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Study of pathogenic bacterial attack in post-operative cataract surgery

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Abstract
Blindness is a major public health problem throughout the world. Cataract is a leading cause of blindness worldwide, accounting for nearly half of all blindness globally. Post-operative surgical infection represents an uncommon but potentially devastating complication of cataract surgery. In present study the pathogenic bacteria have isolated in post operative cataract surgery and also derived sensitivity and resistance pattern with various antibiotics and herbal extracts.

Keywords: Cataract surgery, pathogenic bacteria, antibiotic and herbal extracts

Introduction

Blindness is a major public health problem throughout the world. According to WHO, it is estimated that 45 million of blind cases in the world from which 5.4 million are in India. National program for a control of blindness (NPCB) society has been formed on 20th April, 2002 and there is proposal to upgrade all district hospital, where modern eye facilities will be provide. India was first country to launch a National Program for Control of Blindness in 1976. Gujarat s committed to reduce the burden of avoidable needless blindness by year 2020, adopting the strategy advocated for VISION 2020- "The Right to Sight" with the aim" To intensify an accelerate present prevention of blindness activities so as to achieve the goal of eliminating avoidable blindness' by the year 2020". (NPCB data, 12th plan 2012-2017) [11]

Cataract is a clouding of the lens in the eye that affects vision. When the normally clear lens within our eye becomes cloudy and opaque it is called as "cataract". Cloudiness to large opaque area that causes a noticeable vision loss. Most cataracts are related to aging. Cataracts are very common in older people. By age 80, more than of half of all American either have a cataract. (Allen *et al*, 2006) [2]

Cataract is a leading cause of blindness worldwide, accounting for nearly half of all blindness globally. According to the World Health Organization (WHO), nearly 20 million people worldwide suffer from poor visual acuity, of 3/60 or less, due to cataracts. These numbers are estimated to rise to 40 million by the end of 2020 (Mandal Dr Anaya, 2014) [10].

Post-operative surgical infection represents an uncommon but potentially devastating complication of cataract surgery. In the past several decades, cataract surgery has made major advances with the introduction of small-incision phacoemulsification, viscoelastic substances, and improved lens designs, as well as refinement of surgical techniques. As a result, postoperative care has become simpler and visual recovery has become much faster. Due to these factors, the incidence of post-operative infectious complications has also generally declined. In fact, the incidence of post-operative endophthalmitis has decreased since the mid-1900s from 0.5% to 0.04%-0.41% in the early 21st century. In the past decade, however, these rates appear to have increased due to the greater use of clear corneal incision techniques. As such, it is fundamentally important for the cataract surgeon to be familiar with recognition, etiology, and management of post-operative endophhthalmitis (Kattan *et al.,* 1991, Baseer U. Ahmad *et al*., 2009) [9, 1]

Pathogenic microorganisms cause diseases to the eyes due to their virulence and host's reduced resistance from many factors such as personal hygiene, living conditions, socio-economic status, nutrition, genetics, physiology, fever and age. The areas in the eye that are frequently infected are the conjunctiva and cornea. *Staphylococci* have a special relationship with the eye. They cause severe eye infections which may result in irreversible blindness (Jain and Kamble, 2017) [8]. Bacteria are also responsible for infection after cataract surgery like *Staphylococcus aureus, Escherichia coli, Klebsiella Pneumoniae, Proteus vulgaris, Pseudomonas aeruginosa.*

The common bacterial isolates and their antibiotics susceptibility were studied in 298 bacterial eye infected cases, consisting of 35 blepharitis, 208 conjunctivitis and 55 keratitis. The results yielded 333 bacterial isolates with the implicated bacteria in decreasing order of frequency as *Staphylococcus aureus* 80 (23.70%), *Pseudomonas aeruginosa* 34 (10.10%), *Streptococcus pneumoniae* 29 (8.60%), *Klebsiella pneumoniae* 18 (6.20%), *Escherichia coli* 15 (4.40%), Bacteria were isolated most on the eye infections of the conjunctiva 222 (66.70%), then the cornea 65 (20.10%), and least on the eyelids 44 (13.20%) (Ubani and Ahanna, 2009). *Pseudomonas aeruginosa* is responsible for more than 75% of invasive eye infection. The course of pseudomonal endophthalmitis is typically fulminating developing over hours even in early diagnosis. For survivors, the usual result blindness of the affected eye.

