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CLINICAL INVESTIGATIONS

Dacryocystorhinostomy for Dacryocystitis Caused by Methicillin-resistant *Staphylococcus aureus*: Report of Four Cases

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Background: To evaluate the outcome of dacryocystorhinostomy (DCR) for dacryocystitis caused by methicillin-resistant *Staphylococcus aureus* (MRSA).

Cases: Four otherwise healthy patients with dacryocystitis caused by MRSA were studied (3 with chronic dacryocystitis; 1, acute dacryocystitis). Ophthalmic symptoms were epiphora with purulent discharge in 2 cases, with blepharoconjunctivitis in 1 case, and with lacrimal fistula in 1 case. Culture of the purulent discharge from the affected conjunctival sacs revealed MRSA infection. Initial treatment, which was unsuccessful, included intravenously administered common antibiotics, the use of topical antibiotics and povidone-iodine in the conjunctival sac and mupirocin ointment in the nasal cavity. Subsequently, standard DCR was performed with a bicanalicular silicone tube inserted under local anesthesia, accompanied by the administration of common antibiotics.

Observation: Cultures from all patients were negative for MRSA as soon as 4 days after DCR. None of the patients had epiphora with pus, and the lacrimal passage became patent postoperatively.

Conclusion: Dacryocystitis due to MRSA was resistant to conservative therapy. DCR subsequent to the conservative therapy resulted in almost immediate resolution of the lacrimal fistula and nasolacrimal obstruction, rapid control of dacryocystitis, and a decrease in the period of MRSA infection in the conjunctiva and the nasal cavity. **Jpn J Ophthalmol 2002;46:177–182** © 2002 Japanese Ophthalmological Society

Key Words: Dacryocystitis, dacryocystorhinostomy, lacrimal fistula, methicillin-resistant *Staphylococcus aureus*, mupirocin ointment.

Introduction

The incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) is reportedly increasing,[1–4] and this pathogen has been identified as the cause of corneal and ocular infections.[5–9] MRSA is resistant to many antibiotics.[7,9–12] In addition, the frequency of nasolacrimal duct obstruction was shown to be significantly higher in eyes with bacterial infection than in infection-free eyes.[12] Also, eyes with nasolacrimal duct obstruction had a higher incidence of MRSA growth than those without obstruction.[12] For these reasons, the frequent and chronic use of topical antibiotics in eyes with nasolacrimal duct obstruction could lead to dacryocystitis due to MRSA (MRSA dacryocystitis).

Previous reports showed successful treatment of MRSA dacryocystitis with topical antibiotics or dacryocystectomy after systemic antibiotic infusion, based

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on the patient's condition and preference for treatment.[7] It is true that many hospitalized immunocompromised patients tend to become MRSA carriers[12] and are highly susceptible themselves to MRSA dacryocystitis. Some outpatients in good general health also become infected with MRSA dacryocystitis. A problem with previous methods of treatment is the relatively long period of hospitalization required for the administration of systemic and topical antibiotics or dacryocystectomy. Although dacryocystectomy may reduce the pain of acute dacryocystitis and slightly reduce the degree of epiphora, it does not completely resolve persistent epiphora. To our knowledge, no report has described the clinical course and efficacy of dacryocystorhinostomy (DCR) for MRSA dacryocystitis.

We report here on 4 patients with MRSA dacryocystitis who were successfully treated by DCR.

Materials and Methods

We reviewed the records of 4 patients (3 women, 1 man; 60 to 87 years of age) with MRSA dacryocystitis who had been referred to the outpatient clinic at the Department of Ophthalmology, Hirosaki University Hospital, between April 1995 and March 2000. None of these patients had been recently hospitalized. Although 2 patients had heart disease and 1 had diabetes mellitus, these conditions were well-controlled and all 4 patients appeared healthy, with the exception of their ophthalmic condition. We assigned the diagnosis of obstruction of the nasolacrimal duct in all cases after lacrimal sac irrigation with physiological saline solution. Nasolacrimal duct obstruction had been present for 1–10 years (mean = 5.2 years). Ophthalmic signs were epiphora in all 4 patients, accompanied by purulent discharge in 2 cases, blepharoconjunctivitis in 1 case, and lacrimal fistula in 1 case (Table 1).

