A CLINICAL STUDY ON ORBITAL INFECTIONS AND THE ROLE OF IMAGING AND MICROBIOLOGICAL STUDY IN ITS OUTCOME

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ABSTRACT

BACKGROUND

Orbital infections are caused by variety of bacterial, fungal and parasitic agents. Its appropriate management depends on appreciation of topography of the process within the orbit and periorbital tissues by radio imaging and identification of causative organisms and its sensitivity to antibiotics by microbiological study. Timely management by medical or surgical treatment prevents further complications.

MATERIALS AND METHODS

This is a prospective study for a period of 14 months from June 2015 to July 2016. 30 patients presented to Orbit and Oculoplasty Services, RIOGOH, Chennai, were registered, evaluated and followed up during the study period. A detailed history taking, complete general and ocular examination were done. Slit-lamp and fundus examination, field charting, IOP, Hertel's exophthalmometry were measured. Systemic evaluation was performed. Complete haemogram, radiological investigations and microbiological study were done for appropriate patients. Patients were managed depending on the aetiology either by medical or by surgical intervention. Further response to treatment and the incidence of complications were assessed in the follow up period.

RESULTS

In this study, the most common age group presenting with orbital infections were from 1-10 years, followed by 31-40 years with male preponderance both in paediatric and adult age group. Laterality was to the left eye. Periocular infection was the most common aetiology. CT was done in 63%, B scan in 53% and x-ray in 50% of the patients. These radiological investigations helped in the early diagnosis and appropriate management. 37% of patients underwent microbiological study and depending on the aetiology, 67% underwent medical management and 33% surgical intervention. Common complications encountered were exposure keratitis, lid abscess and panophthalmitis.

CONCLUSION

Orbital infections were more common in paediatric age group and preseptal cellulitis was the commonest infection encountered. Radio imaging aids in diagnosis, identification of complications and in assessment of response to treatment of orbital infections. Microbiological study helped in the identification of strain of organism and in appropriate choice of antibiotics. Most of the orbital infections resolved with early diagnosis and prompt treatment and reduction in the incidence of complications.

KEYWORDS

Orbital Infections, Radio Imaging, Microbiological Study, Preseptal Cellulitis, Orbital Cellulitis.

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BACKGROUND

Orbit is a sterile closed compartment surrounded by bony walls on all sides and anteriorly by orbital septum. It has many potential spaces that make it a primary site of infection. It may present either as a secondary site of infection from the adjacent structures or intermediary site of infection to other vital sites like brain. Inflammation of the orbit and periorbital tissues due to infective pathology is the commonest form of orbital infections, which has myriad of clinical presentations ranging from preseptal cellulitis to cavernous sinus thrombosis.

Orbital infections mainly affects paediatric age group. Most common cause being bacterial in origin.[1] It's main sources are direct inoculation from trauma and skin infections spread from adjacent structures like sinuses and lacrimal system or from a distant focus like otitis media and pneumonia.

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There are five groups of orbital infections.[2]

1. Preseptal cellulitis.
2. Orbital cellulitis.
3. Orbital abscess.
4. Subperiosteal abscess.
5. Cavernous sinus thrombosis.

Common Sources of Orbital Infections According to Age

Neonates (up to 1 Month)	:	Congenital nasolacrimal duct obstruction. Dacryocoele.
Infants and toddlers	:	Nasolacrimal duct obstruction. Sinusitis.
(1 Month - 5 years)	:	Respiratory tract infections.
Children (5-15 years)	:	Hordeolum (externum and internum) sinusitis. Dental abscess.
Adults (>15 years)	:	Sinusitis. Debilitation. Trauma. Dental abscess.

Most Common Causative Organism

Bacteria	:	Common- Staphylococcus aureus, Group A Streptococci, Haemophilus influenza, Rare- Pseudomonas and anaerobic bacteria.
Fungus	:	Mucor, Rhizopus, Aspergillus, Candida albicans.
Parasites	:	Taenia solium, echinococci, microfilariae, Entamoeba.

