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PARANASAL SINUSES AND NASAL CAVITY;
THE NOTORIOUS NEIGHBOURS OF ORBIT

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ABSTRACT: Objectives: To describe the clinical and neuro-radiological patterns of orbital invasion by the sino-nasal diseases. **Study Design:** Descriptive, Retrospective study. **Period:** 2004 to 2009. **Subjects and Methods:** We retrospectively reviewed fifty four cases of nasal and paranasal sinus diseases invading the orbit. The medical charts were analyzed. The data considered for the study was age, sex, ocular presentation and associated systemic problems of the patients. The neuro-radiological results were correlated with the clinical picture. **Results:** The age range was from 6 to 85 years (mean 45.5). Male to female ratio was 3.5: 1. The initial clinical presentation was Proptosis (66.66%), disturbance of vision (25.9%), ophthalmoplegia (11.11%), diplopia (9.26%) and ptosis (9.26%). 79.63% patients had inflammatory etiology and 20.4% had neoplastic lesions in the nasal and paranasal sinuses extending into the orbit.

Key words: Proptosis, Ophthalmoplegia, Nasal and Paranasal sinus diseases, Orbital cellulitis, Neuro-imaging.

INTRODUCTION

Orbit is a pyramidal shaped cavity and paranasal sinuses and the nasal cavity form its first door neighbours. Frontal sinus lies superiorly, maxillary sinus inferiorly, ethmoid sinus and nasal cavity are located medially. Diseases of the orbit are essentially the responsibility of an ophthalmologist but there are certain pathologies of orbit and its contents which require the involvement of an Otolaryngologist. In this article, the clinical and Neuro-imaging patterns of such diseases are discussed.

SUBJECTS AND METHODS

We retrospectively reviewed fifty-four patients suffering from naso-sinus diseases extending into the orbital cavity. The patients were selected from three different centers of Lahore city. The study period was from 2004 to 2009. MRI scan were done on OPEN MRI (0.35T) Opart Toshiba and on 64slice MDCT. On MRI, axial, coronal and sagittal T1,T2,Fat sat and post contrast sequences were acquired. 4mm slices were taken. Similarly thin slices were taken through orbit and paranasal sinus region through CT scan, sagittal and coronal reconstruction were done. Both plain and post contrast images were acquired. Images were seen on both soft tissue and bone window setting. The data was analysed using Statistical package for social sciences (SPSS). The Descriptive Statistics (cross tabulation) were calculated for sino-nasal pathologies.

INCLUSION CRITERIA

Patients with orbital diseases secondary to sino-nasal pathology as confirmed on Computerized Tomography and Magnetic Resonance scans (CT and MR scans).

EXCLUSION CRITERIA

Patients with primary orbital pathologies and patients lacking neuro-imaging data were excluded from the study.

The clinical data including age, sex, ocular symptoms and systemic associations were compiled. The chief presenting complaints were Proptosis, visual disturbances, drooping of the eyelids, restricted extra ocular movements and diplopia. CT and MR scans were studied to confirm the diagnosis and to find the extent of disease process. Gadolinium contrasts studies were used when and where required. The disease patterns were grossly divided into inflammatory and neoplastic.

However, the culture and histo-pathological reports were not available. Therefore, the type of causative organisms and the type of tumour remained unconfirmed.

RESULTS

In this series, the age range was from 6 to 85 years (mean 45.5). Male to female ratio was 3.5:1. Majority of the patients had presented with Proptosis. The next major presenting complaint was visual disturbance. The details are given in table I and II.

Table-I. Major ocular findings (some patients presented with more than one clinical feature)

Chief ocular presentation	No. of patients (%age)
Proptosis	36 (66.66%)
Visual disturbance	14 (25.9%)
Ophthalmoplegia	6 (11.11%)
Ptosis	5 (9.26%)
Diplopia	5 (9.26%)

Many patients had systemic involvement as well, as seen in the following table (table III).

On studying the CT and MR records, 43 (79.6%) patients had inflammatory diseases and 11 (20.4%) patients had neoplastic diseases. The details of Sino-nasal pathologies, which had invaded the orbital cavity to compel the patient for ophthalmic consultation, are featured in table IV.

