

## Endophthalmitis- Microbiological Profile at a Tertiary Eye Care Hospital in Hyderabad

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### Original Research Article

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**Abstract:** This is a retrospective study aimed to identify the microbial etiology of infectious endophthalmitis cases and to determine the antibacterial susceptibilities of bacterial isolates at Sarojini Devi Eye hospital a tertiary care eye hospital. A total of 52 patients with clinically diagnosed infectious endophthalmitis were microbiological evaluated from Jan 2016 to April 2018. Aqueous and vitreous aspirates were aseptically collected and cultured for bacteria and fungus using standard microbiological techniques. The specimens were subjected to Gram-staining and KOH mount. By Kirby-Bauer disk diffusion method Antibiotic sensitivity was performed for the commonly used intravitreal and topical antibiotics. Out of 52 patients studied, 35 (67.31%) had post traumatic endophthalmitis, 12 patients (23.08%) had postoperative endophthalmitis, postcorneal infective endophthalmitis was seen in 02 patients (3.85%) and 03 patients (5.76%) had endogenous endophthalmitis. Of the total 52 cases only 24 (46.15%) were culture positive and 28 (53.85%) were culture-negative endophthalmitis. Bacterial growth was seen in 16 cases (66.67%) and 08 cases (33.33%) had fungal growth. A bacterial predominance was observed among causative organisms of exogenous endophthalmitis with staphylococcus epidermidis species being the most common. In posttraumatic endophthalmitis, gram-positive bacteria were the predominant species, followed by gram-negative bacteria and fungi. The isolated organisms were gram-positive bacteria and candida in postoperative endophthalmitis. In Endogenous endophthalmitis, gram-negative bacteria were the predominant species and gram-positive cocci were also isolated. However, in postcorneal infective endophthalmitis, all infections were fungal. The sensitivity pattern showed varied sensitivity to the antibiotics tested like - peptide antibiotic Vancomycin for Gram-positive coverage showing 100% sensitivity to gram positive organisms and Bacillus spp, and the recently developed third and fourth-generation fluoroquinolones, such as Levofloxacin and Moxifloxacin, with their enhanced activity against Gram-positive pathogens, and broad-spectrum activity covered most organisms (92%) commonly encountered in bacterial endophthalmitis. Good vitreous specimen collection and accurate culture techniques will increase the recovery rate of causative microorganisms and play a major role in treating the cases the results of this study has identified the microbial spectrum of infectious endophthalmitis and their antibiotic susceptibility.

**Keywords:** Endophthalmitis, staphylococcus epidermidis, Pseudomonas aeruginosa, third-and fourth-generation fluoroquinolones.

## INTRODUCTION

Endophthalmitis is a vision-threatening potentially devastating eye infection resulting from traumatic or systemic microbial infection of the interior of the eye. It is a serious intraocular inflammatory disorder affecting the vitreous cavity that can result from exogenous or endogenous spread of infecting organisms into the eye [1]. The causative pathogen of endophthalmitis can come from the outside

environment or from systemic infections transported in the bloodstream. Infectious endophthalmitis can be divided into the broad categories exogenous and endogenous.

Exogenous endophthalmitis is caused by inoculation of the eye by microorganisms from the external environment and most commonly occurs as a complication of ocular surgery or trauma or some times

it may also result from the contagious spread of infectious microbes from the cornea.

Endophthalmitis after ocular surgery is the most common form of the condition. Cataract surgery is by far the most frequently performed intraocular surgery[2]. Post cataract surgery is one of the leading causes of postoperative endophthalmitis (90%) with an incidence of 0.03-0.68% [3]. Recent data indicate that the use of suture less small incision techniques (eg, 23 or 25-gauge incision size) is significantly associated with a higher rate of postoperative endophthalmitis than the sutured 20-gauge technique [4]. It has a heterogeneous etiology and the disease course may show variable pattern even with treatment and intervention. The majority of patients with postoperative endophthalmitis present with an acute onset and within seven days after Surgery[6,7]. Chronic postoperative endophthalmitis is characterized by insidious inflammation and appears less common than the acute variety. Such cases can occur in the early postoperative period but usually manifest several weeks or month after surgery and often include less virulent bacterial and fungal pathogens.

