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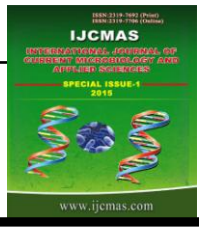

Original Research Article

Etiology and Antimicrobial Sensitivity Pattern in Acute and Chronic Dacryocystitis

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Keywords

Acute Dacryocystitis, Chronic Dacryocystitis, Causative agents, Sensitivity

A B S T R A C T

The purpose of the study is to identify bacterial aetiology and antimicrobial sensitivity in acute and chronic dacryocystitis. Samples were collected from ipsilateral conjunctiva and affected lacrimal sac of 86 (91 eyes) consecutive patients presenting with acute and chronic dacryocystitis. In 16(1 bilateral) acute and 70 (4 bilateral) chronic cases, growth was seen in 76.47% and 37.84% respectively (p= 0.003) of which Gram positive cocci were75.6% and Gram negative bacilli were 22.0%. *S. pneumoniae* was the major organism in both acute *(*53.85%)) and chronic (52.6%) cases. In Gram positive bacteria, *Streptococcus pneumoniae* (53.12%) were observed to be responsible for more than half cases of dacryocystitis followed by *Staphylococcus aureus* (43.75%). *Pseudomonas aeruginosa* was the commonest organism among Gram negative bacteria responsible for about 77.77% of dacryocystitis. Sensitivity of Gram positive cocci to vancomycin was 100%, Gatifloxacin- 93.5%, and Ciprofloxacin- 87.09%. In case of Gram negative bacilli, most sensitive antibiotics were amikacin (100%), gentamycin (100%) and Cephotaxime (100%). This study highlights the role of Gram positive bacteria in general and *S. pneumoniae* in particular ($p<0.001$) in both acute and chronic dacryocystits. Infectious etiology was significantly associated with acute dacryocystitis ($p< 0.01$).

Introduction

Dacryocystitis is the obstruction of nasolacrimal duct or nasolacrimal sac leading to its acute or chronic inflammation, the most common site being nasolacrimal duct (Sunita Agarwal *et al.*, 2002; Eesh Nigam *et al.*, 2008).

The lacrimal excretory system is prone to infection and inflammation for various reasons as mucous membrane-lined tract is contiguous with two surfaces (conjunctival and nasal mucosa) that are normally

colonized with bacteria (Sunita Agarwal *et al.*, 2002).

Various etiological factors have been put forth for the development of dacryocystitis, the most frequent being the infectious causes. The microbiology of dacryocystitis may differ in acute and chronic infections. Acute dacryocystitis is often caused by Gram-negative rods. In chronic form, mixed bacterial isolates are more commonly found with predominance of *Streptococcus pneumonia* and *Staphylococcus* species.

Fungal infections caused by *Candida albicans* and *Aspergillus* occur infrequently (Ramanjit Sihota and Radhika Tandon, 2011), (Iliff NT). Previous studies on etiology of chronic dacryocystitis showed lesser evidence of Gram –negative isolates but recent studies have reported changing trends in bacterial etiology. It also showed changing susceptibility of organisms to various drugs (Coden and Hornblass, 1993; Briscoe *et al.*, 2005).

Dacryocystitis can become a life-threatening infection with the potential to progress to orbital cellulitis and/or orbital abscess, meningitis, or cavernous sinus thrombosis (Mauriello and Wasserman, 1996). Thus an up-to-date knowledge of the spectrum of causative bacteria and their sensitivities is important for treatment of this disease.

This information contributes significantly to postoperative recovery following surgery. Thus, if the treatment is started early, progression to chronicity, microbial resistance and incidence of re-stenosis can be reduced with specific antibiotics to which the organisms are susceptible. This study was undertaken to assess the bacterial profile and antimicrobial susceptibility pattern and then demographic associations in acute and chronic dacryocystitis.

Material and Methods

A prospective study was carried out on 86 consecutive patients (91eyes) of acute and chronic dacryocystitis attending the outpatient department of a tertiary care hospital. All patients underwent thorough clinical and diagnostic workup to reach the appropriate diagnosis.

