Section: Ophthalmology

Research

TRENDS OF ANTIBIOTIC RESISTANCE IN BACTERIAL FLORA IN CASES OF BACTERIAL KERATITIS IN A TERTIARY EYE CARE CENTER

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Abstract

Background: Bacterial keratitis is a major cause of blindness with growing concerns regarding increased resistance of ocular pathogens to commonly used topical antibiotics. To study bacterial profile of eye with keratitis and to determine antibiotic resistance pattern in bacterial flora in cases of bacterial keratitis. **Materials and Methods:** It is a cross-sectional observational study is to be done in 200 patients with unilateral keratitis attending OPD at Sarojini Devi eye hospital, Hyderabad during a period of 18 months after obtaining their consent. **Result:** Overall gram-positive organisms were most susceptible to fourth- generation fluoroquinolones like gatifloxacin, moxifloxacin. Hence they are recommended therapy in gram-positive organisms. Among gram-negative bacteria, Pseudomonas was predominant followed by Escherichia coli. There was increased susceptibility of gram-negative bacteria to tobramycin, gentamicin, ceftazidime, gatifloxacin, moxifloxacin there was increased resistance to ciprofloxacin, ofloxacin and chloramphenicol. **Conclusion:** Fourth-generation fluoroquinolones are recommended as empirical monotherapy for bacterial keratitis mainly moxifloxacin.

INTRODUCTION

Blindness continues to be one of the major public health problem in developing countries. According to the world health organization, corneal opacity is among the major causes of vision impairment in the world today. Scarring of the cornea as a result of infective keratitis has been reported as an important cause of preventable blindness in many studies. Globally it is estimated that ocular trauma and corneal ulceration result in 1.2 to 2 million new cases of corneal blindness annually. Causes of blindness worldwide lists corneal scarring second only to cataract as the major etiology of blindness and visual disability in many of the developing nations in Asia, Africa and the Middle east. The incidence of microbial keratitis 2.5 to 799 per 1 lakh population.[1] Corneal blindness is a major problem in India as it adds a substantial burden to the community in general and health care resources and further. Individuals of corneal blindness are usually of younger age group compared with those suffering of cataract. Hence the impact of corneal blindness is greater in terms of total blind years. According to the World Health Organization, corneal diseases are among the major causes of vision loss and blindness in the world today, after cataract and glaucoma. In India, it is estimated that there are approximately 6.8 million people who have vision less than 6/60 in at least one eye due to corneal diseases; of these, about a million have bilateral involvement.[2,3]

According to the National Programme for Control of Blindness (NPCB) estimates, there are currently 120,000 corneal blind persons in the country. According to this estimate there is addition of 25,000-30,000 corneal blindness cases every year in the country. The burden of corneal disease in our country is reflected by the fact that 90% of the global cases of ocular trauma and corneal ulceration leading to corneal blindness occur in developing countries.[4]

Microbial keratitis is an infection of the cornea. Corneal opacities, which are frequently due to microbial keratitis, remain among the top five causes of blindness worldwide. Microbial keratitis

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disproportionately affects low- and middle-income countries. Studies indicate that the incidence of microbial keratitis may be up to 10 times higher in countries like Nepal and India compared to the United States. Many cases with corneal ulceration end up with corneal blindness or still disastrous outcome such as corneal perforation, endophthalmitis, phthisis bulbi. About 60 to 70% of corneal scar or adherent leucoma are result of neglected or improperly treated corneal ulcers. Thus corneal blindness is a major public health problem and status is expected to increase.

Treatment for corneal infections is based on appropriate antimicrobial therapy, which requires knowledge of the local antimicrobial susceptibility patterns of various antibiotics. Since microbial resistance patterns can vary by year and geographical region, local annual surveys are important in guiding the empiric treatment of bacterial keratitis. This increased antibiotic consumption may have selected for resistant strains of bacteria, and therefore changed the susceptibility profile. Despite the burden of corneal ulcers in India, recent surveillance data from the Indian subcontinent is lacking. In this study, we investigate for trends in antimicrobial resistance in corneal ulcers seen at Sarojini Devi Eye Hospital in Hyderabad.

