

# Pathogens and Antibiotic Sensitivities in Post-Phacoemulsification Endophthalmitis, Kaiser Permanente, California, 2007-2012

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# Purpose

- To characterize pathogenic organisms and antibiotic sensitivities in endophthalmitis cases following phacoemulsification, with special consideration for antibiotic prophylaxis
- To evaluate antibiotic resistance patterns in cases of endophthalmitis
- To inform optimal selection of antibiotic prophylactic agent and route of administration

# Background

- Most common causative organisms of endophthalmitis are Coagulase-negative *Staphylococci*, *S. viridans*, *S. aureus*
- Intracameral antibiotic prophylaxis decreases the rate of endophthalmitis
- Topical antibiotics may provide inadequate bacterial eradication

# Methods

- Setting: 38 surgical centers at Kaiser Permanente, California
- Study design and population: Case series of endophthalmitis cases <90 days after non-complex phacoemulsification from 2007 – 2012. Cases identified with diagnostic codes and validated with chart review.
- Data collection: Batch processing of isolated organisms and antibiotic susceptibility results in relation to antibiotic prophylaxis (intracameral (IC), topical)
  - Gatifloxacin was considered a substitute for moxifloxacin sensitivity
  - Oxacillin was considered a substitute for cephalosporin sensitivity in *Staphylococcus* species in our coverage area
- Data analysis: Descriptive analysis

# Results

## Profile of pathogens causing endophthalmitis

- Among 215 cases of endophthalmitis, 38 (18%) were not cultured and 94 (48%) had no growth
- Of 83 culture-confirmed cases, 96% were Gram-positive, notably Coagulase-negative *Staphylococci* (CoNS) (N=43, 52%)
- 7 cases of MRSA
- 3 cases of Gram-negative organisms (*Kingella*, *P. aeruginosa*, *Moraxella*)
- Fewer cases of endophthalmitis following intracameral antibiotic (N=8), as compared with topical antibiotic (N=56) or no antibiotic prophylaxis (n=19)

# Pathogen profile in relation to route of antibiotic prophylaxis (IC, topical)

Organism isolated	IC antibiotic		No IC, topical antibiotic only			No IC or topical agent	Total
	With topical agent	Without topical agent	Topical ofloxacin	Topical gatifloxacin	Topical aminoglycoside		
<b>Gram-positive organisms</b>							
Coagulase-negative <i>Staphylococcus</i>	3	1	16 <sup>a</sup>	12 <sup>a</sup>	3	9	43
<i>Streptococcus viridians</i>	2	-	4	5	1	2	14
MRSA	-	-	2	1	1	3	7
MSSA	-	-	2	2	-	1	5
Other <i>Streptococcus</i> species <sup>b</sup>	-	-	1	2	-	2	5
<i>Enterococcus</i> species <sup>c</sup>	-	-	2	1	1	1	5
<i>Propionibacterium acnes</i>	1	-	-	-	-	-	1
<b>Gram-negative organisms</b>							
<i>Kingella</i> species	-	-	-	1	-	-	1
<i>Pseudomonas aeruginosa</i>	-	-	-	-	-	1	1
<i>Moraxella</i> species	1	-	-	-	-	-	1
<b>Total</b>	<b>7</b>	<b>1</b>	<b>27</b>	<b>24</b>	<b>6</b>	<b>19</b>	<b>83</b>

<sup>a</sup> One case, shown in two columns, received both topical ofloxacin and topical gatifloxacin.

<sup>b</sup> Three cases of *S. pneumoniae*, one case of *S. agalactiae* (received topical gatifloxacin only) and one case of *Streptococcus* unspecified (topical ofloxacin only).

<sup>c</sup> Four cases of *E. faecalis* and one case of *Enterococcus* species unspecified (received topical gentamicin only).