Table-III. Associated systemic features

Associated systemic features	No. of patients
Headache	08
Hemiplegia / quadriplegia	02
Typhoid	01
Facial palsy	04
Tonic clonic seizures	01
Tooth infection / tooth extraction	05

Table-IV. Detail of pathological processes affecting the paranasal sinuses In addition, nasal cavity.

Sino-nasal pathology	No. of patients
Bacterial sinusitis	24 (44.44%)
Fungal sinusitis	11 (20.37%)
Other glaucomatous inflammation	3 (5.56%)
Ethmoid mucocele	1 (1.85%)
Nasal polyps	4 (7.4%)
Neoplasias	11 (20.37%)

DISCUSSION

The patients in this series belonged to all age groups (6 to 85 years). There was clear male preponderance (42 males as compared to 12 females). Proptosis was seen in majority of the patients indicating the importance of ENT examination and Neuro-imaging in all patients presenting with Proptosis.

Although CT scan provides a good picture of the integrity of the orbital walls, MRI offers some advantage when imaging the paranasal sinuses. It helps to find out the extent of inflammatory process and the tumour. Signal

Table-II. Depicting the number of patients presenting with each clinical feature.

Clinical features	Sinusitis	Nasal polyps	Sinus tumours	Nasal tumours	Ethmoid mucocele	Total no. of patients
Proptosis	20	04	06	05	01	36
Visual disturbance	11	-	02	01	-	14
Ophthalmoplegia	06	-	-	-	-	06
Ptosis	03	-	02	-	-	05
Diplopia	02	-	03	-	-	05

Fig-1. Axial post contrast CT scan image, showing acute Ethmoid infection with abscess formation, extending in to left orbit.

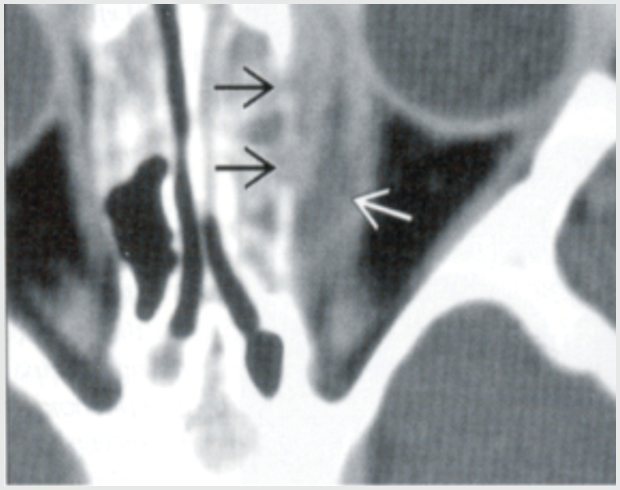


Fig-2. MRI, Axial T2W sequence, showing fungal infection of Ethmoid cells with extension In to right orbit. Characteristic low signals represent fungal infection on T2W sequence.

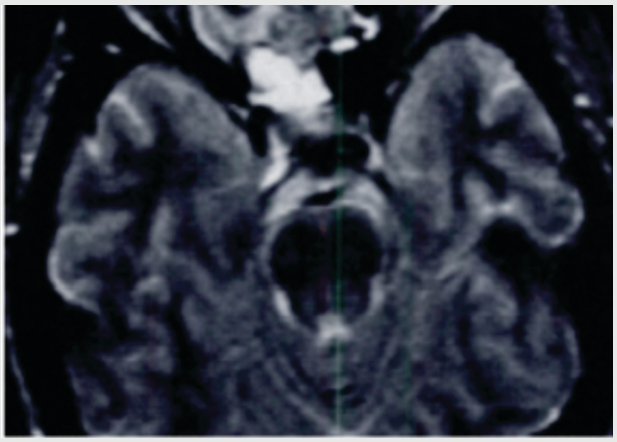


Fig-3. MRI Axial T2W sequence showing Ethmoid fungal infection on left side extending in to left orbit. Proptosis and preseptal thickening is also noted.