Radiological Significance

Imaging techniques like x-ray orbit, B scan, CT, MRI play an important role in the aetiology in exact localisation of infection and its complications, which play an important role in the management of orbital infections.[3]

X-ray orbit Water's view, Caldwell view and lateral view are important views. It reveals paranasal sinus infections characterised 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 its absence does not necessarily rule out an orbital abscess. Blow out fracture and calcification indicates the aetiology of infection towards trauma and parasitic infection, respectively.

Role of B scan is mainly indicated for follow up in orbital cellulitis and it also aids in diagnosis of subperiosteal abscess and orbital abscess. B scan also aids in diagnosing parasitic infections such as hydatid cyst and cysticercosis. It also helps in ultrasonic-guided abscess drainage.

CT and MRI show the extent of the involvement of infection. However, CT is more precise in demonstrating the bony changes.[3] Early intracranial complications like frontal lobe infection and epidural inflammation, late complications like soft tissue scarring of retrobulbar space is well appreciated by CT and MRI. It can also demonstrate intraorbital, subperiosteal and intracranial abscess. MRI is the investigation of choice if infection spreads into the cavernous sinus as it characterises the cavernous sinus better and is more sensitive in showing thrombosis and intracranial site of inflammation.

Importance of Microbiological Study

Ideally aspirates from the involved structures should be obtained and examined for organisms. In case of lacrimal sac infection, infective material is obtained after incision and drainage.

In orbital cellulitis cases, which progresses in spite of treatment need to be investigated to find out the causative organism. Nasal swabs should be taken in those cases. In cases where sinusitis is the primary aetiology, aspirate from the sinuses should be taken.[4]

In subperiosteal and orbital abscess, image-guided aspiration is done and sent for microbiological study. Whenever surgical debridement is done, debrided material also should be subjected for microbiological study. Conditions like panophthalmitis or infection following trauma, conjunctival swab helps in the diagnosis.

The infective material obtained is subjected to Gram staining and culture in specific agar plates like blood agar or nutrient agar. Antibiotic sensitivity is mandatory to prescribe the appropriate sensitive antibiotics and avoid drug resistance.[5] Fungal organisms can be identified by KOH mount, culture in Sabouraud dextrose agar. Blood culture is necessary in cases of sepsis.

Management- Appropriate antibiotics either oral or intravenous depending on the extent and severity of infection[6] should be administered with anti-inflammatory drugs. The chosen antibiotic should be broad spectrum as well as exhibit beta-lactamase resistance and have the ability to penetrate CSF. Intravenous antibiotics are given for 1-2 weeks followed by oral antibiotics for 4 weeks. If fungal infection is suspected, antifungal therapy should be given and any underlying immunocompromised condition should be treated.

Surgical treatment is considered in orbital and periorbital abscess depending on visual status, progression of orbital signs, while being treated with medical therapy for 24-48 hrs.[7] If imaging suggests drainable fluid collection, the surgical intervention is considered. The collected specimen should be sent for microbiological study that helps in further refinement of treatment options. The resolution is generally quick and complete.

In cavernous sinus thrombosis, intravenous antibiotics in massive doses, which should be promptly and effectively commenced as early as possible.

Aim of the Study- To evaluate orbital infections and analyse the role of radio imaging and microbiological study in the early diagnosis, management and outcome of treatment of orbital infections.

MATERIALS AND METHODS

This prospective study was conducted at Orbit and Oculoplasty Department, RIOGOH, Egmore, Chennai, for a

period of 14 months from June 2015 to July 2016. 30 patients with orbital infections were evaluated.

All cases were registered in orbit and oculoplasty department. Detailed history was taken and complete general, systemic and ocular examination were done. Slit-lamp and fundus examination, field charting was done. IOP and Hertel's exophthalmometry were measured. Complete haemogram, imaging like either x-ray, CT, MRI and USG was performed and microbiological study were done for appropriate patients.

Patients were managed depending on the aetiology either by medical or by surgical intervention. Further response to treatment and the incidence of complications were assessed in the follow up period.

Inclusion Criteria- Patients presenting with-

1. Acute proptosis with suspected sepsis.
2. Orbital infections associated with infection of contiguous structures like acute lacrimal apparatus infection and sinusitis.