Inclusion criteria

All patients coming with the symptoms and signs of primary acute or chronic dacryocystitis, were included in the study.

Exclusion criteria

Patients on systemic or topical antibiotics as well as patients with secondary dacryocystitis were excluded from the study.

Specimen collection

Specimens for microbiological analysis were obtained after aseptically cleaning the area surrounding lacrimal sac, lacrimal punctum and taking care not to touch eyelid skin. Specimens are obtained by wiping a sterile cotton swab which was moistened with sterile distilled water from lower conjunctival sac of diseased eye and either of the following

- Spontaneous discharge
- Pus taken after application of pressure over lacrimal sac area
- Discharge following spontaneous bursting of abscess
- Discharge after syringing
- Following incision and drainage
- Surgically excised lacrimal sacs collected during dacryocystorhinostomy when required.

The swabs were transported to the Microbiology laboratory with minimal delay. All swabs obtained were inoculated directly on 5%–10% sheep's blood agar, chocolate agar, MacConkey agar and also inoculated into the brain heart infusion broth. A smear was also made on clean, sterile labelled glass slides for Gram staining. These were examined daily and discarded after 48 hours if growth was not seen.

Microbial cultures were considered significant if growth of the same organism was demonstrated on more than one solid-phase medium, and/or if there was confluent growth at the site of inoculation on one solid medium, and/or if growth of one medium was consistent with direct microscopy findings (*i.e.* appropriate staining and morphology with Gram stain), and/or if the same organism was grown from more than one specimen.

After identification of specific bacterial isolate according to standard laboratory techniques antimicrobial susceptibility testing was done by Kirby Bauer disc diffusion method on Muller Hinton agar according to CLSI (Clinical and laboratory Standards Institute 2003) (CLSI).In Gram positive bacteria, susceptibility test was performed against 25 antibiotics. In Gram negative bacteria, susceptibility test was performed against 23 antibiotics.

Prevalence of Methicillin resistant *Staphylococcus aureus* and *Streptococcus epidermis* (MRSA and MRSE), Extended spectrum beta lactamases (ESBLs) and AmpC Betalactamase was also assessed in the study.

All isolated *Staphylococci* were subjected to oxacillin/cefoxitin disc diffusion test using oxacillin 1µg/ cefoxitin 30µg disc. Ceftriaxone and Cefoperazone were used as screening agents while cefoperazone-sulbactam was used as for confirmation of ESBL.

Statistical analysis

Statistical analysis was done by Chi square test and Fisher test.

Result and Discussion

A total of 86 patients (91eyes) were analysed. 16 patients presented as acute cases (1bilateral) and 70 as chronic cases (4 bilateral).23 patients were male (26.74%) and 63 (73.26%) patients were female. Male to female ratio was found to be 1:3.

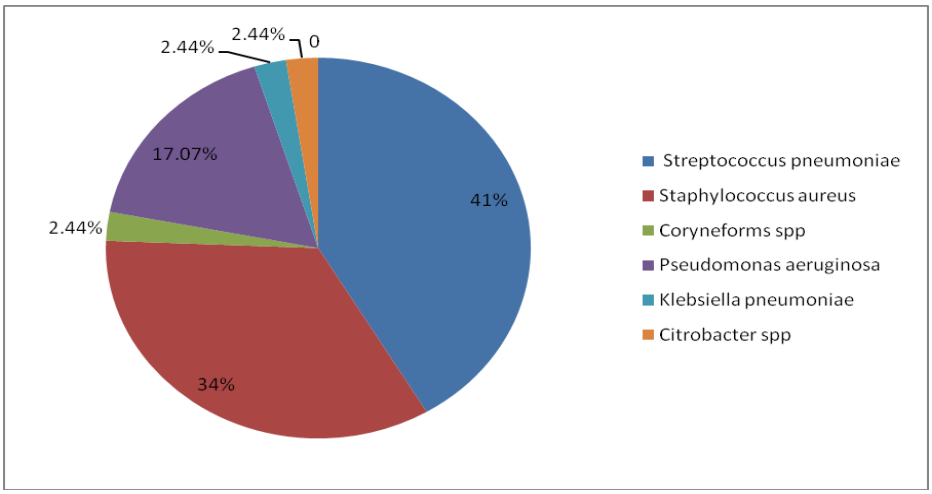
Maximum number of dacryocystitis cases was seen in the age group of 31–40 (24.42%) year followed by 41–50 yrs (19.77%). Mean age was found to be 42 ± 18yrs. Maximum percentage of acute cases were seen in age group of 31–40 yrs and 41-50yrs.Maximum number of bacteria were seen in the age group of 30 years and above, particularly between 31 and 50 yrs with *S. aureus*, *S. pneumoniae* and *P. aeruginosa* predominating. (Table 1)

