures can be avoided and (2) even in cases of massive diseases, limited procedures usually prove sufficient.

However, it is now increasingly obvious that the principles of Functional Endoscopic Sinus Surgery and the Messerklinger's technique i.e., attempting to reverse pathophysiological processes by conservative surgery in defined areas dictated by disease are applicable only in chronic sinusitis and acute recurrent sinusitis. The functional approach is not applicable to all diseases of the nose and sinuses. In addition, the horizons of nasal surgery have grown far beyond FESS and now include various orbital and anterior skull base procedures.

Basic Principles and Surgical Techniques

The techniques of Endoscopic sinus surgery vary with the inferior turbinate. Perforate the insertion of the uncinate process at the attachment of the middle turbinate and with a gentle sawing motion follow the insertion of the uncinate inferiorly. With the Blakesley forceps grasp the uncinate process and with a twisting motion avulse first the inferior aspect of the uncinate followed by avulsion of the superior attachment. The infundibulum is opened up now and the bulla ethmoidalis can be visualised and the surgeon has access to the ethmoidal air cells.

2. Middle Meatal Antrostomy

This procedure is performed

To identify the natural maxillary ostium.

To widen the ostium posteriorly to form a large middle meatal antrostomy.

After complete removal of the uncinate process, the ethmoidal bulla and maxillary ostium are visible. The natural ostium lies at the junction of the anterior and inferior walls of the ethmoidal bulla. If the ostium is incompletely visualised take a curette and remove any residual portion of the uncinate process. Examine the posterior fontanelle for any accessory

ostium. If present, the accessory ostium is connected to the natural ostium using a backbiting forceps. If there is no accessory ostium, a scissors is used to cut and widen the natural ostium posteriorly. The same backbiting forceps can be used to remove the inferior margin of the antrostomy and the upbiting Blakesley forceps to remove the superior portion of the fontanelle adjacent to the ostium.

3. Anterior Ethmoidectomy

This procedure is performed

To remove the ethmoidal bulla and ethmoidal cells anterior to the ground lamella.

To identify the anterior skull base and the anterior ethmoidal artery.

The anterior wall of the ethmoidal bulla is entered with the tip of a straight forceps. The inferior and medial wall is completely removed while maintaining the posterior wall intact. The lateral wall of the ethmoidal bulla is formed by the lamina apayracea which forms the lateral boundary of the dissection. The skull base is defined anteriorly. There may be some cells superior to ethmoidal bulla. As the skull base begins to curve superiorly it forms the ethmoidal dome in the anterior aspect of which can be seen the anterior ethmoidal bulla is fused in most instances

to the ground lamella of the middle turbinate, separating the anterior and posterior ethmoidal cells.

The roof of the ethmoids which separates the air cells from the dura curves upwards as it goes laterally. Medially it is thin and dips down rather sharply to join the cribriform plate. [The diseased cells in this region can be removed with upward biting].

Blakesley Wilde forceps, the tip of which should always be directed slightly laterally to avoid accidental perforation of the ethmoidal roof or cribriform plate. When removing the cells near the lamiha papyracea, which forms the lateral boundary, it is better to use the side of the forceps rather than the tip to prevent accidental perforation. The lamina can be identified because it has a slightly yellowish tinge. Sometimes, it is necessary to open the agger nasi cells to get an adequate view of this area. After clearing the anterior cells it is possible to see the opening of the frontonasal duct. This should be cleared by removing the diseased mucosa surrounding it.

4. Posterior Ethmoidectomy

This procedure is performed

a. To exenterate the posterior ethmoidal cells.

b. To identify the skull base, posterior ethmoidal artery, anterior sphenoidal wall, superior turbinate and sphenoidal ostium.