Exclusion Criteria- Patients presenting with-

1. Proptosis associated with malignancy.
2. Isolated intraocular infection were excluded from the study.

RESULTS

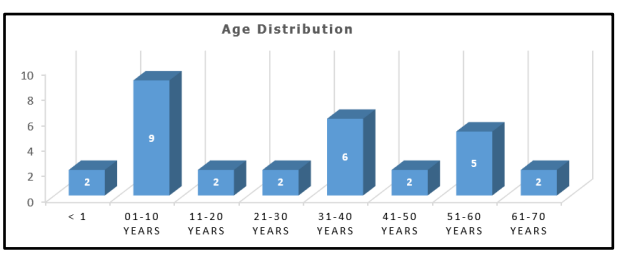


Chart 1. Bar Diagram- Age Distribution in the Study Patients

Our study showed that paediatric age group (1-10 yrs.) is the most common affected group, followed by 31-40 yrs. old, in 51-60 yrs. There are 9 (30%) children who is in 1-10 yrs. old category, 6 (20%) belonging to 31-40 yrs. old category, 5 (17%) in 51-60 yrs. old category.

Sex Distribution

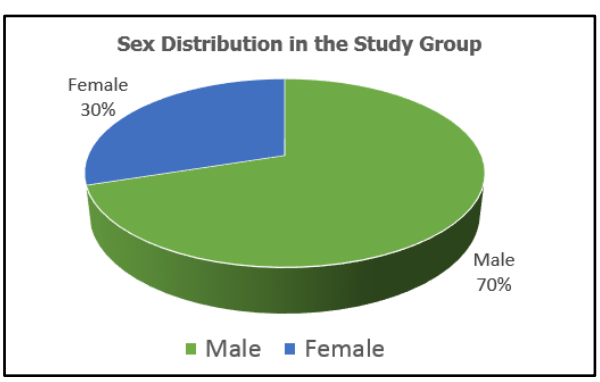


Chart 2. Distribution of Sex in the Study Group

There was a male preponderance (70%) in this study in both paediatric and adult age group.

Laterality of Orbital Infections

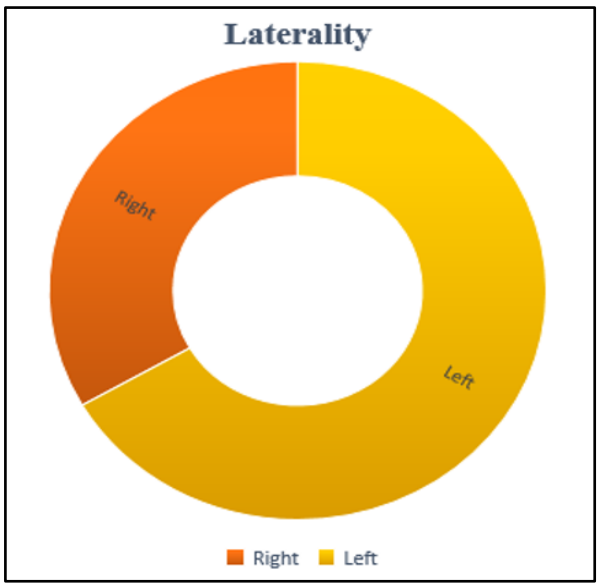


Chart 3. Laterality

All the cases in our study had unilateral affection of the disease and the left eye (66.7%) was more commonly involved compared to the right eye (33.3%).

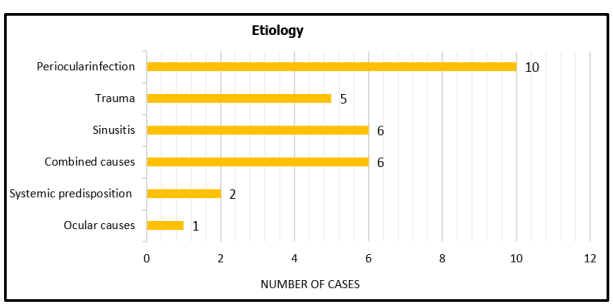


Chart 4. Distribution of Different Causes of Orbital Infections

In this study, periocular infections 10 (33%) including acute dacryocystitis were the commonest cause followed by sinusitis and trauma 5 (16.6%). Systemic conditions like diabetes and immunocompromised state 2 (6.6%) predisposed to fungal infections.