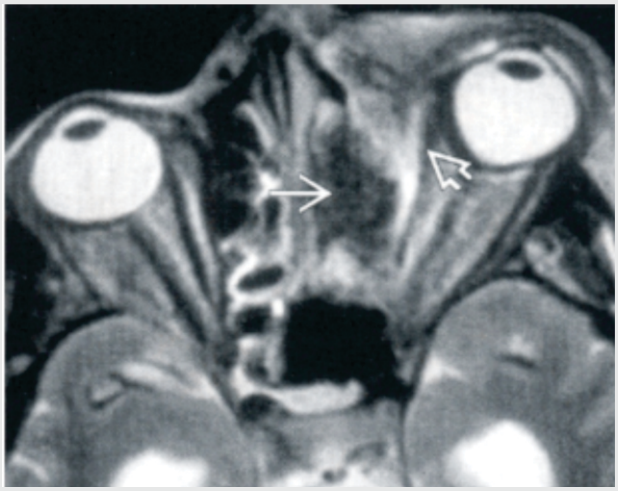
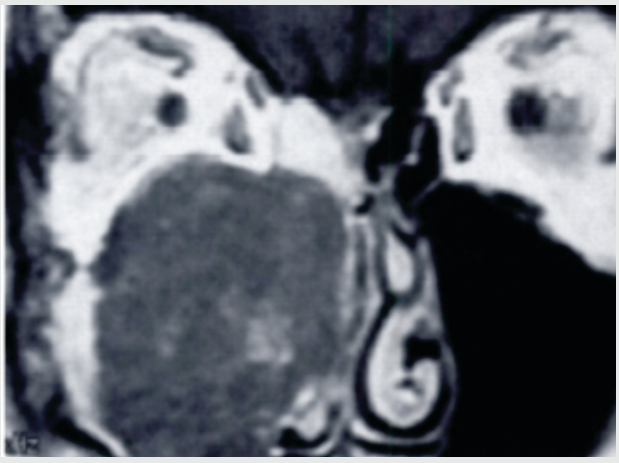


Fig-4. MRI,Coronal T1W sequence, plain image, tumour mass of right maxillary sinus, invading right nasal half and right orbit.



characteristics of the paranasal sinus mass are different from the inflammatory process, which help in differentiating between the two[1,2,3]. Use of Gadolinium also helps to differentiate neoplasm from inflammation[4].

The coronal plane is the best for visualizing osteo-meatal unit which comprises of Middle meatus of the nose and the sinuses, which drain in this meatus[5].

In the present study, there were 44.44% cases with bacterial sinusitis (Fig. 1). In the pre-antibiotic era, complication rate of sinusitis was quite high. With the advent of antibiotics and better diagnostic tools like CT and MRI the morbidity and mortality associated with sinusitis has considerably reduced. Orbital complications are most common with Ethmoidal sinusitis and rare in sphenoidal infections[6].

The spread of infection is mostly through the lamina papyracea. Routes of spread in other sinuses are by

direct extension through bone and indirectly through the valveless venous plexuses of orbit, nose and sinuses[7].

The most common pathogens for bacterial sinusitis are Streptococci, Haemophilis, Staphalococci and Pseudomonas(unfortunately the culture reports were not available in our study). The roots of molar tooth are in the floor of the maxillary sinus and the odontogenic causes account for 15% cases of maxillary sinus infection. There were five patients in our series with odontogenic orbital cellulitis; infection being spread through maxillary sinus.

Orbital complications of adult sinusitis are considered rare but in our study majority of the patients were more than 20 years of age showing that the infection is still not as uncommon as it is usually thought[8].

According to Chandler's classification, orbital complications in acute sinusitis may spread in the following steps[9].

- Pre-orbital cellulitis
- Orbital cellulitis
- Sub-peri-orbital abscess
- Orbital abscess or Phlegmon
- Cavernous sinus thrombosis

In pre-septal cellulitis, there is lid edema and it is the most common complication in children. When infection spreads beyond the orbital septum, Proptosis develops due to orbital cellulitis (in this study 20 out of 36 patients of Proptosis had sinusitis either bacterial or fungal). It also results in restriction of extra ocular movements. At this stage, neuro-imaging is necessary to differentiate between orbital cellulitis and the peri-orbital abscess because orbital cellulitis is treated with intra venous antibiotics and in peri-orbital abscess surgical intervention is required. In severe cases, it can lead to total loss of vision (as one of the patients in our study had no perception of light due to late seeking of medical advice). The causes of blindness are central retinal artery occlusion, optic neuritis, corneal ulceration and panophthalmitis.

