Bacteriology of lacrimal duct obstruction in adults

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Abstract

***Aims*—To determine the current bacteriology of lacrimal duct obstruction (LDO) and to relate the bacteriological findings to the type of symptoms.**

***Methods*—127 samples were obtained from the lacrimal sac in 118 consecutive adult patients with LDO, including nine bilateral cases.**

***Results*—Altogether, 156 isolates were recovered from the 127 samples cultured. Cultures were positive from 84% of the samples. Gram positive bacteria were isolated in 79 (62%) samples. The most frequently cultured bacterial species was *Staphylococcus epidermidis,* representing 27% of the isolates. Gram negative bacteria were recovered from 26 (20%) samples, and these bacteria were statistically significantly more common in cases with copious discharge than in cases with minor discharge (p=0.000). Cases with simple stenosis of the lacrimal duct (SSLD) showed significantly less *Streptococcus* sp (p=0.004) and Gram negative organisms (p=0.004) than those with chronic dacryocystitis.**

***Conclusion*—The bacteriology of SSLD resembles that of normal conjunctival flora. Chronic dacryocystitis in adults is associated with an increased proportion of Gram negative bacteria which may be a reservoir for postoperative intraocular infection. They should also be taken into account in selecting antimicrobial prophylaxis in lacrimal drainage surgery.**

(*Br J Ophthalmol* 1997;**81**:37–40)

Lacrimal sac and/or nasolacrimal duct obstruction, which here is defined as lacrimal duct obstruction (LDO), is an annoying and sometimes an eye threatening ophthalmic problem, which affects patients of every age. The obstruction may be an idiopathic inflammatory stenosis, the primary acquired nasolacrimal duct obstruction (PANDO),[1] which mostly affects middle aged and elderly women, or may be secondary to trauma, infection, inflammation, neoplasm, or mechanical obstruction, the secondary acquired lacrimal drainage obstruction (SALDO).[2] Distal obstruction converts the lacrimal sac into a stagnant pool, which easily becomes infected leading to chronic dacryocystitis with epiphora and purulent discharge.[3] It is, however, noticeable that many patients tolerate LDO with epiphora for many years without clinical infection,[4] representing simple stenosis of lacrimal duct (SSLD).

During the past 20 years there have been only a few studies on the bacteriology of adult LDO. According to them, *Staphylococcus epidermidis* and *Staphylococcus aureus* are the most frequently isolated organisms in adult lacrimal sac infections.[5–7]

The treatment of LDO in adults is surgery, either external or endonasal dacryocystorhinostomy (DCR), or occasionally silicone intubation. Walland and Rose[8] reported a fivefold risk of soft tissue infection after open lacrimal surgery without systemic antibiotic prophylaxis. According to them, postoperative soft tissue infection represents a significant risk of failure in lacrimal surgery. Knowledge of the bacteriology of LDO contributes significantly to the choice of prophylactic antimicrobial agents.

The purpose of this study was to determine the current bacteriology of LDO in Finnish (white) adults and to determine whether the bacteriology of SSLD and chronic dacryocystitis differ from each other.

Materials and methods

PATIENTS

We examined 118 consecutive adult patients with LDO, who had been referred for lacrimal drainage surgery to the outpatient clinic of the Department of Ophthalmology, Turku University Central Hospital, between April 1994 and November 1995. The patients ranged in age from 22 to 89 (mean 63.5) years; 93 (79%) were women and 25 (21%) were men. Nine of the 118 patients with LDO were bilateral cases. Eighteen patients had previously had at least one acute episode of dacryocystitis, and seven of them had suffered from two to five acute episodes. Patients who had undergone lacrimal drainage surgery during the past year were excluded. Five patients had had previous external DCR performed 1–24 years earlier and one patient had undergone silicone intubation 1 year earlier. Altogether, 112 patients had not undergone previous lacrimal drainage operations. Informed consent was obtained from all the patients studied.

OPHTHALMIC EXAMINATION

We performed a routine ophthalmic examination including biomicroscopy, using Haag–Streit 900 instruments paying special attention to the presence of discharge and epiphora. The LDO was confirmed by irrigation of the lacrimal drainage system and by probing up to the nasal wall of the lacrimal sac fossa.

