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CONTACT LENS INFECTIONS – A MICROBIOLOGICAL SURVEY AND STUDY

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ABSTRACT: The present study is made on contact lens infections. Corneal washings, corneal scrapings and swabs were collected from the contact lens wearers in Visakhapatnam, Andhra Pradesh. The samples were cultured in different media. Pure cultures of the organisms were obtained by culturing them in their relevant media. The organisms were identified by performing different biochemical tests. The common isolates were *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Aspergillus, Fusarium, Candida* and *Acanthamoeba*. Out of 100 samples, only 9 samples were positive. Among them 3 samples were positive for *Staphylococcus aureus* and *Pseudomonas aeruginosa* followed by *Aspergillus* in 2 samples, *Fusarium* in 2 samples, *Candida* in 2 samples and *Acanthamoeba* in 1 sample. The commonest age group in our study was 21 to 40 years and female were more positive than males. In the present study, as very few samples positive indicates that the incidence of infections were low among the wearers of contact lenses. These samples were tested for the antibiotic susceptibility pattern invitro using Kirby Bauer method.

Keywords: Contact lens infections, micro-organisms, anti microbial activity, antibiotics

INTRODUCTION

A contact lens is a corrective, cosmetic or therapeutic lens usually placed on the cornea of the eye. About 125 million people use contact lenses worldwide (2%) including 28-38 million in the United States and 13 million in Japan. People choose to wear contact lens for various reasons. Many consider their appearance to be more attractive with contact lens than with glasses, less affected by wet weather, do not steam up, and provide a wider field of vision. Additionally they
are used to reduce the ophthalmological conditions such as keratoconus and aniseikonia which are not accurately correctable with glasses. Contact lens correct the conditions include myopia, hypermetropia, astigmatism, presbyopia and color deficiencies like red – tinted 'X- chrom'. Contact lenses are thin, curved plastic disks designed to cover the cornea of the eye. But studies show that contact lens wearers are more likely susceptible to higher rate of conjunctival infections and serious corneal infections than non–wearers.

Approximately 1 out of every 20 contact lens wearers develops a contact lens related complication each year ranging from self limiting to sight threatening which require rapid diagnosis and treatment to prevent vision loss. Problems associated with contact lens wear may affect the eyelid, the conjunctiva, various layers of the cornea and even the tear film that covers the outer surface of the eye. Common contact lens infections caused by micro- organisms are corneal infections, dry eyes, corneal ulceration, microbial keratitis, gaint papillary conjunctivitis. Corneal infection is localized corneal excavation due to hypoxia and then subsequent disruption. A corneal ulcer starts when a bacteria infects an area of breakdown in the corneal surface. The surface may breakdown forming a small corneal abrasion, due to routine lens use. It is characterized by red, painful eye with discharge and perhaps poor or reduced vision. Occasionally a white spot is observed on the cornea of the involved eye. Presence of foreign body in the eye leads to dry eyes. It is commonly reported in soft lens wearers. Microbial keratitis has become an increasingly important problem in recent years. Symptoms of the bacterial keratitis include pain, photo phobia, tearing, purulent discharge and reduced vision. Early in the course of the disease, a whitish to yellow stromal infiltrate develops and this progresses to stromal and epithelial oedema, anterior chamber reaction, hypopyon and eventually stromal necrosis. Often Gram negative bacteria induce an immune precipitate (Wessely Ring) to form around the nidus of infection. Fungal keratitis in conjunction with contact lens usage is rare and largely restricted to those with diabetes or immuno compromise or who are being treated with steroids. *Candida, Fusarium* and *Aspergillus* are the most commonly isolated organisms. In *Acanthamoeba* keratitis, amoeba attacks the corneal surface and stroma of the eye. Infection occurs as the result of corneal trauma or more commonly because of poor hygiene in care of contact lens, particularly the extended wear variety. Giant papullary conjunctivitis is a type of allergic reaction typically due to protein deposits on contact lenses. It is characterized by a series of visible white clumps, nodules or giant papillae usually on the underside of the upper eyelid. Some times the use of contact lenses leads to the development of allergies Type–I hypersensitivity. The common immunogens include thiomersal, chlorhexidine, chlorobutanol, papain, PMMA, HEMA (contact lens material).

