Bacteriological profile in patients having chronic dacryocystitis presenting for cataract surgery in a tertiary care centre

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Summary

Background: the clinical research specifies that patients with clogged Nasolacrimal Ducts (NLDs) are more likely to cause infectious endophthalmitis secondary to cataract surgery. The current study assessed the bacteriological profile and antimicrobial susceptibility among patients of chronic dacryocystitis presenting for cataract surgery.

Materials and Methods: a cross-sectional study was done on 62 patients with clinically diagnosed chronic dacryocystitis. All patients underwent syringing of the nasolacrimal duct with sterile normal saline under local anaesthesia, and a nasolacrimal regurgitation sample from the lower punctum was collected. The swabs were collected, and organisms were grown on suitable medium. Antibiotic susceptibility was also tested.

Results: chronic dacryocystitis was observed in 7.9% of patients. The growth of Gram-positive organisms was greater than Gram-negative organisms in both lacrimal sac content swabs (65%, 35%) and conjunctival swabs (76%, 24%), respectively. Out of 10 (35.7%) Gram-negative isolates, meropenem, gentamicin, amoxicillin-clavulanic acid, cefepime, piperacillin-tazobactum, levofloxacin, cotrimoxazole were the most sensitive drugs (100%, 100%, 100%, 93.75%, 87.5%, 87.5%, 87.5%, respectively). Ampicillin and cefazolin (16.67% sensitivity in both) were the least sensitive in Gram-negative isolates.

Conclusions: knowledge of the bacteriological profile and antibioGram of chronic dacryocystitis prior to cataract surgery is essential to avert post-operative infections of the eye.

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Ethics approval and consent to participate: the cross-sectional study was conducted for two months and approved by the Institutional Ethical Committee for clinical research.

Informed consent: after taking written informed consent, all patients who underwent syringing (irrigation) of the nasolacrimal duct with sterile normal saline under local anesthesia, and a nasolacrimal regurgitation sample from the lower punctum (lacrimal sac content swabs) was collected. Conjunctival swabs from ipsilateral lower palpebral conjunctiva were also collected.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

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Introduction

Chronic dacryocystitis is an inflammatory condition of the lacrimal sac which is commonly associated with partial or complete obstruction of the Nasolacrimal Duct (NLD) [5]. It is usually caused secondary to obstruction and blockage of normal drainage of tears, which accelerates the proliferation of microbes and subsequent secondary infection [21]. The clinical evidence indicates that patients with clogged NLDs are more likely to develop infectious endophthalmitis following cataract surgery [13,14].

It is considered one of the major significant risk factors for postoperative endophthalmitis [14]. The microbiology of dacryocystitis differs in acute as well as chronic infections. However, fungal infections like candidiasis and aspergillosis occur infrequently [5]. Limited numbers of studies have been implemented so far on the bacteriology of chronic dacryocystitis in the last two decades. In most of these studies, Coagulase-Negative Staphylococci (CONS) and *S. aureus* are the most commonly detected microbes in lacrimal sac infections [5]. However, some variability in organisms was documented in a few studies [1,2,9].

The postoperative infection after the lacrimal drainage system surgery upsurges the risk of failure. Therefore, it reiterates the need to use specific antibiotics through antimicrobial susceptibility testing to reduce the associated morbidity. Endophthalmitis is a vision-

threatening manifestation and may lead to severe damage to the ocular structures, even among patients undergoing an uncomplicated surgical procedure [1,9,23]. Considering such a potential risk, an improvement in diagnosis through microbiological analysis, culture, and sensitivity tests is highly warranted in all cases of chronic dacryocystitis to prevent post-operative infection [7,10]. The higher rates of endophthalmitis following NLD obstruction among the patients also signify routine screening for clinical symptoms and an assessment of the lacrimal system before cataract surgery. Thus, the present study was conducted to evaluate the bacteriological profile and its antimicrobial susceptibility among patients of chronic dacryocystitis presenting for cataract surgery. The emerging results will act as guide work for ophthalmic surgeons.