BACTERIAL ISOLATION

In all, 127 samples of the contents of the lacrimal sac were obtained from 118 patients;

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Accepted for publication
12 September 1996

nine of the patients had cultures obtained from both sides. The collection of the samples was performed either by applying pressure over the lacrimal sac and allowing the purulent material to reflux through the lacrimal punctum, or by irrigating the lacrimal drainage system with sterile saline and collecting the sample from the refluxing material. The samples were collected with sterile cotton wool swabs, ensuring that the lid margins or the conjunctiva were not touched. None of the patients had used either antibiotic eyedrops or systemic antibiotics for at least a week before their visit to the outpatient clinic. Anaesthetic eyedrops were not used before the sample collection. The samples were cultured on the day of collection onto blood, chocolate, and fastidious anaerobic agar and incubated aerobically and anaerobically for 4 days. The anaerobic incubation took place in an anaerobic cabinet (Don Whitley, UK). The bacteriological isolates were identified with standard procedures.

STATISTICS

Fisher's exact fourfold table test was used for comparing the distributions of the isolated micro-organisms between different clinical groups with a p value < 0.05 chosen to be statistically significant.

Results

CLINICAL FINDINGS

A total of 97 (76%) cases showed chronic dacryocystitis with purulent discharge and epiphora. These cases were divided into two subgroups according to the quality of discharge. Forty six cases showed copious purulent discharge or thick mucous discharge coming from the lacrimal sac, and 51 cases showed epiphora and minor mucopurulent discharge only.

Thirty (24%) patients complaining of epiphora did not show any clinical signs of infection of the lacrimal drainage system. In all of these, the reflux from the irrigated lacrimal sac was entirely clear tear fluid and saline. Our clinical diagnosis for these 30 cases was SSLD.

BACTERIOLOGICAL FINDINGS

The results of the aerobic and anaerobic cultures of the 118 patients with LDO are presented in Table 1. Of the 127 samples 107 (84%) yielded a positive culture. Of the 107 samples with positive culture results, 51 (48%) had mixed cultures with two to four organisms isolated. Altogether, 156 organisms were isolated. The majority of micro-organisms were Gram positive bacteria. Altogether, 108 Gram positive isolates were recovered, representing 69% of the overall 156 isolates cultured. Gram positive bacteria were found in 79 samples, accounting for 62% of all the samples. In 26 of the samples two to three different Gram positive bacteria were present. The most frequently cultured species was *Staphylococcus epidermidis*, which was isolated in 42 (33%) of the samples, accounting for 27% of all the isolates. Gram negative bacteria were recovered from 26 samples (20%). They represented 17% of the isolates, the most common Gram negative bacteria being *Haemophilus influenzae*, which represented 4% of the isolates. Anaerobic micro-organisms were present in 20 (16%) samples. They accounted for 13% of the isolates, the most frequently isolated anaerobic bacteria being *Propionibacterium* sp, which represented 10% of the isolates, and 80% of all the anaerobic isolates.

Table 1 Bacteriological findings of the content of the lacrimal sac in 118 adult patients with lacrimal duct obstruction

Micro-organisms isolated	*Number of isolates (n=156)*	*% of all isolates*	*% of samples (n=127)**
Gram positive organisms:	108	69.2	
Staphylococcus epidermidis	42	26.9	33.1
Staphylococcus aureus	19	12.2	15.0
Other *Staphylococcus* sp	13	8.3	10.2
Micrococcus sp	1	0.6	0.8
Streptococcus pneumoniae	8	5.1	6.3
Other *Streptococcus* sp	10	6.4	7.9
Corynebacterium sp	4	2.6	3.1
Other Gram positive rods	11	7.1	8.7
Gram negative organisms:	26	16.7	
Haemophilus influenzae	6	3.8	4.7
Haemophilus parainfluenzae	2	1.3	1.6
Escherichia coli	3	1.9	2.4
Pseudomonas aeruginosa	2	1.3	1.6
Citrobacter sp	2	1.3	1.6
Enterobacter sp	3	1.9	2.4
Klebsiella pneumoniae	2	1.3	1.6
Moraxella catarrhalis	1	0.6	0.8
Morganella morganii	1	0.6	0.8
Acinetobacter lwoffii	1	0.6	0.8
Proteus sp	1	0.6	0.8
Other Gram negative rods	1	0.6	0.8
Gram negative coccus	1	0.6	0.8
Anaerobic organisms:	20	12.8	
Propionibacterium sp	16	10.3	12.6
Other anaerobic Gram positive rods	2	1.3	1.6
Bacteroides fragilis	1	0.6	0.8
Fusobacterium sp	1	0.6	0.8
Fungal organisms:	2	1.3	
Candida sp	2	1.3	1.6
Mixed flora	8		6.3
No micro-organism	20		15.7