Table.1 Age wise bacterial aetiology

Age in years	*Staph. aureus*	*Strep. pneumoniae*	*Coryneform. Sp*	*Pseudomonas. sp*	*Klebsiella. sp*	*Citrobacter. sp*
<5	0	1	1	0	0	0
5-10	0	3	0	0	0	0
11-20	1	1	0	0	0	0
21-30	1	0	0	2	0	0
31-40	4	4	0	4	0	1
41-50	3	2	0	0	1	0
51-60	3	2	0	0	0	0
61-70	2	3	0	0	0	0
71-80	0	1	0	1	0	0
Total	14	17	1	7	1	1

Around three-fourth case of dacryocystitis were observed to be caused by Gram positive cocci (78.05%) and one fourth of the cases by Gram negative bacilli (Figure 1).

Figure.1 Distribution of Gram positive and Gram negative bacteria in dacryocystitis



In Gram positive bacteria, *Streptococcus pneumoniae* (53.12%) were observed to be responsible for more than half cases of dacryocystitis followed by *Staphylococcus aureus* (43.75%). Coryneforms species were observed to be the least common cause of dacryocystitis (3.13%) (Table.2).

Table.2 Distribution of Gram positive bacteria in acute and chronic dacryocystitis

	Acute	Chronic	Total	P value
S.pnemoniae	7(53.85%)	10(52.6%)	17	
S.aureus	6(46.15%)	8(42.1%)	14	0.699
Coryneforms spp	0	1(5.3%)	1	
Total	13	19	32	

Pseudomonas aeruginosa was the commonest organism among Gram negative bacteria responsible for about 77.77% of dacryocystitis. *Klebsiella pneumoniae* and *Citrobacter spp* share the same frequency i.e. around 11.11% each (Table 3).

Table.3 Distribution of Gram negative bacteria in acute and chronic dacryocystitis

Gm negative bacteria	Acute	Chronic	Total
Pseudomonas sp	0	7 (77.78%)	7
Klebsiella sp	0	1(11.11%)	1
Citrobacter sp	0	1(11.11%)	1
		9	9

Growth was present in 76.47% of acute cases as compared to 37.84% of chronic cases which was statistically significant. (p= 0.003) (Table 4).

Table.4 Presence and absence of growth in acute and chronic dacryocystitis

Growth	Acute cases	Chronic cases	Total	P value
Present	13(76.47%)	28(37.84%)	41(45.05%)	0.003
Absent	4(23.53%)	46(62.16%)	50(54.95%)	
	17	74	91	