Many researchers have carried out analyzing studies with respect to various clinical samples of contact lens infections to study the incidence of various pathogens. Robert Cykiert and Steve Chesterman(2006) reported 34 cases of *Fusarium* keratitis with 5 cases occurred during 1982-1992 and concluded that the people who wear soft lenses is at risk of *Fusarium* Keratitis. A study performed by Jayahar Bharathi et al (2007) during the year 1999-2002 found that the culturing of corneal scrapings from 35 patients shows positive for the growth of Gram negative bacilli especially *Pseudomonas aeruginosa.*. Charlotte E Joslin et al (2006) characterized 40 cases of *Acanthamoeba* keratitis outbreak and analyzed the geographical distribution within the Chicago area during the year 2003-2005. A work reviewed during 2004-2005 by Alfonso etal (1986) showed that among 632 contact lens wearers, 79 cases of non-bacterial isolates were found. Out of which 74.7% were fungal isolates and 25.3% were *Acanthamoeba* isolates. The study also concluded the fact that non-bacterial contact lens related keratitis was increased during this period. In the year 2005-2006, an extensive survey which was performed by the CDC (Centre for Disease Control) had revealed that 2% soft contact lens wearers were prone to *Fusarium* keratitis out of 21 cases. In this study, different corneal samples have been examined to study the incident rate of corneal infection.

MATERIAL AND METHODS

Collection of material:

The samples were collected from the contact lens wearers. Local anesthetic eye drops were given to the affected eye to minimize ocular discomfort and facilitate the corneal scraping procedure. A sterile needle was used to collect the corneal scrape. The collected material was plated on the growth media and different staining procedures were performed.

Methods

In the present study various common micro organisms causing contact lens infections are isolated from the samples collected from the residents of Visakhapatnam. These samples were processed by using microbial techniques. These isolates from such specimens formed study material. These isolates were identified by microscopy, culture methods and biochemical tests.

Microscopic examination:

The microscopic examination of the samples was made by Gram's staining and Giemsa's staining.

Culture methods

The culture of pathogens enables colonies of pure growth to be isolated for identification. The specimen is streaked on the culture plates of nutrient agar, mannitol salt agar, blood agar, mac conkey agar or growing in liquid broth (PYG Broth) and incubated at 37^0C for 24 hrs. The colony size, shape, margin, any pigmentation, whether the colony surface is dry or mucoid, whether growth from blood agar showed any haemolysis is noted.

Bio-chemical tests

Following culture method, biochemical tests were often required to identify pathogens by using substrates and sugars to detect their enzymatic and fermentation reactions. Catalase test, oxidase test, coagulase test, sugar fermentation, IMVIC tests, hydrogen sulphide test, urease tests were performed to identify the pathogens.

Antibiotic sensitivity test:

Antibiotic sensitivity was done by modified Kirby Bauer method (Mackie and McCartney,1996). Commercially available antibiotic discs containing an antibiotic concentration range of 10-30 micro grams were taken to test sensitivity. Clarithromycin, doxycycline, imipenem, micocycline, ampicillin, cephalexin, ciprofloxacin, cefoxitin, ofloxacin, erythromycin, tetracycline, amoxycillin, gentamycin, amikacin, tobramycin, cephalosporins, tobramycin and sulfamethaxazole were used to check the antibiotic sensitivity of bacteria, *Staphylococcus aureus* and *Pseudomonas aeruginosa* [Table-3&4]. Antibiotic discs used to check the antibiotic sensitivity of fungi, *Fusarium, Candida and Aspergillus* includes ketoconazole, fluconazole, itraconazole, miconazole, terbinafine, amphotericin–B, nystatin, flucytosine and posaconazole [Table-5, 6&7]. Antibiotic discs used to check the antibiotic sensitivity of protozoa; *Acanthamoeba* is ketoconazole [Table-8].

RESULTS

About 100 different samples were collected and processed. Common pathogens causing contact lens infections were identified and isolated. The results were depicted in [Table 1-2]

Bacteria in the samples were identified by performing the following tests like Gram's staining, catalase, oxidase, hydrogen sulphide test, coagulase, indole, methyl red, voges – proskauer, citrate utilization test and urease.