MATERIALS AND METHODS

It is a cross-sectional observational study in 18 months duration in 200 patients attending opd at sarojini devi eye hospital

Inclusion Criteria

All cases of bacterial keratitis.

Exclusion Criteria

Patients with fungal and viral keratitis patients with any other ocular infections ethical clearance was obtained before the commencement of the study, approval was obtained from the Institutional Ethics committee. Informed consent was obtained from all the patients who satisfied the inclusion criteria.

Study is to be done in 200 patients with unilateral keratitis attending OPD at Sarojini Devi eye hospital, Hyderabad during a period of 18 months after obtaining their consent. History and clinical examination: A Questionnaire designed as per study objectives and local needs was used to record necessary information like sociodemographic profile and clinical history through interviews. Visual acuity of each subject was recorded at the time of presentation using snellens chart or E chart.

Slit-lamp biomicroscope was used to examine the corneal ulcer. Ulcer margin, thinning of floor, satellite lesions, and retained foreign body and pigmentation over the ulcer surface were recorded. Hypopyon if present was measured in millimetres. Corneal sensations were checked with a cotton whisp and Schirmers test was performed to check lacrimation of the patient. After instilling a drop of proparacaine 0.5%, ulcer was stained using sterile sodium fluorescein strips. Size of the ulcer was measured using variable slit on slit lamp and recorded in millimetres. Diagram of each ulcer was drawn in a standard method by performing frontal and cross-sectional sketches.

In the case of bacterial keratitis specimens are sampled under aseptic conditions by using a slit lamp or operating microscope by scraping the edges and base of the ulcerated part. Eyelids and conjunctival sac will be cleaned and procaine eye drops will be instilled. Scraping is taken from edge and base of corneal lesion under slit lamp or operating microscope by using surgical blade. Smears will be made on glass slide and marked with wax pencil on the reverse side and grams staining will be done. BHI broth is inoculated by agitating the spatula directly in the broth.

A clean grease free slide is taken and swabs obtained will be smeared on the slide.

The slide will be air dried and heat fixed. Gram staining will be performed and examined under microscope for the presence of pus cells and organisms. Specimens obtained will be inoculated on Mac conkey agar plate, 5% sheep blood agar plate, chocolate agar plate and incubated aerobically for 18-24hrs and then observed the next day. After 24 hrs of incubation, the culture plates were observed for growth, morphology of colonies and were subjected to gram staining. If gram staining shows gram positive cocci -catalase test, coagulase test, other standard biochemical reactions and tests were done.

If gram staining shows gram negative bacilli catalase test, oxidase test, motility by hanging drop method and other standard biochemical tests are performed. If there was no growth at 24hrs, the plates were further incubated for further 24 hrs. If no growth was observed after 48 hrs of incubation the culture was considered as negative for aerobic bacterial growth

All the bacterial isolates obtained were subjected to antimicrobial susceptibility testing by using Kirby Bauer disc diffusion method For bacterial identification, colony characteristics will be identified by observing the plates, gram staining will be done and appropriate biochemical reactions will be performed Bacteria were identified by a combination of tests as Growth rate, Colonial morphology features, Microscopic morphologic features and biochemical methods.

The commonly performed biochemical reactions will be oxidase test, catalase test, slide coagulase test, tube coagulase test, motility test, indole test, citrate utilization test, urea hydrolysis test, triple sugar iron test, sugar fermentation test.

Laboratory criteria for definitive infection include Growth on two or more media, Growth on at least one medium of the same organisms identified on the smear and Confluent growth at the inoculation sites on at least one solid medium.