For bacteriologic study, a sterile dry swab was applied to the inferior conjunctival fornix of 1 eye and to the nasal cavity. If staphylococci grew, *S. aureus* was differentiated from coagulase-negative staphylococci strains by coagulase production. Disk diffusion and agar screening methods were used to detect methicillin resistance. In the disk diffusion method, resistance was confirmed by the distribution of bacterial growth inhibitory zone diameters against ceftizoxime and methicillin for 18 hours at 35°C. In the agar screening method, the methicillin resistance of isolates was defined as growth on modified Mueller-Hinton agar supplemented with 4% sodium chloride and 4 μg/mL oxacillin after incubation for 40 hours at 35°C. Susceptibility of the strain to ampicillin (ABPC), cefazolin (CEZ), minocycline (MINO), gentamicin (GM), erythromycin (EM), vancomycin (VCM), and ofloxacin (OFLX) was determined by the disk diffusion method.

We evaluated bacterial flora in the conjunctival sacs and nasal cavity each week. When two consecutive tests were found to be negative for bacteria, we considered that MRSA had been eradicated from the conjunctival sac and nasal cavity.

All surgery was performed with the patient under local anesthesia using the technique of Dupuy-Dutemps by either one of two surgeons (MK or YA). Three straight incisions 1.5 cm in length were made over the anterior lacrimal crest in cases 1, 3, and 4. A curved incision of 1.5 cm was made to avoid the lacrimal fistula in case 2. The osteotomy was made as large as possible, with sides being approximately 12 mm, and was created with Kerrison rongeurs (02-095-01, Mizuho, Tokyo). The lacrimal sac and nasal mucosa were opened longitudinally to form anterior flaps and 1.25% povidone-iodine solution was applied upon opening the sac.[6,13] We removed the fistula in case 2. Silicone tubes were inserted and tied with two 4-0 silk knots. The anterior flaps were sutured with three 6-0 silk sutures. The periosteum and orbicularis muscle were closed in separate layers with 6-0 dexon sutures. The skin incision was closed with running 6-0 nylon sutures. A cotton pledget inserted

Table 1. Patients with Methicillin-resistant *Staphylococcus aureus* Growth

Patient No.	Age (years)	Sex	Chief Ocular Complaint	Systemic Disease	Duration of Nasolacrimal Duct Obstruction (years)
1	70	Female	Epiphora, blepharitis	Diabetes mellitus	3
2	67	Female	Epiphora, lacrimal fistula	Operated thyroid	10
3	60	Female	Epiphora, discharge	Heart disease	1
4	87	Male	Epiphora, discharge	Atrial fibrillation, cholelithiasis	7

Table 2. Pre- and Postoperative Treatment*

Patient No.	Before DCR		After DCR		
	Systemic Antibodies	Ocular Drugs	Intravenous Antibiotics	Oral Antibiotics	Ocular Antibiotics
1	None	0.6% Povidone-iodine solution, 0.3% dibekacin sulfate	CTM	CCL	0.3% OFLX 3% dibekacin sulfate
2	VCM, CZOP (IV), CFPN-PI, LVFX, MINO (oral)	0.5% VCM	MINO	MINO	0.3% OFLX
3	None	0.6% Povidone-iodine solution	FMOX	CCL	0.3% OFLX
4	None	0.5% VCM	CTM	LVFX	0.3% OFLX

*DCR: dacryocystorhinostomy, VCM: vancomycin, CZOP: cefozopran, IV: intravenous, CFPN-PI: cefcapene pivoxil, LVFX: levofloxacin, MINO: minocycline, CTM: cefotiam, FMOX: flomoxef sodium, CCL: cefaclor, OFLX: ofloxacin.

into the nasal cavity was removed 1 week after surgery and the silicone tubes were removed 2 to 3 months after surgery. Postoperative treatment included antibiotics administered intravenously and orally as well as ocular antibiotics (Table 2). Lacrimal sac irrigation with 0.5% OFLX ophthalmic solution was performed at days 3, 5, and 7 after DCR.