# Results

## Sensitivities of Gram-positive isolates

- Sensitivities available on 68 Gram-positive cases
- Nearly half of CoNS cases resistant to cefuroxime and fluoroquinolones
- All MRSA cases (N=6), CoNS (N=32), and *Enterococcus* cases (N=4) sensitive to vancomycin
- *S. viridans* cases predominantly sensitive to fluoroquinolones

# Sensitivities of Gram-positive isolates (number sensitive / number tested)

	<b>CoNS (N=34)</b>	<b>MRSA (N=6)</b>	<b>MSSA (N=5)</b>	<b><i>S.viridans</i> (N=13)</b>	<b><i>Streptococcus species</i> (N=5)</b>	<b><i>Enterococcus</i> (N=5)</b>
<b>Cephalosporins</b>						
Cefazolin	13/13	0/3	2/3	4/4	1/1	0/1
Ceftazidime	6/17	0/3	0/1	1/2	1/1	0/1
Ceftriaxone	9/16	0/3	1/1	9/9	2/2	0/1
Cefuroxime	7/12	1/3	--	--	1/1	0/1
Cephalothin	15/15	3/3	1/1	3/3	1/1	0/1
<b>Fluoroquinolones</b>						
Ciprofloxacin	11/18	0/4	1/1	0/3	1/1	1/3
Gatifloxacin	7/12	1/3	2/2	6/7	1/2	2/3
Ofloxacin	8/14	0/3	2/3	8/8	1/2	0/1
<b>Aminoglycosides</b>						
Gentamicin	19/19	4/4	3/3	3/5	0/1	0/1 <sup>a</sup>
Amikacin	14/15	1/3	1/1	0/4	0/1	0/2 <sup>a</sup>
Neomycin	13/14	0/3	3/3	0/8	0/2	0/2 <sup>a</sup>
Tobramycin	5/5	0/1	1/1	1/1	--	--
<b>Polypeptides</b>						
Bacitracin	11/14	1/3	2/3	8/8	2/2	1/2
Polymyxin B	8/14	0/3	0/3	0/8	0/2	0/2
<b>Other</b>						
Clindamycin	27/32	0/6	2/3	6/6	4/4	0/1
Oxacillin	18/30	0/6	3/3	2/5	2/3	0/1
Sulfisoxazole	11/14	2/3	2/3	1/3	1/1	0/1
Tetracycline	20/22	3/3	3/3	1/2	0/1	--
Trimethoprim	11/14	3/3	3/3	2/4	0/1	1/1 <sup>a</sup>
Vancomycin	32/32	6/6	5/5	9/10	5/5	4/4

<sup>a</sup> Enterococcus is considered intrinsically resistant to cephalosporins, clindamycin and trimethoprim. Organisms tested as sensitive to trimethoprim may have *in vitro* activity, but trimethoprim is not clinically effective against Enterococcus. In addition, aminoglycosides are not effective against Enterococcus even if *in vitro* testing suggests susceptibility; higher doses would be required and would need to be specifically tested.

# Results

## Sensitivities of isolates after prophylactic IC antibiotic only

- 4 cases with cultures and sensitivities
  - 2 cases of CoNS: 1 resistant to prophylactic moxifloxacin, 1 resistant to prophylactic cefuroxime
  - 2 cases of *S. viridans*: 1 susceptible to prophylactic moxifloxacin, 1 not tested to prophylactic agent
  - All susceptible to vancomycin

Intracameral agent received Topical agent received	CoNS		<i>S. viridans</i>	
	Moxifloxacin Gatifloxacin	Cefuroxime None	Moxifloxacin Gatifloxacin	Cefuroxime Gatifloxacin
Oxacillin	R <sup>b</sup>	R <sup>b</sup>	R	-
Cephalosporins				
Cefazolin	S <sup>b</sup>	-	-	-
Ceftazidime	R	-	-	-
Ceftriaxone	R	-	S	-
Cefuroxime	R	-	-	-
Cephalothin	S <sup>b</sup>	-	-	-
Fluoroquinolones				
Ciprofloxacin	R	R	-	-
Gatifloxacin (surrogate for moxifloxacin)	<b>R</b>	-	<b>S</b>	<b>S</b>
Ofloxacin	R	-	S	S
Vancomycin	S	S	S	S

S = Sensitive, R = Resistant

<sup>a</sup> The table does not show cases whose antibiotic sensitivity was not tested or was tested to other agents.