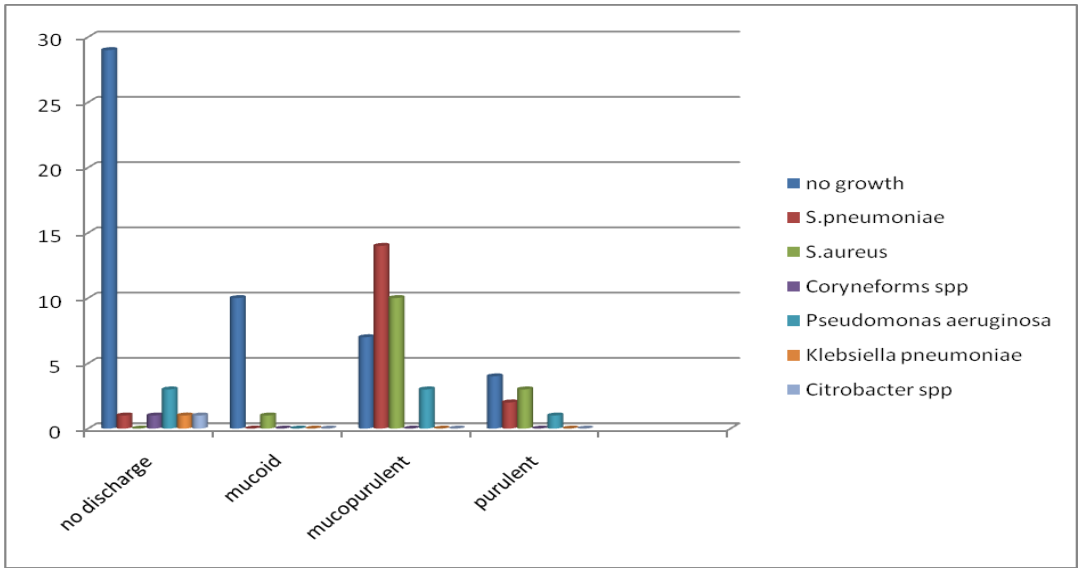
Both acute [13(100%)] and chronic cases [19 (67.86%)] have predominance of Gram positive bacteria while Gram negative bacteria were seen only in chronic cases which was found to be statistically significant (p=0.038) (Table 5).

Table.5 Distribution of Gram positive and Gram negative bacteria in acute and chroni cases

	Acute dacryocystitis	Chronic dacryocystitis		p value
Gram positive bacteria	13	19	32	
Gram negative bacteria	0	9	9	0.038
	13	82	41	

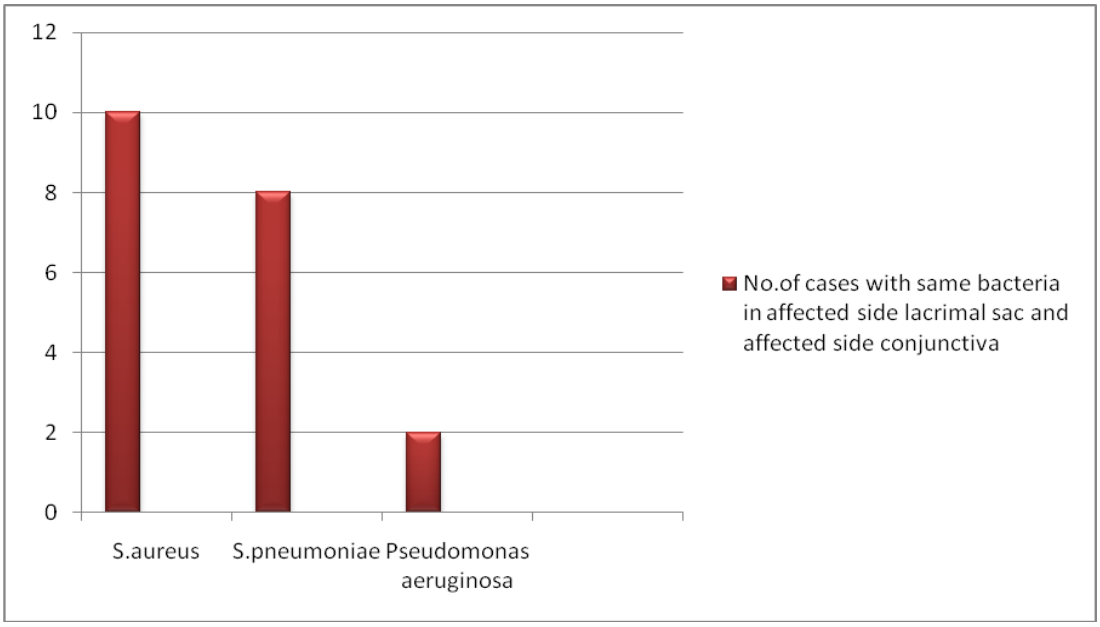
Most cases of *S. pneumoniae* [14(82.35%)] and *S. aureus* [10(71.43%)] were associated with mucopurulent discharge which was found to be statistically significant ($p<0.05$) (Figure 2).

