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ORBITAL INFECTIONS
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INTRODUCTION

Orbit is a closed sterile compartment surrounded by bony walls and anteriorly by the diaphanous orbital septum. The orbit houses the eyeball and subserves the major functions of protection of the eye and facilitation of the extreme degree of motility by the eye. As such, it may be a secondary site for infection originating in the surrounding structures or an intermediary for infection to other sites. Orbital infections most commonly results from a contiguous source of infection.

The orbital anatomy and its relationship to the other adjacent as well as remote structures are essential in understanding the pathogenesis of orbital infections. These relationships also explain the potentially devastating consequences of orbital infection and influence therapeutic decisions. Orbital and periorbital infectious may be caused by variety of bacterial fungal and parasitic agents.

Appropriate management depends on recognition of primary source of infection, identification of the responsible organisms and appreciation of the topography of the process within the orbit and periorbital tissues. Integration of the history physical examination and ancillary testing allow the achievement of these primary goals.

ANATOMY OF THE ORBIT

EMBRYOLOGY AND DEVELOPMENT

The orbit develops from the mesoderm surrounding the optic vesicle and optic stalk. The orbital mesoderm is derived from several sources. Above the mesodermal capsule of the forebrain forms the roof of the orbit. Below and laterally, the maxillary process forms the floor and lateral walls of the orbit. Medially, the frontonasal process forms the medial wall of the orbit. The pre and orbitospheoid contributes to the roof, medial and lateral walls posteriorly.

Of the seven orbital bones, the first to be laid down is the ethmoid at 6-8 wks of gestation. The trochlea begins to consolidate at about 9 wks of gestation. Except for the lesser wing of the spheroid which is initially cartilaginous, all other bones of the orbit are membranous and begin to ossify during the 3^{rd} month. Fusion takes place between 6-7 month. At birth orbit is 55% adult size. It reaches 79% at 3 yrs and 94% at 7 yrs of age. Generally orbits do not grow much after 7 years. The growth of cranium, face and paranasal sinuses influence the size and shape of the orbit. The angle subtended by the orbital axes is nearly 180^0 at first and diminishes to approximately 105^0 at 3 months of gestation and at birth the angle is 71^0. By 3 year of age the orbital axes attains its adult condition of 68^0.

WALLS OF THE ORBIT

The walls of the orbit consist of roof, floor, medial and lateral wall. They are lined by periosteum. The four wall for the most part separated by ill-defined rounded borders the medial walls of the orbits are almost parallel whereas the lateral walls make an angle of about 90^0 with each others.

ROOF OR VAULT OF THE ORBIT

The roof of the orbit is triangular and formed by the triangular orbital plate of the frontal bone and is completed posteriorly by the lesser wing of sphenoid.

It faces downwards and slightly forwards. It's concave anteriorly and flattens posteriorly.

The named features of roof include

- Lacrimal fossa - which lies behind the zygomatic process of the frontal bone. It lodges lacrimal gland and also some orbital fat in the posterior part called as the accessory fossa of Rochon - Duvigneaud.

- The fovea for the trochlea of the superior oblique muscle its located antero medially. It's a smaller depression about 4mm from the orbital margin. Sometimes the ligaments

which attach the u-shaped cartilage of the pulley, to it are ossified into spicule of bone called at spinal trochlearis.

- The frontosphenoidal suture is usually obliterated in the adults.

- Orbital part of roof may have apertures and depressions. The apertures called cribra orbitalia. It most marked in fetus and infants. These apertures allow the veins to pass from the diploe to the orbit.

The roof of the orbit is thin, translucent and fragile except where formed by lesser wing of the sphenoid. Occasionally in old age parts of the roof may be absorbed.

MEDIAL WALL OF THE ORBIT

Medial wall is approximately oblong and is flat or slightly convex. It lies parallel to the sagittal plane.

From the front backwards it is formed by four bones united by vertical sutures.

- Frontal process of maxilla

- Lacrimal bone

- Orbital plate of ethmoid

- Small part of the body of sphenoid

The orbital plate of ethmoid is the largest. The named features of the medial wall consists of

- Lacrimal groove - formed by the frontal process of the maxilla and the lacrimal bone which lodges the lacrimal sac. It is bounded by the anterior and posterior lacrimal crests. There is no definite upper boundary but below it's continuous with the osseous nasolacrimal canal. It's around 5mm deep, gradually becoming shallower as it ascends and is about 14 mm high.

The anterior and posterior ethmoidal foramen lies on the fronto ethmoidal suture at the junction of the roof and medial wall.

It is the thinnest orbital wall. The orbital plate of the ethmoid (Lamina papyracea) is very thin and hence infection from the ethmoid sinus can easily extend into the orbit.

There may be few variations in the lacrimal bone which may be divided by accessory sutures into several parts.

FLOOR OF THE ORBIT

The floor is triangular and slopes slightly downwards and laterally. It's the shortest orbital boundary and is formed by

- Orbital plate of maxilla
- Orbital surface of zygomatic bone
- Orbital process of palatine bone

The floor is continuous with the lateral wall anteriorly but is separated from it posteriorly by inferior orbital fissure.

The named features of floor includes

- Infraorbital sulcus - floor is traversed by this sulcus which runs forwards from the inferior orbital fissure.
- Infraorbital canal - Near the floors midpoint the sulcus becomes a canal completed by a plate of bone passing from its lateral side to medial at the infra orbital suture which further opens at the infraorbital foramen.
- Attachment of the inferior oblique muscle which is located lateral to the opening of the nasolacrimal canal. It's usually a small pit or rough area.

The floor is thinnest at the infraorbital groove and canal. The tumors of the maxillary sinus below can easily invade the orbit.

LATERAL WALL OF THE ORBIT

This wall is triangular. It makes an angle of 45^0 with median plane and faces anteriomedially and slightly up in its lower part. It's convex posteriorly flat in the centre and anteriorly it is deeply concave.

It's formed by

- Orbital surface of greater wing of sphenoid posteriorly
- Orbital surface of the zygomatic bone anteriorly.

The named features of lateral wall includes

- Spina musculi recti lateralis - is a small bony projection on inferior margin of superior orbital fissure. Part of lateral rectus muscle is attached to it.
- Zygomatic groove and foramen - runs from anterior end of inferior orbital fissure to a foramen in the zygomatic bone.
- Whitnalls tubercle - is a small elevation on the orbital surface of the zygomatic bone behind the lateral orbital margin. Gives attachment to lateral check ligament suspensory ligament of the eyeball, aponeurosis of the levator palpebrae superioris.

It's the thickest orbital wall especially at the orbital margin,

THE ORBITAL MARGINS

The orbital margin is commonly quadrilateral with rounded corners and spiral. The inferior orbital margin is continuous with anterior lacrimal crest and superior with the posterior lacrimal crest.

Each side measures about 40mm, but usually the width is greater than the height. The orbital margin is formed by frontal, zygomatic and maxillary elements.

SUPERIOR MARGIN

This is formed by the orbital arch of the frontal bone. The supraorbital notch is located about 25mm from the midline. This is occasionally converted into a foramen by ossification of the ligament which spans it. Sometimes medial to this a second notch or foramen may occur. Supraorbital grooves leading from these notch or foramina are sometimes seen. A supraciliary canal appears in about 50% of skulls. It has a small opening near the supraorbital notch.

LATERAL MARGIN

This margin is strongest of the orbital outlet. It’s formed by the zygomatic process of the frontal bone and by zygomatic bone.

INFERIOR MARGIN

It's formed by zygomatic bone and maxillary bone. The suture between these two bones is sometimes marked by a tubercle and can be felt about halfway along the margin just above the infraorbital foramen. This margin is slightly raised above the floor of the orbit.

MEDIAL MARGIN

It is the anterior lacrimal crest on the frontal process of the maxilla and posterior lacrimal crest on the lacrimal bone. Hence for medial margin is not continious, but is considered to ascend from the anterior crest over the maxillary frontal process to the superior margin.

ORBITAL FISSURES

Superior orbital fissure

It lies between lesser and greater wings of sphenoid and connects the middle cranial fossa with the orbital cavity. It's located between the roof and lateral wall of the orbit.

It's often described as comma shaped. It's wider at the medial end below the optic foramen and it tapers forward its lateral extremity. It's about 22m long. The long axis of the fissure is directed laterally upwards and forwards. The common tendinous ring - annulus tendinous communis of the rectus muscle spans the superior orbital fissure between

its medial and lateral parts. This ring divides the fissure in 3 parts and the structures through each part are as follows:

Lateral limb is closed by duramater and nothing passes through it.

Above the annulus passes - Lacrimal nerve

Trochlear nerve

Frontal nerve

Superior ophthalmic vein

Recurrent lacrimal artery.

In between the two heads of the lateral rectus from above

downwards - Superior division of oculomotor nerve

Nasociliary nerve

Sympathetic roots of ciliary ganglion

Inferior division of oculomotor nerve

Abducent nerve

Sometimes the ophthalmic veins.

Below the annulus - Inferior ophthalmic vein

Sympathetic nerves from plexus around

Internal carotid artery.

Inferior orbital fissure

It lies between the lower margin of orbital surface of greater wing of sphenoid and maxilla and orbital process of the palatine bone. It connects pterygopalatine and infratemporal fossa with the orbital cavity. It's located between the lateral wall and the floor of the orbit.

It commences inferolateral to the optic foramen. Runs antero laterally and is about 20 mm long and ends about 2 cm from the inferior orbital margin. It is closed in the living subject by periorbital and muscle of muller and is narrower centrally than at its ends. The width of the fissure depends on the developmental stage of the maxillary sinus and thus is relatively wide in the fetus and infant.

