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Bacteriological Profile and Antimicrobial Susceptibility of Congenital Nasolacrimal Duct Obstruction-Associated Conjunctivitis

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ABSTRACT

Objective: To find out the common causes of bacterial conjunctivitis in infants having congenital nasolacrimal duct obstruction and to find out suitable and effective topical antibiotics for their infection.
Study Design: Cross Sectional study.
Place and Duration of Study: Department of Ophthalmology, Combined Military Hospital, Lahore Pakistan, from Jul 2024 to Dec 2024.
Methodology: Infants up to the age of 01 years presenting to our department with pus and watery discharge form one or both eyes were included in current study who had previously not used any antibiotics, or left topical antibiotics for the past 2 weeks a least were included. Presence of nasolacrimal dust obstruction was confirmed with dye disappearance test. Infants with an abnormal dye disappearance test were included a sterile throat swab was then used to take the sample of pus discharge from the conjunctival sac and sent to lab for culture and sensitivity in a safe manner.
Result: A total of 129 samples were taken from 105 patients, with 60 being females (57.14%) and 45 being males (42.50%). Sixty-four samples (49.60%) were taken from the right eye and 65 samples (51.40%) were taken from left eye. Twenty-four samples (18.60%) showed no growth after 48 hours of incubation under 37° C. Thirty-nine (30.20%) showed growth of Staphylococcus Epidermidis. Ampicillin showed resistance in most of the isolates 51.00% resistance while ceftriaxone 69.52 %, ciprofloxacin 65.00%, co-trimoxazole 84.76% and meropenem showed 93.33% sensitivity.
Conclusion: Staphylococcus Epidermidis is the most common organism causing conjunctivitis is patients with nasolacrimal duct obstruction. Most isolates showed resistance to Ampicillin.

Keywords: Bacterial conjunctivitis, Congenital Nasolacrimal Duct Obstruction, Epiphora, Topical Antibiotic Sensitivity, Staphylococcus Epidermidis.

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INTRODUCTION

Epiphora is by far the most common cause for which parents take their infants to any eye OPD in Pakistan.[1] Among other disorders of the eye causing epiphora in the young, epiphora is usually associated with pus discharge which is due to obstruction of the nasolacrimal duct.[2,3]

In about 5-20 percent of infant, this leads to recurrent bacterial infections and rarely acute dacryocystitis.[4,5] These infections are caused by wide range of bacteria including both gram positive and gram-negative organisms.[6,7] Usually, these infections are treated non-surgically by the use of empirical topical antibiotics drops and ointments, including quinolones, aminoglycosides and chloramphenicol along with lacrimal massage.[8] These interventions help in opening the nasolacrimal duct obstruction in about 85% of the infants by 1 year of age. Patients who fail to respond to medication are offered surgical procedures. Initially, lacrimal probing is performed under general anesthesia. Patients are advised daily lacrimal massage post operatively for 30-40 times daily along with topical antibiotic eye drops. Probing can be repeated 2-3 times, while in failed cases dacryocystorhinostomy is the treatment of choice.

The purpose of current study was to find out the organisms causing bacterial conjunctivitis associated with nasolacrimal duct obstruction for better control of conjunctivitis and to avoid complications such as pre-septal cellulitis and acute dacryocystitis so far to our knowledge no study has been done for profiling of bacteria causing conjunctivitis associated with nasolacrimal duct obstruction (NLDO) among Pakistani population.

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METHODOLOGY

This observational cross-sectional study was conducted at Department of Ophthalmology, Combined Military Hospital Lahore, Pakistan, from Jul 2024 to Dec 2024, after obtaining approval from the from ethical review committee of Combined Military Hospital Lahore (ERC Number 594/2024 Dated 01 Jul 2024).

Inclusion Criteria: Infants up to the age to 1 years, of either gender, with epiphora and pus discharge were included. Nasolacrimal duct obstruction was confirmed by Regurgitation test positivity and fluoresceine dye disappearance test.

Exclusion Criteria: Infants who had used any topical or systemic antibiotics during the past 2 weeks, those presenting with complaints of discharge but negative Regurgitation test and normal fluoresceine dye disappearance test, those with any concurrent active ocular or systemic disease, past ocular surgical history and those who had undergone any sort of surgical treatment for congenital nasolacrimal duct obstruction were excluded.

A sample size of 73 was calculated using the OpenEpi online sample size calculator keeping the incidence of congenital nasolacrimal duct obstruction at 5%.[9] The sampling technique was non-probability purposive sampling, and data was collected after obtaining informed consent from parents.