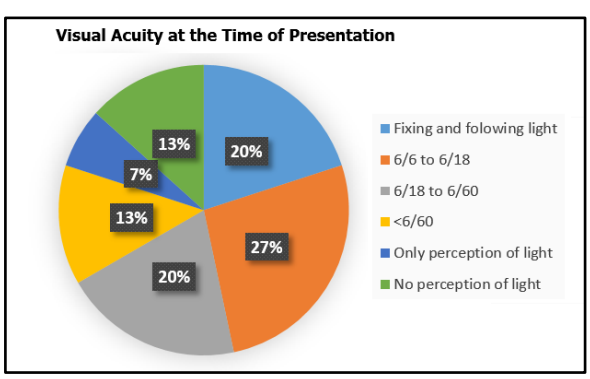


Chart 5. Visual Acuity at the Time of Presentation

In this study, most of the paediatric and adult cases who had preseptal cellulitis had good vision (>6/18). 26.7% had vision better than 6/18. 20% of paediatric were fixing and following light. 20% had vision between 6/18 to 6/60. Patients with orbital cellulitis and abscess had V/A less than 6/60, whereas patients with severe ocular infections presented with only perception of light 7%. 13% patients had vision of 6/60. Debilitated patients who presented with fungal sinusitis with orbital abscess presented with no perception of light (13%) and had very poor prognosis.

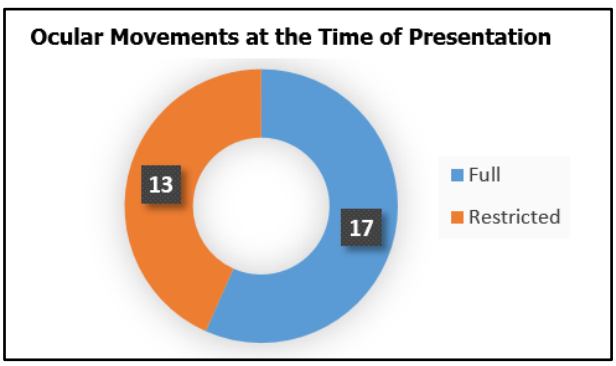


Chart 6. Ocular Movements of the Patients at the Time of Presentation

In our study, we inferred that 56.7% of patients (17) had full ocular movements. Those patients were all cases of preseptal cellulitis and one case of orbital cellulitis. All other cases of orbital cellulitis, orbital abscess and cavernous sinus thrombosis presented with restricted ocular movements.

Distribution of Signs on Evaluation

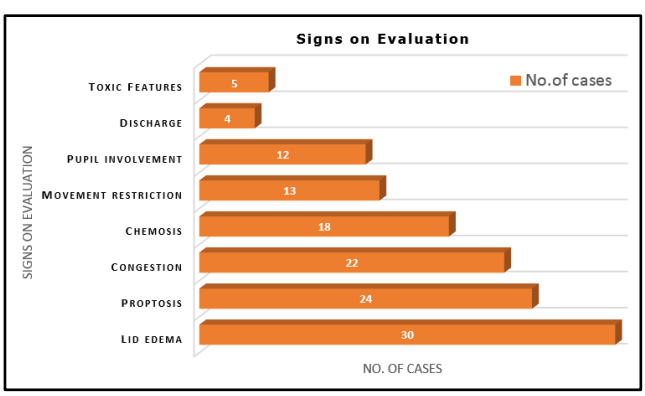


Chart 7. Signs Among the Patients of Orbital Infection

In this study, we can infer that all the patients- 100% (30) in the study group presented with lid oedema and 80% (24) of the patients presented with proptosis. Congestion and chemosis 70% were the next common among the presenting signs followed by movement restriction. Pupil involvement was there in 40% of patients, discharge was present only in ocular infection patients. Toxic features 5 (16.7%) were present in cases of fungal sinusitis with orbital abscess and cavernous sinus thrombosis.