The posterior ethmoidal cells are entered through the postero infero medial part of the ground lamella. The septae of the posterior ethmoidal cells are removed carefully. The posterior ethmoidal artery which lies several millimeters anterior to the anterior wall of the sphenoid sinus is identified. The mucosa of the anterior wall of the sphenoid sinus is removed. It is slightly bluish in colour in contrast with the yellowish colour of the medial orbital wall and skull base. The skull base descends inferiorly as it posterior ethmoidal cells are posteriorly the anterior sphenoid wall, laterally the lamina papyracea, superiorly the skull base and the superior turbinate medially. The optic nerve can indent into the posterior ethmoidal sinus cells in this region. Remember that the path through the ethmoid does not lead to the anterior wall of the sphenoid sinus but further superiorly and laterally.

5. Sphenoidotomy

This procedure is performed

To enter the sphenoid sinus by removing the anterior wall and deal with the disease inside.

To study the anatomy of the interior of the sphenoid sinus in detail.

The anterior wall of the sphenoidal sinus is identified with certainly by the following facts:

The anterior wall is about 7 cm from the anterior nasal spine at 30 degrees from the floor of the nose.

The anterior wall of the sphenoid sinus can be entered by a straight suction 1 cm above the choana.

6. Frontal Recess Surgery

This procedure is performed

To expose the frontal recess

To identify the frontal sinus ostium

To establish drainage for the frontal sinus

To establish drainage at the frontal recess

Anteriorly – Aggernasi

Posteriorly – anterior ethmoidal artery and nerve

Medially - middle turbinate

Laterally – lacrimal fossa

The skull base that has been identified posteriorly is followed inferiorly till the anterior ethmoidal artery is identified. This forms the

posterior boundary. The frontal sinus opening can be visualized by dissecting upwards towards the skull base between middle turbinate medially and residual uncinate process laterally. Agger nasi cells have to be completely removed. The infundibulotomy incision is extended into the Agger nasi cells just lateral to the insertion of the middle turbinate on the lateral nasal wall. This provides better access to the Agger nasi cells giving direct access to the frontal opening. Using the Blakesley forceps any lamellae from the Agger nasi cells which will be just anterior to the frontal opening are removed. After identifying the frontal opening the anterior wall of the ostium, which also forms the posterior wall of the Agger nasi, is removed. The posterior table of the frontal sinus will be clearly visible.

Cells within frontal recess also have to be removed completely. Residual uncinate process has to be removed. The mucous membrane of the frontal sinus ostium is preserved, otherwise stenosis of the ostium of the frontal sinus may occur.

MATERIALS AND METHODS

The materials for the present study were collected from patients who attended the out patient department of Government Rajaji Hospital, Madurai between 2006 to 2008.

A total of 50 patients who had clinical features suggestive of fungal infections of nose and paranasal sinuses were evaluated using a standard proforma and underwent the following investigative procedures systematically as and when needed.

a) Haematological Investigations:

Complete haemogram, Blood sugar level, serum electrolytes, serum proteins, blood grouping etc., were done as preliminary investigations to assess the general health condition as well as to rule out any underlying disorders.

b) Radiological Procedures:

Relevant X-rays of the nose and paranasal sinuses were taken for all patients and those who were provisionally diagnosed as fungal granulomas were subjected to CT scanning of the nose, paranasal sinuses and brain with contrast enhancement studies.

c) Immunological Procedures

Cutaneous reactivity to Aspergillus species was tested by the prick test.

d) Pathological Diagnosis

Biopsied materials were places in three sterile bottles as follows.

Bottle A containing sterile normal saline for staining with 10% potassium hydroxide Bottle B with sterile normal saline for fungal culture.

Bottle A & B were transported to the microbiology lab within one hour of the procedure.

Bottle C sent to the pathology department of Histopathological examination.

Bottle A specimen was mounted with 10% potassium hydroxide. This dissolves or makes the tissue elements translucent and the fungi are easily observed when examined as a wet preparation fungal elements stained black, easily visible.