Post-traumatic endophthalmitis along with retained intraocular foreign body has a much higher incidence of 3-17% [5]. Endophthalmitis is an important complication of open globe injury. About 25% of endophthalmitis cases are a result of ocular trauma and these are more often associated with a poorer visual outcome than otherwise similar globe injuries [35]. The risk for developing endophthalmitis after sustaining open globe injuries is estimated at about 7% [1, 35, 36]. The incidence of endophthalmitis in cases of penetrating ocular trauma has been reported to range from 3.3% to 30% and after intraocular foreign body from 1.3% to 61% [35, 37].

### **Endogenous endophthalmitis**

Endogenous endophthalmitis is less common and occurs secondary to hematogenous dissemination and spread from a distant infective source in the body [8].

In patients with endogenous endophthalmitis, constituting only 2-10% of overall cases, predisposing risk factors usually exist [9-14]. Endogenous endophthalmitis is caused by hematogenous spread of infectious organisms from distant sites in the body, originating through the hematogenous seeding of the posterior segment of the eye from a distant site through direct intravenous acquisition through blood transfusion, indwelling devices, or contaminated needles or injection paraphernalia or illicit drugs or by iatrogenic administration of medications such as B vitamins and insulin. Patients who have compromised immune systems are at risk for developing endogenous endophthalmitis. Predisposing conditions include diabetes mellitus, systemic malignancy, sickle cell anemia, systemic lupus erythematosus, and human

immunodeficiency virus (HIV) infection, extensive gastrointestinal surgery, endoscopy, and dental procedures may all increase risk of endogenous endophthalmitis. Systemic immunomodulatory therapy and chemotherapy may also put patients at risk[9-14]. Although the eye may be the only location where the infection can be found, there is an extraocular focus in 90% of cases. the possibility of pneumonia, urinary tract infection, bacterial meningitis, or a liver abscess as possible sources of infection. must also be considered. Liver abscesses have been reported as the most common infectious origin[10,15-17], followed by pneumonia, endocarditic, soft tissue infection, urinary tract infections, meningitis, septic arthritis, and orbital cellulitis[9]. It is important to also consider endogenous endophthalmitis in newborns and infants, especially those younger than 6 months.

Causative organisms of endogenous endophthalmitis may be bacteria, as well as fungi, and rarely parasites. In contrast to exogenous forms of this disease, in endogenous endophthalmitis fungal pathogens play an important role[9,10,18].The prognosis is directly related to the offending organism and the systemic status of the patient.

Both categories of endophthalmitis lead to subsequent intraocular inflammation and potentially severe vision loss. The outcome of the infection varies with the microbial agent involved and the rapidity of and response to treatment.

Though endophthalmitis is a rare clinical entity, it can quite possibly lead to devastating outcomes either in the form of permanent blindness, disharmonisation of the eyeball structures (phthisis bulbi) or loss of the eyeball (evisceration), depending on various factors[3]. The hallmark of the ophthalmic lesion is a corneal ring abscess accompanied by rapid progression of pain, chemosis, proptosis, retinal hemorrhage, and perivasculitis. Systemic manifestations include fever, leukocytosis, and general malaise.

Spectrum of causative organisms varies, depending on the region and environment and it also depends on the type of injury, the living environment, and the time from injury to wound repair [19-21]. Postoperative endophthalmitis can occur after any intraocular procedure The organisms recovered from postoperative endophthalmitis and post-traumatic endophthalmitis usually originate from the conjunctiva, eyelid, or nose of the patient[24,25]. Bacteria account for approximately 80–90% of culture-positive cases [22,23], and Gram-positive cocci are the most common isolates among these bacteria Most reports published Gram-positive coagulase negative staphylococci (*Staphylococcus epidermidis*) as the leading organism isolated from post-cataract surgery endophthalmitis [26,27].

In post-traumatic endophthalmitis, both environmental and host flora like *Staphylococcus epidermidis*, *Staphylococcus aureus* and other bacteria like *Pseudomonas* species, *Bacillus cereus* and fungi like *Candida* are the causative organisms. With regard to *B. cereus* - endophthalmitis is a devastating malignant eye infection because of the rapidity with which the infection progresses and the bacterium's elaboration of a multitude of extracellular tissue-destructive virulence factors.

