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## Endophthalmitis Caused by *Serratia marcescens*

Steven M. Cohen, MD; Harry W. Flynn, Jr, MD; Darlene Miller, MT, MA

■ **BACKGROUND AND OBJECTIVE:** To describe the clinical features and treatment outcomes of 10 patients with culture-proven *Serratia marcescens* endophthalmitis.

■ **PATIENTS AND METHODS:** Records from the microbiology laboratory for the period from January 1980 through June 1993 were reviewed. Ten patients were identified who had positive anterior chamber or vitreous cultures and clinical signs of endophthalmitis. The medical records for these 10 patients were reviewed, and the patients were contacted for reexamination when possible.

■ **RESULTS:** All 10 cases of *S. marcescens* endophthalmitis occurred after ocular surgery. Eight eyes received intraocular antibiotics and 2 eyes were pri-

marily enucleated or eviscerated. All organisms were sensitive to aminoglycosides and to ceftazidime. Repeat vitreous cultures were positive in 5 cases despite appropriate initial therapy with intravitreal and intravenous antibiotics. Final visual acuity was 20/400 or better in 4 of 10 eyes. A total of 4 eyes were enucleated or eviscerated at final follow-up. Eyes with light perception or better visual acuity had a mean follow-up of 23 months.

■ **CONCLUSION:** *S. marcescens* can cause persistent endophthalmitis despite appropriate intravitreal and systemic antibiotic therapy. Eyes with *S. marcescens* endophthalmitis have a poor visual prognosis.

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### INTRODUCTION

*Serratia marcescens*, a member of the Enterobacteriaceae, is a motile, gram-negative rod that is involved in opportunistic and nosocomial infections.<sup>1</sup> At one time this organism was considered to be nonpathogenic in humans.<sup>2,3</sup> Currently, it is recognized as an important human pathogen with a

predilection for immunocompromised tissues.<sup>4</sup> This bacteria is ubiquitous in water, soil, and food.

*S. marcescens* can cause conjunctivitis, keratitis, and both exogenous and endogenous endophthalmitis.<sup>5-14</sup> This article reviews the clinical features and treatment outcomes of 10 patients with culture-proven *S. marcescens* endophthalmitis.

### PATIENTS AND METHODS

We reviewed the clinical records in the microbiology laboratory of the Bascom Palmer Eye Institute, University of Miami School of Medicine, Miami, Florida, to identify cases of culture-proven *S. marcescens* endophthalmitis treated from January

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TABLE 1  
Clinical Characteristics of the Patients

Case No.	Age (years)	Sex	Systemic Disease	Eye	Previous Surgery	Time to Symptoms
1	50	M	Diabetes mellitus	OS	Trabeculectomy with 5-fluorouracil	1 day
2	69	M	None	OD	Phacoemulsification with posterior chamber intraocular lens	1 day
3*	64	F	Diabetes mellitus	OD	Phacoemulsification with posterior chamber intraocular lens	1 day
4*	71	M	Diabetes mellitus	OS	Extracapsular cataract extraction with posterior chamber intraocular lens, primary posterior capsulotomy/wound leak	3 days
5*	45	M	None	OD	Penetrating keratoplasty suture removal/dehiscence of graft	1 day
6	51	M	Diabetes mellitus	OD	Penetrating keratoplasty, anterior vitrectomy, anterior chamber intraocular lens, stitch abscess	29 days
7*	81	M	None	OD	Extracapsular cataract extraction, anterior vitrectomy, anterior chamber intraocular lens	1 day
8	77	M	Renal failure on dialysis, alcoholism	OD	Scheie procedure	5 years
9†	72	F	None	OD	Scleral buckle	30 days
10*	73	F	Rheumatoid arthritis	OD	Extracapsular cataract extraction with posterior chamber intraocular lens	1 day

OS = left eye; OD = right eye.

\*Cases 3-5, 7, and 10 were reported in reference 14.

†Case 9 was reported in reference 17.

1980 to June 1993. Ten cases were identified with positive anterior chamber or vitreous cultures.