Results

When MRSA growth was positive, 3 of our cases were treated as having chronic dacryocystitis and 1 case was treated for acute dacryocystitis. The 3 chronic cases were treated with 0.3% topical OFLX and the one acute case was treated with 1% topical sulbenicillin odium (SBPC) (Table 3). The mean period of administration of topical antibiotics until the finding of MRSA positivity was 4.7 months (range, 4–6 months). Organisms cultured from conjunctiva and nose before DCR are shown in Table 4. Of the 4 patients, 3 had only MRSA growth and 1 had both MRSA and *Serratia marcescens* growth in the conjunctiva. In 2 of the 4 cases, bacteriologic study of isolates from within the nares revealed MRSA growth in one of these patients (Tables 4 and 5). Antibiotic sensitivity was studied in four methicillin-resistant strains, all of which were resistant to ABPC, CEZ, and EM, but were sensitive to VCM (Table 6). Two strains were resistant and two were sensitive to GM and OFLX. One strain was sensitive and three were resistant to MINO. MRSA isolated from the nose showed the same pattern of resistance as MRSA isolated from the conjunctiva. These 2 patients received nasal administration of mupirocin ointment,[1,4,8] but we could not eliminate MRSA from the nasal cavity of 1 patient (Tables 4 and 5). Topical antibiotics including 0.3% dibekacin sulfate and 0.5% VCM or 0.6% povidone-iodine were used to eliminate the MRSA in these patients before DCR. Although the lacrimal sac was frequently irrigated with 0.5% VCM, 0.3% dibekacin, and 1.25% povidone-iodine to eliminate MRSA, the infection did not resolve. We, therefore, decided to perform DCR.

None of the 4 patients who underwent DCR experienced fever, wound infection, or other postsurgical difficulties. MRSA was not isolated from bacterial swabs taken from the second to the fourth postoperative days, and thereafter none of these patients has become positive for MRSA. Neither has there been recurrence of obstruction or complaints of epiphora postoperatively. Passages of the nasolacrimal duct were patent in all four cases as evidenced by lacrimal irrigation.

Table 3. Antibiotic Use at Time of Methicillin-resistant *Staphylococcus aureus*-Positive Result

Patient No.	Dacryocystitis	Antibiotic Used Topically*	Duration (months)
1	Chronic dacryocystitis	1% SBPC	4
2	Acute dacryocystitis	0.3% OFLX	2
3	Chronic dacryocystitis	0.3% OFLX	6
4	Chronic dacryocystitis	0.3% OFLX	4

*SBPC: sulbenicillin sodium, OFLX: ofloxacin.

Table 4. Organisms Cultured From Conjunctiva and Nose Before Dacryocystorhinostomy

Patient No.	Conjunctiva*	Nose
1	MRSA only	No examination
2	MRSA and *Serratia marcescens*	No growth
3	MRSA only	No examination
4	MRSA only	MRSA and *Staphylococcus epidermidis*

*MRSA: methicillin-resistant *Staphylococcus aureus.*

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Table 5. Elimination of Methicillin-resistant *Staphylococcus aureus* at Conjunctival Sac and Anterior Nares Before Dacryocystorhinostomy

Patient No.	Applied to Conjunctiva*	Elimination	Applied to Nose	Elimination
1	0.6% Povidone-iodine solution, 0.3% dibekacin sulfate	No	Nothing	N/A
2	0.5% VCM	No	Mupirocin ointment	No
3	0.6% Povidone-iodine solution	No	Nothing	N/A
4	0.5% VCM	No	Mupirocin ointment	No

*VCM: vancomycin.

Although the duration between the initial consultation and performance of DCR ranged from 97 to 150 days, it took only 2 to 4 days until negative MRSA tests were obtained (Table 7). Cultures from conjunctiva and the nose in all 4 patients were negative after DCR, but in 1 patient the same MRSA with the same antibiotic susceptibility grew from a culture from a silicone tube removed 7 months after DCR (Table 8).