<sup>b</sup> Resistance to oxacillin in *Staphylococcus* species assumes resistance to all cephalosporins, regardless of the shown *in vitro* sensitivity results.



# Results

## Sensitivities of Gram-positive isolates after prophylactic topical antibiotic

- 56 cases of endophthalmitis following topical antibiotics only
- Only 45 cases with cultures and sensitivities
  - 5 of 10 cases that had received ofloxacin were resistant
  - 2 of 5 cases that had received gatifloxacin were resistant
  - 0 cases that had received aminoglycosides were resistant

	Topical ofloxacin <sup>b</sup> (N=21)	Topical gatifloxacin <sup>b</sup> (N=18)	Topical aminoglycoside (N=6)
<b>Fluoroquinolones</b>			
Ciprofloxacin	5/9	2/7	2/5
Gatifloxacin	8/9	<b>3/5</b>	0/1
Ofloxacin	<b>5/10</b>	5/6	1/3
<b>Aminoglycosides</b>			
Tobramycin	2/2	2/2	<b>2/2</b>
Gentamicin	11/11	7/9	<b>4/4</b>
<b>Oxacillin</b>	10/18	9/15	3/5

<sup>a</sup> The table does not show cases whose antibiotic sensitivity was not tested or was tested to other antibiotics.

<sup>b</sup> One case, shown in two columns, received both topical ofloxacin and topical gatifloxacin.

# Limitations

- Limited number of organisms recovered for susceptibility testing makes for small samples
- Sensitivities did not always include prophylactic agent given
- *In vitro* testing results may differ from *in vivo* experiences
- MIC data is superior to Kirby-Bauer testing, but was not available

# Conclusions and Recommendations

- Most isolated endophthalmitis cases were caused by Gram-positive organisms
- Culture-confirmed cases that had received fluoroquinolone prophylaxis (either IC or topical) demonstrated a degree of bacterial resistance with *in vitro* testing
- While pathogens were generally susceptible to aminoglycosides *in vitro*, prior reports suggest ineffectiveness, likely due to poor ocular penetration
- Vancomycin has the best sensitivity profile for the most common causes of endophthalmitis and should be considered for IC prophylaxis

# References

- Arshinoff SA, Bastianelli PA. Incidence of postoperative endophthalmitis after immediate sequential bilateral cataract surgery. *Journal of cataract and refractive surgery*. 2011;37(12):2105-2114.
- Friling E, Lundstrom M, Stenevi U, Montan P. Six-year incidence of endophthalmitis after cataract surgery: Swedish national study. *Journal of cataract and refractive surgery*. 2013;39(1):15-21.
- Moloney TP, Park J. Microbiological isolates and antibiotic sensitivities in culture-proven endophthalmitis: a 15-year review. *Br J Ophthalmol*. 2014;98(11):1492-1497.
- Shorstein NH, Winthrop KL, Herrinton LJ. Decreased postoperative endophthalmitis rate after institution of intracameral antibiotics in a Northern California eye department. *Journal of cataract and refractive surgery*. 2013;39(1):8-14.
- Yalvac IS, Basci NE, Bozkurt A, Duman S. Penetration of topically applied ciprofloxacin and ofloxacin into the aqueous humor and vitreous. *J Cataract Refract Surg*. 2003;29(3):487-491.

# Questions?

- Please contact Geraldine Slean ([gslean@yahoo.com](mailto:gslean@yahoo.com)) with any inquiries. Thank you!