Four to five colonies were selected from the agar plate and with the help of a bacteriological loop the

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colonies were inoculated into peptone water and incubated for 4-5 hrs to achieve turbidity. This is prepared by adding 0.5 ml of 1% anhydrous Bacl2 to 99.5ml of 1% H2SO4 in a test tube this is sealed and kept in the refrigerator. The Mueller Hinton agar was streaked using a sterile cotton swab that has been submerged in the bacterial suspension. The surface of the plate was swabbed in three directions to even distribution of the inoculum over the entire plate. Within 15 minutes of inoculation, the antibiotics discs were placed and the plates were incubated at 35 degrees C for 24 hrs. After overnight incubation, the degree of sensitivity was determined by measuring the zones of inhibition of growth around the disc. The results were interpreted by using CLSI guidelines. Zone diameters were measured and considered as resistant and sensitive forms

Ocular Examination

A. Best corrected Visual acuity RE-CF 1⁄2 METRE, LE-6/6) sensitivity pattern- sensitive to ciprofloxacin, chloramphenicol, moxifloxacin, cefoxitime, gentamicin, tobramycin, gatifloxacin, ofloxacin, cefotaxime.

RESULTS

Bacterial keratitis is one of the predominant cause of blindness and ocular morbidity in developing countries. In south India the incidence of corneal ulceration is ten times higher (11.3 per 10,000) than in comparable population in the USA.A prospective cross-sectional study was carried out at Sarojini Devi eye hospital, Hyderabad to study the bacterial flora in bacterial keratitis and trends of antibiotic resistance in bacterial keratitis.

200 patients who fulfilled the criteria of inclusion criteria were undertaken for the study.

Table 1: Distribution of patients according

Sex	Frequency	Percent
Female	71	35.5
Male	129	64.5
Total	200	100.0
Age intervals in years		
1 to 10	3	1.5
11 to 20	9	4.5
21 to 30	15	7.5
31 to 40	28	14.0
41 to 50	41	20.5
51 to 60	76	38.0
61 to 70	21	10.5
71 to 80	7	3.5
Etiology		
Contact Lens	3	1.5
Surface Diseases	11	5.5
Trauma	186	93.0
Symptoms		
Pain	137	68.5
Redness	177	88.5
Watering	181	90.5
DOV	160	80.0
Foreign body sensation	200	100.0
Photophobia	140	70.0
Laterality		
Bilateral	7	3.5
Unilateral	193	96.5
Eye		
Right eye	143	71.5
Left eye	57	28.5
Gram		
Positive	185	92.5
Negative	15	7.5

Among 200 patients included in our study,129 were males (64.5%), 71 were females (35.5%) with male to female ratio of (1.8:1) showing male preponderance. In our study mean age of presentation in our study was 48.52 years. The highest incidence was seen between the fourth and sixth decades of life. A greater number of patients (90%) had complaints of redness, watering, and foreign body sensation.

Gram-positive isolates were 185 (92.5%) and Gram-negative were 15(7.5%)

Table 2: Demonstrates the probability of antibiotic in bacterial keratitis

		Resistant		Sensitive	Total
Cefoxitin	Positive	Count	79	106	185
		%	42.7%	57.3%	100.0%
	Negative	Count	6	9	15
		%	40.0%	60.0%	100.0%

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Total		Count	85	115	200
		%	42.5%	57.5%	100.0%
Chi Square = 0.041, P Value = 0.839 (Ns)					
Chloramphenicol	Positive	Count	41	144	185
		%	22.2%	77.8%	100.0%
	Negative	Count	5	10	15
		%	33.3%	66.7%	100.0%
Total		Count	46	154	200
		%	23.0%	77.0%	100.0%
Chi Square = 0.041, P Value = 0.839 (Ns)					
Cefotaxime	Positive	Count	75	110	185
		%	40.5%	59.5%	100.0%
	Negative	Count	0	15	15
		%	0.0%	100.0%	100.0%
Total		Count	75	125	200
		%	37.5%	62.5%	100.0%
Chi Square = 0.978, P Value = 0.323 (Ns)					
Ciprofloxacin	Positive	Count	75	110	185
		%	40.5%	59.5%	100.0%
	Negative	Count	0	15	15
		%	0.0%	100.0%	100.0%
Total		Count	75	125	200
		%	37.5%	62.5%	100.0%
Chi Square = 9.730, P Value = 0.002 (S)					
Ofloxacin	Positive	Count	72	113	185
		%	38.9%	61.1%	100.0%
	Negative	Count	11	4	15
		%	73.3%	26.7%	100.0%
Total		Count	83	117	200
		%	41.5%	58.5%	100.0%
Chi Square = 1.221, P Value = 0.269 (Ns)					
Gentamicin	Positive	Count	14	171	185
		%	7.6%	92.4%	100.0%
	Negative	Count	0	15	15
		%	0.0%	100.0%	100.0%
Total		Count	14	186	200
		%	7.0%	93.0%	100.0%
Chi Square = 1.221, P Value = 0.269 (Ns)					
Moxifloxacin	Positive	Count	11	174	185
		%	5.9%	94.1%	100.0%
	Negative	Count	0	15	15
		%	0.0%	100.0%	100.0%
Total		Count	11	189	200
		%	5.5%	94.5%	100.0%
Chi Square = 0.944, P Value = 0.331 (Ns)					
Tobramycin	Positive	Count	7	178	185
		%	3.8%	96.2%	100.0%
	Negative	Count	3	12	15
		%	20.0%	80.0%	100.0%
Total		Count	10	190	200
		%	5.0%	95.0%	100.0%
Chi Square = 7.681, P Value = 0.006 (S)					