All 10 patients had clinical examinations, diagnostic procedures, and treatments performed by the full-time faculty members in the Department of Ophthalmology. Six eyes had cultures from both the anterior chamber and the vitreous, 1 had cultures from the anterior chamber only, and 3 had cultures from the vitreous only. The criteria for positive cultures in endophthalmitis established by the Infection Control Committee at our institution were met in all cases and included one of the following: growth of the same organism on two or more culture media, or semiconfluent growth on one and positive smears at the inoculation site.<sup>14</sup>

## RESULTS

The average age of the patients was 65 years (range 45 to 81). Seven patients had systemic risk factors (Table 1). All of the cases occurred after ocular surgery. Three cases occurred within 1 day of uncomplicated cataract surgery with intact wounds. Two cases occurred after complicated cataract surgery, 1 after inadvertent rupture of the posterior capsule and another in an eye with an intentional posterior capsulotomy that also had a wound leak. Two cases occurred after corneal transplants, 1 after a stitch was removed and a wound dehiscence developed and another 29 days after transplant when an intact stitch

TABLE 2  
Clinical Features of the Cases on Initial and Final Examination

Case No.	VA on Presentation With Endophthalmitis	Afferent Pupillary Defect	Hypopyon	Proptosis	White Blood Cell Count ( $\times 10^3/\mu\text{l}$ )	Final Visual Acuity	Follow-up (months)
1	Hand motion	No	1 mm	No	4.8	20/50	28
2	Hand motion	No	None	No	4.7	20/60	12
3	20/300	No	0.5 mm	No	10.2	20/70	16
4	Hand motion	No	0.5 mm	No	10.8	20/200	16
5	20/400	No	1.5 mm	No	10.1	Hand motion	36
6	Hand motion	NA	None	Yes	7.5	No light perception	27
7	Light perception	Yes	None	No	16.0	E	
8	No light perception	Yes	10 mm	Yes	7.7	E	
9	No light perception	Yes	None	No	17.9	E	
10	Light perception	Yes	0.5 mm	No	19.4	E	

VA = visual acuity; E = enucleated or eviscerated; NA = not available.

became infected. Two cases occurred after filtering surgery, 1 within 1 day of trabeculectomy and 1 at 5 years after a full-thickness Scheie procedure. One case of panophthalmitis occurred from a chronically infected scleral buckle. The scleral buckle was removed, replaced, and removed again prior to the onset of panophthalmitis.

Visual acuity on presentation ranged from 20/300 to no light perception (Table 2). Primary treatments included vitreous and anterior chamber cultures with injection of intraocular antibiotic (n = 4), pars plana vitrectomy with injection of intraocular antibiotics (n = 3), anterior chamber tap with repair of corneal wound dehiscence (n = 1), enucleation (n = 1), and evisceration (n = 1).

In each patient, the *S. marcescens* was sensitive to the antibiotics given. No aminoglycoside-, cef-tazidime-, imipenem-, or ciprofloxacin-resistant organisms were identified (Table 4). Five of six eyes undergoing repeat vitreous culture had persistent positive cultures despite appropriate initial intravitreal and systemic antibiotic therapy (Table 3). Two of these eyes achieved final visual acuity of 20/200 or better.

Final visual acuity was 20/400 or better in 4 of 10 eyes (Table 2). Four eyes were enucleated or eviscerated. Eyes with light perception or better visual acuity had a mean follow-up of 23 months.

## DISCUSSION

*S. marcescens* is a gram-negative rod that can cause a variety of infectious diseases in humans. Studied and named by Bartolomeo Bizio in 1823, *S. marcescens* has the third oldest name of any bacterium. Bizio's experiments on the propagation of the organism, which he thought was a plant, predated Pasteur's work on germ theory by 40 years.<sup>1</sup> Because of its ability to grow on food and produce a blood-red pigment, the bacteria struck fear in the superstitious people of the Middle Ages. Such an account of blood (probably pigment from *S. marcescens*) miraculously forming on bread was first recorded at the Siege of Tyre by Alexander the Great in 332 B.C.E.<sup>1</sup>