In cases of preseptal cellulitis, follow up of motility restriction and pupil involvement is necessary as appearance of these two signs signify the progression of infection to orbital cellulitis.

Figure 1. Preseptal Cellulitis

Figure 2. Orbital Cellulitis

Laboratory Findings in the Study Group

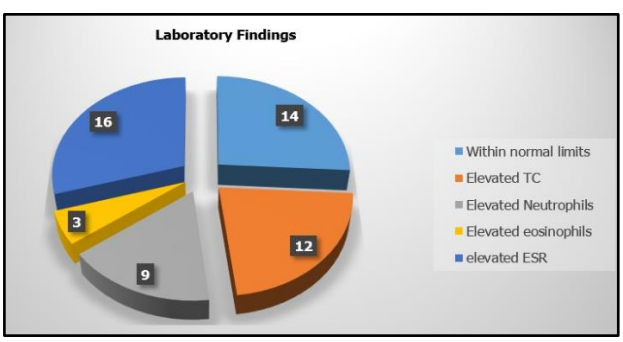


Chart 8. Laboratory Findings in the Study Group

Here, 46.6% (14) of patients had normal laboratory values, among which most of had preseptal cellulitis. 40% (12) of patients had elevated total count who were having orbital cellulitis and abscess. 53.3% (16) of patients had elevated ESR.

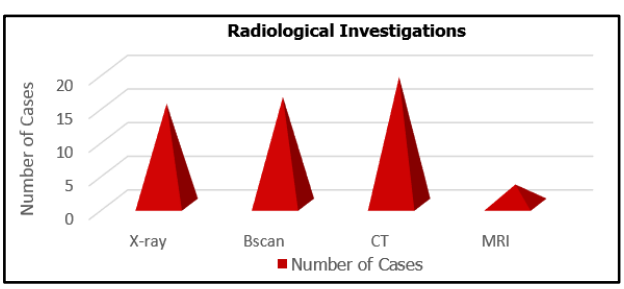


Chart 9. Radiological Investigations Done in the Study Group

Out of 30 patients, 50% (15) were taken x-ray as primary investigation for trauma and periocular infection where 7 patients had sinus haziness. B scan was done in 53.3% (16) patients of trauma and ocular infections to find the extent of orbital infections. CT scan was done in 63.3% (19) of patients with trauma, sinusitis, systemic conditions and periocular infections. It mainly helped us to diagnose orbital abscess in cases of orbital cellulitis, to look for intracranial complications and to assess the prognosis following treatment. MRI was done only in 3 patients who were diagnosed to have sinusitis as primary infection causing orbital abscess and cavernous sinus thrombosis.

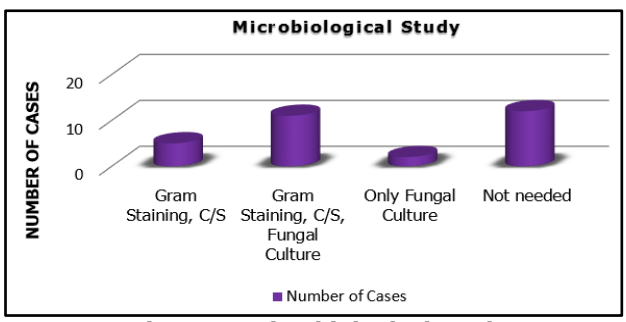


Chart 10. Microbiological Study

In this study, Gram staining and culture and sensitivity were done in 16.7% (5) of cases of suspected bacterial aetiology like periocular infections and sinusitis. Fungal culture was added to them in 36.7% (11) of cases with trauma (3) ocular and periocular infections (6) sinusitis with systemic predisposition (5), which caused orbital cellulitis in most cases.

Fungal culture was alone done in cases suspected fungal sinusitis (2). Microbiological study was not done in clear-cut preseptal cellulitis that resolved completely.