In our study, most of the staphylococcus aureus isolates were resistant to methicillin, fluoroquinolones, and aminoglycosides. Ofloxacin resistance was more in MRSA and MRSE.

Table 3: Distribution of sensitivity and resistance pattern of antibiotics among gram positive organisms

DRUG	Staph aureus (N=18)		Staph epidermidis (N=158)		Strep pneumoniae (N=9)	
	S	R	S	R	S	R
VANCOMYCIN	18 (100.0)	0 (0.0)	158 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)
CEFOXITIN	5 (27.8)	13 (72.2)	94 (59.5)	64 (40.5)	7 (77.8)	2 (22.2)
CHLORAMPHENIC OL	15 (83.3)	3 (16.7)	123 (77.8)	35 (22.2)	6 (66.7)	3 (33.3)
CEFOTAXIME	10 (55.6)	8 (44.4)	93 (58.9)	65 (41.1)	7 (77.8)	2 (22.2)
CIPROFLOXACIN	3 (16.7)	15 (83.3)	120 (75.9)	38 (24.1)	1 (11.1)	8 (88.9)
OFLOXACIN	3 (16.7)	15 (83.3)	109 (69.0)	49 (31.0)	1 (11.1)	8 (88.9)
GATIFLOXACIN	15 (83.3)	3 (16.7)	147 (93.0)	11 (7.0)	9 (100.0)	0 (0.0)
GENTAMYCIN	18 (100.0)	0 (0.0)	145 (91.8)	13 (8.2)	8 (88.9)	1 (11.1)
MOXIFLOXACIN	16 (88.9)	2 (11.1)	150 (94.9)	8 (5.1)	8 (88.9)	1 (11.1)
TOBRAMYCIN	17 (94.4)	1 (5.6)	153 (96.8)	5 (3.2)	8 (88.9)	1 (11.1)
NOVOBIOCIN	NT	NT	158 (100.0)	0 (0.0)	NT	NT

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There was maximum resistance observed to ofloxacin 15(83.3%) of a total of 18 isolates of staphylococcus aureus. maximum susceptibility of staphylococcus aureus isolates was observed to Gatifloxacin 15(83.3%), Moxifloxacin 16(88.9%), tobramycin 17(94.4%), and also gentamicin 18(100%). In our study highest susceptibility of staphylococcus epidermididis was observed to Gatifloxacin147(93%), Moxifloxacin 150(94%), Tobramycin 153(96.8%). Streptococcus pneumonia showed maximum resistance to ciprofloxacin and ofloxacin was (88.9%). Highest susceptibility was seen to Gatifloxacin (100%), Moxifloxacin (88.9%), Gentamicin (88.9%), Tobramycin (88.9%).

Table 4: Distribution of sensitivity and resistant patterns among gram negative bacteria.