The collected data gathered included demographic information from each participant's parents regarding the age, gender and medical background. All individuals underwent Fluoresceine dye disappearance test with fluoresceine stirps which were placed in the conjunctival sac after putting one drop of artificial tears, polyvinyl alcohol on the fluoresceine strips on both eyes, conjunctival sac was then examined after 05 minutes for retention of any fluoresceine in the conjunctival sac. Pus or watery discharge was then collected on a sterile throat swab stick from conjunctival sac and was sent to microbiology lab for culture and sensitivity in a safe and sterile manner as per protocols of concerned laboratory. Culture and sensitivity were done on blood and chocolate agar for 48 hours under 37° C incubation. Samples yielding positive growths were then further processed for antimicrobial susceptibility via the commonly used disc diffusion method.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 22. Normality of data was checked by using Kolmogorov-Smirnov test. Age was non normally distributed, represented by median (IQR). Qualitative variables (Laterality, Bacteria, Ampicilin, Ceftriaxone, Ciprofloxacin, Co-trimoxazole, Levofloxacin and Meropenem) were presented as frequency and percentages). Chi-square test (for qualitative variables) was applied for the association and *p*-value of ≤0.05 was considered as statistically significant.

RESULTS

A total of 129 samples taken from 105 patients with 60 females (57.14%) and 45 males (42.50%), 24(22.85%) patients had involvement of both eyes, the median age of participants was 2.0 (5.0 – 2.0) months. Out of total, 64 samples (49.60%) were taken from the right eye and 65 samples (51.40%) were taken from left eye. Out of total 105 patients 59(56.19%) were aged between 0-3 months, 22(20.95%) were between 3-6 months, 13(12.38%) were between 6-9 months while 11(10.47%) were between 9-12 months. However, Out of total 129 samples Staphylococcus Epidermidis was the most frequent isolate (n=30,30.20%) followed by streptococcus pneumoniae (n=27,20.90%), Haemophilus Influenza (n=22,17.10%), Staphylococcus Aureus (n=15, 11.60%), Haemophilus Parainfluenza (n=1, 0.80%) and Enterococcus Faecalis (n=1, 0.80%) respectively while 24 samples showed no growth after 48 hours of incubation under 37° C as shown in Table-I.

Table-I: Incidence of Different Bacterial Isolates (n=129)

Bacterial Isolates	n (%)
Staphylococcus Epidermidis	39(30.2%)
Streptococcus Pneumoniae	27(20.9%)
Staphylococcus Aureus	15(11.6%)
Haemophilus Influenzae	22(17.1%)
Haemophilus Parainfluenzae	01(0.8%)
Enterococcus Faecalis	01(0.8%)
No Growth	24(18.6%)

Out of 129 samples, 24(18.60%) showed no growth. Figure shows that the antimicrobial susceptibility patterns of bacterial isolates against six commonly used antibiotics. Out of 105 samples, the highest sensitivity was observed with meropenem, with 93.33% of isolates being sensitive and only 6.67% resistant, indicating it is the most effective antibiotic among those tested. cotrimoxazole also demonstrated high effectiveness, with a sensitivity rate of 84.76% and a relatively low resistance rate (15.24%). Moderate levels of sensitivity were observed for ceftriaxone (69.5%), ciprofloxacin (64.76%), and levofloxacin

(64.76%), with corresponding resistance rates ranging 30.5% to 35.24%. However, ampicillin exhibited the poorest performance, with nearly equal sensitivity (49.5%) and resistance (50.5%) percentages, suggesting limited clinical utility due to high resistance.

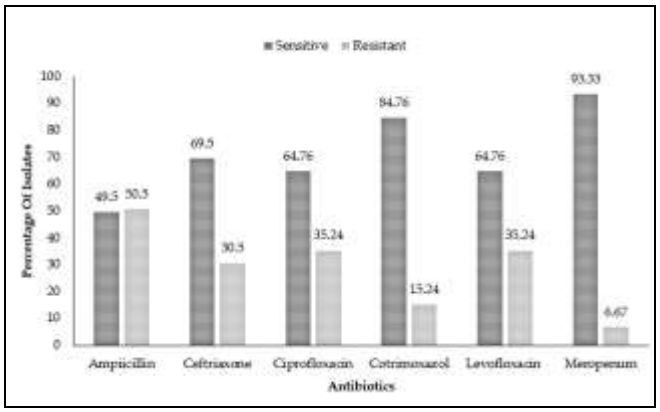

Figure: Comparison of Sensitivity and Resistance Rates of Bacterial Isolates to Common Antibiotics (n=105)

Ampicillin shows a statistically significant association (p=0.010) with Gram staining results. Resistance was higher in Gram-positive isolates (57.3%), whereas sensitivity was higher in Gram-negative isolates (73.9%). However, ciprofloxacin also shows a significant association (p=0.025). Resistance was notably higher in Gram-negative isolates (56.5%), while sensitivity was more common among Gram-positive isolates (70.7%). For ceftriaxone, cotrimoxazole, levofloxacin, and meropenem, there was no statistically significant association in antibiotic sensitivity between Gram-positive and Gram-negative groups (p>0.05), suggesting similar effectiveness regardless of Gram stain. Meropenem had very high sensitivity in both groups (92.7% in Gram-positive, 95.7% in Gram-negative), indicating strong broad-spectrum activity (Table-II).