Figure.2.Distribution of growth according to discharge



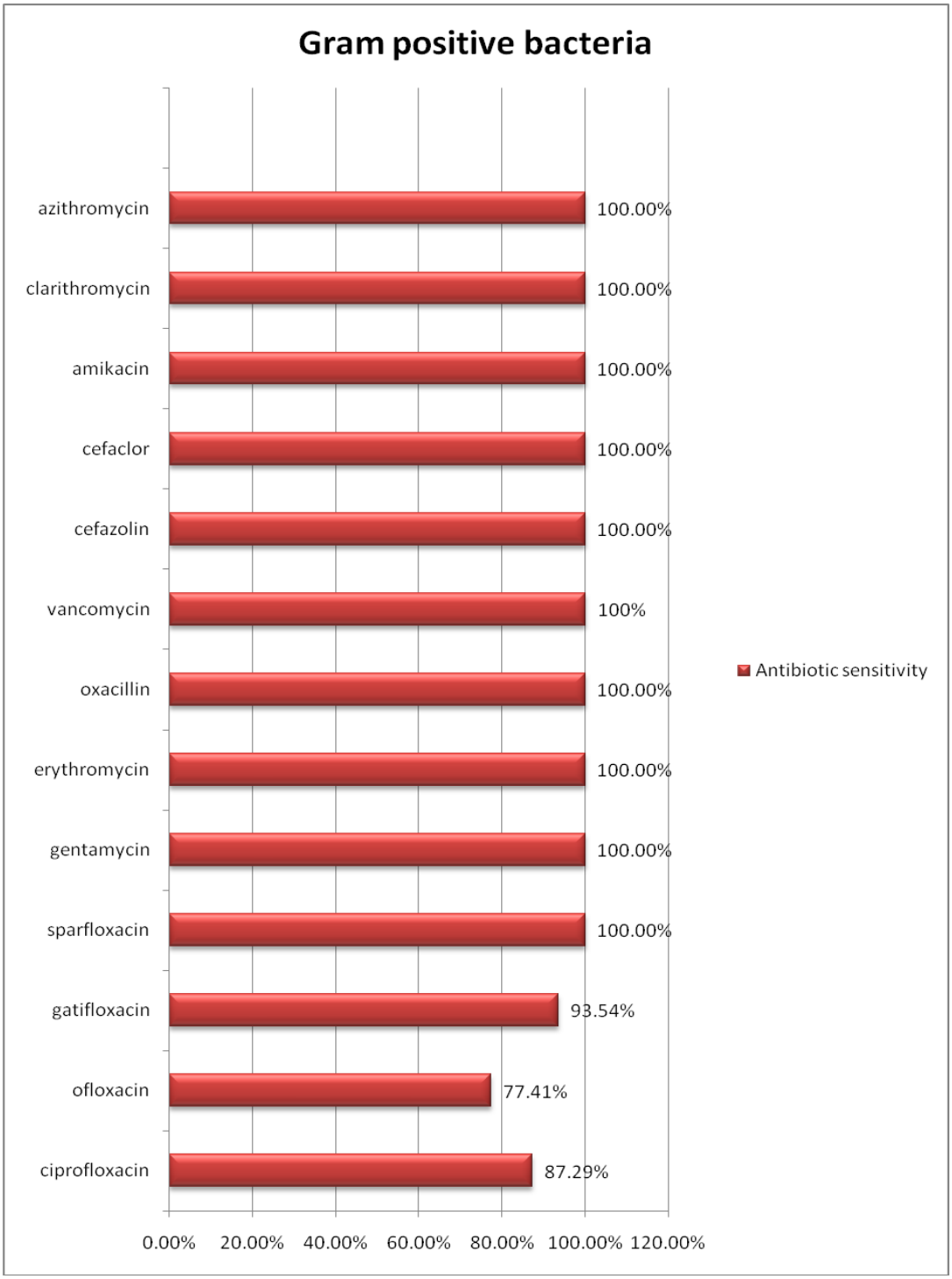
Same bacterial etiology was found in the affected lacrimal sac and conjunctiva in 20(86.96%) cases which was statistically in significant (p=0.085) (Figure 3).