In contrast to exogenous endophthalmitis, endogenous endophthalmitis results from the hematogenous spread of microorganisms from distant foci and across the blood-ocular barrier [16]. Both bacterial and fungal agents are noted as potential causative agents of endogenous endophthalmitis; However, in Asian studies, bacteria are predominant causes to endogenous endophthalmitis [28,29]. The causative organisms are bacteria like, *Staphylococcus epidermidis*, *Klebsiella* and *Bacillus cereus*. In Asia, infection from *Klebsiella* species in patients with liver abscesses is reported as the most common cause of endogenous endophthalmitis.

Fungal endophthalmitis has become an increasing issue in western countries. *Candida albicans* followed by *Aspergillus* spp are the predominant species [9,18]. *Candida* species are a part of the human flora where they exist as commensals on the mucosal surface of the respiratory, gastrointestinal, and female genital tracts [30]. When the immune system is compromised these organisms potentially become pathogenic. *Candida* species are the most common cause of nosocomial fungal infections [17, 31, 32].

The incidence of Endophthalmitis has decreased in recent decades<sup>33</sup> and, Endophthalmitis is now a rare [6, 33, 34]. Ophthalmic disease. But its severity and its rapid, indistinct prognosis require timely diagnosis and effective treatment to provide satisfactory visual results and to prevent irreversible vision loss.

The purpose of this study is to better understand the specific microbial pathogens responsible for the development of the various forms of endophthalmitis and to highlight the microbiological profile of culture positive endophthalmitis cases and also assess in vitro susceptibility of bacterial isolates from each type of endophthalmitis cases.

## **MATERIALS & METHODS**

This retrospective review study was conducted on patients who were diagnosed with or suspected to have infectious Endophthalmitis at the Sarojini Devi EYE Hospital, HYDERABAD, and Telangana from January 2016 to April 2018. According to the possible sources of infectious endophthalmitis, the patients were divided into four groups as follows: Endophthalmitis

with trauma, Endophthalmitis associated with microbial keratitis, Endogenous endophthalmitis, and Endophthalmitis with postoperative infection after sterile ocular surgery, including cataract surgeries. The diagnosis was based on clinical evaluation and as per the standard protocol of the institute. Patients demographics, clinical history, presentation delay, clinical examination, microbiological profile, culture sensitivity, treatment given, and final clinical outcome, and follow-up interventions were recorded.

The patients presented with the following symptoms- diminution of vision, ocular pain and redness, Photophobia, watering and foreign body sensation.

The clinical presentation of post-operative endophthalmitis was classified into fulminant, acute and chronic type depending on the time of occurrence. The fulminant disease was defined as the onset of symptoms within 4 days, the acute within 6 weeks and chronic more than 6 weeks.

In case of post-traumatic endophthalmitis signs and symptoms were evaluated with regard to the degree of traumatic injury which included decreased vision, pain, lid swelling, corneal ring ulcer, anterior chamber inflammation, hypopyon, vitritis, or frank purulence.

Samples were taken from diseased tissues from all patients with suspected or diagnosed infectious endophthalmitis. Corneal samples in case of corneal ulcers associated endophthalmitis were obtained after topical anesthesia using 0.5% proparacaine hydrochloride, by scraping the base and edges of the ulcerated part of the cornea with a sterile special knife.

Other samples of endophthalmitis were taken from the aqueous humor and/or vitreous fluid. Fluids from the anterior chamber were aspirated through the limbus using a needle on a 1 mL syringe. Vitreous specimens were obtained through the pars plana prior to antibiotic injection or vitrectomy by the ophthalmologist and sent to the microbiology laboratory. All protocols were followed according to established methods [38].

The intra-ocular specimens- aqueous fluid (AC tap) and vitreous humor were processed within 30 min of their collection. The culture media used were 5% blood agar, 5% blood chocolate agar (CA), brain heart infusion broth, thioglycollate broth and Sabouraud dextrose agar (SDA). The inoculated media for bacterial cultures were incubated at 37°C, and the fungal culture media SDA, was incubated at 25°C. CA was incubated in an atmosphere of 10% CO<sub>2</sub> (anaerobic system Mark V Jar, Hi-Media). All the culture media for bacteria and fungus were incubated for 2 weeks in case of no growth before declaring the

sample as sterile. The isolated fungi and bacteria were identified by standard methods [39-41].