Bottle B specimen was sent for fungal culture. It was cultured on potato-Dextrose agar (PDA). The best grade of white Potatoes should be used. They should be washed and sliced, unpeeled at the rate of 250 g/l of

water and allowed to steam for 1 hr in an autoclove with its exhaust open. The filtrate should be distinctly turbid. A clear filtrate is to be avoided. Agar and dextrose one added to give serial concentration of 2% each and the whole was then tubed, autoclaved and stained for use. Properly made, each tube showed have a small button of sedimented material in its base. Potato – dextrose agar made in this manner in an excellent medium, this interval can sometimes be hastened by reducing the concentration of dextrose to 1%.

When growth was present, a bit of growth was removed from the colony, toasted apart in a drop of water and examined as a wet preparation.

Slide cultures show the structure and arrangement of the growth and true morphology and hence were used.

These cultures were prepared by adding a bit of growth to a small portion of agar on a slide. A coverslip was place on top and the slide was incubated in a most petridish. After a week, when the spores had matured, the cover slip and the medium were gently removed. A drop of 10% KOH was added and the coverslip replaced. Slide is heated gently and allowed to cool approximately 15 minutes. The preparation was then examined

under microscope. Some of the mycelium would have adhered to the slide and the spore heads, conidiophores etc., will be intact and seen in their characteristic arrangement. Aspergillus species was easily identified by the presence of typical conidiophores.

Bottle C was used for routine histopathological examination of the specimen under low and high power magnification with a light microscope.

Our treatment policy:

The adequate management of fungal infections of the Nose and Sinuses at our institute revolves around five major principles.

a) Timely diagnosis, usually dependent on a high index of suspicion.
b) Control of local and systemic predisposing factors.
c) Surgical debridement geared to the level of invasiveness of the fungus
d) Anti-fungal treatment
e) Long term follow up
f) All the patients in this study underwent

1. Endoscopic Sinus Surgery

Post – operatively patients were advised to come for regular follow up. The nasal douching was given to every patient from the 5th post-operative day after the first postoperative endoscopic examination and cleaning. Patients were treated by beclomethasone aqueous nasal spray, anti-histamines and vitamins.

The patients were requested to come for follow up on the 15th post-operative day for endoscopic examination and cleaning and whenever possible thereafter (usually once in a month). Patients with Allergic aspergillus sinusitis did not require antifungal therapy. Anti-fungal therapy was given based on the type of fungal infections and its invasiveness (mycormycosis)

OBSERVATIONS

All patients were evaluated as per the following parameters.

1. Age
2. Sex
3. Clinical symptoms
4. Clinical sign
5. Histopathological examination
6. CT Scan of Nose and sinuses
7. Surgical procedure
8. Complications
9. Follow up and Recurrence

1. Age

Number of cases in this study: 50

Age (years)	No. of Patients	Percentage %
<20	8	16%
21 - 40	34	68%
41 – 60	8	16%
> 60	-	0%

The majority of cases were in 2nd group, is between 21-40 years.

2. Sex

Number of cases in this study : 50

Total number of cases	Males	Females
50	18	32

Out of the 50 patients study 18 were males and 32 were females. All of them were racially Indian.

Age / Sex / Incidence

Number of cases in this study : 50

Age	Sex		Incidence		Total
	Male	Female	Male	Male	
< 20	2	6	4%	12%	16%
21 – 40	12	22	24%	44%	68%
41 – 60	4	4	8%	8%	16%
>60	-	-	-	-	-

There were more females than males in this study. Females in this study formed 64% of total number of cases.

3. Clinical symptoms

Number of cases in this study: 50

Symptoms	No. of Patients	Percentage %
1. Nasal Nasal obstruction Nasal discharge Post nasal discharge	50	100%
2. Headache	38	76%
3. Ocular	8	16%

All the patients in our study had nasal symptoms (100%). They are nasal obstruction, nasal discharge post nasal discharge. Frequent sneezing, reduced sense of smell (Hyposmia) or complete loss of smell (Anosmia) and nasal bleeding.

Ocular symptoms like proptosis, epiphora, diplopia blurring of vision in our study was 16%.