*S. marcescens* can cause a variety of ocular infections. All patients in this series had exogenous endophthalmitis from this gram-negative organism. Nonocular infections with *S. marcescens* have been reported to be more common in male patients and in patients with altered host resistance.<sup>4</sup> The male:female ratio of 2.3:1 in this study is very similar to the 2.5:1 ratio found in patients with systemic *S. marcescens* infections.<sup>4</sup> In this series, all of the infected eyes underwent previous ocular surgery and therefore had altered ocular defenses. In addition, 6 patients in this study had significant systemic diseases, most commonly diabetes mellitus,

TABLE 3  
Primary Treatments and Culture Results

Case No.	Primary Procedure	Anterior Chamber Culture	Vitreous Culture	Intraocular Antibiotics	Subconjunctival Antibiotics	Systemic Antibiotics	Additional Surgery	Repeat Culture
1	Vitreous tap	+	-	Vancomycin 1 mg Chloramphenicol 1 mg Dexamethasone 0.4 mg	Vancomycin Gentamicin	Vancomycin Gentamicin	None	NP
2	Vitrectomy	+	+	Vancomycin 1 mg Ceftazidime 2.25 mg Dexamethasone 0.4 mg	Vancomycin Ceftazidime (Dexamethasone)	Oral ciprofloxacin	Vitreous tap	-
3	Vitreous tap	+	-	Cefazolin 5 mg Gentamicin 100 mcg	Vancomycin Gentamicin (Aristocort, Fujisawa, Deerfield, IL)	Gentamicin	Vitrectomy	+
4	Vitrectomy	+	+	Gentamicin 100 mcg Vancomycin 200 mcg	Gentamicin Vancomycin (Dexamethasone)	Vancomycin Gentamicin	Vitrectomy	+
5	Anterior chamber tap repair of dehiscence	+	NP	Vancomycin 1 mg Gentamicin 100 mcg into anterior chamber only	Gentamicin Vancomycin	Ancef (SmithKline Beecham, Pittsburgh, PA) Gentamicin	None	NP
6	Vitrectomy*	-	+	Vancomycin 1 mg Gentamicin 100 mcg	Gentamicin (Dexamethasone)	Ceftriaxone	Vitrectomy twice	+
7	Vitreous tap	NP	+	Vancomycin 1 mg Tobramycin 100 mcg	None	Tobramycin Ancef	Vitreous tap Enucleation	+
8	Evisceration	NP	+	None	None	Gentamicin	None	
9	Enucleation	NP	+	None	Gentamicin	Gentamicin Carbenicillin	Removal of buckle twice	NP
10	Vitreous tap	+	+	Vancomycin 1 mg Tobramycin 150 mcg	None	Ceftriaxone	Vitreous tap Enucleation	+

NP = not performed.  
\*Two vitrectomies with culture and injection of vancomycin 1 mg and gentamicin 0.1 mg done prior to referral.

which may have altered their resistance. The presence of systemic diseases did not affect final outcome in these patients. Two of 4 healthy patients had no light perception as a result of the endophthalmitis.

Only 3 eyes in this study were initially treated with vitrectomy. All 3 of these eyes required additional vitrectomy or vitreous tap and re-treatment with intraocular antibiotics. Two of these eyes retained

20/400 or better visual acuity. Recent evidence suggests that pars plana vitrectomy provides a substantial benefit to eyes that present with light perception or worse visual acuity and endophthalmitis.<sup>15</sup> In this study, both eyes (cases 7 and 10) that presented with initial visual acuity of light perception were initially treated with vitreous tap and intraocular antibiotics. Both of these eyes were eventually enucleated.

TABLE 4  
*Serratia marcescens* Sensitivity to Antibiotics

Antibiotic	No. of Isolates	MIC <sub>50</sub>	MIC <sub>90</sub>	No. of Resistant Cases
Amikacin	10	< 2.0	< 2.0	0
Gentamicin	10	< 0.5	< 0.5	0
Tobramycin	10	< 1.0	< 2.0	0
Ceftazidime	10	< 8.0	< 8.0	0
Imipenem	10	< 4.0	< 4.0	0
Ciprofloxacin	10	< 0.5	< 0.5	0

MIC<sub>50</sub> = concentration of drug required to kill 50% of the isolates (µg/ml); MIC<sub>90</sub> = concentration of drug required to kill 90% of the isolates (µg/ml).