It transmits

- Infraorbital and zygomatic nerves
- Orbital & periosteal branches from the pterygopalatine ganglion.
- Branch from inferior ophthalmic vein to the pterygoid plexus.

RELATIONS OF THE ORBIT

SUPERIOR RELATIONS

The roof formed by the orbital plate of the frontal bone contains between its two laminae anteromedially, the frontal air sinus. Occasionally the ethmoid air cells can also invade the roof. Superior to the roof is the meninges and the frontal bone of the cerebral hemisphere.

Relations of roof - The frontal nerve and supraorbital artery are in contact with the periorbita. Inferior to these are levator palpebrae and the superior rectus muscle. The trochlear nerve lies medially in contact with periorbita. Lacrimal gland adjoins the lacrimal fossa. Superior oblique muscle is located in the junction of roof and medial wall.

MEDIAL RELATIONS

Running from front to backwards are the lateral nasal wall, infundibulum, ethmoid sinus and sphenoidal air sinus. The optic foramen is located in the posterior end of the medial wall.

The medial wall is related anteriorly to the lacrima sac surrounded by lacrimal fascia. Behind it is attached orbicularis oculi muscle, septum orbitale and check ligament of medial rectus. Medial rectus adjoins the wall. In between medial rectus and superior oblique muscle are the anterior and posterior ethmoidal and infratrochlear nerves along with the termination of the ophthalmic artery.

INFERIOR RELATIONS

Inferiorly are located the maxillary sinus. The infraorbital nerves and vessels lie within the infraorbital canal.

The floor is posteriorly related to a small sinus in the orbital process of palatine bone which may invade it. Inferior rectus adjoins the floor near the apex of the orbit and anteriorly it's separated by inferior oblique muscle and fat. In between the muscles or lateral to the lateral rectus is located the nerve to inferior oblique.

LATERAL RELATIONS

Laterally orbit is related in the anterior part to the temporal fossa containing temporalis muscle and posteriorly to the middle cranial fossa, meninges and temporal lobe of cerebral hemisphere.

The lateral rectus muscle is in contact with the whole of the lateral wall. Lacrimal nerve and artery are above it. Inferior pole of the lacrimal gland reaches the lateral wall.

OPTIC CANAL

Optic canal is formed by the two roots of the lesser wing of the sphenoid. It connects middle cranial fossa to the apex of the orbit.

The canal is directed antero laterally and slightly downwards at an angle of 36^{o} with the median plane. Projected backwards the two axes

meet on dorsum sella at about 90°. The canal is infundibular, oval is shape and its longer diameter is vertical. The cranial opening is flattened transversely. The middle part of the canal is circular. The upper and lower borders of the intracranial ends are sharp; the medial and lateral borders are rounded. Rarely the optic foramen may be double. The lateral border of orbital opening is the anterior border of posterior roof of lesser wing of the sphenoid. The medial border is less defined.

The distance between the intracranial openings is 25mm and between orbital openings is 30 mm. Orbital openings are 6-6.5mm vertically and 4.5 - 5 mm horizontally. In the middle portion it is 5x5mm. The canal is narrowed by the periosteum. The lateral wall is 5.7 mm long, the roof - 10 - 12 m in length and may vary. The upper and medial walls are longer. The longer the optic canal the narrower it is and vice versa.

Anteriorly the roof of each canal extends more than its floor, while posteriorly the floor projects beyond the roof, this gap is filled in by durameter.

The optic canal is close to the sphenoidal air sinus and sometimes to the posterior ethmoidal sinus. The bone between canal and sinuses is often very thin and the canal may ridge the interior of the sinus. These sinuses may invade the lesser wing and may surround the canal completely. The canal is separated from the medial end of the superior

orbital fissure by a bar of bone. Superior to canal is the gyrus rectus and olfactory tract.

The canal transmits the optic nerve and its meningeal coverings, the ophthalmic artery embedded in the dural sheath and branches from the periarterial sympathetic plexus.

PERIORBITA

Periorbita or orbital periosteum is the periosteum of the bones that form the walls of the orbit. It's loosely attached to the bones.

Like elsewhere it is sensitive. It is supplied by the trigeminal nerve branches which lie in contact with it – frontal, lacrimal, zygomatic, infraorbital and ethmoidal nerves. Since it is loosely attached to bone it may be lifted from the bone by blood or pus. However it is attached firmly at the following points

- at the orbital margin, where it is thickened to form the arcus marginale and continuous with the periosteum of the face
- at the sutures , where it is continuous with sutural ligaments
- at fissures and foramina
- at the lacrimal fossa

At the superior orbital fissure, optic canal and anterior ethmoidal foramen it becomes continuous with the endosteal layer of the duramater. In the optic foramen the dural sheath of the nerve is adherent to periorbita. Fine processes pass from the periorbita to divide the fat into lobules and to form coverings for vessels and nerves. Around the optic canal and the medial end of superior orbital fissure it is thicker to form the fibrous ring, the common tendinous ring, which gives origin to the tendon of four rectus muscle. There is a gap in the periorbita over the inferior orbital fissure. This gap is bridged by connective tissue with some smooth muscle fibers which contribute to the orbitalis muscle.

It is adherent to the posterior lacrimal crest and divide here to enclose the lacrimal fossa and is separated from the sac by loose areolar tissue. At the orbital margin it becomes continuous with the periosteum on the external surface of the skull. It also gives rise to sheets that enter the eyelids to form the orbital septum. It also gives a process to hold the trochlea for the superior oblique tendon in position.

The periorbita is liable to ossification where it covers the infraorbital canal and at the attachment to the posterior lacrimal crest.

ORBITAL CONTENTS

Orbital volume is around 30cc. The contents of orbit include the following:

1. Eyeball- it occupies about 20% of the space of the anterior segment of the orbit.

2. Fascia- it comprises of fascia bulbi (tenons capsule/tunica vaginalis oculi), fascial sheaths of the muscles, check ligaments, connective tissue supporting the orbital fat and the periorbital membrane and orbital septum.

3. Muscles-

Skeletal muscles –	Extraocular muscles
	Four recti – lateral, medial, superior and Inferior
	Two obliques – superior and inferior
	Levator palpebrae superioris
Smooth muscle –	orbital muscle of muller

4. Vessels –

Arterial circulation

- mainly ophthalmic artery which is a branch of internal carotid artery
- infraorbital artery , branch of maxillary artery
- branch from middle meningeal artery

Venous circulation

- Superior ophthalmic vein - it is formed by the supra orbital and angular vein of the face. It receives branches from the large ethmoidal branches, two superior vortex veins and the lacrimal vein

- Inferior ophthalmic vein - it begins as a venous network on the orbital floor receiving branches from the lower lid region of the lacrimal sac, the inferior rectus and inferior oblique muscles and two inferior vortex veins.

- Central retinal vein

Lymphatics – in the orbit there are no lymph nodes or lymph vessels. Probably the main lymph drainage from the orbit accompanies the veins through the inferior orbital fissure to the internal maxillary nodes and then to the superior deep cervical nodes.

5. Nerves-

- Optic nerve – it is the nerve of visual sensation.

- Cranial nerves

    i. Oculomotor nerve – supplies medial, lateral and superior recti and inferior oblique muscles. It's

parasympathetic to the intraocular muscles conveyed through ciliary ganglion and short ciliary nerves.

ii. Trochlear nerve – supplies superior oblique

iii. Abducent nerve- supplies lateral rectus

iv. Trigeminal nerve – supplies eyeball, lacrimal gland, conjunctiva, lids and large areas surrounding skin of the face as well as conveys parasympathetic fibers through first and second division (ophthalmic and maxillary branches)

- Sympathetic nerves – to the eyeball, lacrimal gland, smooth muscles and vasomotor fibres

- Parasympathetic nerves – to the lacrimal gland by seventh cranial nerve.

LACRIMAL GLAND

The lacrimal gland is a tubo acinar structure; it consists of large orbital part and a small palpebral part. It has no definite capsule. Around 12 ducts of the gland pass from the orbital part through the palpebral part to open into the superior conjunctival fornix. It secretes the aqueous constituent of tears.

It is supplied by the lacrimal artery which is a branch of ophthalmic artery. It receives parasympathetic secretomotor nerve supply from lacrimatory nucleus of the facial nerve. The sympathetic post ganglionic fibers arise from the superior cervical sympathetic ganglion. These fibers reach the lacrimal gland through the lacrimal nerve. Sensory fibers are derived from the ophthalmic division of trigeminal nerve.

SURGICAL SPACES IN THE ORBIT

Orbit is divisible into four spaces.

Subperiosteal space

This is a potential space between orbital bones and the periorbita. It is limited anteriorly by strong adhesions of the periorbita to orbital rim. Subperiosteal abscess and mucocele are commonly seen in this space.

Peripheral orbital space (Anterior space)

This space is bounded peripherally by periorbita internally by the four extraocular muscles with the inter-muscular septa and anteriorily by the septum orbitale. Posteriorly it merges with central space. The content of this space are -Fat

- Muscles - superior oblique, inferior oblique, levator palpebrae superioris

- Nerves – lacrimal, frontal, trochlear, anterior and posterior, ethmoidal
- Veins – superior ophthalmic and inferior ophthalmic
- Lacrimal gland
- Half of lacrimal sac

Central space (muscular cone, posterior or retrobulbar space)

It's bounded anteriorly by tenons capsule lining the back of the eye and peripherally by the extraocular recti muscle and their intermuscular septa. In the posterior part where intermuscular septa are imperceptible it continues with the peripheral orbital space. Its contents include

- Optic nerve and its meninges
- Superior and inferior division of oculomotor nerve
- Abducent and Nasociliary nerve
- Ciliary ganglion
- Ophthalmic artery, superior ophthalmic vein
- Central orbital fat

Sub tenon's space

It's a potential space around the eyeball between the sclera and tenon's capsule. Pus collected in this space is drained by incision of tenon's capsule through the conjunctiva.