Table-II: Association of Gram Staining and Antibiotics (n=105)

Antibiotics		Gram Staining		*p*-value
		Positive (n=82) n (%)	Negative (n=23) n (%)	
Ampicillin	Sensitive	35(42.7%)	17(73.9%)	0.010
	Resistance	47(57.3%)	06(26.1%)	
Ceftriaxone	Sensitive	54(65.9%)	19(82.6%)	0.199
	Resistance	28(34.1%)	04(17.4%)	
Ciprofloxacin	Sensitive	58(70.7%)	10(43.5%)	0.025
	Resistance	24(29.3%)	13(56.5%)	
Cotrimoxazole	Sensitive	70(85.4%)	19(82.6%)	0.748
	Resistance	12(14.6%)	04(17.4%)	
Levofloxacin	Sensitive	50(61.0%)	18(78.3%)	0.146
	Resistance	32(39.0%)	05(21.7%)	
Meropenem	Sensitive	76(92.7%)	22(95.7%)	1.000
	Resistance	06 (7.3%)	01 (4.3%)	

DISCUSSION

In the current study, most of the sample showed positive growth of Staphylococcus Epidermidis followed by Streptococcus Pneumoniae, Hemophilus Influenzae and Staphylococcus Aureus while 18.6% showed no growth. Fifty-seven point one percent patients were females while 42.5% were males. Twenty-seven percent had involvement of both eyes. Most of the isolates of S. Epidermidis, S. Pneumoniae and S. Aureus showed resistant to ampicillin but showed good sensitivity to ceftriaxone, ciprofloxacin, co-trimoxazole and meropenem. While most of the isolates of H. Influenzae showed resistant to ciprofloxacin but showed good sensitivity to all other antibiotics including ampicillin.

Current study showed positive culture in 82.4%, while 18.6 % revealed no growth. This can be compared with similar studies.[10-13] In one study, 73% cases were culture positive, while in a similar study done in year 2022 by Yang *et al*., 62.7% of the samples came out positive for microbial growth.[13]

In our study, more patients were females 57.14% as compared to males, which is similar to a study done in the year 2023 by Rizvi *et al.*, where 65.4% were females.[14] Slightly more incidence of CNLDO among females may be attributed to narrow bony canal of nasolacrimal duct among female subjects.[15]

The present study showed more incidence of NLDO in infants between aged between 0-3 months (56.19%), followed by 20.95% in patients between 3-6 months age, which is as compared to a similar study which showed 34% patient between age 0-3 months while 39% between aged 4-6 months age.[16]

In current study most of the isolates showed good sensitivity to ciprofloxacin, which is in accordance with a similar study, while most of the isolates were resistant to ampicillin, which is in accordance with a similar study done by Dhore *et al*.[17,18]

Current study showed good sensitivity of gram-negative organism to ampicillin because most of the isolates were of Hemophilus influenza.

Our study showed 30.2% isolates to be Staphylococcus Epidermidis, 20% Streptococcus Pneumoniae, 11.6% Staphylococcus Aureus, 17.1% Haemophilus Influenzae, 0.8% Haemophilus Parainfluenza and Enterococcus Faecalis these percentages are comparable to a similar study done by

Sharma *et al.*, which showed Streptococcus Pneumoniae 32%, coagulase-negative Staphylococcus 25% and Staphylococcus Aureus in 11%.[19]

LIMITATIONS OF STUDY

Our study had certain limitations. Samples were taken from the conjunctival sac after dye disappearance test so contamination with the normal flora of the conjunctival sac was not taken into account, long term follow-up of patients was not done and bacteriological profile of patient with failed probing was not done or any patients with intubation were not included.

CONCLUSION

Staphylococcus Epidermidis is the most common organism causing conjunctivitis is patients with nasolacrimal duct obstruction. Most isolates showed resistance to Ampicillin.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

UNK & MS: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

MISK & SF: Data acquisition, data analysis, approval of the final version to be published.

JAK & AH: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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