4. Clinical signs

Number of cases in this study : 50

Signs	No. of Patients	Percentage %
1. Nasalpolyp & fungalmass	50	100%
2. Ocular manifestations		
Proptosis		
Epiphora	8	16%
Diplopia		
Ophthalmoplegia		

5. Histopathology and fungal culture

Total number of cases in this study : 50

Histopathology showed all cases were aspergillus

Causative organism	No. of Patients	Percentage %
Aspergillus flavus	20	40%
Aspergillus fumigatus	8	16%
Aspergillus niger	4	8%
Aspergillus terreus	2	4%
No growth	16	32%
Mucoromysis	Nil	Nil

Fungal culture, in our study showed out of 50 patients, 20 are Aspergillus flavus, 8 are Aspergillus fumigatus, 4 are Aspergillus niger, 2 are Aspergillus terreus.

6. CT Scan of nose and sinuses

Total number of cases in this study : 50

Sinus Involvement	No. of Patients	Percentage %
Maxillary sinus	44	88%
Ethmoidal sinus	38	76%
Frontal sinus	24	48%
Sphenoidal sinus	26	52%
All sinuses	14	28%
Orbital involvement	10	20%

6a. Unilateral / Bilateral comparison study

Total number of cases in this study : 50

Side of the nose and sinuses	No. of Patients	Percentage %
Right	6	12%
Left	8	16%
Unilateral	14	28%
Bilateral	36	72%

7. Complications :

a) By disease process

Number of cases in this study : 50

Complications	**No. of Patients**	**Percentage %**
1. Orbital complications		
Proptosis	6	12%
Epiphora	2	4%
2. Intracranial	Nil	Nil

9. Follow up and recurrence :

Number of cases in this study : 50

No. of Cases	**Month of Follow up**	**No. of recurrence**
16 Cases	18 Months	4
24 cases	12 months	2
10 cases	6 Months	-

DISCUSSION

The fungal diseases of the nose and paranasal sinuses encompasses not one disease entity but a multitude of an entire spectrum of different diseases. We have studied different disease causes namely allergic aspegillus sinusitis (50 cases). Although the treatment of these diseases is vastly different, the presentation and clinical features are quite similar and thus they could be studied together. The authors have attempted to study these diseases under the common heading highlighting the important differences whenever required.

Age: The majority of cases in our study were between the age group of 21-40 years. They constituted 68% of the total number of cases. This was followed by the age group between 41-60 years and less than 20 years who constituted 32% total number of cases.

The study by Waxman et al, showed that the mean age of patient in his series was 29 years and another study by manning et al, showed the mean age of 32 years.

This compares favorably with these studies.

Sex : In our study there was a clear female preponderance numbering 32 out of 50 cases (64%) and males 18 out of 50 cases (36%) Reported data

by Waman et al. showed female preponderance with allergic sinusitis and female ratio who constituted 63% over all incidence of allergic aspergillus sinusitis in our study was 64% female ratio. This corresponds well with the previously mentioned study.

Symptoms : All the patients in our study had nasal symptoms. The nasal symptoms included, nasal obstruction, nasal discharge frequent sneezing, reduced sense of smell (Hyposmia) complete loss of smell (Anosmia) and nasal bleeding. The next most common symptom was headache was seen in 76% of our patients. The next common symptoms was ocular symptoms such as epiphora, proptosis, diplopia and blurring of vision comprising about 16%.

Various other studies such as those by, jonathan et al., Waxman et al., Klossek et al., showed that the commonest symptoms in allergic Aspergillus sinusitis is chronic nasal obstruction and postnasal discharge. These findings compare favourably with our studies.

An another study by Isha thagi et al., the main symptom was headache seen in 100% his patients, followed by ocular symptoms and then followed by nasal symptoms and (Nasal obstruction and nasal

discharge). This corresponds well with the previously mentioned study. We had four cases with wheezing symptoms.

Signs: In our study, out of 50 patients, all 50 patients presented with nasal polyps, fungal mass (100%). The ocular signs such as proptosis diplopia and opthalmoplegia was seen 16%.