CLASSIFICATION OF ORBITAL INFECTIONS

There are five groups of orbital infections. In general the symptoms increase in severity down the classification and the group 3 and 4 may be considered as complication of orbital cellulitis.

Group 1 – preseptal cellulitis

It's also called as periorbital cellulitis. It affects the eyelids and skin around the eyes, but not the orbit of the eye. It is less serious, but spread to orbit is however possible.

Group 2 – orbital cellulitis

It's an infection of orbital soft tissue without abscess formation.

Group 3 – Subperiosteal abscess

It may result from orbital cellulitis or sinusitis. Pus collects between the bony wall and the periosteum.

Group 4 – orbital abscess

It occurs within the soft tissue of the orbit. It is generally the complication of orbital cellulitis.

Group 5 – cavernous sinus thrombosis

It consists of infection and thrombosis in the cavernous sinus which drains blood from both the orbits.

POTENTIAL SOURCES OF ORBITAL INFECTIONS

1. Periorbital
    - sinusitis
    - dental abscess
    - trauma – lacerating injury, open/closed fracture involving sinus and nasal bone, foreign body
    - periocular or sinus surgery
    - periocular infection
    - ruptured dacryocele/ dacryocystitis
    - maxillary osteomyelitis
    - meningitis
    - cavernous sinus thrombosis
2. Ocular
    - panophthalmitis
    - ocular surgery

3. Systemic predisposition

    - diabetes mellitus
    - septicaemia
    - systemic malignancy
    - chronic diarrhoea
    - AIDS
    - Immunosuppressant
    - Steroids

4. miscellaneous disorders

    - ethmoidal osteoma
    - munchausens syndrome

5. masquerade syndromes

    - intraocular tumors – retinoblastoma, uveal melanoma
    - periocular tumors- rhabdomyosarcoma, squamous cell carcinoma, myositis

Common sources according to the age

Neonates (upto 1 month)	- ruptured dacryocoele
	-untreated conjunctivitis
Infants and toddlers	- sinusitis
(1month – 5 years)	- respiratory tract infections
children (5-15 years)	- sinusitis
	- dental abscess
Adults	- sinusitis
	- debilitation
	- trauma
	- dental abscess

WORK UP OF A PATIENT WITH ORBITAL INFECTION

A patient presenting with orbital infection has to be systematically evaluated to arrive at a correct diagnosis and to manage efficiently.

Evaluation should be started from the detailed history which should include the information regarding the onset, progression and duration of symptoms. Other relevant history which would give clue towards the etiology should be enquired such as

- symptoms of sinusitis
- history of trauma
- orbital or sinus surgery
- tooth extraction
- debilitating disorders
- systemic infections
- drug intake – steroids, immunosuppressants

This should be followed by detailed examination which includes

- visual acuity

- examination of lids
- extraocular movements
- anterior segment of eye
- posterior segment of eye
- intraocular pressure
- fields
- slit lamp examination

The following should be looked for in particular to get the clue toward the diagnosis

1. dislocation of globe – abscess secondary to sinusitis
2. discharge – punctual, nasal or fistula – dacryocystitis, sinusitis, maxillary osteomyelitis
3. tenderness over sinuses – sinusitis
4. hemifacial swelling – dental abscess, maxillary osteomyelitis
5. oral cavity examination – dental abscess, mucormycosis
6. oropharynx and nose – mucormycosis
7. meningeal irritation – intracranial involvement

In relevant cases other departmental consultations like otorhinolaryngology, neurology and diabetology should be obtained.

To obtain the final diagnosis and decide about the management following investigations are done whenever necessary

- Laboratory investigations
- Radiological investigations
- Biopsy and Histopathological examination

ORBITAL INFECTIONS

PRESEPTAL CELLULITIS (PERIORBITAL CELLULITIS)

It's the infection of the subcutaneous tissue of the eyelids anterior to the orbital septum. The infection is usually the result of localized injury, foreign body or insect bite in the skin of periorbital area. The site of entry of the infecting agent may not be apparent when acute preseptal cellulitis develops. The edema due to cellulitis may spread to the other eye because of the loose attachment of the connective tissue in the midline.

Causative organism : Staphylococcus aureus, group A streptococci, Haemophilus influenzae are commonly seen in the age group of 6 – 30 months. Pseudomonas aeruginosa and anaerobic bacteria rarely cause preseptal cellulitis.

Signs and symptoms : It is associated with periorbital swelling, redness, edema of the eyelids and localized tenderness. No proptosis is associated and ocular movements are not affected. There is no visual loss or conjunctival edema.

Complications : The condition is often associated with abscess formation under the skin of the eyelid. To drain this incision should be made at the site of maximum fluctuation.

Treatment : Suitable oral antibiotics are the treatment of choice. In case of infants and children intravenous antibiotics can be started. Additional to antibiotics non steroidal anti-inflammatory drugs are given. The resolution is generally quick and complete.

ORBITAL CELLULITIS

It's an inflammatory process that affects the orbital tissue located posterior to the septum with potentially devastating consequences.

Causative organism : Most commonly isolated organisms include streptococcal species, staphylococcus aureus, haemophilus influenza type B. less commonly pseudomonas, klebsiella, ekinella and enterococcus are involved. Polymicrobial infection with aerobic and anaerobic bacteria are more common in patients over the age of 15 years.

The fungi causing orbital cellulitis predominantly are mucor and aspergillosis. They cause fulminant orbital cellulitis in patients who are immunocomprised or who are in a state of diabetic ketoacidosis.

The other specific infections include

- tuberculosis, syphilis, actinomycosis, nocardiosis, anthrax, typhoid

- mycotic infections – phycomycosis, sporotrichosis, maduramycosis, crytococcosis, rhinospridiosis, candidiasis

- parasitic infections – amoebiasis, filariaisis, trichinasis, schistosomiasis, ecchinoccocosis, cysticercosis

- molluscs

- arthropoda – myiasis

Signs and symptoms : The clinical picture includes

- Proptosis – is usually axial and may be extreme and is always irreducible. It may even result in luxation of the globe.

- Swelling of the lids which may become woody hard with redness of skin

- Chemosis is marked and conjunctiva may protrude outside the palpebral aperture

- Limitation of movements of globe usually in all directions

- Local pain and general symptoms of profound toxicity- fever, nausea, vomiting and prostration.

Complications

- keratitis – rapid necrosis and perforation
- papilloedema or neuritis
- progressive optic atrophy
- retinal haemorrhages
- venous thrombosis , arterial embolism
- exudative retinal detachment
- septic uveitis , panophthalmitis
- cavernous sinus thrombosis , meningitis
- acute infarction of sclera, choroid, retina(orbital infarction syndrome)
- orbital compartment syndrome
- intracranial abscess

Differential diagnosis : Idiopathic orbital inflammatory disease

Thyroid ophthalmopathy,

Neoplasm,

sarcoidosis,

rheumatological diseases like wegners granulomatosis, polyarteritis nodosa, gaint cell arteritis.

Treatment : Once the patient is diagnosed to have orbital cellulitis he/she should be admitted.

Frequent monitoring of systemic and ocular parameters is essential. Systemic monitoring includes recording heart rate, blood pressure, temperature and evaluation for level of sensorium and deficits. Ocular parameters include evaluation degree of proptosis, state of eyelid skin, position of globe, visual acuity and papillary response. Any change in vision and papillary response warrants change in treatment strategy.

Intensive antibiotic therapy is started with the broad spectrum antibiotics. The choosen antibiotic should cover sinus pathogen, as well as exhibit beta lactamase resistance and have the ability to penetrate CSF. Intravenous antibiotics are given for 1-2 weeks and then oral antibiotics for 4 weeks.

If fungal infection is suspected, the underlying metabolic abnormality has to be corrected. Intra venous antifungal therapy has to be started.

Steroids may be efficacious in the orbital cellulitis secondary to paranasal disease especially in pediatric patients.

Supportive therapy should consist of nonsteroidal anti inflammatory, analgesics, antipyretics and rehydration therapy.

Surgical treatment is considered depending on visual status, progression of orbital signs, and no clinical improvement while being treated with medical therapy for 24-48hrs. The main goal is to decrease orbital pressure and to obtain a culture. In fungal etiology – surgical debridement of sinuses can be of help. If imaging suggests drainable fluid collection the surgical intervention is considered.

SUBPERIOSTEAL ABSCESS

It is a collection of purulent material between the orbital bony wall and periosteum. It may develop from orbital cellulitis or from spread of an adjacent infection.

Signs and symptoms : Symptoms are similar to that of orbital cellulitis. Signs include visual loss, limitation of movements and directional proptosis due to intraorbital mass effect and entrapment of extraocular muscle. Diagnosis is confirmed by the radiological investigations.

Treatment : Investigations and initial treatment is as for orbital cellulitis.

The abscess is drained through most likely area by incision of some 2-3 cm along the orbital margin. Periosteum is incised and pushed away from bone by blunt dissection and abscess drained. If caries bone is found, it has to be excised. Drainage is easy if the abscess is located in peripheral fascial compartment. In acute cases as little as possible of dissection is done and in chronic cases an extensive opening into nose or sinuses may be done. Part of operation can be done by nasal route(endoscopic) too.

ORBITAL ABSCESS

It is the collection of pus within the orbital tissue. Thus infections are usually secondary to orbital cellulitis and can be differentiated from orbital cellulitis by the occurrence of orbital apex syndrome which is consistent with organized infection in posterior orbit.