Figure.3.Distribution of cases with same organism in affected lacrimal sac and ipsilateral conjunctiva



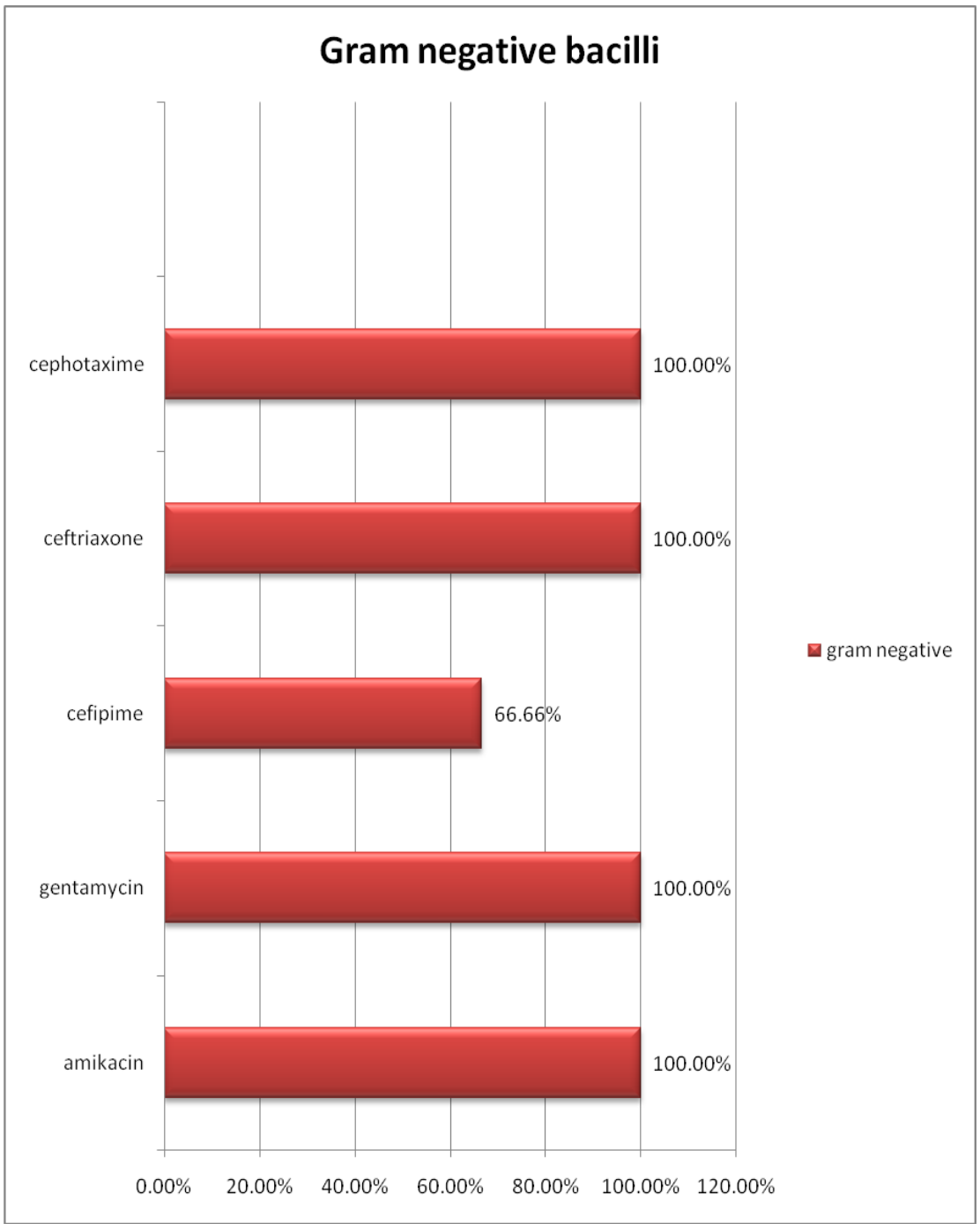
Streptococcus pneumoniae were observed to be 100% sensitive against all groups of drugs while *Staphylococcus aureus* showed excellent susceptibility against most groups of antibiotics but lower sensitivity was seen against gatifloxacin (85.71%), ciprofloxacin (71.43%) and ofloxacin (50%) (Figure 4).