In a study by Waxman et al., the most common sign was nasal polyposis. This findings compares favorably with our studies.

Histopathological Examination

A total of 50 different fungal diseases have been reported in fungal sinusitis (Washburn et al)

Aspergillus, an ubiquitous fungus of the class Ascomycetes is the most commonly encountered fungus in the environment and is the most common species encountered in fungal sinusitis generally and presumably in allergic fungal sinusitis. The latter is largely based on histopathological findings of fungi with morphologic features similar to Aspergillus and not on the basis of culture documentation. In our series 100% of fungal sinusitis were histopathologically proven to be aspergillus.

Waxman et al., in his study showed that all his 15 patients were histopathologically proven to be allergic aspergillus sinusitis. In our study

shows 100% allergic aspergillus sinusitis. Klossek et al in his case series of 100 cases documented that 94% were histopathologically proved allergic aspergillus sinusitis Various other organisms have been reported as pathogens in allergic aspergillus sinusitis. These includes curvularia. Alternaria and Drechsleria. Ence et al reported 14 patients with aspergillusfungal sinusitis caused by different fungi. Bipolaris spicifera B. Australians, Aspergillus, Alternaria and Cuvularia lunata. The identification of these fungi may be related to the improved ability of microbiology laboratories to identify the diverse hyphae with variations in the Conically spores.

In our study, all cases of Allergic aspergillus sinusitis were sent for the fungal culture. In all these cases, the material sent for culture were fungal balls taken from the infected sinus cavities out of 50 cases 34 were culture positive for Aspergillus and remaining were negative. 20 were Aspergillus flavus, 8 were Aspergillus fumigatus, 4 were Aspergillus niger and 2 were Aspergillus terreus Rhinomucormycosis was not present in our study in histopathological Examination.

In our studies, no other species of fungus was identified either on the HPE or culture Examination.

CT Scan of Nose and Sinuses: All our patients in this series underwent CT scan preoperatively, MRI scan was not considered due to high cost factor and relatively low amount of extra information in cases of fungal diseases of the nose and paranasal sinuses.

Manning et al., 1997 have reported that in T2 weighted MRI images there is a signal void corresponding to surgically proven areas of thick inspisated allergic mucin. Morning et al., also claim allergic fungal sinusitis is a distinct clinical entity with a highly specific radiographic appearance based on CT and MRI.

The authors agree with the above study with the respect to the CT findings. All patients in our series with allergic aspergillus sinusitis demonstrated areas of high alteration centrally within involved sinuses by CT. These areas corresponded to surgical findings of thick allergic mucin. Some cases demonstrated a starry sky pattern of material, which appeared to be calcium densities on bone windows. CT Scanning has been very useful in defining the full extent of the disease. Aspergillus sinusitis often has a mixture of high and low density areas within the sinuses. Bone windows allow a very accurate assessment of possible invasion.

Generally, only one series is involved with Aspergillus most commonly the maxillary sinus. In our study maxillary sinus (88%) is the common involvement. Next Ethmoid 80% frontal sinus 52% sphenoid sinus 44% All sinuses involvement 24%

Green et al., found orbital involvement 80%

In our study orbital involvement 12%

Intracranial extensions were not seen in any of the 25 cases.

Surgical Procedures:

In our study, 50 cases were operated by Endoscopic sinus surgery. Endoscopic sinus surgery with less morbidity and mortality, clearance was total and recurrence rate is almost minimal in our study. Even though in our cases we had no complications acquired in functional endoscopic sinus surgery, only in 6 cases recurrence were noted. None of the patients developed complications and patients were discharged nextday itself. This correlates well with the previous study.

We treated our patients with steroids. both topically and systemically. The use of topical intranasal steroids is routine and we restrict the use of systemic steroids. It is our experience that the topical intranasal steriods alone when taken regularly is effective in preventing

recurrence of the disease. However Allphin et al. feel that topical intranasal steroids are effective only after a course of oral corticosteroids.