Signs and symptoms : Symptoms are similar to orbital cellulitis – proptosis, swelling of eyelids, defective vision and redness. Signs include severe exophthalmos , chemosis, complete ophthalmoplegia, venous engorgement or papilloedema on fundus examination. Systemic toxicity is marked.

Complications

- Infective /toxic neuropathy
- orbital apex syndrome

- loss of vision

- intracranial complications

Treatment : Investigations and initial treatment is as for orbital cellulitis.

Surgical drainage of abscess – wide free incision is made over the suspected area through the lid in the region of palpebral sulcus. If there is no indication of site, the infero external quadrant should be chosen. If suppuration is found in peripheral fascial compartment, the incision should be extended to free the lateral palpebral ligament and lateral rectus muscle is divided to provide the access to central compartment.

In fulminating cases, when central abscess exists then drastic surgical measures are indicated. Kronlein lateral approach is usually most effective. If function of eye is lost then drainage by evisceration is carried out. Post operative monitoring is warranted to detect reformation of abscess and complications.

CAVERNOUS SINUS THROMBOSIS

Infection of paranasal sinuses particularly those of ethmoid and sphenoid and less commonly the frontal and orbital complication from these sinus infections can cause thrombophlebitis of the cavernous sinus. The valveless nature of the veins connecting the cavernous sinus causes easy spread of infection.

Sl.No.	Source	Disease	Route
1	Nose and danger area of face	Furuncle Septal abscess	Pharyngeal plexus
2	Ethmoid sinus	Orbital cellulitis Abscess	Ophthalmic veins
3	Sphenoid sinus	Sinusitis	Direct
4	Frontal sinus	Sinusitis Osteomyelitis	Supraorbital and ophthalmic veins
5	Orbit	Cellulitis and abscess	Ophthalmic veins
6	Upper eyelid	Abscess	Angular vein and ophthalmic vein
7	Pharynx	Acute tonsillitis Peritonsillar abscess	Pharyngeal plexus
8	Ear	Petrositis	Petrosal venous sinuses

Clinical features : onset is abrupt with chills and rigors. Patient is acutely ill. Eyelids get swollen with chemosis and proptosis. Cranial nerves 3, 4 and 6 related to the sinus get involved individually and sequentially causing total ophthalmoplegia.

Pupil is dilated and fixed. Optic disc shows congestion and edema with diminution of vision. Sensation in the distribution of trigeminal (ophthalmic division) is diminished. Usually unilateral in majority of cases, tends to spread and involve other side which may occur within few hours. Systemic toxic symptoms are severe.

Common organism : Staphylococcus aureus – 70-92%, frequently pencillase resistant, streptococci

Treatment : Intravenous antibiotics in massive doses which should be promptly and effectively commenced as early as possible. Monitoring of the general and ocular parameters has to be carried out. Attention to the focus of infection, drainage of infected ethmoid or sphenoid sinus should be done. Systemic steroids may prove of some assistance if response to antibiotics is poor. Role of anticoagulants is not clear. Prognosis depends largely on the prompt commencement of treatment.

INVESTIGATIONS

Accurate diagnosis of the orbital infections, the predisposing factors and the response to treatment requires through clinical examination and series of diagnostic procedures. They are

1. Non invasive techniques
    - exophthalmometry
    - laboratory investigations
    - radiological investigations

2. Invasive techniques
    - Contrast enhanced CT scan
    - MR venogram

Laboratory investigations

a. complete haemogram
b. mantoux test
c. blood culture
d. culture from fluid aspirated/drained
e. urine analysis
f. stool examination for ova/ cyst

RADIOLOGICAL INVESTIGATIONS

X ray orbit

Important radiological views are

- Water's view
- Caldwell view
- Rhese view
- Lateral view

In orbital infections radiography mainly reveals paranasal sinus diseases characterized by sinus opacification, mucosal thickening and presence of fluid level. Gas or fluid gas level in the orbit is strongly suggestive of orbital abscess though the absence of this finding does not necessarily rule out an orbital abscess. Blow out fracture and calcification indicates the etiology of infection towards trauma and parasitic infection respectively.

Ultrasonography

a. Preseptal cellulitis - results in diffuse swelling of the lids and the globe is unaffected

b. Orbital cellulitis - results in diffuse swelling of orbital structures. Echograms of orbital fat are widened but the reflectivity remains predominantly high. If on follow up

examination, there is a progressive decrease of reflectivity in certain areas, abscess formation should be suspected.

c. Subperiosteal abscess – these lesions are well outlined, located adjacent to the orbital wall and are sharply demarcated from the orbital soft tissue by the smooth highly reflective periosteum. On B scan they have fusiform appearance when examined in longitudinal orientation. Reflectivity of the sub periosteal fluid is typically very low and the internal structure is regular.

d. Orbital abscess– they have low to medium reflective lesions which can appear as multiloculated or a solitary mass. Blood and pus may be difficult to distinguish from one another. However blood has a tendency to layer more than the pus. Follow up examination may be a way to distinguish between these two conditions. Abscess tends to increase in size but the blood usually reduces. Follow up scan will also help to asses the response to treatment. It can also be helpful to guide the insertion of the needle into the abscess cavity.

Computed tomography and Magnetic resonance imaging

Both CT and MRI show the extent of involvement of the soft tissue by the infection; However CT is more precise in demonstrating the bony changes.

CT is usually not necessary in patients with preseptal cellulitis. In orbital cellulitis majority of cases show proptosis, scleral thickening, subperiosteal abscess and occasionally infection of peripheral surgical space. Intracranial complications like frontal lobe cerebritis and epidural inflammation is well shown by CT and MRI. Soft tissue scarring of retrobulbar space can be seen year after bacterial orbital cellulitis. It can also demonstrate intra orbital, sub periosteal and intracranial abscess.

Infections of central surgical space obliterate the soft tissue planes that exist normally between the optic nerve sheath complex, orbital fat and the rectus muscles. The intraconal fat shows abnormal density on CT and MRI. Infections in the peripheral surgical space obliterates the the plane between the rectus muscle, peripheral fat and wall of orbit.

Infection in sub periosteal space is demonstrated by displacement of the contrast enhanced periosteal membrane away from the orbital wall. A diffuse inflammatory process or small subperiosteal collection can be treated medically and followed with imaging studies.

Once infection has extended into the cavernous sinus or beyond, MRI is the investigation of choice. MRI demonstrates and characterizes the cavernous sinus better and is more sensitive in showing a thrombosis and intracranial site of inflammation.

TREATMENT

Medical treatment

During pre antibiotic era, the rate of blindness and mortality with orbital infections were 20.5% and 17% respectively. Overtime, both the rates have declined. The incidence of vision loss since then has been reported to be 3-11% and mortality stands at 1-2.5%.

Most of the orbital infections respond to medical treatment. The corner stone of the medical treatment is broad spectrum antibiotics, which can be started intravenously and later changed to oral administration. Sulbactam and ampicillin is the first drug of choice since it has good tissue penetration and wide spectrum. It is given at a dose of 100mg/kg/day. Other drugs which can be administered are ceftriaxone, vancomycin, cefuroxime or clindamycin. Switching to oral drugs is based on the clinical judgement.

If fungal etiology is suspected then treatment includes amphotericin-B, voriconazole institution along with prompt debridment. The supportive treatment consists of nasal decongestants, anti inflammatory drugs and antipyretics.

In our study we analysed the efficacy of cefotaxime and gentamicin started empirically. Cefotaxime is the prototype of the cephalosporins of third generation. It exerts potent action on aerobic gram negative as well

as some gram positive bacteria but is not so active on anaerobes, staphylococcus aureus and pseudomonas aeuroginosa. In adults it is given at a dose of 1-2 G intramuscularly or intravenous, 6-12hourly and in children 50-100mg/kg/day.

Gentamicin is more potent and has broader spectrum of action. It is active against pseudomonas aeuroginosa and most strains of proteus, E coli, Klebsiella and staphylococcus aureus. For an average adult with normal renal function it is given in dose of 1-1.5mg/kg intramuscular or intravenous 8 hourly.

In suspected cases of anaerobic infections metronidazole was administered. It is generally used in combination with gentamicin or cephalosporins. In serious cases it was administered intravenous at dose of 15 mg/kg infused over 1hour followed by 7.5mg/kg every 6 hours till oral therapy could be instituted. In cases of parasitic infections Albendazole 15mg/kg for 8 days was administered.

Surgical treatment

When the presence of pus is apparent and the case does not seem to be controlled by the medical treatment, surgical relief should not be delayed. The decision regarding the time and type of surgical intervention requires considerable clinical judgment. Injudicious measures too early precipitate a catastrophe or delay entails the loss of vision or life.

When the pus presents under the skin or conjunctiva a free incision should be made into the abscess and pus should be drained. Subcutaneous induration is the surest early localizing sign.

Sub periosteal abscess should be drained as described earlier. If an abscess of orbital tissue is diagnosed with reasonable certainty a wide and free incision should be made over the suspected area as described earlier. Since the introduction of newer generation antibiotic drugs the need for drastic surgery has considerably reduced.

In parasitic lesions, depending on the location of the cyst appropriate surgical treatment is carried out. If the cyst is located in central space lateral orbitotomy is the surgery of choice.

PART – II

AIM OF THE STUDY

To analyze

- the prevalence pattern and etiopathogenesis of orbital infections
- the role of radiological investigations to diagnose orbital infections
- the course of orbital infections with treatment

MATERIALS AND METHODS

Orbital infection was diagnosed in 126 patients who attended Regional Institute of Ophthalmology Government Ophthalmic Hospital between the period of September 2006 to September 2008.