DRUG	Pseudomonas (N=8)		E. coli (N=6)	
	S	R	S	R
CEFOXITIN	3 (37.5)	5 (62.5)	6 (100.0)	0 (0.0)
CHLORAMPHENICOL	3 (37.5)	5 (62.5)	6 (100.0)	0 (0.0)
CEFOTAXIME	8 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)
CIPROFLOXACIN	5 (62.5)	3 (37.5)	1 (16.7)	5 (83.3)
OFLOXACIN	2 (25.0)	6 (75.0)	1 (16.7)	5 (83.3)
GATIFLOXACIN	8 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)
GENTAMYCIN	8 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)
MOXIFLOXACIN	8 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)
TOBRAMYCIN	5 (62.5)	3 (37.5)	6 (100.0)	0 (0.0)
CEFTAZIDIME	7 (87.5)	1 (12.5)	NT	NT
COTRIMOXAZOLE	4 (50.0)	4 (50.0)	6 (100.0)	0 (0.0)

Among gram-negative bacteria, pseudomonas was more common than Escherichia coli in our study. Pseudomonas accounted for 8 (23.6%) of all bacterial isolates in our study Pseudomonas reported resistance to 5(62.5%) chloramphenicol, 3 (37.5%) ciprofloxacin, 6(75%) ofloxacin. Pseudomonas showed maximum resistance to ofloxacin 6 (75%) followed by ciprofloxacin 3(37.5%) and chloramphenicol 5(62.5%). The isolates showed highest susceptibility to ceftazidime 7(87.5%), moxifloxacin 8(100%), gatifloxacin 8(100%), gentamicin 8(100%) and tobramycin 5(62.5%). Escherichia coli accounted for 6 (3%) of all bacterial isolates. Maximum resistance in Escherichia coli was observed to ciprofloxacin 5(83.3%), ofloxacin 5 (83.3%), and highest susceptibility pattern was observed to Gatifloxacin (100%), Moxifloxacin (100%), Gentamicin (100%), Tobramycin (88.9%) and chloramphenicol (100%).

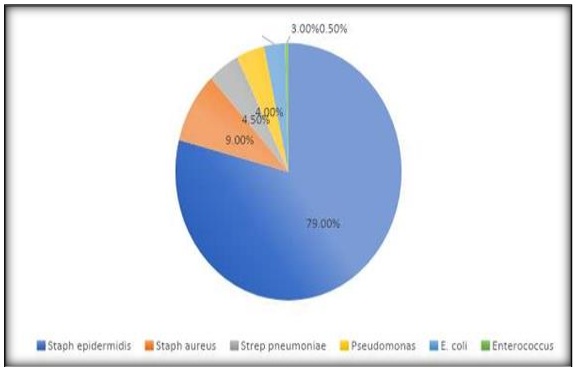

Figure 1: Distribution of cases according to the frequency of organism isolated on culture

Gram-positive organisms found were Staphylococcus epidermidis- 158 (79%) Staphylococcus aureus - 18 (9%) Streptococcus pneumonia - 9 (4.5%) Gram negative organisms found were Pseudomonas - 8(4%) Escherichia coli - 6 (3%).

DISCUSSION

Among 200 patients included in our study,129 were males (64.5%), 71 were females (35.5%) with male to female ratio of (1.8:1) showing male preponderance. These values are similar to study conducted by Jayaram Kaliamurthy et al,[5] on spectrum of bacterial keratitis in India. Out of 2170 patients 1274 were males (58.7%) and 896 (41.3%) were females. A similar study conducted by Maria Cabrera et al,[6] on bacterial keratitis in Sydney reported an increased incidence of males (52%) in their study.

In our study mean age of presentation in our study was 48.52 years. The highest incidence was seen between the fourth and sixth decades of life. A similar study conducted by Jayaram Kaliamurthy et al,[5] showed the mean age of presentation was 45+/-16.6 years. A study conducted by Maria Cabrera et al,[6] showed patients in the fourth and fifth decade, that is the middle age group is at higher risk with a mean age of 54 years. The reason for such age distribution may be due to their involvement in outdoor activities and frequent exposure to risk factors.

A greater number of patients (90%) had complaints of redness, watering, and foreign body sensation. Apart from these, most of the patients (80%) presented with diminution of vision while the pain was the presenting complaint in patients (88%).