Antifungal agents were not used in any of our cases with allergic Aspergillus sinusitis. This view point is shared by many authors (Allphin et al., Klossek et al., Jonathan et al.,) who feel that the use of antifungal agents in the cases of allergic aspergillus sinusitis is unwarranted.

Similar reports have been published by many authors, regarding the endoscopic approach is the sole approach in the treatment of allergic aspergillus sinusitis. However some authors feel that the external approach definitely has its place in the treatment of this condition especially in the cases of orbital (or) intracranial extension of this disease.

Complications : Complications of endoscopic sinus surgery have been as major and minor according to the degree of morbidity and the treatment needed to prevent permanent serious sequlae.

Complications seen in our study includes intraoperative haemorrhage in 4 cases (8%) and no cerebrospinal leak. Pneumocephalus and other reported major complications (Markmay et al., 1994) includes orbital hematoma. Loss of vision, diplopia, epiphora, meningitis, brain abscess and focal brain haemorrhage which were not seen in our study.

Intracranial complications can be prevented by not disturbing the mucosa lying against the roof of the ethmoid sinus. It is also worth remembering that the vertical bony wall of the olfactory groove where the middle turbinate attaches to the roof of the ehymoid sinus may be extremely thin and should be avoided. The authors feel that two other guidelines may help to prevent cerebrospinal fluid leaks. 1. Instrumentations or suction cannulas should be placed into the nose or sinuses only under endoscopic guidance. 2. The basal lamella should be entered at a point farthest from the roof of the ethmoids posteriorly and inferiorly rather than anteriorly and superiorly.

Intra operative haemorrhage serve enough to require blood transfusion is rare (Markmay et al.,) in our review none of them required blood transfus ion. The authors agree with other reported studies that this kind of preoperative bleeding is mostly from the interruption of the sphenopalatine artery as it courses over the face of the sphenoid sinus, just above the arch of the posterior nasal choanae. However the author do not agree with the suggestion of Markmay et al., who recommended the use of the suction and cautery for the control bleeding. In our experience the

good combination of hypotensive anaesthesia and adequate packing will control the bleeding.

The most frequently encountered minor complication in our study 28% (14 cases) were synechiae. These adhesions were usually seen between the middle turbinate and septum or lateral wall of the nose Careful handling of the tissues during surgery, minimizes the chances of contact between the two adjacent raw surfaces. Careful postoperative cleaning of the sinus cavity will also help in the prevention of adhesion of the 50 patients in our study, 14 had synechiae which were released in the outpatient department and there was no recurrence.

Periorbital ecchymosis is the next minor complication and a total of 8%. These complications were seen after the endoscopic sinus surgery. This occurs usually due to violation of lamina papyracea. The authors agreed with other reported studies that the violation of the lamina papyracea occurs most commonly with uncinectomy during endoscopic sinus surgery.

Follow up and recurrences:

Post treatment endoscopic surveillance is essential for long term success since recurrent disease is common. Also patients symptoms alone are not a satisfactory measure for persistent/ recurrent disease.

In this series 16 of our patients were followed up for a period of 18 months after surgery. 24 patients were followed up for a period of 12 months and another 10 patients followed up for a period of 6 months. We have not lost any patients during the follow up period. All our patients are carefully counselled both preoperatively and post operatively on the importance of regular follow up treatment and proper medication. 4 recurrences were noted with in 12 months.

The authors feel that the complete and radical removal of fungal debris and careful regular follow up with intranasal steroids and if required systemic steroids when employed judiciously will results in the best long term result after surgery.