Objectives

The objectives of this study were: i) to determine the prevalence of chronic dacryocystitis in patients presenting for cataract surgery; ii) to determine the bacteriological profile of chronic dacryocystitis patients, and iii) to determine the antibiotic susceptibility of the isolates.

Materials and Methods

The cross-sectional study was conducted for two months and approved by the Institutional Ethical Committee for clinical research. A total of 62 cases of clinically diagnosed chronic dacryocystitis who attended the Ophthalmology Outpatient Department (OPD) for cataract surgery (784) were included in the study. Patients who had received either topical or systemic antibiotics in the past week were excluded from the study. After taking written informed consent, all patients who underwent syringing (irrigation) of the nasolacrimal duct with sterile normal saline under local anesthesia, and a nasolacrimal regurgitation sample from the lower punctum (lacrimal sac content swabs) was collected. Conjunctival swabs from ipsilateral lower palpebral conjunctiva were also collected.

The swabs were collected with sterile cotton swabs and immediately transported to the microbiology laboratory and inoculated on sheep blood agar and MacConkey agar. Organisms grown were then identified by standard bacteriological procedures [8]. Antimicrobial susceptibility test was done by commercially available (HIMEDIA) Discon Muller Hinton Agar by Kirby-Bauer disc diffusion method as per the Clinical and Laboratory Standards Institute guidelines 2022 [4,15].

Period and place of study

The study was conducted for 4 months (May-August 2022) integrating the Ophthalmology and Microbiology Departments of GMCH Nagpur.

Results

A total of 124 swabs (62 lacrimal sac content swabs and conjunctival swabs each) were collected from 62 patients with chronic dacryocystitis. Chronic dacryocystitis was observed in 7.9% of 784 cataract patients. Among 62 patients, 48 (77.4%) were females and 14 (22.6%) were males (Figure 1). Bacterial growth was seen in 45% of lacrimal sac content swabs and 39% of conjunctival swabs. (Table 1) The present study observed mono-microbial growth in all the culture-positive swabs.

Table 1. Results of culture of lacrimal sac content swabs and conjunctival swabs.

Swabs	Total	Growth	% growth	% no growth
Lacrimal sac content swabs	62	28	45	55
Conjunctival swabs	62	24	39	61