Patients who were admitted and treated were included in the study. These patients were evaluated clinically and radiologically.

Patient Evaluation

All the patients who were included in the study were worked up in the following manner.

1. detailed history with reference to
    - duration of illness
    - onset
    - associated symptoms
    - prior treatment medical/surgical
2. Complete general examination
    - anemia, jaundice, clubbing, nourishment, lymphadenopathy
    - pulse, blood pressure, respiratory rate, temperature

3. Complete ocular examination

   - visual acuity
   - orbit and eyelids
   - anterior and posterior segment

4. Evaluation of eye using

   - direct and indirect ophthalmoscopy
   - field charting, colour vision
   - IOP measurement
   - Hertels exopthalmometry

5. Laboratory investigations

   - complete blood count
   - culture of the aspirate

Examination of ENT, abdomen, CNS, RS, CVS were done. Radiological investigations like X ray orbit, ultrasonography, CT were done whenever needed. Patients were also referred to ENT department, Neurology, Dental surgeon, Physician for an expert opinion regarding diagnosis and management whenever indicated.

ANALYSIS AND DISCUSSION

Total numbers of cases of orbital infections included in the study period of September 2006 to September 2008 were 126. The study included only the in patients during the study period.

Breakdown classification of orbital infections

Group	**Cases**	**Percentage**
Preseptal cellulitis	78	61.90
Orbital cellulitis	42	33.33
Sub periosteal abscess	2	1.58
Orbital abscess	3	2.38
Cavernous sinus thrombosis	1	0.79

In our study preseptal cellulitis was the most common among the orbital infections constituting 61.90% of the cases. This is in agreement with the study conducted by the Ilker Devrim, Guler Kanra and associates.

Age incidence of orbital infections

Age group(years)	Cases	Percentage
1-10	35	27.77
10-20	3	2.38
20-30	14	11.11
30-40	21	16.66
40-50	26	20.63
50-60	15	11.90
60-70	7	5.55
>70	5	3.96

It is evident from the above table that the children between the age group of 1-10 years are the most affected age group followed by the 40-50 year age group in our study. This may be due to the increased susceptibility of these age groups to the etiology of the orbital infections. Periocular infections were common in the 1-10 year age group and trauma formed the common association in the 40-50 year age group.

Sex incidence of orbital infections

Sex	Cases	Percentage
Male	83	65.87
Female	43	34.12

Male preponderance was noted in our study. There is no obvious sex predilection of orbital infections noted in the previous studies.

Laterality of orbital infections

Laterality	Cases	Percentage
Right	56	44.44
Left	70	55.55

All the cases in our study had unilateral affection of the disease and the left eye was involved more commonly compared to the left eye.

Classification of associated conditions leading to orbital infections

Etiopathogenesis	Cases	Percentage
Trauma	23	18.25
Sinusitis	13	10.31
Dacryocystitis	26	20.63
Periocular infection	35	27.77
Ocular surgery	8	6.34
Panophthalmitis	12	9.52
Systemic predisposition	9	7.14

In our study periocular infection was the most common condition which led to orbital infection. It included hordeolum externum, insect bite etc. In the study by Elgin K Weiss A, et al the ratio of sinusitis accompanying orbital infection was ranging between 81-91%. In our study it constitutes only 10.3%. This may be due to increased incidence of periocular infection in our country.

ANALYSIS OF THE INVESTIGATIVE PROCEDURES

Classification of etiology of orbital infections

Etiology	Cases	Percentage
Bacterial	113	89.68
Fungal	4	3.17
Parasitic	7	5.55
Rhinosporidiosis	2	1.58

Bacteria formed the major causative organism of orbital infection in our study. Causative organisms were confirmed by histopathological and culture reports. This is in conjunction with many other studies and one such is done by Mc Kinley, Yen et al. Gram positive organisms were more common in our study (92 patients).

Analysis of total WBC count and ESR

Group	Cases	Total count	ESR
Preseptal cellulitis	78	10	-
Orbital cellulitis	42	40	5
Subperiosteal abscess	2	2	1
Orbital abscess	3	3	3
Cavernous sinus thrombosis	1	1	1

Total WBC count was found to be higher in all the groups of orbital infections than in preseptal cellulitis. ESR is a non specific investigation and was not seen to be increased in any case of preseptal cellulitis in our study. These findings are in agreement with the studies done by Ilker Devrim et al.

X ray findings

Signs	Cases
Sinus haziness	16
Calcification	3
Blow out fracture	4

X ray is one of the basic investigations. Sinus haziness was seen in 16 cases out of which 13 cases had it as the cause for the orbital infection and in the remaining 3 cases it was a coincidental finding. Calcification was seen in the 3 cases of parasitic cysts of the orbit. X ray was helpful in identifying the associated condition in orbital infection but it was not confirmatory.

Ultrasonography of the orbit

Conditions diagnosed	Cases
Parasitic cysts	7
Orbital cellulitis	3
Orbital abscess	34
Subperiosteal abscess	2

In our study ultrasonography was done in all the cases. It contributed greatly in diagnosing parasitic cysts, orbital abscess and subperiosteal abscess. It is cost effective and useful in follow up of treated cases.

The limitation of this investigation is that the exact assessment of orbital apex and paranasal sinus is not possible. Intracranial extension of orbital infection which is associated with a mortality rate upto 80% is certainly not assessed sufficiently with sonography.

CT scan of orbit

Conditions diagnosed	Cases
Orbital cellulitis	28
Subperiosteal abscess	2
Orbital abscess	3
Cavernous sinus thrombosis	1

CT scan was done in 34 cases in our study. It is the most comprehensive imaging technique in patients with suspected orbital infection. It is most important and essential to identify the complications and to know the response of treatment on follow up.

Analysis of course of orbital infections with treatment

Group	Cases	Cases resolved	Cases went in for complications	Percentage of complicated cases
Preseptal cellulitis	78	71	7	8.97
Orbital cellulitis	42	34	8	19.04
Subperiosteal abscess	2	1	1	50
Orbital abscess	3	3	-	-
Cavernous sinus thrombosis	1	1	-	-

Complications encountered

Complication	Cases
Panophthalmitis	5
Keratitis (rapid necrosis and perforation)	3
Retinal hemorrhages	1
Lid abscess	7

The total resolution rate of orbital infection is 87.30% with treatment in our study. The treatment included both the medical and surgical modality. 7 cases of preseptal cellulitis went in for lid abscess which were treated with incision and drainage. Resolution was noted in all these cases. 5 cases of orbital cellulitis went in for panophthalmitis out of which 3 cases had to be eviscerated because of unresponsiveness to medical therapy.

Surgical treatment

Surgical treatment was done in 22 cases. All the 7 cases infected due to parasite underwent surgical treatment. The other cases included the lid abscess drainage, subperiosteal abscess & orbital abscess drainage and evisceration for panophthalmitis.

SUMMARY

126 patients who attended Regional Institute of Ophthalmology Government Ophthalmic Hospital between the period of September 2006 to September 2008 with orbital infection were included in the study.

The analysis included the prevalence pattern of orbital infections, sex incidence, laterality, associated conditions, efficacy of investigative procedure and the course of disease with treatment.

The findings of the analysis are as follows:

- Of all the 126 the incidence of preseptal cellulitis was 61.9%
- 27.77% were in the 1-10year age group
- Male preponderance with 65.87%
- All patients had unilateral affection with left eye preponderance
- Periocular infection(27.77%) formed the most common cause for the orbital infection
- Bacteria was found to be the commonest etiology for the orbital infection

- Total WBC count and ESR were higher in other groups than preseptal cellulitis.

- X ray was helpful in identifying the associated conditions but was not confirmatory

- Ultrasonography was useful in diagnosing orbital abscess, parasitic cysts and subperiosteal abscess but it could not be used to assess the intracranial complications.

- Ct scan is the most comprehensive investigation for orbital infection.

- Ultrasonography and CT scan could be used for follow up after treatment to assess the response to treatment.

- 87.30% of cases resolved with treatment

CONCLUSION

- Orbital infections are more common in children and preseptal cellulitis is the commonest infection encountered. Periocular infections are the most common associated condition for the orbital infections.

- Bacteria formed the major causative organism for orbital infections. Among this gram positive organisms predominated.

- Ultrasonography and CT scan help in diagnosis, identification of complications and in assessment of response of treatment in orbital infections. They are complimentary to each other.

- Most of the orbital infections resolve with the prompt treatment. Surgical approach forms the treatment of choice in parasitic infections.

INDEX TO THE MASTER CHART

1. Serial number
2. Name
3. Age – M –months
4. Sex
5. Eye involved
6. Associated signs- C- congestion, CH- chemosis, MR- movements restricted, P-proptosis, L-lid edema, A-ASOM
7. Vision – R- right eye, L- left eye, B- both eye, NC- not cooperative
8. Fundus- N- normal, V- no view, C- changes, RH- retinal hemorrhages
9. Predisposing factors- T- trauma, S- sinusitis, D-Dacryocyctitis, PI-periocular infection, OS- ocular surgery, PO- panophthalmitis, SP-systemic predisposition
10. Lab Investigations – WNL- normal haemogram, TC- increased total WBC count, E- eosinophils increased, ESR- increased ESR
11. Plain X ray orbit- SH- sinus haziness, BF- blow out fracture, C-calcification, NAD- no abnormality detected

12. CT scan – OC- orbital cellulitis, P- parasitic cyst, OA- orbital abscess, BF- blow out fracture, SPA- Subperiosteal abscess, CST- cavernous sinus thrombosis

13. Specialty clinic referred- ENT- otorhinolaryngologist, DM- diabetologist

14. Diagnosis – P-preseptal cellulitis, OC- orbital cellulitis, SPA- subperiosteal abscess, OA- orbital abscess, CST- cavernous sinus thrombosis.