*Number of samples.

Both the 30 cases carrying the clinical diagnosis of SSLD, and the 97 cases with chronic dacryocystitis, showed a preponderance of staphylococci, Gram positive rods, *Propionibacterium* sp, and a few other anaerobic organisms (Table 2). Not a single isolate of streptococci occurred in samples of the cases with SSLD, whereas these organisms were isolated significantly more often (20%) in samples of the cases with chronic dacryocystitis (p=0.004). Gram negative organisms were also isolated significantly more often (26%) in the cases with chronic dacryocystitis than in the cases with SSLD (p=0.004). There were significantly more cases with SSLD (33%) than cases with chronic dacryocystitis (10%) in which no micro-organism was found (p=0.005). In chronic dacryocystitis both the cases with copious purulent or mucous discharge and those with minor mucopurulent discharge showed Gram positive organisms frequently (Table 3), although these were even more

Table 2 Bacteriological findings in 30 cases with simple stenosis of the lacrimal duct and in 97 cases with chronic dacryocystitis

	Number of isolates (% of samples)		*p Value*
Micro-organisms isolated	*Simple stenosis (n=30)**	*Chronic dacryocystitis (n=97)**	*Simple stenosis v chronic dacryocystitis*
Gram positive organisms:	16†	92‡	0.02
Staphylococci	13 (43.3)	61 (62.9)	
Streptococci	—	19 (19.6)	0.004
Gram positive rods	3 (10.0)	12 (12.4)	
Gram negative organisms:	1	25	0.004
Haemophilus sp	1 (3.3)	7 (7.2)	
Enterobacteria	—	12 (12.4)	
Other Gram negative organisms	—	6 (6.2)	
Anaerobic organisms:	5	15	0.54
Propionibacterium sp	4 (13.3)	12 (12.4)	
Other anaerobic organisms	1 (3.3)	3 (3.1)	
Yeast	—	2 (2.1)	0.58
No micro-organism	10 (33.3)	10 (10.3)	0.005

*Number of samples.
†Gram positive bacteria found in 13 samples.
‡Gram positive bacteria found in 65 samples.

frequent in the cases with minor mucopurulent discharge (p=0.03). However, about half (52%) of the samples of the cases with copious purulent or mucous discharge showed Gram negative organisms, whereas these bacteria were isolated in only one sample (2%) of the cases with minor mucopurulent discharge. This difference was statistically highly significant (p=0.000).

Discussion

During the past 50 years the microbiological flora of dacryocystitis have gradually changed. The proportion of *Streptococcus pneumoniae*, which in the 1930s was the most common species cultured after to *Staphylococcus epidermidis* (*albus*),[3] has decreased.[5 7 9] In this study Gram positive bacteria were found in 69% of the isolates. This is in close agreement with the observation of 65% of Gram positive organisms by Coden *et al*.[7] The most common organisms cultured in our study were *Staphylococcus* species, accounting for 47% of the isolates. This percentage compares fairly well with the results of Thicker and Buffam,[6] Huber-Spitzy *et al*,[5] and Coden *et al* [7] (their percentages being 73%, 51%, and 49% respectively). *Streptococcus pneumoniae* represented 5% of the isolates in our study, which is higher than Huber-Spitzy *et al* [5] and Coden *et al* [7] reported (their percentages being 2% and 2.3%).