TABLE 5  
Visual Acuity After Treatment for Endophthalmitis of Specific Organisms\*

Organism	No. of Cases	> 20/50 (%)	> 20/400 (%)	No Light Perception (%)
Coagulase negative <i>Staphylococcus</i> <sup>18</sup>	48	52.1	89.1	2.2
<i>Propionibacterium</i> species <sup>19</sup>	22	54.5	72.7	9.1
<i>Staphylococcus aureus</i> <sup>20</sup>	27	48.2	63.0	14.8
Streptococcal species <sup>21</sup>	48	10.4	31.2	33.3
<i>Serratia marcescens</i> (current study)	10	10.0	40.0	50.0
<i>Bacillus</i> species <sup>22</sup>	18	5.6	11.1	77.8
<i>Pseudomonas aeruginosa</i> <sup>14</sup>	12	0.0	8.3	66.7

\*All from reports of cases treated at the Bascom Palmer Eye Institute.

In this series, the choice of intraocular antibiotics varied and was based on the preference of the treating physician. *S. marcescens* is usually sensitive to gentamicin, third-generation cephalosporins, imipenem, and fluoroquinolones.<sup>12</sup> The biotypes of organisms in this study were the same as the biotypes commonly seen in systemic diseases. In all cases in which intraocular antibiotics were used, the organisms cultured were sensitive to the antibiotics given. Despite seemingly adequate initial intraocular antibiotic treatment, five eyes had intraocular cultures that were persistently positive. Of these five eyes, three were treated with intraocular gentamicin and two with intraocular tobramycin. Although gentamicin-resistant *S. marcescens* endophthalmitis has been described,<sup>13</sup> all organisms in this series were sensitive to gentamicin (Table 4). The infections in these five eyes treated with aminoglycoside antibiotics may have persisted because

either the antibiotics were poorly distributed intraocularly, or they were administered in too low a dose because of fear of retinal toxicity.<sup>16</sup> Because of its low retinal toxicity and excellent coverage of gram-negative organisms, ceftazidime has recently been suggested as an alternative to aminoglycosides for coverage of gram-negative endophthalmitis.<sup>14</sup>

Although 6 eyes in this study had a hypopyon, none had the pink hypopyon that has been previously reported in *S. marcescens* endophthalmitis.<sup>7</sup> A red pigment is present in only 7% of clinical isolates of *S. marcescens*.<sup>4</sup> Therefore, the absence of a pigmented hypopyon should not be used to exclude the possibility of endophthalmitis caused by this organism.

*S. marcescens* can survive in water and has been found to create nosocomial infections from contaminated irrigating solutions.<sup>4</sup> Eyedrop bottles used postoperatively by three patients in this study were cul-

tured. The eyedrop bottles of two patients revealed extensive growth of the organism: one from a timolol maleate 0.5% bottle and one from a prednisolone acetate 1% bottle. Examination of the isolates from the intraocular fluids and the medications revealed that the organisms had the same biotype. The bottles may have become culture positive after being in contact with an infected eye, or the eyes may have become infected because of bacteria in the eyedrops. Because of the potential for ocular medications to become contaminated, it is prudent to use new medications in the immediate postoperative period to avoid infection of the eye from inadvertently contaminated ocular medications.

Compared with other causes of bacterial endophthalmitis, the visual acuity outcomes for eyes in which endophthalmitis develops from this organism are generally poor (Table 5). Of the 4 eyes in this study with good visual outcomes, 2 had no clinical or microbiologic evidence of vitreous involvement at any time during the disease (cases 1 and 2). Of the 8 eyes in which the vitreous was clinically or microbiologically infected with *S. marcescens*, only 2 eyes recovered to visual acuity of 20/200 or better. The poor visual acuity outcomes in these patients approach those reported for other invasive opportunistic organisms, namely, *Bacillus* species and *Pseudomonas aeruginosa*.<sup>14</sup>

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