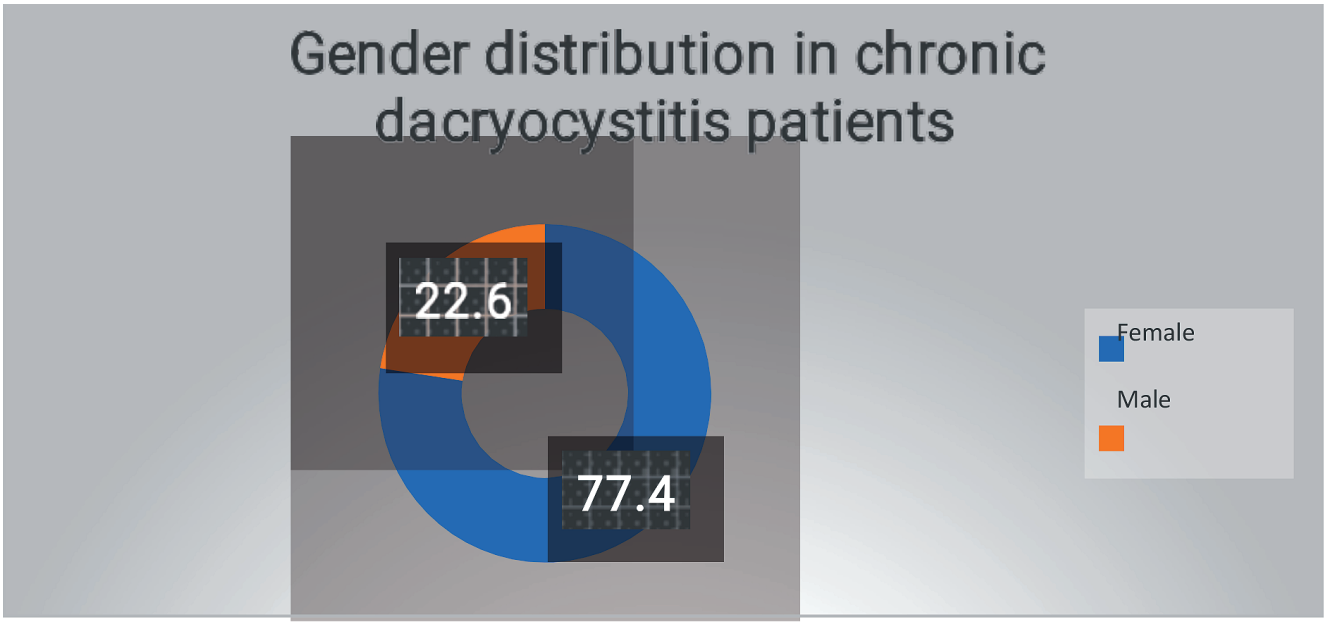

Figure 1. Gender distribution in chronic dacryocystitis patients.

The growth of Gram-positive organisms was greater than that of Gram-negative organisms in both lacrimal sac content swabs (65%, 35%) and conjunctival swabs (76%, 24%), respectively. In Gram-positive, the most common organism grown was *S. aureus,* followed by *Streptococcus pneumoniae.* In Gram-negative, the most common organism grown was *Pseudomonas aeruginosa* in both swabs (Table 2). We compared the bacterial etiology of lacrimal sac contents with ipsilateral conjunctival swabs to ascertain the anatomical contiguous site flora of conjunctiva. We found 20 (71.42%) isolates in ipsilateral conjunctival culture to be similar to lacrimal sac content culture. As lacrimal sac content swabs are more relevant to the present study, we compared the antibioGram of these isolates (Table 3, Table 4).

Table 2. Distribution of bacterial isolates in lacrimal sac content swabs and conjunctival swabs from chronic dacryocystitis patients.

Bacterial agents	Lacrimal sac content swabs (%)	Conjunctival swabs (%)
Gram-positive isolates total	18 (65)	18 (76)
S. aureus	10 (36)	8 (34)
CONS	2 (7)	6 (25)
S. pneumoniae	6 (22)	4 (17)
Gram-negative isolates total	10 (35)	6 (24)
Pseudomonas species	4 (14)	2 (8)
E. coli	2 (7)	1 (4)
K. pneumoniae	2 (7)	1 (4)
P. mirabilis	2 (7)	2 (8)
Total	28 (100)	24 (100)

CONS, Coagulase-Negative Staphylococci.

Table 3. Antibiotic sensitivity pattern among Gram-positive isolate in lacrimal sac content swabs (n=18).

Drugs	*S. aureusn*=10 (%)	CONSn=2 (%)	*S. pneumoniaen*=6 (%)	Total antibiotic sensitivity of Gram-positive isolates (%)
Penicillin G	3 (30)	0 (00)	5 (83.33)	56.67
Erythromycin	5 (50)	1 (50)	6 (100)	66.67
Clindamycin	5 (50)	2 (100)	6 (100)	83.33
Linezolid	10 (100)	2 (100)	6 (100)	100
Vancomycin	10 (100)	2 (100)	6 (100)	100
Co-trimoxazole	8 (80)	1 (50)	6 (100)	76.67
Tetracycline	5 (50)	1 (50)	6 (100)	66.67
Levofloxacin	6 (60)	2 (100)	6 (100)	86.67
Gentamicin	9 (90)	2 (100)	6 (100)	96.67
Chloramphenicol	6 (60)	1 (50)	6 (100)	70

CONS, Coagulase-Negative Staphylococci.

Table 4. Antibiotic sensitivity pattern among Gram-negative isolate in lacrimal sac content swabs (n=10).