Gram negative organisms represented 17% of the isolates of the total material in this study, the most frequently isolated species being *Haemophilus influenzae* (4%). Previously, Huber-Spitzy *et al* [5] reported Gram negative organisms accounting for 26% of isolates, the most frequent species being *Escherichia coli* (12%). Coden *et al* [7] observed Gram negative organisms in 27% of all isolates, including *Pseudomonas aeruginosa* in 9% and *Haemophilus* species in 6% of isolates.

In the cases with chronic dacryocystitis Gram negative organisms were isolated in 26% of samples in this study. Gram negative organisms occurred statistically highly significantly more frequently in cases with copious purulent or mucous discharge than in cases with minor discharge. This tallies with the practice that chronic dacryocystitis with mucous or purulent discharge is a contraindication for elective intraocular surgery. In lacrimal drainage surgery of such cases the antimicrobial prophylaxis should also cover Gram negative organisms.

In this study anaerobic bacteria were seen in 13% of the overall 156 isolates, mostly including *Propionibacterium* species (80% of anaerobic isolates). Previously, anaerobic bacteria have been reported to account for 7% of isolates, the most frequent anaerobic bacteria being *Propionibacterium acnes* (67% of anaerobic isolates).[7] Thicker and Buffam[6] found no anaerobic bacteria from the lacrimal sac in their study. Huber-Spitzy *et al* [5] cultured two anaerobic bacteria (one *Propionibacterium* species and one anaerobic *Streptococcus* species) from purulent abscesses of the lacrimal sac in their study of 150 patients with acquired dacryocystitis.

Normal flora of human conjunctiva mostly consisted of Gram positive bacteria, which represented up to 97% of cultured aerobic isolates.[10] The most common bacterium was *Staphylococcus epidermidis*, accounting for 57–87% of isolates,[9–12] while *Streptococcus* species accounted only for 6% of all aerobic isolates of normal conjunctiva.[10] Gram negative bacteria represented 0–5% of aerobic isolates.[9–12] The most frequent anaerobic bacteria in normal conjunctival flora was *Propionibacterium* species, accounting for 19% of all isolates and 81% of all anaerobic bacteria.[10] An interesting finding in our study was the paucity of Gram negative bacteria and *Streptococcus* species in the cases with SSLD, suggesting that the bacterial flora of this group are comparable with those of normal conjunctiva. This finding may explain why patients with SSLD did not have an increased risk for endophthalmitis after intraocular surgery.[13]

In conclusion, chronic dacryocystitis in adults was associated with an increased proportion of Gram negative bacteria. These were clearly not related to conjunctival flora.

Table 3 Distribution of aetiological agents in 97 cases with chronic dacryocystitis according to quality of discharge

	Number of isolates (percentage of samples)		*p Value*
Micro-organisms isolated	*Copious purulent or mucous discharge (n=46)**	*Minor mucopurulent discharge (n=51)**	*Copious v minor discharge*
Gram positive organisms:	40†	52‡	0.03
Staphylococci	26 (56.5)	35 (68.6)	
Streptococci	9 (19.6)	10 (19.6)	
Gram positive rods	5 (10.9)	7 (13.7)	
Gram negative organisms:	24	1	0.00
Haemophilus sp	7 (15.2)	—	
Enterobacteria	12 (26.1)	—	
Other Gram negative organisms	5 (10.9)	1 (2.0)	
Anaerobic organisms:	10	5	0.09
Propionibacterium sp	8 (17.4)	4 (7.8)	
Other anaerobic organisms	2 (4.3)	1 (2.0)	
Yeast	1 (2.2)	1 (2.0)	0.73
No micro-organism	3 (6.5)	7 (13.7)	0.20

*Number of samples.
†Gram positive bacteria found in 26 samples.
‡Gram positive bacteria found in 39 samples.

These Gram negative bacteria are potential pathogens in postoperative infections, both in intraocular and lacrimal drainage surgery. For this reason antimicrobial prophylaxis in lacrimal drainage surgery should also cover Gram negative rods.

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