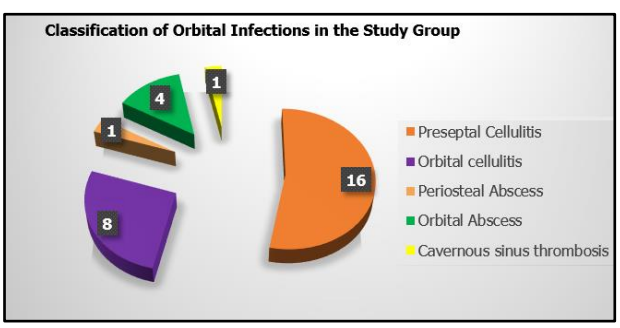


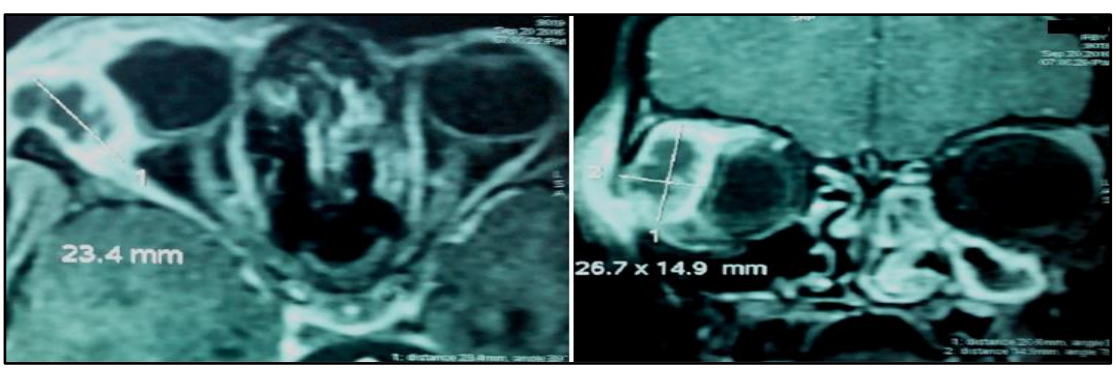
Chart 11. Classification of Orbital Infections in the Study Group

In this study-

- Preseptal cellulitis was seen in 53.4%.
- Orbital cellulitis was seen in 26.7%.
- Periosteal abscess was seen in 3.3%.
- Orbital abscess was seen in 13.3%.
- Cavernous sinus thrombosis in 3.3%.

Figure 3. Orbital Abscess

Figure 4. Subperiosteal Abscess



Figures 5 and 6. MRI Contrast Axial and Coronal View Showing Hyperintense Lesion in the Superotemporal Quadrant with Central Necrosis Suggestive of Orbital Abscess

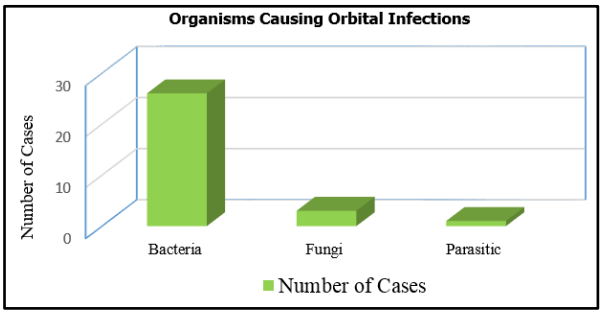


Chart 12. Organisms Causing Orbital Infections

Bacteria was the major causative organism. Gram staining 7 cases showed Staphylococcus aureus, 5 showed Streptococcus with pseudomonas in 2 cases, followed by Klebsiella in 1 case. Second commonest cause was fungus, which was proved by fungal culture in 3 cases.

