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Original Research Article

# Microbiological profile and antibiotic susceptibility pattern of chronic dacryocystitis at a tertiary eye care centre in Western India

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ABSTRACT

**Background**: Chronic dacryocystitis is a low-grade infection & inflammation of the lacrimal sac. If neglected the infection may extend to surrounding orbit, brain and paranasal sinuses leading to sight and/or life-threatening complications. Thus appropriate, effective and timely antibiotic treatment/ prophylaxis is desirable. The present study was aimed to document the current microbiological profile and antibiotic susceptibility in adult patients of chronic dacryocystitis seen at our tertiary eye care centre in western India.

**Materials and Methods:** The study was a cross-sectional, prospective, observational study. The study included 60 adult patients of chronic dacryocystitis. In every case two samples from the lacrimal sac collected via the regurgitation technique or by lacrimal passage syringing were sent for microbiological evaluation. Gram staining was used for identification of bacterial pathogen. KOH mount was used for identification of fungi. The second swab was used for performing culture -sensitivity. The Clinical and Laboratory Standard Institute Guidelines were used to know the antimicrobial sensitivity. Kirby-Bauer disk diffusion method was used for this purpose. The statistical analysis was done using descriptive statistics as mean, standard deviation, median and percentages. Microsoft excel worksheet was used.

**Results:** 60 samples were taken. 53/60 (88.3%) samples showed microbial isolates after 24-48 hours of incubation. 78.3% were gram positive organisms and 10% were gram negative organisms. The most common gram-positive organism was *Staphylococcus aureus* (68.3%) and the most common gram-negative organism was *Pseudomonas aeruginosa* (8.3%). Amongst the antibiotics the most sensitive antibiotic was Ampicillin + Sulbactam (92.5%) and the most resistant antibiotic was Ciprofloxacin (3.8%). The antibiotic most sensitive to gram positive organisms was Ampicillin and Sulbactam, Cephalexin, Linezolid, Cloxacillin and Vancomycin. The antibiotic most sensitive to gram negative organisms was Gentamicin, Amikacin, Gatifloxacin, Ceftazidime, Meropenem and Polymixin -B.

**Conclusion:** The current microbiological profile and antibiotic susceptibility of the microorganisms responsible for chronic dacryocystitis is an invaluable tool in the treatment of chronic dacryocystitis with the most appropriate and effective antibiotic.



## 1. Introduction

Chronic dacryocystitis is a chronic low-grade infection of the lacrimal sac.[1,2] The most common cause of nasolacrimal duct obstruction (NLDO) in older persons is involutional stenosis. The clinicopathology suggests that oedema and infiltration due to infection cause compression of the NLD lumen.[1,2] This may be attributed to anatomical predisposition, unidentified infection/ autoimmune diseases. It is usually due to complete NLDO preventing normal

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drainage of tears into the nose. Tear retention and stasis leads to secondary infection. Dacryocystitis results from primary or secondary obstruction of the nasolacrimal duct. It presents either as acute or chronic dacryocystitis. Chronic dacryocystitis is classically managed by either conventional dacryocystorhinostomy or by endoscopic Laser DCR surgery under antibiotic cover.[3] Antibiotics help in control of post-operative infection as well as reduce chances of rebleed due to secondary infection.[4–7] The microbiological profile of dacryocystitis and the antibiotic sensitivity would help us tailor the antibiotic regime for greater effectivity. The microbiological profile differs as per the geographical location.[8] Thus we undertook this study to explore the microbial profile and antibiotic sensitivity of dacryocystitis patients at our tertiary care centre in Western India.