The following describes the clinical course of a representative case (case 2).

Case Report

A 67-year-old woman had chronic dacryocystitis on the left side for 10 years. After the chronic dacryocystitis became acute, she was treated for acute dacryocystitis with intravenous cefozopran (1 g/12 hours) for 4 days, oral cefcapene pivoxil (300 mg/day) for 7 days, and 0.5% topical OFLX four times daily for 2 months. Because her acute dacryocystitis did not improve, an incision of the lacrimal sac was made to drain pus. Cultures of the pus were highly positive for MRSA that was sensitive only to VCM, arbekacin sulfate, and GM. No growth of MRSA was detected from the nasal cavity. She was then treated with intravenous VCM (1 g/12 hours) for 2 days, oral levofloxacin (300 mg/day) for 3 days, and 0.5% topical OFLX four times daily. Although lacrimal sac pus was drained, acute dacryocystitis did not improve and the lacrimal fistula persisted (Figure 1). Cultures of the pus from the fistula were highly positive for MRSA again. Thereafter, she was referred to Hirosaki University Hospital. She was carefully treated by oral administration of MINO (200 m/day) for 5 days and 0.5% VCM 6 times daily but still without improvement of the lacrimal fistula. We performed DCR and removed the lacrimal fistula at the same time. Postoperative treatment included intravenous MINO (100 mg/day) for 4 days, oral MINO (200 m/day) for 2 days in succession, and topical 0.5% OFLX and 0.1% fluorometholone four times daily for 2 to 3 weeks. Mupirocin ointment was applied to the nasal cavity.

The results of the cultures from the conjunctival sac and nasal cavity were negative for MRSA as soon as 4 days after the DCR. She has had no complaint of epiphora, and was found to have no obstruction on irrigation (Figure 2). There have been no further occurrences of MRSA infection in this patient in 6 months.

Table 6. Antibiotic Sensitivity in Methicillin-resistant *Staphylococcus aureus* Strains Found in Patients*

Patient No.	Antibiotic†						
	ABPC	CEZ	MINO	GM	EM	VCM	OFLX
1	R	R	R	S	R	S	R
2	R	R	R	S	R	S	R
3	R	R	S	R	R	S	S
4	R	R	R	R	R	S	S

*Susceptibility was determined by disk diffusion methods.

†ABPC: ampicillin, CEZ: cefazolin, MINO: minocycline, GM: gentamicin, EM: erythromycin, VCM: vancomycin, OFLX: ofloxacin. R: resistant, S: sensitive.

Discussion

Pathogens causing dacryocystitis in adults have been reported.[14,15] Gram-positive organisms were most common, with *Staphylococcus epidermis* and *S.*

Table 7. Intervals Before and After Dacryocystorhinostomy

Patient No.	From Initial Consultation to DCR (days)	Negative MRSA test after DCR (days)*
1	97	4
2	150	2
3	120	4
4	127	3

*MRSA: methicillin-resistant *Staphylococcus aureus.*

Table 8. Organisms Cultured From Conjunctiva and Nose After Dacryocystorhinostomy

Patient No.	Conjunctiva	Nose
1	None	None
2	None	None*
3	None	None
4	None	None

* There was methcillin-resistant *Staphylococcus aureus* growth in cultures from silicone tube removed 7 months after dacryocystorhinostomy.

aureus being the most frequently encountered organisms. Gram-negative organisms were the second most commonly encountered. Fifty percent of the isolates were resistant to most oral antibiotics.[14] Management of dacryocystitis usually employed systemic antibiotics initially, followed by DCR after the control of infection. The success rate was reported to be about 90%.[16]

Infection with MRSA tends to occur in immunocompromised hosts,[2,4] and recently hospitalized patients.[12] Although our 4 patients were elderly, none was considered immunocompromised and none had been recently hospitalized.