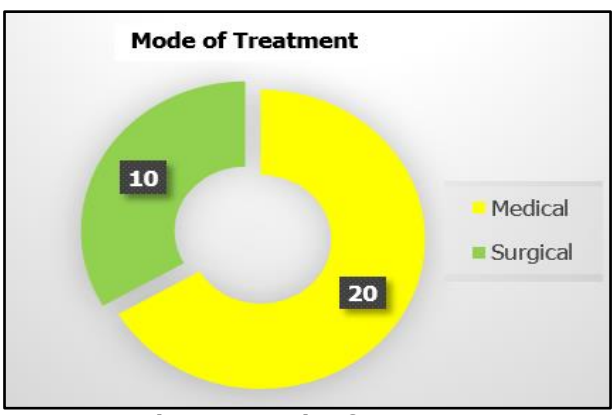


Chart 13. Mode of Treatment

67% of the cases were treated with medical management. Out of 20 cases, 13 were preseptal cellulitis, 6 were orbital cellulitis and 1 was cavernous sinus thrombosis.

33% (10) of cases with orbital abscess, subperiosteal abscess and acute dacryocystitis were managed surgically.

Incidence of Complications in the Study Group

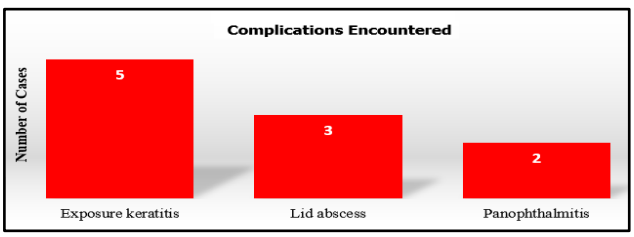


Chart 14. Complications Encountered

Analysis of Course of Orbital Infections Following Treatment

Patients Treated with Medical Treatment

65% (13) of the medically-treated patients were preseptal cellulitis. Out of which (10) patients resolved completely and 3 patients showed improvement.

30% (6) of them were with orbital cellulitis, of which 2 had complete resolvement and 4 improved.

5% (1) case of cavernous sinus thrombosis treated with broad-spectrum antibiotics got resolved completely.

Group	No. of Cases	Percentage of Cases	Prognosis within 2 wks.	No. of Cases
Preseptal cellulitis	13	65	Cured	10
			Improved	3
Orbital cellulitis	6	30	Cured	2
			Improved	4
Cavernous sinus thrombosis	1	5	Cured	1

Table 1. Distribution of Patients Treated with Medical treatment

Patients Treated with Surgical Treatment

Group	No. of Cases	Percentage of Cases	Prognosis within 2 Weeks	No. of Cases
Preseptal cellulitis with acute dacryocystitis	3	30	Cured	3
Orbital cellulitis	2	20	Cured	1
			Improved	1
Subperiosteal abscess	1	10	Deteriorated	1
Orbital abscess	4	40	Improved	3
			Deteriorated	1

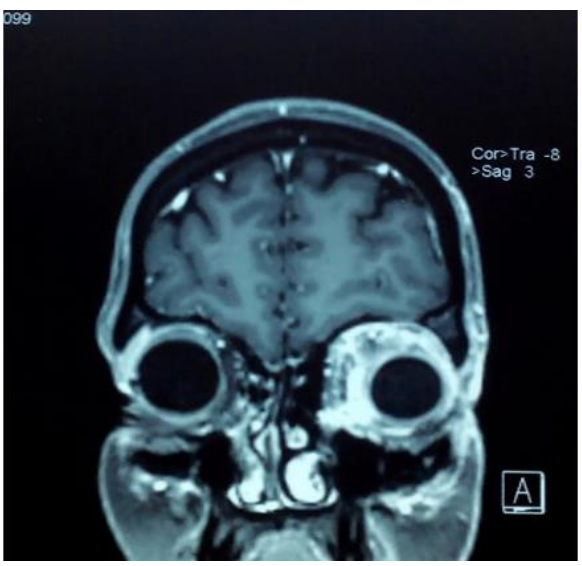
Table 2. Distribution of Patients Treated with Surgical Treatment

70% (7) of the surgically treated were cases improved and 30% (3) patients deteriorated.