Direct smears were prepared from the AC tap and vitreous specimens-one for KOH preparation for detecting fungi, a Gram-stain and a Giemsa stain for cytology. The criteria used to consider the isolated microbial agent as the causative agent were - (i) growth on a single medium correlating with direct smear findings, (ii) growth of the same organism on two or more of the inoculated media and/or (iii) confluent growth in any solid medium.

By Kirby-Bauer disk diffusion method Antibiotic sensitivity was performed for the commonly used intravitreal and topical antibiotics.

As most systemically administered antibiotics do not reach sufficiently high intraocular concentration a more effective way to achieve a high concentration of an antimicrobial substance within the eye and the infected tissue is intravitreal drug application.

Current antibiotic standard protocols for intravitreal application are empirically based and include the peptide antibiotic vancomycin (1.0 mg/0.1 mL) for Gram-positive coverage,<sup>6</sup> in combination with the  $\beta$ -lactam antibiotic ceftazidime (2.25 mg/0.1 mL) for Gram-negative coverage[6]. In patients sensitive to  $\beta$ -lactam drugs, amikacin (400  $\mu$ g/0.1 mL), an amino glycoside antibiotic, was considered instead of ceftazidime.

Gram-positive organisms reportedly have a 99% susceptibility to vancomycin [42]. As such, it has become one of the mainstays of endophthalmitis treatment.

The third and fourth-generation fluoroquinolones, such as levofloxacin and moxifloxacin, with their enhanced activity against Gram-positive pathogens, offer broad-spectrum activity that covers most organisms commonly encountered in bacterial endophthalmitis[43]. Levofloxacin and fluoroquinolones in general, penetrate well into the eye.

In contrast with exogenous endophthalmitis, endogenous endophthalmitis requires systemic antimicrobial therapy. Identification of the causative pathogen by culture of blood, urine, or cerebrospinal fluid culture is successful in more than 75% of endogenous endophthalmitis cases [9, 10, 44]. Positive cultures from vitreous samples can be achieved much less frequently in endogenous endophthalmitis than in exogenous endophthalmitis[9, 10, 44].

Systemic antimicrobial therapy is the mainstay of endogenous endophthalmitis treatment. Fungal endophthalmitis: The most commonly reported causes of fungal endophthalmitis are *Candida* species (50%)[35,4548]. In fungal endophthalmitis, treatment

should be instituted as soon as the diagnosis is made, under close supervision by the attending physician. Treatment guidelines for mild forms of fungal chorioretinitis and vitreitis suggest systemic antifungal therapy combined with serial ophthalmologic examinations [49,50]. Surgical intervention combined with systemic and intraocular antifungal drug application is warranted in cases of moderate or severe vitreous involvement [49, 50]. Most current treatment protocols recommend Amphotericin B (5–10  $\mu$ g/0.1 mL) and triazoles as primary therapeutic options.

## RESULTS

Among the 52 patients with endophthalmitis - 38(78.08%) were men, and 14(26.92%) were women. Out of 52 patients studied, 35 (67.31%) had post traumatic endophthalmitis .12patients (23.08%) had postoperative endophthalmitis, postcorneal infective endophthalmitis was seen in 2 patients (3.85%) and 03 patients (5.76%) had endogenous endophthalmitis.

Among the cases highest incidence 15 (28.85%) was seen in the 31-40 years age group followed by 41 - 50 years age group11 (21.15%) and the age groups of 0 -14 & 15 - 30 had a similar incidence of 06 (11.54%) cases while in the age group of 51-60 the incidence is 10 (19.23%) and in the age group 61-80 the incidence was 04 (07.69%) cases.

During the study period, specimens from all these endophthalmitis cases (52 patients- 38men,14 women) were collected and subjected to microbiological analysis and of the total cases only 24 (46.15%) were culture positive and 28 (53.85%) were culture-negative endophthalmitis. Cultures were confirmed by standard biochemical tests as per the clinical and laboratory standards institute (CLSI) guidelines. Bacterial growth was seen in 16 cases (66.67%) and 08 cases (33.33%) had fungal growth.

The highest culture-positive rate 100%(3/3) was found in Endogenous endophthalmitis and Endophthalmitis with post corneal keratitis100%(02/02) followed by postoperative endophthalmitis50% (06/12) and by posttraumatic endophthalmitis37.14% ( 13 of 35).