15. Treatment- M- medical, S- surgical.

16. Follow up – C- cured, I- improved, P- progressed

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LIST OF SURGERIES PERFORMED

SL NO	NAME	AGE	SEX	OP/IP NO	DIAGNOSIS	SURGERIES
1	Muniammal	60	F	416756	RE-mature cataract	RE-ECCE with PCIOL
2	Rani	52	F	431564	RE-immature cataract	RE-ECCE with PCIOL
3	Kuppuraj	56	M	423431	LE-nuclear cataract	LE-ECCE with PCIOL
4	Mohan	45	M	421676	LE-nasal pterygium	Excision done
5	Ratinam	67	M	421896	RE-immature cataract	RE-ECCE with PCIOL
6	Raghu	23	M	87460	LE-chalazion	Incision & Curettage
7	Fathima	56	F	447532	RE-immature cataract	RE-ECCE with PCIOL
8	Subramani	53	M	445892	RE-mature cataract	RE-ECCE with PCIOL
9	Gowri	21	F	37869	LE-chalazion	Incision & Curettage
10	Selvan	56	M	448732	LE-immature cataract	LE-SICS with PCIOL

11	Alamelu	64	F	449673	RE-senile entropion	RE-lateral tarsal strip
12	Muthusami	67	M	451456	RE- immature cataract	RE-SICS with PCIOL
13	Abdul	52	M	452776	RE-chronic dacryocystitis	RE-DCT
14	Shakunthala	55	F	453654	LE-perforated fungal corneal ulcer	LE-conjunctival flap
15	Sethu	34	M	461342	RE-chronic dacryocystitis	RE-DCR
16	Sambantham	54	M	467563	RE-immature cataract	RE-SICS with PCIOL
17	Ganesan	23	M	468890	RE-lid tear	Lid tear sutured
18	Fernandes	58	M	467693	LE-immature cataract	LE-SICS with PCIOL
19	Santhi	38	F	468843	RE-corneal tear	Corneal tear sutured
20	Papammal	65	F	469432	RE-immature cataract	RE-SICS with PCIOL
21	Annakili	70	F	469972	LE-hypermature cataract	LE-SICS with PCIOL
22	Perumal	53	M	472381	RE- immature cataract with POAG	RE-trab with ECCE with PCIOL and PI

23	Balaraman	50	M	476389	RE-chronic dacryocystitis	RE-DCR
24	Arasu	49	M	477658	LE-immature cataract	LE-SICS with PCIOL
25	Vijayalakshmi	16	F	478654	LE-congenital ptosis	Frontalis sling
26	Danarajan	45	M	468563	RE-panophthalmitis	Eviceration with PMMA implant
27	Koteshwaran	54	M	473452	RE-immature cataract	Phaco with PCIOL
28	Sakunthala	56	F	483425	LE- immature cataract	Phaco with PCIOL
29	Ponnammal	62	F	485674	LE-basal cell carcinoma	Excision with lid reconstruction
30	Pongodi	50	F	488743	RE-corneoscleral tear	Corneoscleral tear sutured

PROFORMA

Name :

Age :

Sex :

Address :

Complaints:

History of present illness

H/O swelling of lids

H/O redness/watering/irritation/photophobia/discharge

H/O proptosis

H/O defective vision/ field of vision

H/O pain – nature/severity/ aggravating and relieving factors

H/O fever/headache

H/O trauma/insect bite

H/O contact with pet animals

H/O ENT symptoms – nasal block/ear discharge

H/O diabetes/hypertension/any chronic illness

Past history

H/O similar episodes in the past

H/O tuberculosis/syphilis/malignancy

H/O any ocular/ENT surgery

Personal history

Vegetarian/Non – vegetarian

Family history

H/O tuberculosis

H/O similar problems in family/siblings

Treatment history

Any medical/surgical treatment taken

General Examination

Built – well/moderate/poor

Nourishment-well/moderate/poor

Consciousness

Anemia/Jaundice/Cyanosis/Clubbing/Lymphadenopathy

Vitals – Pulse, Temperature, Blood pressure, Respiratory rate

Ocular Examination

Head posture

Facial symmetry

Right eye	Examination	Left eye
	Visual acuity Eyelids Eyelashes Extraocular movements Conjunctiva Cornea Anterior chamber Iris Pupil Lens Proptosis – Axial/eccentric Retropulsion Pulsation Orbital margins Forced duction test Fundus Intraocular pressure Exophthalmometry	
	Slit lamp examination	