Figure 7. Panophthalmitis

Figure 8. Exposure Keratitis

Figure 9. Lid Abscess



Figures 10 and 11. MRI T1 Weighted Images Axial and Coronal View Showing Hyperintense Signal in the Left Orbital Cavity, which is Extending to Left Side of Cavernous Sinus

DISCUSSION

In the present study, most common age group presented with orbital infections were from 1-10 years followed by 31-40 years.[5,8] There was a male preponderance both in paediatric and adult group and more common involvement of left eye. A study on preseptal and orbital cellulitis conducted by Datta G Pandian et al at JIPMER in 2010 showed that paediatric age group was the most common affected age group followed by age group between 30-40 years, which supports our study, which also shows the same distribution of age group.[8] This study also tells that males were more common in the adult group. These results were also similar to our study.

Periocular infections were the most common aetiology followed by trauma. Visual acuity at the time of presentation is more than 6/18 in most of the adult cases and fixing and following light in paediatric cases. Only 13% of patients had visual acuity lesser than 6/60. There was restricted ocular motility in 43% of patients. These were also similar to the previous-mentioned study.[8] According to the study done by Nicholas J. Potter et al, most patients with orbital cellulitis presented with decrease in visual acuity and restricted ocular movements. These results are comparable to our study where decrease in visual acuity and restricted ocular movements were common on orbital cellulitis and orbital abscess group.[9]

Most common presenting signs were lid oedema, congestion, chemosis and ocular motility restriction. In laboratory investigations, 47% had normal findings and 53% had elevated ESR, followed by elevated total count and neutrophils in 40% and 30% of patient's, respectively. 63% patients underwent CT as a mandatory investigation, 53% had B scan and 50% had x-ray. These radiological investigations helped in the early diagnosis and appropriate management. 37% of patients had Gram staining, culture and sensitivity and fungal culture to identify the infective pathogen. 17% had only Gram staining, culture and sensitivity and fungal culture alone was done in 7% of patients in whom fungal sinusitis was diagnosed in CT scan. In diagnosis, 53% constituted preseptal cellulitis followed by orbital cellulitis and orbital abscess in 27% and 13%, respectively. CT scan was an important radiological investigation done in this study for diagnosing the various grades of orbital infections. Its importance is cited in the study by Nicholas J. Potter.[9] In the microbiological study, we can infer that bacteria- Staphylococcus and Streptococcus constitutes the most common pathogens. This is supported by the study done by Mithra O. Gonazalez and Vikram D. Durairaj on orbital cellulitis and preseptal cellulitis.[10] Same is proved by study of Steven H. McKinley et al.[5]

67% of patients were treated medically with IV and oral antibiotics and antifungals. 33% were treated surgically with

incision and drainage/debridement followed by medical management.[11] In the medically-treated group, 65% of patients got complete resolvement and 35% improved in visual acuity, signs and symptoms. In the surgically-treated group, 40% resolved completely, 40% improved and 20% deteriorated in spite of treatment. This had correlation with the results of Starkey et al study.[11] Incidence of complications, 17% had exposure keratitis, 10% had lid abscess and 7% of panophthalmitis.[12,13] This result had similarity with study of RT Younis et al and A Chaudry et al.[12,13]

CONCLUSION

Orbital infections are more common in paediatric age group and preseptal cellulitis is the commonest infection encountered. Bacteria is the major causative organism of orbital infections. Among that, gram-positive organisms are the commonest. Fungi constituted the second major cause.

Radio imaging, x-ray, B scan, CT scan and MRI help in diagnosis, identification of complications and in assessment of response to treatment of orbital infections. They are complimentary to each other.

Microbiological study with Gram staining, culture and sensitivity and fungal culture aid in the identification of organism and appropriative choice of antibiotic is important in complete cure of infection. Most of the orbital infections resolve with prompt treatment. Surgical approach is the treatment of choice in abscess, followed by medical treatment as per the sensitivity. Radio imaging aids in assessing the response to treatment and to modify treatment for a better outcome.

Infections of the orbit and periorbital tissue are important subset of orbital inflammatory disease not only because of frequency of presentation, but also because of associated local and systemic morbidity. Treatment requires a well-coordinated and prompt multidisciplinary approach. The key to successful treatment includes high index of suspicion, early diagnosis and correction of underlying medical disease. An early definitive diagnosis is associated with more favourable outcome.

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