In posttraumatic endophthalmitis, gram-positive bacteria were the predominant species, followed by gram-negative bacteria and fungi. The isolated organisms were gram-positive bacteria and *Candida* in postoperative endophthalmitis, the organisms isolated in endogenous endophthalmitis cases are staphylococci epidermidis, klebsiella spp and candida spp. However, in post corneal infective endophthalmitis, all infections were fungal.

By Kirby-Bauer disk diffusion method Antibiotic sensitivity was performed for the commonly used intravitreal and topical antibiotics.The following

antibiotic discs were tested (1) Vancomycin (2) Levofloxacin, (3) Gatifloxacin(4) Moxifloxacin (5) Cefuroxime (6) Ceftriaxone (7) Ceftazidime (8), Ciprofloxacin,(9) Amikacin (10) Tobramycin(11) Imipenem(12) Cefotaxime were tested depending on the organism isolated.

The sensitivity pattern showed varied sensitivity to the antibiotics tested like, - peptide antibiotic Vancomycin for Gram-positive coverage showing 100% sensitivity to gram positive organisms and Bacillus spp, and the recently developed third and

fourth-generation fluoroquinolones, such as Levofloxacin and Moxifloxacin, with their enhanced activity against Gram-positive pathogens, and broad-spectrum activity covered most organisms(92%) commonly encountered in bacterial endophthalmitis.

Ceftazidime  $\beta$ -lactam antibiotic for Gram-negative coverage and in patients sensitive to  $\beta$ -lactam drugs, Amikacin, an aminoglycoside antibiotic, have been considered instead of ceftazidime showing good sensitivity to other organisms.

**Table-1: Showing Gender distribution**

Gender	No.of cases	Per cent
Males	38	73.08%
Females	14	26.92%

**Table-2: Showing age distribution of cases**

Age	No. of cases	Per cent
0 -- 14 years	06	11.54%
15--30 years	06	11.54%
31-40 years	15	28.85%
41-50 years	11	21.15%
51--60 years	10	19.23%
61--80years	04	7.69%

**Table-3: Showing Aetiology of Endophthalmitis**

Aetiology	No. of cases	Per cent
Endophthalmitis with trauma	35	67.31%
Endophthalmitis with postoperative infection	12	23.08%
Endophthalmitis post corneal keratitis	02	3.85%
Endophthalmitis endogeneous	03	5.76%

**Table-4: Showing Culture results of total cases (52)**

Culture	No.of cases	Per cent
culture positive	24	46.15%
culture negative	28	53.85%

**Table-5: Showing Results of culture positive cases**

Culture	No.of cases	Percent
Bacterial	16	66.67%
Fungal	08	33.33%

**Table-6: Showing distribution of culture positive cases**

Type of endophthalmitis	Total no. of cases	Culture positive cases	Per cent
Endophthalmitis with trauma	35	13	37.14%
Endophthalmitis with postoperative infection	12	06	50%
Endophthalmitis post corneal keratitis	02	02	100%
Endophthalmitis endogeneous	03	03	100%

**Table-7: Showing organisms isolated**

Causative organism	No. of cases	Per cent
Staphylococcus epidermidis	09	37.50
Pseudomonas spp	02	08.33
klebsiella	02	08.33
Bacillus cereus	02	08.33
Staphylococcus aureus	01	4.17

candida	08	33.34
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**Table-8: Showing distribution of organisms isolated**

organism	Post trauma (13)	Post operative (06)	Post corneal inf. (02)	Endogenous (03)
Staphylococcus epidermidis	05	03	--	01
Pseudomonas spp	01	01	--	--
klebsiella	--	01	--	01
Bacillus cereus	01		--	01
Staphylococcus aureus	01	--	--	--
candida	05	01	02	-

**Table-9: Showing Culture sensitivities of organisms in cases with endophthalmitis**

organism	Sensitive	Resistant
Staphylococcus epidermidis	Tobramycin, levofloxacin, Ciprofloxacin, cefuroxime and vancomycin	--
Pseudomonas aeruginosa	Amikacin, Ceftazidime, levofloxacin, Cefotaxime, and Ceftazidime	, Tobramycin, Ciprofloxacin, Vancomycin
Klebsiella spp.	Amikacin, Ciprofloxacin, Ceftazidime levofloxacin, and Tobramycin	Cefotaxime, and Vancomycin
Staphylococcus aureus	Amikacin, Cefotaxime, Ciprofloxacin, Vancomycin, Ceftazidime	

**DISCUSSION**

A total of 52 patients with clinically diagnosed infectious endophthalmitis was studied and among whom 38(78.08%) were men, and 14(26.92%) were women. This is in accordance with other similar studies by Schirmbeck T *et al.* Norregaard JC *et al.* and Duch-Samper AM *et al.* [51,52,53], where there is predominance of males and this finding might be due to gender-based behavior and male involvement in higher risk working activities, which may have resulted from the large number of cases of post-traumatic endophthalmitis, usually predisposed by the type of economic occupation of the patient, more common among men.