## 2. Materials and Methods

The study was carried out at our Western Regional Institute of Ophthalmology, Ahmedabad in western India. The study was an observational, cross -sectional, prospective study. The study period was from November 2021 to November 2023. Ethical approval was obtained from the institutional review board. We adhered to the tenets of the Declaration of Helsinki. Adult patients with chronic dacryocystitis attending the out- patient department were enrolled. Informed and written consent was taken from all patients for participating in the research. The diagnosis of dacryocystitis was confirmed by a history of watering (epiphora), a positive ROPLAS (regurgitation on pressure over the lacrimal sac) and/or nasolacrimal duct blockage on syringing of the lacrimal passages. Patients with acute dacryocystitis, intranasal disorders, trauma were excluded from the study. All patients were subjected to a thorough history taking, ophthalmic examination including slit lamp examination. We looked specifically for lacrimal sac swelling below the medial canthus, presence and type of discharge, ROPLAS. The sample collection was done using strict aseptic precautions. The conjunctival cul de sac was irrigated with ringer lactate and cleaned with a sterile cotton swab. Gentle pressure was applied over the lacrimal sac, the regurgitate was collected on two cotton swabs avoiding touching the skin and conjunctiva. Similarly, while doing syringing the regurgitate was collected on two sterile cotton swabs. The samples were sent to the microbiology laboratory in sterile glass bottles without delay. Gram staining was used for identification of bacterial pathogen. KOH mount was used for identification of fungi. The second swab was used for performing culture -sensitivity. Inoculation was done on culture media as blood agar, nutrient agar, chocolate agar, Mac Conkey agar. The samples were incubated for 24-48 hours. The culture plates were examined daily for microbial growth. The identification for microbes included morphological characteristics, staining, biochemistry as per the standard laboratory protocol.[9,10] The Clinical and Laboratory Standard Institute Guidelines were used to know the antimicrobial sensitivity. Kirby-Bauer disk diffusion method was used for this purpose.[11]

### 2.1. Statistical analysis

The statistical analysis was done using descriptive statistics as mean, standard deviation, median and percentages. Microsoft excel worksheet was used. On an average as per the institute data of previous years on an average thirty to forty patients of chronic dacryocystitis were seen per year. Given the study period of two years and a dropout rate of 10% we calculated the sample size to be sixty.

## 3. Results

The demographics of the cases are shown in Table 1. The female: male ratio was 1.2. The majority of the patients were in the 41-60-year age group. The mean age of the patients was 48.9 years ± 11.7 standard deviation. The age range was 18-77 years. The median age was 51 years. Table 2 documents the clinical presentation of the patients. The clinical presentation of the patients was watering (epiphora) and an increases tear lake in all patients. A positive regurgitation test on pressure over the lacrimal sac could be elicited in 100% of the patients. Mattering of the eyelashes due to the constant watering was seen in 91.6% patients. Mucoid discharge was observed in 61.6% of the patients. Mucocele was the presentation in seven (11.6%) cases. Table 3 shows the microbes isolated from the lacrimal sac. The sample positivity rate was 53 of 60 samples (88.3%). The culture report was negative in seven cases. Gram positive isolates were seen in 47/60 (78.3%) of the cases. Gram negative isolates were less common and were seen in 6/60 (10%) of the cases. The most common organism isolated was *Staphylococcus aureus* 41/60 (68.3%) of cases. The next most common organism was *Pseudomonas aeruginosa* 5/60 (8.3%).

**Table 1:** Patient demographics

| **Age at Presentation** | **Number (Percentage)** |
|---|---|
| 18-30 | 3 (5%) |
| 31-40 | 9 (15%) |
| 41-50 | 17(28.3%) |
| 51-60 | 21(35%) |
| 61-70 | 7(11.6%) |
| >70 | 3(5%) |
| Total | 60(100%) |
| **Gender** | **Number** |
| Male | 27(45%) |
| Female | 33(55%) |
| Total | 60(100%) |

Table 4 shows the antibiotic susceptibility patterns of the patients. The overall susceptibility of the organisms

**Table 2:** Clinical presentation of chronic dacryocystitis

| Clinical Presentation | Number of Patients (Percentage) |
|---|---|
| Watering | 60 (100%) |
| Regurgitation on pressure over lacrimal sac | 60 (100%) |
| Increased tear lake | 60 (100%) |
| Mattering of eyelashes | 55 (91.6%) |
| Mucoid Discharge | 37 (61.6%) |
| Mucocele | 7 (11.6%) |
| Total number of patients | 60(100%) |

**Table 3:** Microbiological profile of the patients with chronic dacryocystitis

| Microbial profile | Number (Percentage) |
|---|---|
| **Gram positive isolates** | 47 (78.3%) |
| 1. *Staphylococcus aureus* | 41 (68.3%) |
| 2. *Staphylococcus epidermidis* | 3 (5%) |
| 3. *Streptococcus pneumoniae* | 3 (5%) |
| **Gram negative isolates** | 6 (10%) |
| 1. *Pseudomonas aeruginosa* | 5 (8,3%) |
| 2. *E. Coli* | 1 (1.6%) |
| Total number of sample positive cases | 53 (88.3%) |
| Total number of sample negative cases | 7 (11.6%) |
| Total number of cases | 60 (100%) |

to the commonly used antibiotics has been documented. In our study the antibiotic sensitivity was Ampicillin and Sulabactam (92.5%), Gentamicin (73.5%), Cotrimoxazole (58.5%) and Ciprofloxacin (3.7%). *Staphylococcus aureus* was most susceptible to penicillin group and vancomycin. *Staphylococcus epidermidis* was most sensitive to penicillin group and vancomycin. *Streptococcus pneumoniae* was most sensitive to penicillin and vancomycin. Pseudomonas was most sensitive to aminoglycosides and higher antibiotics as meropenem.