Fungi in the samples were identified by performing the following tests like Gram's staining, staining with lacto phenol cotton blue, growth on SDA Medium, growth on Czapek dox agar medium and growth in human serum.

Protozoa in the samples were identified by performing the following tests like Giemsa's staining, growth on PYG medium, growth on NNA plates with *Escherichia coli.*

Table: 1 Age and sex wise distribution of patients with contact lens infection

S. No	Age	No. of Patients	Male (positive samples)	Female (positive samples)
1	0-20	2	Nil	1
2	21-40	94	1	6
3	41-60	4	1	-
4	61 & above	Nil	-	-

Table-1 shows that majority of people in the age group of 21-40 use contact lens and also more positive samples were obtained in this group. Age group of 41-60 (one uniocular ophakics using contact lens) occupies next in the present data.

Table: 2 : Percentage of organisms isolated in contact lens infection

S. No	Name of the Organism	Positive Samples	Percentage
1	*Staphylococcus*	3	3%
2	*Pseudomonas*	3	3%
3	*Candida*	2	2%
4	*Fusarium*	2	2%
5	*Aspergillus*	2	2%
6	*Acanthamoeba*	1	1%

Table-2 shows that the most predominant organism in positive samples was *Pseudomonas* with (3%) and *Staphylococcus* (3%) which was followed by *Aspergillus* (2%) *Candida* (2%) *Fusarium* (2%) and *Acanthamoeba* (1%).

Antibiotic susceptibility

About 100 samples of corneal swabs, corneal scrapings and corneal washings were collected from the contact lens wearers in Visakhapatnam. These samples were tested for the antibiotic susceptibility pattern in vitro using Kirby Bauer method. The results were tabulated in [Tabular forms 3 - 8]

Table-3: Antibiotic susceptibility of *Staphylococcus aureus* isolated from corneal sample

Antibiotic	Susceptibility
Amikacin	Sensitive
Cefoxitin	Sensitive
Clarithromycin	Sensitive
Imipenem	Intermediate
Tobramycin	Intermediate
Ciprofloxacin	Resistant
Micocycline	Resistant
Sulfamethaxazole	Resistant
Doxycycline	Resistant

Table-3 indicates that *Staphylococcus aureus* was highly sensitive to the drug Amikacin and highly resistant to Doxycycline.

Table-4:Antibiotic susceptibility for *Pseudomonas aeruginosa* isolated from corneal sample

Antibiotic	Susceptibility
Ciprofloxacin	Sensitive
Gentamycin	Sensitive
Amoxycillin	Intermediate
Erythromycin	Intermediate
Ampicillin	Intermediate
Tetracycline	Intermediate
Amikacin	Intermediate
Ofloxacin	Intermediate
Cephalexin	Resistant

Table-4 indicates that *Pseudomonas aeruginosa* was highly sensitive to the drug Ciprofloxacin and highly resistant to Cephalexin.

Table-5: Antibiotic susceptibility of *Candida* isolated from corneal sample

Antibiotic	Susceptibility
Amphotericin –B	Sensitive
Fluconazole	Sensitive
Ketoconazole	Sensitive
Nystatin	Sensitive

Table-5 indicates that *Candida* was highly sensitive to the drug Amphotericin –B.

Table-6: Antibiotic susceptibility of *Fusarium* isolated from corneal sample

Antibiotic	Susceptibility
Fluconazole	Sensitive
Amphotericin-B	Sensitive
Terbinafine	Sensitive
Flucytosine	Intermediate
Ketoconazole	Intermediate
Miconazole	Intermediate
Itraconazole	Intermediate
Posaconazole	Resistant

Table-6 indicates that *Fusarium* was highly sensitive to the drug Fluconazole and resistant to Posaconazole

Table-7: Antibiotic susceptibility of *Aspergillus* isolated from corneal sample

Antibiotic	Susceptibility
Ketoconazole	Sensitive
Fluconazole	Sensitive
itraconazole	Sensitive

Table-7 indicates that *Aspergillus* was highly sensitive to the drug Ketoconazole