Out of 52 endophthalmitis patients studied, majority of cases 67.31% were due to post traumatic endophthalmitis (35), followed by 23.08% postoperative endophthalmitis (12) patients. This is similar to a Thailand study by Bhoomibunchoo *et al.* [54]. But it differs from other previous studies by H. Karacal *et al.* [55] A. Gupta *et al.* [56], and T. P. Moloney *et al.* [57], Bispo PJ [58] *et al.* Bohigian GM [59] *et al.* Chaib AR [60] *et al.* in which most cases developed endophthalmitis after intraocular surgery. All the above studies were in developed countries and the discrepancy in results in our study may be attributed to the higher incidence of ocular injury that occurs with industrial and agriculture procedures in developing countries and also large number of cases referred especially from rural areas, related to severe trauma, which require care in more specialized referral tertiary eye care hospital like .S.D Eye Hospital.

Among the cases highest incidence 28.85% was seen in the 31 -40 years age group, followed by 41 - 50 years age group 21.15%; 15 - 30 had a incidence of 11.54% cases while in the age group of 51-60 the incidence is 19.23% The incidence therefore was seen in working age group ( 80.79%) of all patients. This is in agreement to a similar study done by Fang Duan *et al.* in china [61].

Culture methods are still considered the “gold standard” in the diagnosis of infectious diseases. Of the total cases only 24 (46.15%) were culture positive and 28 (53.85%) were culture-negative endophthalmitis The culture-positive rates were close to those reported from previous studies by C. Long *et al.* [62], C. Bhoomibunchoo [54], (33.33%) Lalitha *et al.* [63] (53%) and Gupta *et al.* [64] (52.5%).

In several previous studies also with regards to the culturing of the causative organisms of the endophthalmitis there has been always only less than fifty percent positivity, even though patients have endophthalmitis, but the cultures of their aqueous and vitreous are negative. This may be attributed to various reasons like - the sample size may be inadequate, the site of sampling may be inappropriate, inordinate delay in transporting the specimen or may be the culture techniques are not sensitive enough or the sensitivity of tests may be poor.

The low culture-positivity can also be attributed to, a great delay in seeking the specialized treatment [51], which might have resulted from lack of the patient knowledge because of illiteracy or seeking some treatment either clinical or surgical at the local

physician, use of intra vitreal antibiotics, before coming to this hospital, which might have reduced the load of the viable microbes in the inoculums [5]. Endophthalmitis cases that failed to obtain positive results from culture tended to have a later onset and a better visual outcome [7].

The highest culture-positive rate 100 % (3/3) was found in endogenous endophthalmitis and Endophthalmitis with post corneal keratitis 100% (02/02) followed by postoperative endophthalmitis 50% (06/12) and by posttraumatic endophthalmitis 37.14% ( 13 of 35).

A study in South India by R. Ramakrishnan [65], reported that the highest rate of culture positivity was in specimens from eyes with endophthalmitis due to trauma followed by postsurgical endophthalmitis and endogenous endophthalmitis these findings are dissimilar to our results.

This may be attributed to discrepancy shown by organisms in their virulence depending on the region and the environment.

Our study showed among the positive cultures, a predominance of gram positive microorganisms, which is in agreement to other similar studies [51, 58].

Gram positive bacteria mainly coagulase negative Staphylococcus (CONS) are predominant (37,50%) this is similar to study by H Bhattacharjee *et al.* [66] which showed 22.88% of Coagulase negative staphylococci isolation out of the bacterial cultures, followed by Candida (33.34%).

Depending on the infecting organism, a correlation is thought to exist between clinical presentation and microbiologic spectrum. Gram-positive, coagulase-negative organism seems to cause less severe infections compared with more virulent Gram-negative and "other" Gram-positive organisms [7].