*E. coli* was sensitive to penicillin and quinolones. Overall, the antibiotic to which most organisms were resistant was ciprofloxacin.

## 4. Discussion

Microbiology of the regurgitate or discharge in chronic dacyocystitis patients is important for preventing postoperative infections as well as for treating subclinical infections in chronic dacryocystitis patients. The most common cause of nasolacrimal duct obstruction (NLDO) in older persons is involutional stenosis. The clinicopathology suggests that edema and infiltration due to infection cause compression of the NLD lumen. This may be attributed to anatomical predisposition, unidentified infection/ autoimmune diseases. Chronic dacryocystitis is a chronic low-grade infection of the lacrimal sac. It is usually due to complete NLDO preventing normal drainage of tears into the nose. Tear retention and stasis leads to secondary infection.

In our study chronic dacryocystitis was most common in the 41-60 years age group with a mean of 48.9 years. This was similar to other series of chronic dacryocystitis reported by other investigators.[12–15] Dacryocystitis was more common in the females in our study. This may be due to an anatomically narrower NLD in women. Many studies have documented predilection for the female gender.[16–18] The clinical presentation of dacryocystitis in our patients was epiphora, positive ROPLAS, discharge, chronic conjunctivitis. Similar reports are there in the contemporary world literature.[19–22]

Variation in the microbes isolated as per the geographic location have been documented by a number of studies. ‘The culture positivity rate in our study was 53/60(88.3%). A number of studies from across the globe show different propensity of microorganisms as seen in cited studies from Iran, Nepal, Egypt, Europe, Ethiopia, Northern India.[23–27] Our study showed gram positive cocci as the most common organism isolated (47/60, 78.3%). This has also been observed in other studies. Bharathi M et al reported 69.7% of microbial isolates to be gram positive cocci.[13] The corresponding percentages from other studies include 61.8% (Eslami F et al), 66.7% (Negm S et al), 64.9% (Mills DM et al).[23,25,26] *Staphylococcus aureus* was the most common organism (68.3%). This was similar to other studies. The percentage of gram-negative organisms seen was 10%. The most common gram-negative microbe was *Pseudomonas aeruginosa* (8.3%). Bharathi M and Negm S et al have reported 10% and 11% of the microbial isolates to be *Pseudomonas aeruginosa*.[12,25] In our study the antibiotic sensitivity was Ampicillin and Sulabactam (92.5%), Gentamicin (73.5%), Cotrimoxazole (58.5%) and Ciprofloxacin (3.7%). There is a wide variation in the antibiotic sensitivity of the organisms amongst studies from across the globe. Assefa Y et al reported antibiotic sensitivities as Ceftriaxone (95.3%), Nalidixic acid (81.3%), Erythromycin (84.2%), Gentamicin (83.3%).[28] Ahuja S et al reported that gram positive organisms were most sensitive to Vancomycin, Fluoroquinolones, Chloramphenicol, Erythromycin, Clindamycin, Tetracycline.[28] Gram negative organisms were most sensitive to Piperacillin/Tazobactam, Imipenem, Chloramphenicol, Amikacin.

The documented findings of a few studies are presented in the following text.

Eshragi et al reported the microbiological spectrum of acute and chronic dacryocystitis of 100 patients.[29] The mean age was 44 years. The female: male ratio was 1.78. The most common isolate was *Staphylococcus aureus* (26%). Gram positive organisms were most common (54%). Gram negative isolates were common in acute dacryocystitis (52%) versus chronic dacryocystitis (18%).