Table-8: Antibiotic susceptibility of *Acanthamoeba* isolated from corneal sample

Antibiotic	Susceptibility
Ketoconazole	Sensitive

Table-8 shows that *Acanthamoeba* was sensitive only to Ketoconazole

DISCUSSION

In the present study, about 100 samples from people wearing contact lens were collected. The commonest age group in our study was 21 to 40 years and female were more positive than males [Table-1]. The samples were cultured in different media. Pure cultures of the organisms were obtained by culturing them in their relevant media. The microorganisms were identified by performing different biochemical tests. The common isolates were *Pseudomonas aeruginosa, Staphylococcus aureus, Aspergillus, Fusarium, Candida, Acanthamoeba*. Out of 100 samples, only 9 samples were positive, among them 3 samples were positive for *Staphylococcus aureus* and *Pseudomonas aeruginosa*, followed by *Aspergillus* in 2 samples, *Fusarium* in 2 samples, *Candida* in 2 samples and *Acanthamoeba* in 1 sample [Table-2].

These samples were treated for antibiotic susceptibility pattern in-vitro using Kirby Bauer method and the results are as follows. The antibiotic susceptibility of *Staphylococcus aureus* [Table-3] shows that it was sensitive to Amikacin, Cefoxitin and Clarithromycin. The antibiotic susceptibility of *Pseudomonas aeruginosa* [Table-4] shows that it was sensitive to Ciprofloxacin and Gentamycin. The antibiotic susceptibility of *Candida* [Table-5] shows that it was sensitive to Amphotericin-B, Fluconazole, Ketoconazole, Nystatin. The antibiotic susceptibility of *Fusarium* [Table-6] shows that it was sensitive to Fluconazole, Amphotericin-B, Terbinafine. The antibiotic susceptibility of *Aspergillus* [Table-7] shows that it was sensitive to Ketoconazole, Fluconazole, Itraconazole.The antibiotic susceptibility of *Acanthamoeba* [Table-8] shows that it was sensitive to Ketoconazole.

Treatment of dry eyes includes installation of artificial tears over the lens 3-8 times per day. Giant papillary conjunctivitis is one type of allergic manifestation and is treated by substituting other type of plastic for the preparation of contact lens. Symptomatic treatment can be given with local cortisone drops. Keratitis treatment includes local atropine 1% antibiotic drops & by using dark glasses. The treatment also involves cleaning of lenses with surfactants like clerz or pliagel, enzymatic treatment, sokage of lenses in hydrogen peroxide for 10 minutes. Corneal infection also results if the people have any infection in the body can settle in the eye. Patients with bed sore, urinary or faecal incontinence can easily pass on infection to the eye. In such cases contact lenses should not be used. Fungus growth is usually due to lack of disinfection of a duplicate pair. Disinfection by boiling or by using chemicals like chlorhexidine, thiomersal, hypochlorites, quaternary ammonium compounds, hydrogen peroxide, benzalkonium chloride and ascorbic acid should be done every day. The treatment of bacterial keratitis includes topical application of an aminoglycoside tobramycin (14mg/ml) together with a broad spectrum cephalosporin (eg: cefazolin 50 mg /ml). Ciprofloxacin 0.3% and ofloxacin 0.3% may be as effective as the combination if the organism were susceptible. The treatment of fungal keratitis includes topical natamycin (pimafucin) for six weeks or longer. This may be combined with oral ketoconazole, fluconazole or itraconazole and sub conjunctival injections of fluconazole may be appropriate in some cases. For *Acanthamoeba* treatment, the traditional therapy of topical propamidine, neomycin, miconazole, clotimazole and oral ketoconazole is being replaced with topical application of 0.02% poly hexamethylene biguanide every 1-2 hrs until clinical improvement (1-2 weeks) and then gradual reduction to 4 times a day. The treatment continued for a month until the inflammation has resolved. Corticosteroids are especially used for the treatment of giant papillary conjunctivitis.

The present study is pertained to the natives of Visakhapatnam which indicates that the incidence of corneal infections were low among the wearers of contact lenses. Most of the contact lenses were used by the educated people, so they maintain the lenses under good hygienic conditions.

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