In India, fungi cause 10-20% of post-operative endophthalmitis, while in west the dominance is of bacteria [39,40,41,63,64,68]. Fungal infection is associated with poorer prognosis and indolent course of the disease [64,67,68].

The proportion of fungal infections is similar to studies done in Australia by Connell's [69] *et al.* were in culture-positive endophthalmitis cases, were due to Candida.

In posttraumatic endophthalmitis, gram-positive bacteria were the predominant species, followed by gram-negative bacteria and fungi. The isolated organisms were gram-positive bacteria and candida in postoperative endophthalmitis, while the

organisms isolated in endogenous endophthalmitis cases are staphylococci epidermidis, klebsiella spp. and candida spp. However, in postcorneal infective endophthalmitis, all infections were fungal.

In our study we could also isolate bacteria like Pseudomonas species (8.33%), klebsiella (8.33%), Bacillus cereus (8.33%). A South Indian study by Jambulingam M [70] *et al.* also reported 11.53% isolation. By various studies, it can be observed that the common cause of organism entry into the eye is secondary to infected irrigating solutions, inadequately sterilized instruments and the operative environment. The isolation of Pseudomonas and fungi like candida species has been found to be significantly high in hot and humid climates [70].

The intravitreal injection of antibiotics has become the primary method of administration in the treatment of exogenous endophthalmitis [1,71,72].

By Kirby-Bauer disk diffusion method Antibiotic sensitivity was performed for the commonly used intravitreal and topical antibiotics. The following antibiotic discs were tested (1) vancomycin (2) levofloxacin, (3) gatifloxacin (4) moxifloxacin (5) cefuroxime (6) ceftriaxone (7) ceftazidime (8), ciprofloxacin, (9) amikacin (10) tobramycin (11) imipenem (12) Cefotaxime were tested depending on the organism isolated.

The sensitivity pattern showed varied sensitivity to the antibiotics tested like, vancomycin showing 100% sensitivity to gram positive organisms and Bacillus spp, Levofloxacin & ceftazidime and Amikacin showing good sensitivity to other organisms. This is in consistent with a previous study by N. Wang, *et al.* [73], and M Kernt. A Kampik *et al.* [74].

## CONCLUSION

Endophthalmitis is one of the most serious and worst devastating functional outcomes after ocular surgery or trauma and in people with systemic infections. Treatment of endophthalmitis remains challenging and to improve patient visual prognosis and to ensure better quality of life and socioeconomic reestablishment rapid early and accurate diagnosis is essential along with appropriate and early treatment. Following and adhering to the standard surgical protocols and prophylaxis guidelines before performing intraocular surgeries can bring down the rate of exogenous endophthalmitis in post-operative patients intravitreal antimicrobial drug application achieves the high intraocular substance levels needed for effective endophthalmitis treatment. Strict guidelines should be adhered to, while managing endophthalmitis, by following the standard dosage, accurately dispensing and delivering intravitreal antibiotics.

The third- and fourth-generation fluoroquinolones, such as levofloxacin and moxifloxacin, showed a high percentage of sensitivity to several of the bacteria. Our present sensitivity data for antibiotics will help clinician in choice of antibiotics for endophthalmitis.

Most cases of endogenous endophthalmitis, where the primary focus of infection is outside the eye, require systemic antimicrobial therapy. Supplementary intravitreal drug application and vitrectomy may be supportive.

In fungal endophthalmitis, vitrectomy and intravitreal amphotericin B are indicated in case of severe vitreous involvement. Recent advances in therapy using antimycotic drugs, including the second-generation triazole agent voriconazole and the echinocandin caspofungin, may offer new treatment options to manage fungal endophthalmitis, but these drugs need further evaluation.

Good vitreous specimen collection and accurate culture techniques will increase the recovery rate of causative microorganisms and play a major role in treating the cases. Modern diagnostic techniques such as real-time polymerase chain reaction (RT-PCR) have been reported to provide improved diagnostic results over traditional culture techniques and may have a more expanded role in the future.

While the role of povidone-iodine in prophylaxis of postoperative endophthalmitis is established, there remains controversy with regard to the effectiveness of other measures, including prophylactic antibiotics. Due to its broad-spectrum properties, moxifloxacin is one of the most promising candidates in endophthalmitis prophylaxis as an intracameral adjunct during cataract surgery. The role of which should be further investigated and clarified

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