Other consultation

Pediatrics/ENT/Neurology/Radiology/Diabetology

Other system

CNS/CVS/ENT/Abdomen/RS

Provisional diagnosis

Investigations

TC, DC, ESR, Heamoglobin

RBS, Urine analysis

Blood culture, Aspirate culture

Mantoux

Radiological

X ray orbit

B scan

CT/MRI scan

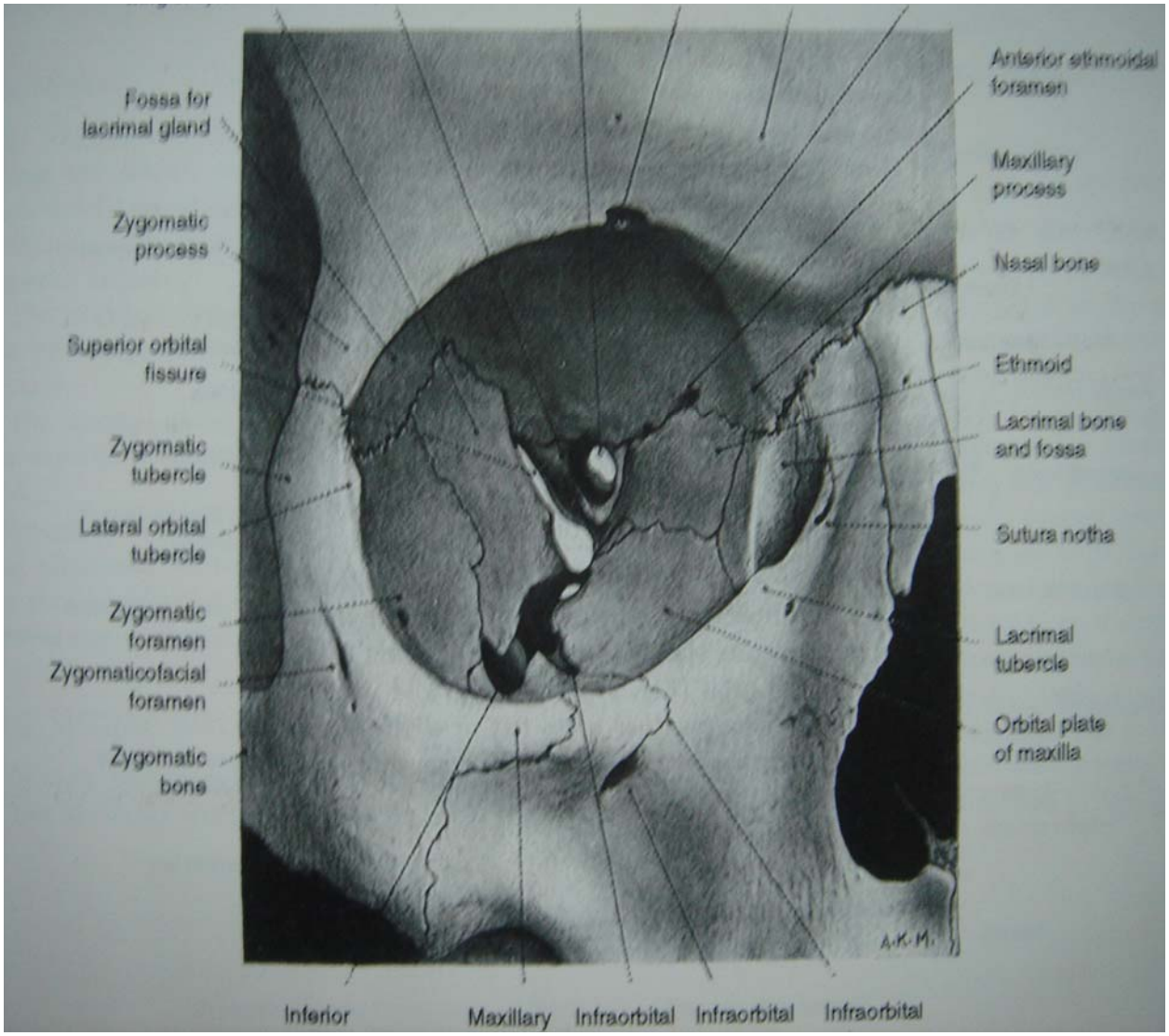
Final Diagnosis

Treatment

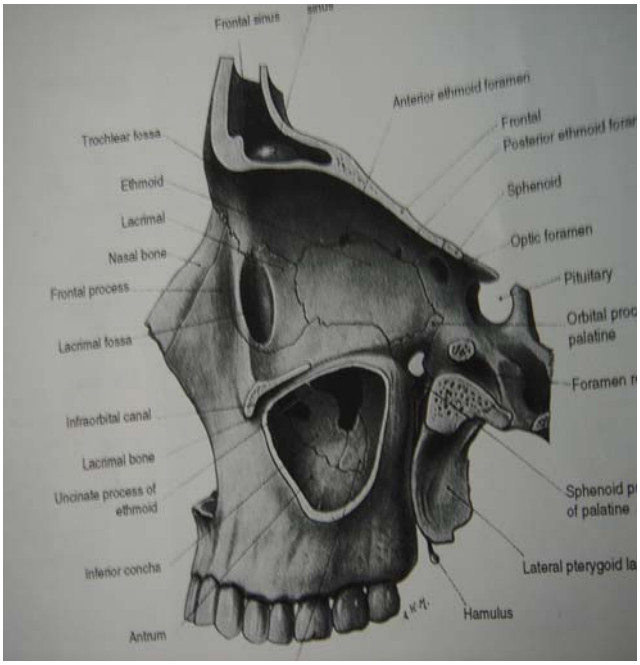
Medical/Surgical

Follow up period and advice

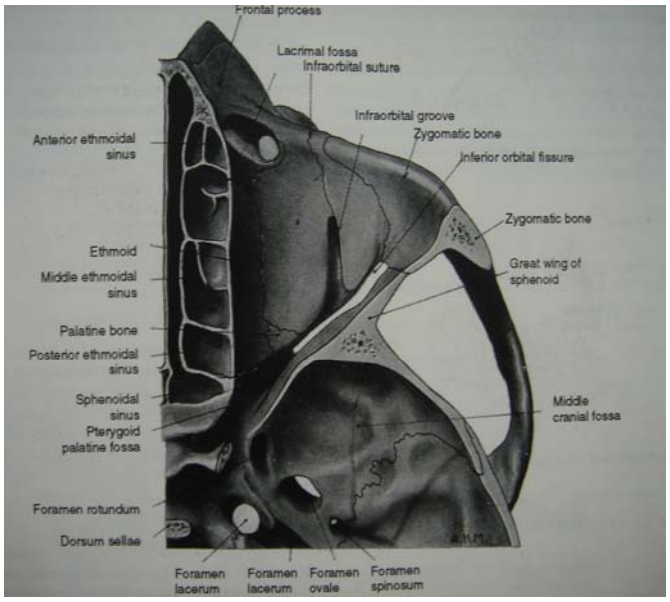
RIGHT ORBITAL CAVITY



MEDIAL WALL OF ORBIT



FLOOR OF ORBIT

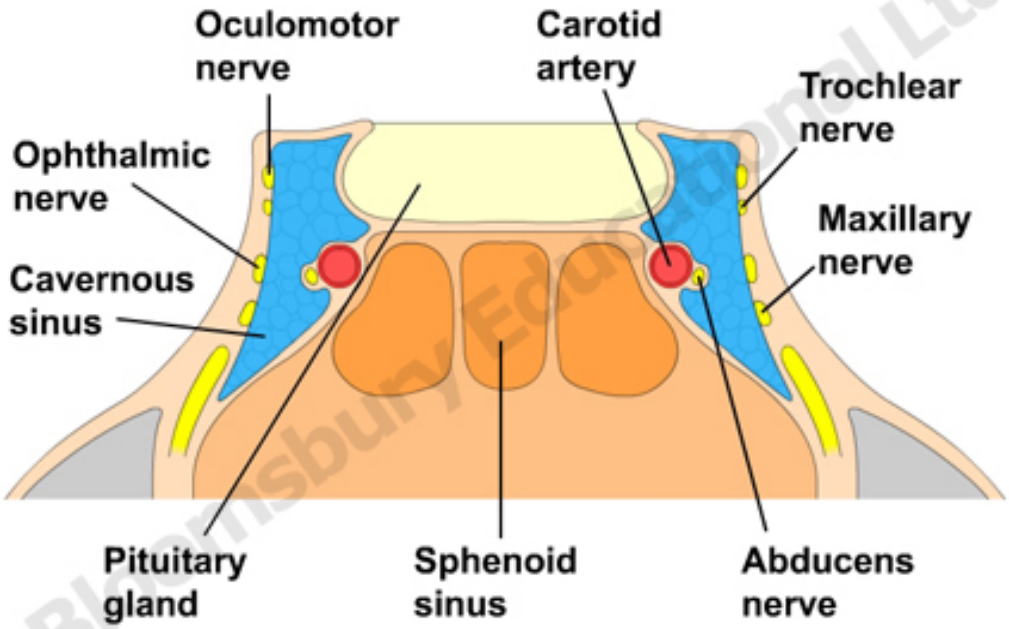


FUNGAL SINUSITIS EXTENDING INTO THE ORBIT LEADING TO PROPTOSIS

RIGHT EYE PROPTOSIS

CT SCAN SHOWING EXTENSION OF FUNGAL SINUSITIS INTO THE ORBIT

Cavernous sinuses



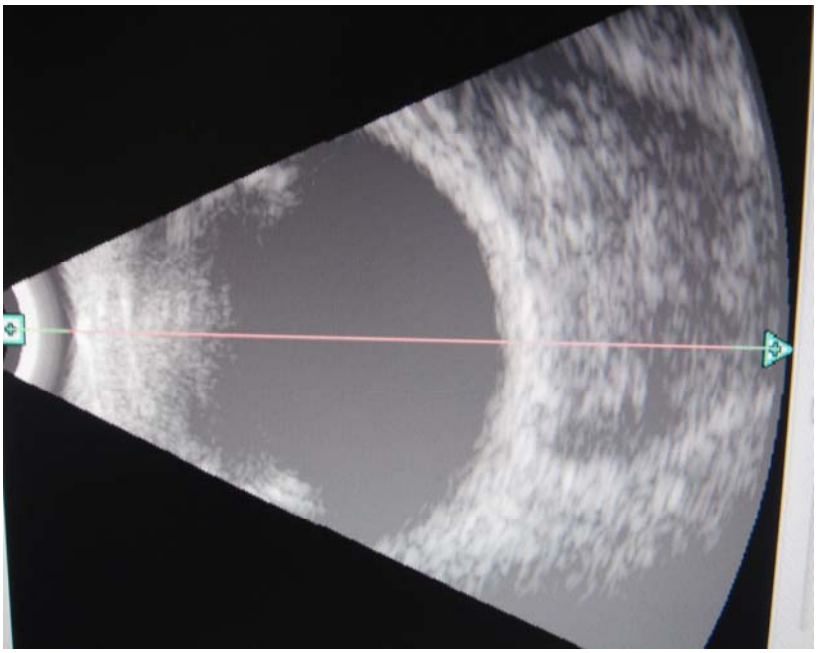
Pascalis Spyrou

PRESEPTAL CELLULITIS

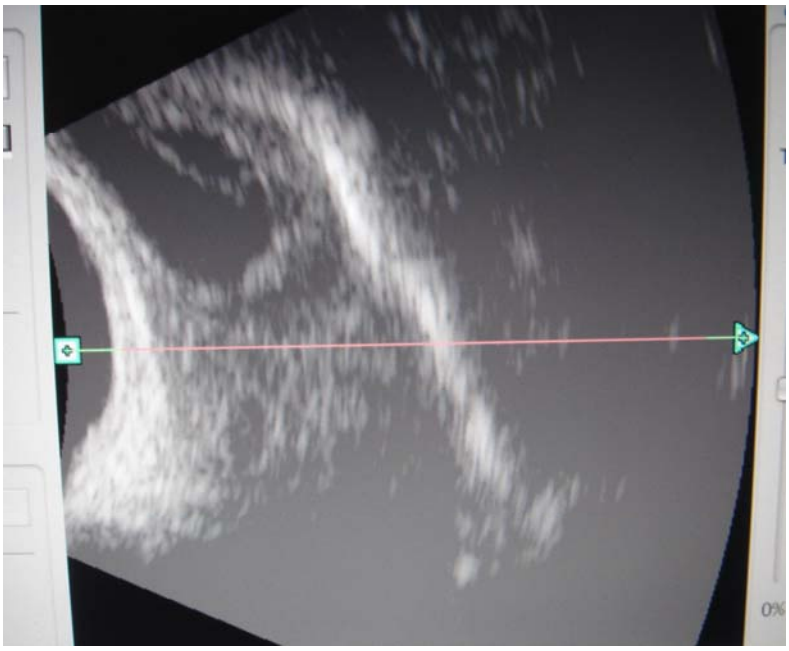