The aim of the study was to isolate & identify the pathogenic bacteria from the post-operative Cataract surgery infection. The antibiotics sensitivity and resistance pattern has been derived by using different group of antibiotics such as Moxifloxacin, Tobramycin, Ofloxacin, Vancomycin, and Ceftazidime which are used in ophthalmology hospital. The herbal therapy was also found to be effective in present study. Prompt diagnoses are needed to minimize the bacterial infection after cataract surgery. Particular attention should be given to this condition because it can progress very rapidly and complete vision loss can be occur within 15-20 days.

Material and Methods

In assessment to isolate and identify the pathogenic bacteria from the post-operative cataract surgery infection and study their susceptibility and resistance pattern with various antibiotics, present work was under taken.

Collection of samples

A total 33 sample were collected during period of one year from different Ophthalmology hospitals of Akola District such as civil hospital, Patil hospital, Thorat ophthalmology hospital, Dammani hospital. Samples were collected in sterile container containing nutrient broth and transferred immediately to laboratory for further processing.

Isolation and Identification

After incubation loopful of each enriched culture was streaked on CLED agar and Nutrient agar were incubated at 37°C for 24 hours. Colonies with different morphological characters and gram's characters were selected and inoculated on respective selective media viz. cetrimide agar and Pseudomonas isolation agar, Macconkey agar, mannitol salt agar, EMB agar.

Studies on antibiotic sensitivity and resistance pattern

After identification the isolates were subjected to antibiotic sensitivity test by adapting Disc Diffusion Technique. (Kirby-Bauer *et al.,* 1996, CLSI 2007) [3, 6]

The Antibiotics were used: Moxifloxacin (10mcg), Tobramycin (10mcg), Ofloxacin (5mcg), Vancomycin (30mcg), and Ceftazidime (30mcg).

Preparation of Herbal extracts

Extraction methods allow to obtained products in pharmaceutical forms suitable for oral or external dosage according to the place of action recommended. This preparation is known as "Decoctions". In this process, the crude drug is boiled in a specific volume of water for defned time: it is then cooled and strained or filtered. The starting ratio of crude drug to water is fixed e.g. 1:4 or 1:16. The volume is then brought down to one-fourth its origin volume by boiling during the extraction procedure. Then, the concentrated extracts are filtered and used as such or processed further.

Sr. No.	Scientific name	Comman name	Plant part
1.	*Emblica officinalis*	Aamla	Leaf
2.	*Ricinus communis*	Castor plant	Leaf

Infrared Spectroscopy

IR Spectroscopy involves the interaction of infrared radiation with matter. It covers a range of techniques, mostly base on absorption spectroscopy. It can be used to identify and study chemical.

Result and Discussion

Table 1: Patients detail with age group including both sex

Sr. No.	Age group	Sex	
		Male	Female
1.	0-10	1	0
2.	10-20	0	0
3.	20-30	0	0
4.	30-40	1	1
5.	40-50	2	1
6.	50-60	5	7
7.	60-70	6	4
8.	70-80	3	1
	Total	18	14

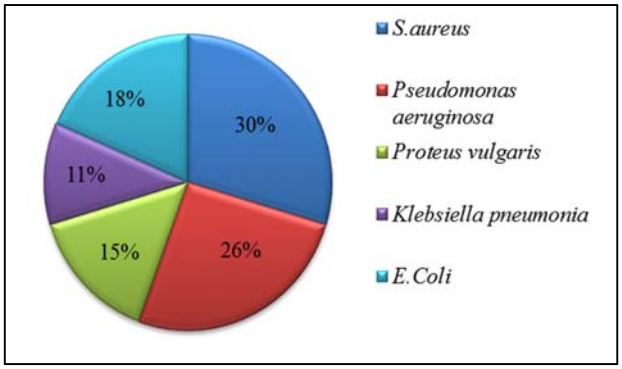

Fig 1: Frequency distribution of the isolates

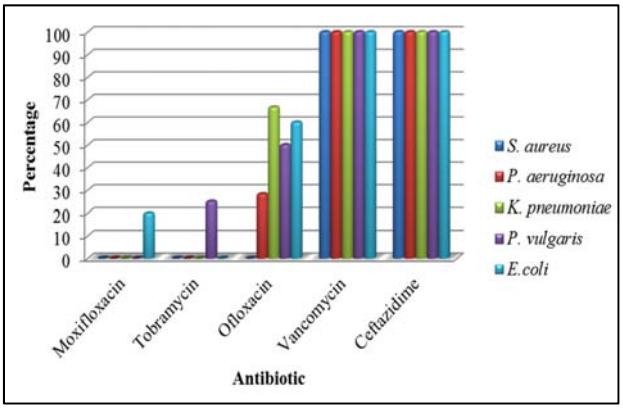

Fig 2: Antibiotic resistance pattern of different pathogen from after cataract surgery infection.