In our study, out of 200 bacterial isolates, Gram-positive isolates were 185 (92.5%) and Gram-negative were 15(7.5%). A similar study conducted by Al –Dhaheria et al,[7] identified (91.4%) gram-positive isolates and (8.6%) gram-negative isolates, in a total of 2037 bacterial isolates in 3 years. A study conducted by Bhavna Chawla et al,[8] identified Out of 292 bacterial isolates, 255 (87.3%) were gram-positive and 37 (12.7%) were gram-negative.

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In our study, out of a total of 200 bacterial isolates, Gram-positive organisms found were Staphylococcus epidermidis- 158 (79%) Staphylococcus aureus - 18 (9%) Streptococcus pneumonia - 9 (4.5%) Gram negative organisms found were Pseudomonas - 8(4%) Escherichia coli - 6 (3%). There has been growing concern regarding increased resistance of ocular pathogens to commonly used antibiotics. In our study trends of antibiotic resistance was noted in 5 leading pathogens Among 185 gram-positive organisms, Staphylococcus epidermidis was the most common organism found in our study of almost 158 isolates (79%) followed by staphylococcus aureus 18 (9%), Streptococcus pneumonia 9 (4.5%).

In a similar study conducted by Bhavna Chawla et al, of a total of 292 bacterial isolates, 227 (77.7%) were staphylococcus epidermidis. In our study 13(72%) out of 18 isolates of staphylococcus aureus and 64(40.5%) out of 158 isolates of staphylococcus epidermidis isolates were methicillin-resistant in our study. There was 100% sensitivity to vancomycin in methicillin-resistant staphylococcus aureus and staphylococcus epidermidis. No isolates were resistant to vancomycin in our study.

In a study conducted by Shuo Xu Dawen et al,[9] of a total of 257 bacterial isolates 214 (83.27%) were gram-positive and 43 (16.73%) were gram- negative, most common pathogen was staphylococcus epidermidis (58.37%) followed by staphylococcus aureus (20.62%) and streptococcus pneumonia (2.33%) out of which (16.98 %) of staphylococcus aureus and (64%) of Staphylococcus epidermidis were methicillin-resistant and all staphylococcus aureus were sensitive to vancomycin in this study. A similar study conducted by Pragna Lalitha et al10, of a total of 3685 bacterial isolates Staphylococcus aureus isolates were 197 (5.3%) identified no resistance to vancomycin in Staphylococcus aureus isolates over 12-year period.

In our study, most of the staphylococcus aureus isolates were resistant to methicillin, fluoroquinolones, and aminoglycosides. Ofloxacin resistance was more in MRSA and MRSE in our study. There was maximum resistance observed to ofloxacin 15(83.3%) of a total of 18 isolates of staphylococcus aureus in our study. A similar study conducted by Pragna Lalitha et al,[10] where 3685 bacterial isolates had susceptibility testing over 12-year period in south India, demonstrated a significant increase in MRSA over 12-year period and increased resistance of ofloxacin from 11.1% to 66.7%.

In our study maximum susceptibility of staphylococcus aureus isolates was observed to Gatifloxacin 15(83.3%), Moxifloxacin 16(88.9%), tobramycin 17(94.4%), and also gentamicin 18(100%). A Similar study conducted by Bhavna Chawla et al,[8] where susceptibility to Gatifloxacin (95.5%), Moxifloxacin (92.83%), Tobramycin (90.07%) was observed in all gram-positive organisms. In our study 49(31%) were resistant to ofloxacin in a total of 158 Staphylococcus epidermidis isolates was similar to a study conducted by Pragna Lalitha et al,[10] observed 70 of 150 isolates (46.7%) were resistant to ofloxacin.

There was an increase in susceptibility of chloramphenicol to staphylococcus epidermididis observed in this study similar to a study conducted by Savitri Sharma et al.[11] In our study highest susceptibility of staphylococcus epidermididis was observed to Gatifloxacin 147 (93%), Moxifloxacin 150 (94%), Tobramycin 153(96.8%). All staphylococcus epidermidis were sensitive to vancomycin in this study similar to the study conducted by Shuo xu dawen et al.[9]

In our study Streptococcus pneumonia showed maximum resistance to ciprofloxacin and ofloxacin was (88.9%). Highest susceptibility was seen to Gatifloxacin (100%), Moxifloxacin(88.9%), Gentamicin (88.9%), Tobramycin (88.9%). A Study conducted by Jayaram Kaliamurthy et al,[5] dentified 992 (82%) isolates were gram-positive among 2175 bacterial isolates over 8 years, Streptococcus pneumoniae were 148 (12.3%). Streptococcus pneumoniae showed 95% susceptibility to gatifloxacin, 86.5% to moxifloxacin, 94% to gatifloxacin, 86.5% to ofloxacin.