ORBITAL CELLULITIS

CAVERNOUS SINUS THROMBOSIS

ULTRASONOGRAPHY



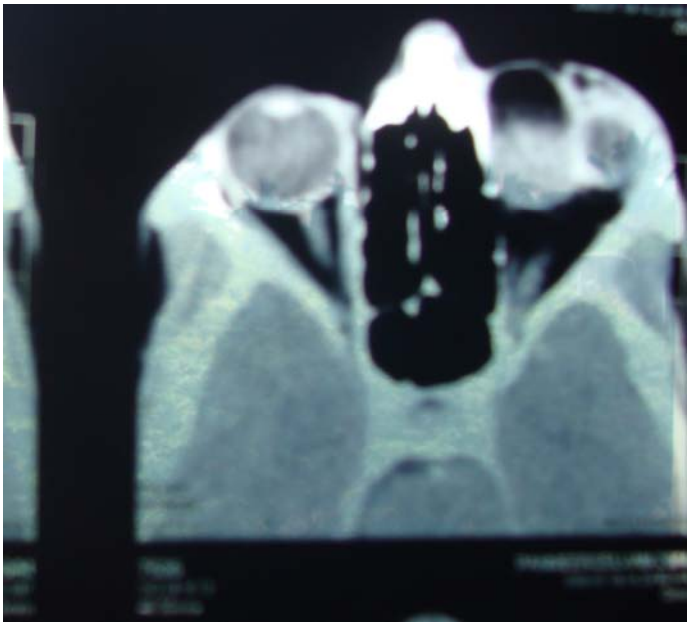
B SCAN SHOWING ORBITAL ABSCESS



B SCAN SHOWING PARASITIC CYST IN ORBIT

ORBITAL ABSCESS

RIGHT EYE ECCENTRIC PROPTOSIS



CT SCAN SHOWING FLUID GAS LEVEL

PRESEPTAL CELLULITITS

PRE TREATMENT

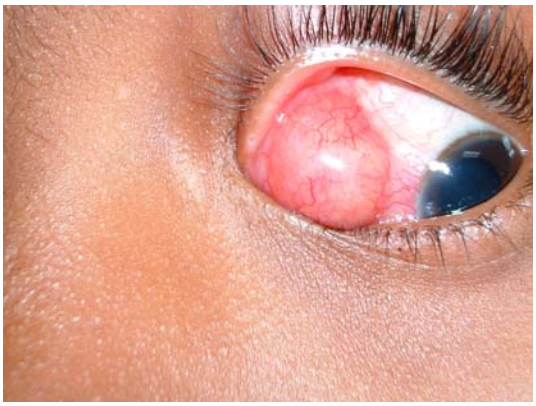
POST TREATMENT

COMPLICATIONS

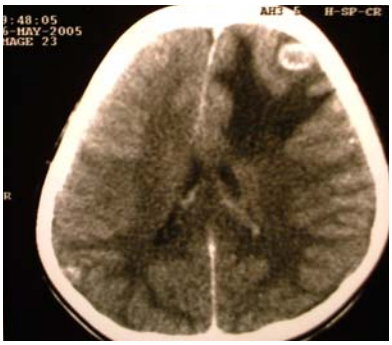
KERATITIS SECONDARY TO ORBITAL CELLULITIS

PANOPHTHALMITIS

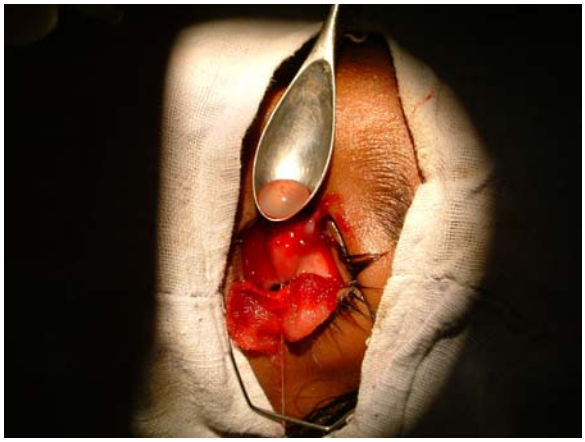
PARASITIC INFECTION WITH NEUROCYSTICERCOSIS



CONJUNCTIVAL PARASITIC CYST 1

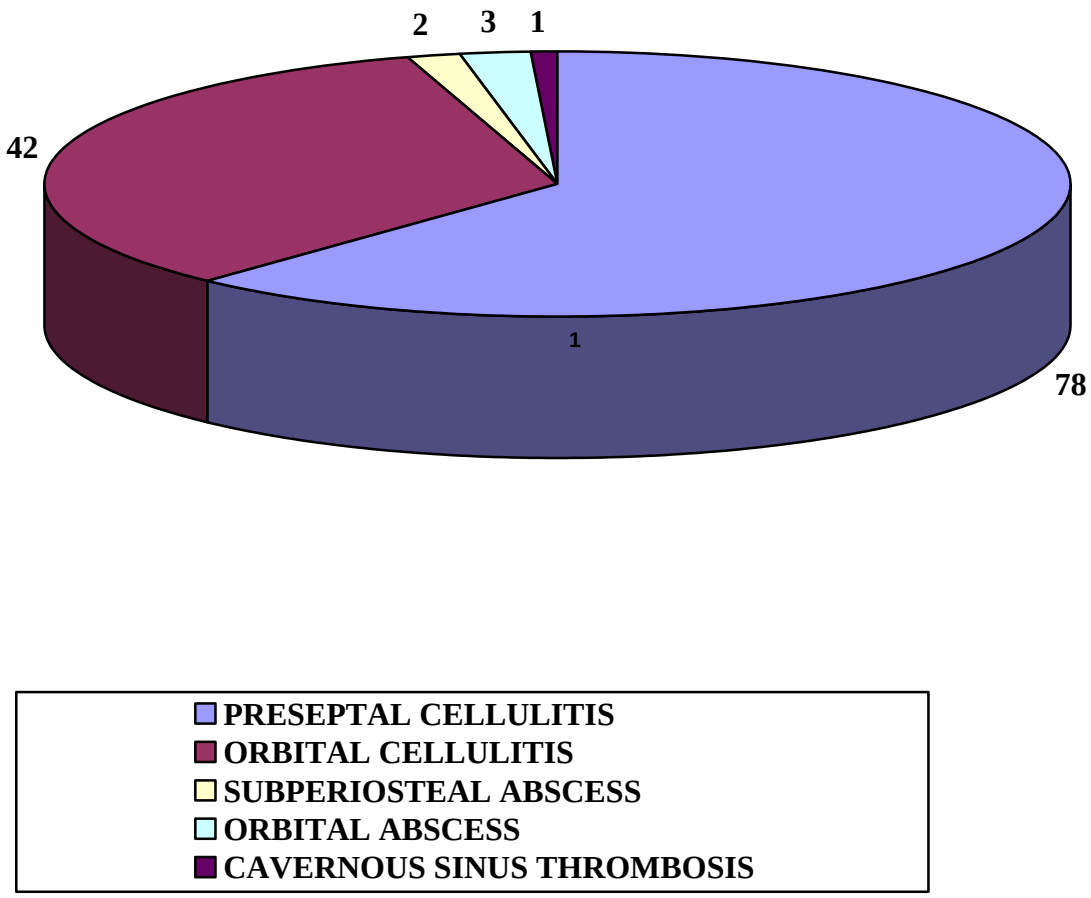


CT SCAN SHOWING NEUROCYSTICERCOSIS

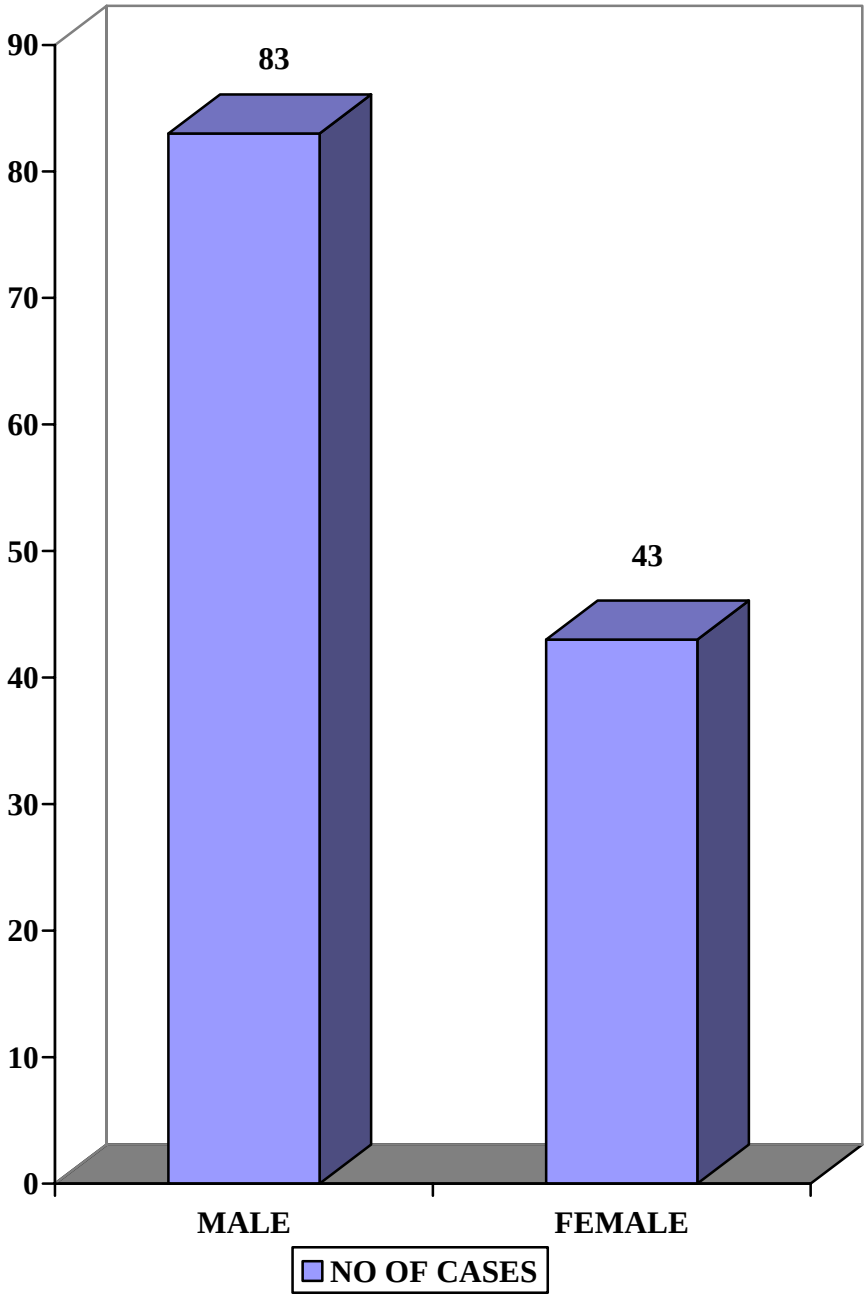


SURGICAL EXCISION OF CYST

INCIDENCE OF ORBITAL INFECTIONS



SEX INCIDENCE OF ORBITAL INFECTIONS



CLASSIFICATION OF ASSOCIATED CONDITIONS