Drugs	*Escherichia coli* N=2 (%)	*Klebsiellapnemoniae* N=2 (%)	*Proteusmirabilis* N=2 (%)	*Pseudomonas aeruginosa* N=4 (%)	Total antibiotic sensitivity of Gram-negative isolates (%)
Ampicillin	0	0	1(50)	-	16.67
Amoxicillin-clavulanate	2 (100)	2(100)	2(100)	-	100
Piperacillin-tazobactam	2 (100)	-	-	3 (75)	87.5
Netilmicin	-	-	-	3 (75)	75
Cefazolin	0	0	1 (50)	-	16.67
Cefotaxime	1 (50)	2 (100)	2 (100)	3 (75)	81.25
Ceftazidime	1 (50)	2 (100)	2 (100)	3 (75)	81.25
Cefepime	2 (100)	2 (100)	2 (100)	3 (75)	93.75
Meropenem	2 (100)	2 (100)	2 (100)	4 (100)	100
Gentamicin	2 (100)	2 (100)	2 (100)	4 (100)	100
Tobramycin	1 (50)	1 (50)	2 (100)	3 (75)	68.75
Levofloxacin	2 (100)	2 (100)	1 (50)	4 (100)	87.5
Amikacin	1 (50)	1 (50)	1 (50)	3(75)	56.25
Co-trimoxazole	2 (100)	2 (100)	1 (50)	4(100)	87.5

Out of 18 (64.3%) Gram-positive isolates, linezolid and vancomycin were the most sensitive drugs (100% sensitive for all Gram-positive isolates), followed by gentamicin (96.67%), levofloxacin (86.67%). *S. pneumoniae* isolates were found to be sensitive to almost all the antibiotics tested. Penicillin G and erythromycin (56.67% and 66.67%, respectively) were among the most ineffective antibiotics among Gram-positive isolates. No methicillin-resistant *Staphylococcus aureus* was detected in the current study (Table 3). Out of 10 (35.7%) Gram-negative isolates, meropenem, gentamicin, amoxicillin-clavulanic acid, cefepime, piperacillin-tazobactum, levofloxacin, cotrimoxazole were the most sensitive drugs (100%, 100%, 100%, 93.75%, 87.5%, 87.5%, 87.5%, respectively). Ampicillin and cefazolin (16.67% sensitivity in both) were the least sensitive among Gram-negative isolates (Table 4).

Discussion

There is renewed interest in the microbiological spectrum of chronic dacryocystitis as there have been changing trends of bacteriological patterns and susceptibility profiles to different antibiotics. Although there are many studies on the bacteriological profile of chronic dacryocystitis, to the best of our knowledge, no prior reports in India have studied the bacteriological profile of chronic dacryocystitis in cataract patients. In the present study, chronic dacryocystitis was found to be 7.9% among 784 patients who came for cataract surgery. Thomas *et al.* reported 6.6% of chronic dacryocystitis in their cataract population, which was close to our study. This high prevalence may be because of poverty among our patients, as they work in farms and factories and are exposed to a lot of smoke, fumes, and irritants. They also have poor knowledge of personal hygiene [17,24]. There was female preponderance among chronic dacryocystitis patients 48 (77.4%) in the present study, which is in line with many previous studies [5,10,21] attributed to anatomical and hormonal factors in both genders.

The bacteriological profile in the current study revealed 45% culture positivity in lacrimal sac content swabs and 39% in conjunctival swabs. The culture positivity is comparable with Rizvi *et al*. [22] (37.84%) and Pradeep A. V. *et al*. [21] (47.73%); however, Owji *et al*. [18] reported culture positivity as high as 100%. Low isolation rates in the present study may be attributable to the lack of anaerobic or fungal etiological diagnosis or different sample collection methods.

Although the sample size in the present study was small, there was a 71.42% similarity in the growth of the organism and its antibioGram in lacrimal sac content swabs and conjunctival swabs. Owji *et al*. [18] reported 90% similarity in isolation from the lacrimal sac and conjunctiva of the involved side as against Pradeep A. V. *et al.* [21], who reported only a 9.52% similarity. This may be because the lacrimal sac content swabs were taken of regurgitated material after syringing of the lacrimal sac, and then conjunctival swabs from ipsilateral lower palpebral conjunctiva were collected. This similarity in culture of two swabs canal can be explained by the fact that NLD obstruction can allow bacteria to grow the nasolacrimal duct and lacrimal sac, in due course refluxing back onto the ocular surface (conjunctiva sac) [12,14] and also because of anatomically contiguous mucosal surfaces [21]. Conjunctiva swabs and lacrimal sac content swabs from punctum are not ideal but are useful in resource-limited settings like India, where affordability is an issue.