**Table 4:** Antibiotic susceptibility of patients with chronic dacryocystitis

| Antibiotic | *S. aureus* | *S. epidermidis* | *S.pneumoniae* | *P. aeruginosa* | *E. coli* |
|---|---|---|---|---|---|
| Ampicillin+ Sulbactam | 41(68.3%) | 3(5%) | 3(5%) | 1(1.6%) | 1(1.6%) |
| Cotrimoxazole | 23(38.3%) | 2(3%) | 2(3%) | 3(5%) | 1(1.6%) |
| Cephalexin | 33(55%) | 2(3%) | 3(5%) | - | - |
| Tetracycline | 31(51.6%) | 2(3%) | 1(1,6%) | 1(1.6%) | - |
| Cefotaxime | 21(35%) | 1(1.6%) | 3(5%) | 1(1.6%) | - |
| Ciprofloxacin | 0 | 0 | 0 | 1(1.6%) | 1(1.6%) |
| Gatifloxacin | - | - | - | 3(5%) | 1(1.6%) |
| Levofloxacin | 24(40%) | 1(1.6%) | 3(5%) | - | - |
| Linezolid | 39(65%) | 2(3%) | 3(5%) | - | - |
| Cloxacillin | 39(65%) | 3(5%) | 2(3%) | - | - |
| Roxithromycin | 33(55%) | 2(3%) | 3(5%) | - | - |
| Lincomycin | 34(56.6%) | 3(5%) | 2(3%) | - | - |
| Gentamicin | 31(51.6%) | 2(3%) | 1(1.6%) | 4((6.6%) | 1(1.6%) |
| Vancomycin | 41(68.3%) | 3(5%) | 3(5%) | - | - |
| Mupirocin | 41(68.3%) | 3(5%) | - | - | - |
| Piperacillin | - | - | - | 2(3%) | 1(1.6%) |
| Chloramphenicol | - | - | - | 1(1.6%) | 1(1.6%) |
| Meropenem | - | - | - | 4(6.6%) | 1(1.6%) |

Luo B et al reported that *Streptococcus pneumoniae* was the most common isolate in adult 11(14.86%) and paediatric dacryocystitis 30(24.79%).[30] Overall in chronic dacryocystitis *S. pneumoniae* was the most common isolate 29(28.48%) while *Staphylococcus aureus* 8(42.11%) was the most common isolate in acute dacryocystitis. They found that gram positive and gram negative isolated were equal in number in adults with chronic dacryocystitis with NLDO. There were more gram-negative isolates in adult chronic dacryocystitis than paediatric dacryocystitis.

Shah CP, Santani D in a comparative study of the bacteriological profile and antibiogram of dacryocystitis reported that the most common organism associated with the infection was *Staphylococcus aureus*.[31] Gram positive and gram-negative isolates were equally distributed in the study.

Ali MJ et al reported that gram positive organisms (56%, 63/112) were the most common. *Staphylococcus aureus* was the most common isolate (25%, 28/112)[32] H. influenzae was the most common gram-negative isolate (30.2%) of all gram-negative isolates. 10.7% of the patients showed no organisms. Gram positive organisms were sensitive to penicillins and vancomycin. Gram negative organisms were sensitive to quinolones and aminoglycosides.

Assefa Y et al reported the bacteriological profile and drug susceptibility patterns in dacryocystitis patients.[28] Most common isolate was Coagulase negative *staphylococcus aureus*. 29% of the isolates were resistant to only one antibiotic and 16% were resistant to two, three and four antibiotics. Amoxicillin (38.7%), ciprofloxacin (25.8%), Chloramphenicol (25.8%), Cotrimoxazole (25.8%) and Ampicillin (19.4%) were resistant to the bacterial isolates.

Xian X in their study on microbial isolates in dacryocystitis and canaliculitis patients from China reported *S. epidermidis* as the most common organism. Vancomycin and Imipenem were the most susceptible antibiotics.[33]

Biswas P in their recent article have highlighted the emerging trend of antimicrobial resistance in ocular infections and the need for antibiotic tailoring in these scenarios.[34]

The most common organism in our study was *Staphylococcus aureus*. The commonly used antibiotic to which most isolates of *S. aureus* were sensitive was Ampicillin and Sulbactam. Most of the organisms isolated including both gram positive and gram negative were resistant to Ciprofloxacin, a very commonly used antibiotic. Most of the gram-negative organisms were sensitive to Gentamicin, Amikacin and Gatifloxacin.

## 5. Conclusion

In the present era inadvertent use of antimicrobial agents has led to the emergence of resistant strains of microorganisms. A microbiological evaluation and antibiotic sensitivity documentation can help in the prescription of appropriate and effective antibiotics at the same time restricting their inadvertent use. Long term, larger sample size and follow up studies would be required to constantly document the dynamic changes in the microbial ecosystem and subsequent antimicrobial susceptibility and usage.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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