Figure.4 Antibiotic sensitivity pattern of Gram positive bacteria



No MRSA was observed. Gram negative organisms were 100% sensitive to the tested antibiotics except cefipime (66.66%) and ceftazidime (85.71%) which showed decreased sensitivity for *Pseudomonas aeruginosa* (Figure 5).

Figure.5 Antibiotic sensitivity pattern of Gram negative bacteria



One extended spectrum beta-lactamases (ESBL) was identified in *Pseudomonas aeruginosa*. No AmpC beta-lactamases (AmpC) were observed for *Pseudomonas* spp. No ESBL and AmpC were observed for *Klebsiella spp* and *Citrobacter spp*.

Overall resistance seen in our study were 7.32% and was observed only in chronic type of dacryocystitis (10.71%). This was not found statistically significant. Resistance was observed in one isolate of *Pseudomonas aeruginosa* to Cefepime and Ceftazidime.

Two isolates of *Staphylococcus aureus* showed resistant to ciprofloxacin and ofloxacin and other to ofloxacin and gatifloxacin, respectively.

The present study included 86 patients (91 eyes i.e., 5 bilateral) who were diagnosed as cases of acute and chronic dacryocystitis on clinical assessment and relevant investigation. The patients were analyzed to correlate the clinical findings and bacterial culture and sensitivity.

Male (73.26%) to female (26.74%) ratio was found to be 1:3 in our study. Bharathi *et al.* (2003) in their study observed female to male ratio of 3.9:1 and female contributing 80.9% of cases. Maximum number of cases was above 30 yrs and was significantly more in chronic dacryocystitis (Bharathi *et al.*, 2003).

In another study of chronic dacryocystitis, Xuguang *et al.* (2005) reported mean age of 45.5yrs (ranging 18-71yrs) in which male were 14.3% and female were 85.7% Sun *et al.* (2005) (NN Sood *et al.*, 1967) reported in his study, that nearly 72% cases were over the age of 40 yrs with higher incidence of female cases (62%) which was comparable with study by Delia *et al.* (2008) who also reported average age of the patients 42.7 yrs (18–78yrs) with female predominance of 61.04%, though lesser when compared to other studies showing 83% of female cases (Sood *et al.*, 1967; Traquair, 1994; Delia *et al.*, 2008).

Reasons for female been affected more may be because bony nasolacrimal canal is narrower and flatter against the nasal floor in female than in male patients and that the diameter and the sectional angle between the bony canal and the nasal floor generally increased with age up to 40 years (Kei-ichi Shigeta *et al.*, 2007).

In our study, 17 cases (18.7%) were of acute dacryocystitis and 74 (81.3%) cases were of chronic type. Only half of these cases were observed to show growth and none showed polymicrobial culture. Reasons for absence of growth may also include anatomical, geographical and racial etiologies and not just infectious cause. Patient may not have given proper history and might have used antibiotic treatment. Other reasons may be the presence of anaerobes or *Mycobacterium* species which were not cultured in our study.

In our study, growth was present in 76.47% of acute cases and 37.84% of chronic cases which was statistically significant (p= 0.003). Gram positive cocci was found in 78.05% of the isolates which were the most common organisms in both groups being higher in acute type (p=0.038). This was similar to study done by Coden and Hornblass (1993) who reported 65% Gram positive isolates, Bharathi *et al.* (2003) reported 69.7% and Hartikainen *et al.* (1997) 69% of Gram positive cocci in chronic dacryocystitis patients (Coden and Hornblass, 1993; Bharathi *et al.*, 2003; Jouko Hartikainen *et al.*, 1997).