By the time MRSA positivity was revealed, most of the patients had been diagnosed as having chronic dacryocystitis and had been treated by wide-spectrum topical antibiotics for the relatively short time of 2 to 6 months. However, because the duration of nasolacrimal duct obstruction was as long as 3 to 10 years, MRSA growth in the conjunctiva of these cases developed.

We initially tried to eliminate MRSA from the conjunctiva medically; however, MRSA did not resolve. One case (case 2) was treated with VCM intravenously,[1,7] but only the acute dacryocystitis was cured[7] and the lacrimal fistula remained. A previous report of dacryocystitis associated with MRSA described 2 patients who never became negative for MRSA despite long-term therapy with topical and systemically administered antibiotics, topical mupirocin, and dacryocystectomy.[8] Another study showed that patients with nasolacrimal duct obstruction needed a 1- to 6-month course of antibiotic treatment.[12] Based on these reports and our 4 cases, we believe that it is difficult to resolve MRSA by these conservative methods in a short time.

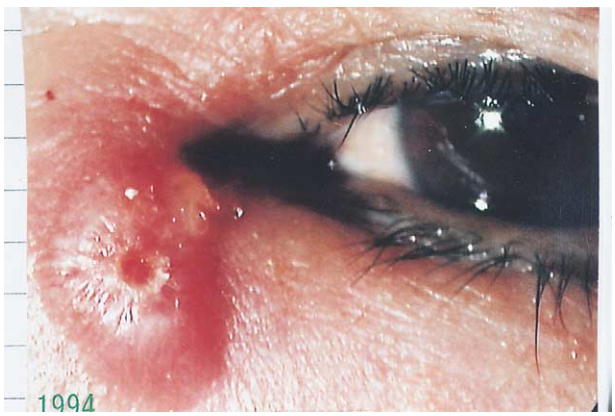

Figure 1. Lacrimal fistula at patient's left eye before dacryocystorhinostomy.

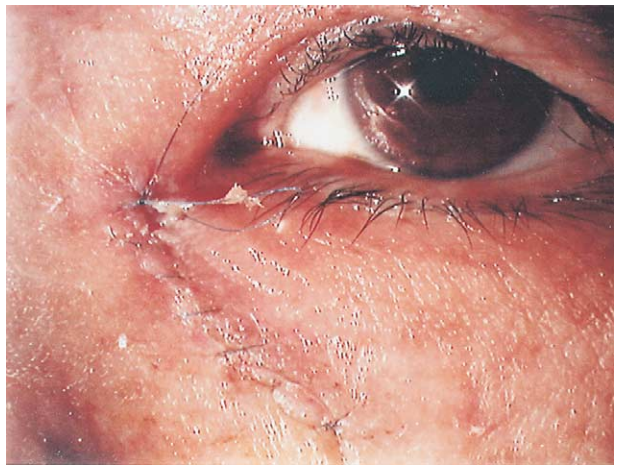

Figure 2. One week after dacryocystorhinostomy. No fistula or wound infection was found.

The lacrimal fistula in our case was slow to resolve even with intravenous VCM. Because of a report that a fistula infected by MRSA did not close[17] and our patient desired to undergo all surgical treatments at one time, we removed the fistula when we performed the DCR.

Management of dacryocystitis consists of DCR after the control of infection with systemic antibiotic therapy and even with incision, drainage, and direct application of antibiotics.[7,14] We tried to eliminate MRSA from conjunctiva and the nasal cavity by medical treatment but could not. MRSA is known to be resistant to numerous antibiotics. In all our cases, MRSA tests became negative soon after DCR and, further, we experienced no special difficulty due to MRSA while conducting the DCR. We concluded that it is advisable to perform DCR for the MRSA dacryocystitis quickly before trying to control lacrimal sac infection. DCR can be considered the treatment of choice for four reasons.

First, DCR is a common surgical method and can be performed quickly if pathogens are MRSA. Second, VCM is not needed pre- and post-DCR. Third, the

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risk of the development of VCM-resistant enterococci is reduced. Fourth, the period of hospitalization can be shortened. We believe that if the patient's general condition is good, DCR should be performed quickly to treat MRSA dacryocystitis that is resistant to medical treatment.

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