SUMMARY AND CONCLUSION

- This study on fungal diseases of the nose and paranasal sinuses was conducted at ENT Department. Govt. Rajajji Hospital, Madurai on 50 cases. Out of these 50 cases all are Allergic Aspergillus sinusitis.
- The most common age group with fungal diseases of the nose and paranasal sinuses was between 21 – 40 years of age. There was a clear female preponderance with 64% and male cases constituted 36%.
- All patients in this study had nasal symptoms. The other most common symptom was headache seen in 76% of our cases. 50 patients (100%) presented with a nasal mass either polyps or fungal mass. The ocular sign were seen in 16% of cases.
- In our series of 50 cases, 50 (100%) histopathologically proven to be Allergic Aspergillus sinusitis. Fungal culture showed that Aspergillus flavus (40%), Aspergillus fumigatus (24%), Aspergillus niger (8%) and Aspergillus terreus (4%), were culture positive and no mucormycosis present.
- CT. scan was found to be highly valuable in pre-operative evaluation and intra-operative guidance.

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The details of the proforma used in this study as follows:

A STUDY OF FUNGAL DISEASES OF THE NOSE AND PARANASAL SINUSES

Name of the patient : age : Sex :

S.No :

Place of residence : Occupation :

Socioeconomic Status : Hospital Number :

HISTORY

A) COMPLAINTS DURATION

1)

2)

3)

B) H/O Present Illness

NOSE: SYMPTOMS DURATION

I) Nasal obstruction R/L/B

II) Nasal Discharge R/L/B

III) Headache

IV) Facial pain Unilateral / Bilateral

V) Nasal Bleeding R/L/B

VI) Change of voice

VII) Smell disturbances Hyposmia / Anosmia

VIII) Nose deformity

EYE

I) Proptosis

II) Pain

III) Watery Eyes

IV) Blurring of vision

V) Diplopia

ORAL CAVITY

I) Pain

II) Palatal ulcer

III) Mouth ulcer

CRANIALNERVES:

I) Anosmia

II) Loss of vision

III) Diplopia

IV) Ophthalmoplegia

V) Trigeminal Anaesthesia

VI) Facial palsy

VII) Nasal regurgitation

MISCELLANEOUS: H/O Loss of Weight & Appetite

PAST HISTORY:

1. Previous treatment

    a) Drugs - Steriod therapy - Duration

    b) Surgery - Endoscopic / External approach / Combined

2. H/o Immuno suppression

3. H/o Diabetes / Hypertension / IHD

PERSONAL HISTORY:

Smoking / Alcoholic / Snuff / Gardening

FAMILY HISTORY :

OCCUPATIONAL HISTORY :

1) GENERAL EXAMINATION :

Build :

Nourishment :

Anaemia :

Weight / BP / Temperature :

SYSTEMIC EXAMINATION

Cardiovascular system : Heart sounds / Murmur

Respiratory System :

Abdomen :

Central Nervous System :

LOCAL EXAMINATION

1. NOSE **:** Skin

External Contour

Nasolabial fold

Anterior Rhinoscopy :

Septum Deviated to R/L/Midline	-
Mass	-
Probing	-
Nasal Airway	-
Bleeding on touch	-
Nasal discharge	-

Posterior Rhinoscopy :

Mass

Discharge

Choanae / Eustachian Tube

2. ORBIT :

Proptosis

Acuity of vision

Movement of the eye ball

Lacrimation

Oedema of the eyes

Hypertelorism

3. ORAL CAVITY :

Oral mucosa

Teeth

Hard & Soft palatal ulcer

4. EXAMINATION OF CRANIAL NERVES :

5. EAR :

6. THROAT :

Indirect Laryngoscopic Examination

INVESTIGATIONS

Routine blood and urine tests

Blood sugar / urea / Lipid profile

Radiological Investigations

X-ray or Paranasal sinuses

& Nasopharynx

CT Scan of Nose and Sinuses

MRI

Nasal Endoscopy Findings

PROVISIONAL DIAGNOSIS:

OPERATIVE TREATMENT:

Endoscopic sinus surgery

PER-OPERATIVE FINDINGS

POST-OPERATIVE COMPLICATIONS

HISTOPATHOLOGICAL REPORT

FUNGAL CULTURE REPORT

FINAL DIAGNOSIS

POST- OPERATIVE TREATMENT AND FOLLOW UP