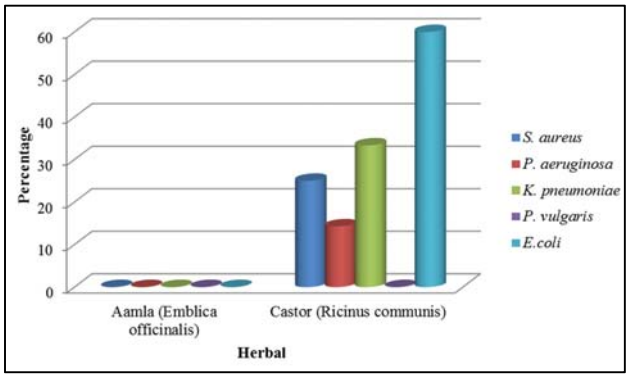

Fig 3: Herbal resistant pattern of different pathogen after cataract surgery infection

Discussion

Eye is a wonder gift of god to man, It is a priceless gift but man can't understand it, it is a part of our body and it is a very important, so we have no eyes we can't see anything.

Blindness is a major public health problem through in the world. 45 million of blind people in the world out of which, 5.4 million of blind people are in India. India was first country to launch a National Program for Control of Blindness in 1976. Gujarat s committed to reduce the burden of avoidable needless blindness by year 2020, adopting the strategy advocated for VISION 2020- "The Right to Sight" with the aim" (NPCB data, 12th plan 2012-2017) [11]

Cataract is a clouding of the lens in the eye that affects vision. When the normally clear lens within our eye, become cloudy and opaque it is called as "cataract". The lens is the clear part of the eye that helps to focus light or an image, on the retina.

In present study 32 samples were collected from the different Ophthalmology hospital of akola such as Government Medical Collage, Patil Hospital, Thorat Ophthalmology hospital, Dammani hospital from Akola. The patients were belonging to both sex groups, varying from 10 to 80 years of age from rural and urban areas. Highest infection was found to be in the patients belonging to the age group of 50-70 years. Female people were noted to be at an increased risk of corneal ulcers as compare to male.

Out of total 32 Sample, 21 samples found to be positive with bacterial infection & 11 found to be negative. A total 27 different isolates have been found. As per the frequency distribution chart we have found *Staphylococcus aureus* 29.62%, *Pseudomonas aeruginosa* 25.92%, *Proteus vulgaris* 14.81%, *Klebsiella pneumonia* 11.11%, and *Escherichia coli* 18.51%. (Fig. 1)

The ideal ophthalmic anti-infective exhibits broad- spectrum activity against gram-positive, gram-negative, and atypical bacterial species. These pathogens can cause potentially blinding infection such as keratitis and endophthalmiitis, both of which are associated with ophthalmic surgery or traumatic injury. These infections often require aggressive antibacterial therapy, preferably with newer generation of antibiotics.

All the isolates were showing 100% resistance against Vancomycin and Ceftazidime. Moxifloxacin and Tobramycin showed 75% to 100% sensitivity against all pathogenic bacteria. Ofloxacin was 100% effective on *Staphylococcus aureus,* while 30% to 70% resistant against *Pseudomonas aeruginosa, Klebsiella pneumonia, Proteus vulgaris* and *Escherichia coli.* (Fig. 2)

Gulshan Rashna *et al.,* in 2013 observed antibacterial activity of Vancomycin. These antibiotics showed higher antibacterial activity against gram-positive and gram-negative bacteria but in our study, we have found 100% resistance against Vancomycin. Moxifloxacin demonstrated a broad spectrum activity against several key ocular pathogen tested by Callegun M C *et al.,* in 2003 [5].

Tobramycin is a new aminoglycoside antibiotic with a broad antibacterial spectrum. Brogden *et al.,* in 1976 have found that Tobramycin has found more active against *Staphylococcus aureus* and *Pseudomonas aeruginosa* at low concentration. Our study is according to the above said works.

Natural treatment can also promote healthy vision, strengthen blood capillaries in the eye and prevent eye sensitivity without doing further harm. Decoction method allows obtaining product in pharmaceutical forms suitable for oral or external dosage according to the place of action recommended.

Infrared spectroscopy involved the interaction of infrared radiation with matter. It covers a range of techniques mostly based on absorption spectroscopy. It can be used to identify and study chemicals. In presence study the solid dry sample was taken. A basic IR spectrum is essentially a graph of infrared light absorbance (or transmittance) on the vertical axis vs. frequency of wavelength on the horizontal axis.