Fungal sinusitis was seen in 11 (20.37%) patients (Fig.2 and 3). Most common fungi affecting the Sino-nasal cavity are Mucormycosis, Histoplasma, Candida and Aspergillus. Mucormycosis is seen in immuno-compromised hosts while Aspergillus can occur in immuno-competent individuals as well[10]. The severity of the fungal infection is related to the underlying immune status of the patient[11].

Fungal extension into the orbit also occurs through osseous erosion or vascular invasion.

There were three cases with granulomatous inflammation other than the fungal infection. Other causes of granulomas in the sinuses and nasal cavity are Tuberculosis, Syphilis and Collagen vascular diseases like Sarcoidosis, Lymphoma and Wegner's Granulomatosis. There were two cases of Sarcoidosis in our study. The cause of granulomatous inflammation in the third patient could not be determined.

Although mucoceles of paranasal sinuses are quite commonly mentioned in the literature (4-8.5% of expanding orbital lesions),[12] but there was only one case of Ethmoidal mucocele in our series. It develops from obstruction of a sinus ostium[13].

Other inflammatory lesions in this study were nasal polyps (4 patients, 7.4%), which are usually caused by recurrent inflammation of the nose and paranasal sinuses.

Neoplasms of nasal cavity and paranasal sinuses constitute 1% of all malignant tumours and 3% of all tumours of Otolaryngology[14].

In this study, the Sino-nasal neoplastic lesions affecting the orbit were 20.4% as compared to 79.6% inflammatory cases (Fig.4). It is inconsistent with the literature published so far, which indicates that the neoplasms affecting the paranasal sinuses and the nasal cavity are less in comparison with the inflammatory diseases.

Radiologically most tumours are hypo intense or iso-intense on T1 weighted MRI. On T2 weighted, they are

slightly hyper intense and enhance with a solid pattern after contrast administration, when compared with muscle and brain. Secretions are hypo-intense on T1 weighted MRI and exhibit higher signal intensity than tumours on T2 weighted images[15]. In inflammatory mucosal diseases, there is peripheral enhancement on contrast administration.

The tumours found in our series were squamous cell carcinoma, Juvenile angiofibroma (arises from nasopharynx and invades the orbit through the inferior orbital fissure), Esthesioblastoma and Adenocarcinomas (provisionally diagnosed on neuro imaging, as histopathological reports were not available). Squamous cell carcinomas most commonly arise from maxillary sinus while most of the Adenocarcinomas arise from ethmoid air cells. Rare tumour, esthesioblastoma arise from olfactory mucosa and the Lymphomas constitute the commonest sarcomas of the Sino nasal tract[16].

In the present study, all the patients of neoplasia had Proptosis. The direction of Proptosis with displacement of the globe provides a good clue to the origin of the tumour. In ethmoidal tumours the eyeball is displaced laterally, upward displacement shows maxillary tumour and the frontal sinus tumours cause downward displacement of the globe.

CONCLUSIONS

Due to the close vicinity of the orbit to the paranasal sinuses and nasal cavity, ophthalmologists must consider the possibility of invasion of Sino-nasal diseases to the orbital cavity. Orbital invasion is a poor prognostic sign. It directly affects the planning of the surgical procedure. Neuroimaging is mandatory in such cases in planning the multidisciplinary management.

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CORRECTION

Correction Prof-1680.wpd

The amendment of the Professional Vol:17, No.04 (Prof-1680) titled: “Unilateral ethmoidal polyps” on page 603 & 604 is as under;

INCORRECT

ABSTRACT
Period: From Jan 2007 to June 2009.

MATERIAL AND METHODS
Period: From Jan 2007 to June 2009.

CORRECT

ABSTRACT
Period: From Jan 2007 to June 2010.

MATERIAL AND METHODS
Period: From Jan 2007 to June 2010.