The bacteriological flora of chronic dacryocystitis in the present study shows a predominance of Gram-positive bacteria 64.3% in lacrimal sac content swabs and76%inconjunctival swabs, which is a close agreement with Assefa *et al*. [2] (61.3%) in their nasolacrimal discharge samples. Luo *et al*. [16] reported an equal proportion of Gram-positive and Gram-negative isolates in chronic dacryocystitis of adult cases as against the present study, having only 35.7% Gram-negative isolates of lacrimal sac content swabs. Among the distribution of Gram-positives (in the present study, *S. aureus* 36%, *S. pneumoniae* 22%, CONS 7%), some variability is observed between different studies [2,5,21]. *P. aeruginosa* (14%) was the predominant organism among Gram-negatives, followed by *E. coli, Proteus mirabilis,* and *K. pneumoniae* (7% each). There was wide variation in the distribution of Gram-negatives in different studies [2,6,7]. This variation in the distribution of Gram-positive and Gram-negative organisms can be ascribed to different geographic areas, sociodemographic pictures, and different sample sizes in different studies Hayashi *et al*. [13] in their study of bacteriology of conjunctiva in obstructed nasolacrimal duct in pre cataract surgery patients, found majority of bacteria to be resistant to levofloxacin, cefazolin, gentamycin. In a study from Turkey, the highest sensitivity to linezolid, teicoplanin, tigecycline, vancomycin, and mupirocin (antibiotic sensitivity of 100% for all) was demonstrated in CONS and *S. aureus* (most commonly isolated organisms from the lacrimal sac) [3]. One of the Indian studies demonstrated *Staphylococcus* spp. as a major pathogen in their lacrimal sac samples and found vancomycin, amikacin, cephalosporins (III generation), and amoxiclav (100%, 89%, 83%, and 78% sensitivity, respectively) as effective antibiotics. They reported penicillin (28%) and erythromycin (25%) as the least effective antibiotics. Authors suggested amoxiclav and third-generation cephalosporins to be used to treat chronic dacrocystitis, while amikacin and vancomycin were to be reserved for severe cases [21]. In the present study, all Gram-positive bacteria were most sensitive to vancomycin, linezolid, gentamycin, levofloxacin (100%, 100%, 96.67%, 86.67%, respectively), and penicillin (56.67%%) and erythromycin (66.67%) as least susceptible antibiotics. However, among Gram-negative isolates, meropenem, gentamicin, amoxicillin-clavulanic acid, cefepime, piperacillin-tazobactam, levofloxacin, clotrimazole were the most sensitive drugs (100%, 100%, 100%, 93.75%, 87.5%, 87.5%, 87.5%, respectively). Ampicillin and cefazolin (16.67% sensitivity in both) were the least sensitive in Gram-negative isolates. As gentamicin and levofloxacin are effective antibiotics in both Gram-positive and Gram-negative isolates, these antibiotics can be used for the treatment of chronic dacryocystitis. Vancomycin and meropenem can be reserved for severe cases.

Dacryocystitis prior to cataract surgery can lead to infectious endophthalmitis post-surgery. Thus, antibiotic therapy has a therapeutic as well as prophylactic role. The present study is the first of its kind to analyze the bacteriology of chronic dacryocystitis in cataract patients, but it has a few limitations. The aerobic culture was done; anaerobes and fungal isolates were not studied in chronic dacryocystitis patients. The study included conjunctival swabs and lacrimal sac content swabs after syringing, although the methods are acceptable, specimens directly collected from the lacrimal sac reduce the chances of contamination [20]. The sample size in the current study was small; the inclusion of a larger number of samples will give a clearer picture.

Conclusions

Chronic dacryocystitis in cataract patients is quite high in our region. Both Gram-positive and Gram-negative organisms are implicated in the etiology of chronic dacryocystitis in cataract patients. Gentamicin and levofloxacin can be used for treatment in most cases. Knowledge of the bacteriological profile and antibiogram of chronic dacryocystitis prior to cataract surgery is vital to prevent postoperative infections of the eye. Though the findings in our study are meaningful, further studies are needed to address this.

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