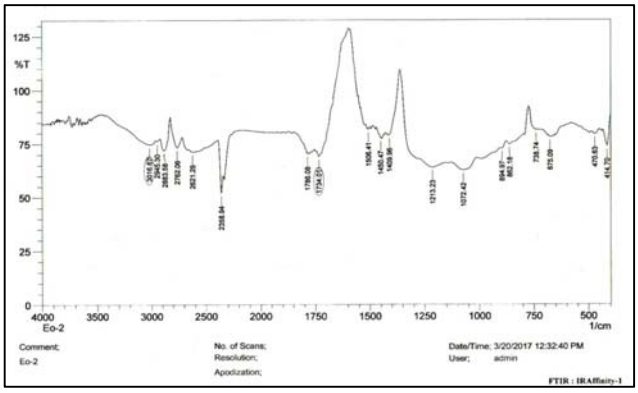

Fig 4: FT-IR Spectra of *Emblica officinalis*

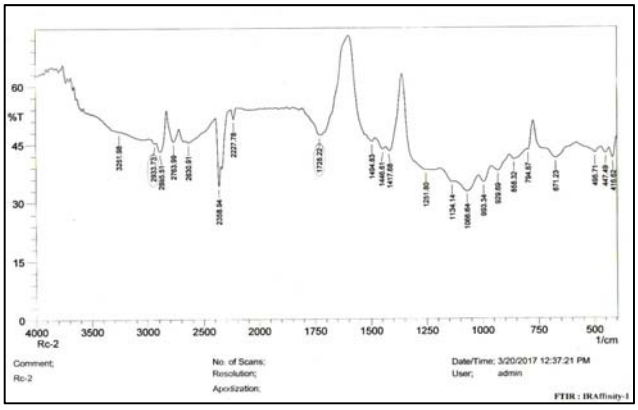

Fig 5: FT-IR Spectra of *Ricinus communis*

FT-IR Spectroscopy was performed to obtain the finger prints of *Emblica officinalis* and *Ricinus communis* (Fig. 4 and 5). In the IR-Spectra of *Emblica officinalis* it was found that leaves extract showed the relative peak intensities of 3016 cm^{-1} and 1724 cm^{-1}. Broad signals 3016 cm^{-1} indicate the presence of O-H, 1734 cm^{-1} indicate the presence of C=O group. These two ranges indicate the presence of Ascorbic acid, Gallic acid and Ellagic acid. In the IR spectra of *Ricinus communis* it was

found that leaf extract showed the relative peak intensities of 2933 cm^{-1} and 1728 cm^{-1}. The ranges indicate the presence of Ricinoleic acid. The result of the herbal study showed the leaves extract of *Emblica officinalis* and *Ricinus communis* indicate the presence of effective antimicrobial activity which can be used against bacterial infection after cataract surgery.

In presence study the herbal compound such as *Emblica officinalis* leaf extract and *Ricinus communis* leaf extract used against *S. aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus vulgaris* and *Escherichia coli.* The sensitivity and resistance pattern of isolates against leaf extracts was observed. All the isolates showed 0.00% resistance against *Emblica officinalis* extracts. For *Ricinus communis* extracts *S. aureus* showed 25%,, *Pseudomonas aeruginosa was* 14.28%, *Klebsiella pneumonia* was 33.33%, *Proteus vulgaris* was 0.00%, *Escherichia coli* was 60% resistance. (Fig. 3)

In 2012, Parminder Nain *et al.,* suggested *Emblica officinalis* (Aamla) has been considered the best of the ayurvedic rejuvanative herbs, because it is tridosaghna. The aim of their study was to investigate antimicrobial activity. Leaves extract of *Emblica officinalis* evaluated for its antimicrobial activity by using agar well diffusion method. The extract exhibited antibacterial activity with zone of inhibition. The organisms were sensitive to extract of the *Emblica officinalis* leaves extracts, and could be considered as a potential source of natural antimicrobial.

Conclusion

Cataract is a leading cause of blindness nearly half of all blindness globally. Post-operative surgical infections represent an uncommon but potentially divesting complication. These infections often required aggressive antibacterial therapy, preferably with newer generations of antibiotics. It has been generalized that failed to antibiotic treatment is due to genetic alteration in common pathogen. In present study Moxyfloxacin, Tobramycin, Ofloxacin war found to be higher affectivity. *Emblica officinalis* leaf extract had shown effective antibacterial activity which can also be used as alternative therapy as a herbal treatment. Particular attention should be given to these condition because it can progress very rapidly and complete vision loss can appear within 15 days, so prompt diagnosis and effective antibiotic treatment.

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