The most common bacteria in the present study were found to be *Streptococcus pneumoniae* amongst the Gram positive bacteria (53.12%). *Streptococcus pneumoniae* was also the most common amongst all culture positive isolates (41%) in both acute and chronic group. This observation was different from earlier studies which showed that *Staphylococcus aureus* were most common organism isolated in chronic dacryocystitits (Bharathi *et al.*, 2003; Mills *et al.*, 2007). Only few studies correlated with our study which demonstrated *Streptococcus pneumoniae* as most common bacteria (Usha *et al.*, 2006; Umesh Bareja and Ghose, 1990). The

change in bacterial pattern in our study may be because of the environmental and geographical variation.

There were no Gram negative bacteria associated with acute cases which was found to be statistically significant (p=0.038).The most common Gram negative bacteria in chronic dacryocystitis was found to be *Pseudomonas aeruginosa* (77.77%) followed by *Klebsiella pneumonia* (11.11%) and *Citrobacter spp* (11.11%). This goes well with studies by Coden and Hornblass (1993), Briscoe *et al.* (2005), Bharathi *et al.* (2003), Delia *et al.* (2008) and Mandal *et al.* (2008).

In contrast to our study, Mills *et al.* (2007) showed greater growth positivity in chronic cases when compared to acute.

In our study, all patients presented with epiphora (100%). Lacrimal discharge was absent in 36 cases (39.56%), mucopurulent discharge was present in 34 cases (37.36%), mucoid discharge was seen in 11 (12.09%) cases and purulent discharge was noticed in 10 cases (10.99%). In acute dacryocystitis, 64.71% cases were associated with mucopurulent discharge and 35.29% cases were purulent in nature while in chronic cases mucopurulent discharge was observed in 31.08% cases while purulent discharge was noted in 5.4% cases. Thus, most cases of acute dacryocystitis were associated with mucopurulent and purulent discharge as compared to chronic cases though not statistically significant. In the present study, we have also seen that *Streptococcus pneumoniae* and *Staphylococcus aureus* were most strongly associated with mucopurulent discharge (<0.001). *Staphylococcus aureus* was more commonly associated with purulent discharge compared to other organisms (<0.05). Mucopurulent discharge was found to be associated with Gram positive bacteria when compared to Gram negative bacteria and this was statistically significant (p<0.05). Our findings were similar to the other studies done by various workers (Eesh Nigam *et al.*, 2008; Bhavna Raina and Sudhir Bhagotra, 2008; Machin *et al.*, 2003; Kuchar *et al.*, 2000). However, our data differed from these studies by having 100% cases of epiphora and most cases with mucopurulent discharge. The present study thus points towards epiphora as a major symptom in dacryocystitis.

Association of ipsilateal side conjunctival growth with affected side dacryocystitis showed no statistical significance. This was similar to study conducted by Bale (1987), Bareja and Ghose (1990) Umesh Bareja and Ghose (1990).

Analysis of the in vitro susceptibility shows that most of the antibiotics were 100% sensitive to Gram positive bacteria except for fluoroquinolone group i.e. gatifloxacin (93.54%), ciprofloxacin (87.05%) and ofloxacin (77.41%) which showed resistance to *Staphylococcus aureus*.

Similarly, Gram negative organisms were 100% sensitive to all the tested antibiotics except cefipime (66.66%) and ceftazidime (88.88%) which was particularly to *Pseudomonas aeruginosa*. One Extended spectrum beta lactamases (ESBLs) was seen in *Pseudomonas aeruginosa*.

In our study, we have also observed resistance to antibiotics which was present only in chronic cases which was similar to Bharathi *et al.* (2003) and Sood *et al.* (1967). This may be because of long term irrational use of antibiotics in case of chronic type.

The present study highlights the role of Gram positive bacteria in general and

Streptococcus pneumoniae in particular ($p<0.001$) in both acute and chronic dacryocystits. Infectious etiology was significantly associated with acute dacryocystitis ($p< 0.01$).

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