Among gram-negative bacteria, pseudomonas was more common than Escherichia coli in our study. Pseudomonas accounted for 8 (23.6%) of all bacterial isolates in our study. Pseudomonas reported resistance to 5 (62.5%) chloramphenicol, 3 (37.5%) ciprofloxacin, 6(75%) ofloxacin. Pseudomonas showed maximum resistance to ofloxacin 6 (75%) followed by ciprofloxacin 3(37.5%) and chloramphenicol 5(62.5%) in our study. The isolates showed highest susceptibility to ceftazidime 7 (87.5%), moxifloxacin 8 (100%), gatifloxacin 8 (100%), gentamicin 8 (100%) and tobramycin 5 (62.5%).

A study conducted by Jayaram kaliamurthy et al5 identified 213 isolates of gram-negative bacteria, pseudomonas accounted for 117(9.7%) showed the highest susceptibility to gatifloxacin 105 (89.7%), tobramycin 86 (73.5%), gentamicin 105(89.7%) . A study conducted by Al Dhaheria et al,[7] identified, of a total of 2037 isolates Pseudomonas was the most common gram-negative organism found of (38.4%) showed most susceptibility to moxifloxacin (96.3%). In our study, Escherichia coli accounted for 6 (3%) of all bacterial isolates. maximum resistance in Escherichia coli was observed to ciprofloxacin 5(83.3%), ofloxacin 5 (83.3%), and highest susceptibility pattern was observed to Gatifloxacin (100%), Moxifloxacin (100%), Gentamicin (100%), Tobramycin (88.9%) and chloramphenicol (100%). A study conducted by Pragna Lalitha et al,[10] identified 110 (3%) isolates of E.coli of total of 3615 bacterial isolates, showed 90% susceptibility to gentamicin

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CONCLUSION

Bacterial keratitis is a major cause of blindness in developing countries. There have been growing concerns regarding increased resistance of ocular pathogens to commonly used topical antibiotics. A proper clinical examination, laboratory investigations, sensitivity, and resistance patterns would be beneficial inappropriate antimicrobial treatment. In our study, gram-positive organisms were majorly isolated and among which Staphylococcus epidermidis was the predominant organism followed by staphylococcus aureus and streptococcus pneumonia. Gram-positive cocci were sensitive to second-generation fluoroquinolones. Now there is an increased trend of resistance to second-generation fluoroquinolones like ciprofloxacin and ofloxacin. Most Staphylococcus aureus and staphylococcus epidermidis isolates were resistant to methicillin, fluoroquinolones (ciprofloxacin, ofloxacin), cephalosporins, aminoglycosides during the study. No vancomycin resistance was identified in Methicillin-resistant staphylococcal aureus and methicillin-resistant staphylococcal epidermidis. Hence vancomycin is preferred for MRSA and MRSE.

Overall gram-positive organisms were most susceptible to fourth- generation fluoroquinolones like gatifloxacin, moxifloxacin. Hence they are recommended therapy in gram-positive organisms. Among gram-negative bacteria, Pseudomonas was predominant followed by Escherichia coli. There was increased susceptibility of gram-negative bacteria to tobramycin, gentamicin, ceftazidime, gatifloxacin, moxifloxacin there was increased resistance to ciprofloxacin, ofloxacin and chloramphenicol. Hence, fourth-generation fluoroquinolones are recommended as empirical monotherapy for bacterial keratitis mainly moxifloxacin. Finally, a recommendation about the importance of culture and sensitivity patterns, integrating microbiological workup, and avoiding ‘cocktail therapy‘‘ for bacterial keratitis is the only way of ever-increasing drug resistance.

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