Preoperative Antibiotics for Infection Prophylaxis in Cataract Surgery

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Postoperative Endophthalmitis

- Mostly after cataract surgery
- Almost totally caused by bacteria
- Entering eye:
  - At the time of surgery
  - Postoperatively, before wound epithelialization
- Patient’s ocular surface and eyelid flora
- 75% - 95% Gram +
- Important percentage of culture-negative endophthalmitis (EVS: 30.7 %)

(Eifrig CW, Ophthalm Surg Lasers 2002;33)
(Speaker MG, Ophthalmology 1991; 98)
Postoperative Endophthalmitis

- Potentially devastating, vision-threatening complication
- Incidence – 0.072 % / 0.082 %
  (Kattan H.M., Ophthalmology 1991)
  (Aaberg T.M., Ophthalmology 1998)
- USA: 4,000 cases/year
- 1/10 or worse final visual acuity in 15-30% of cases
  (Yu-Wai-Ma P, J Cataract Refract Surg, Mar 2008)
Endophthalmitis and Cataract Surgery (ECCE vs Faco)

- 30,000 cases, Mass Eye & Ear, 1964-1977: 0.06%
- 23,625 cases, Bascom Palmer: 0.07%
- 1999 – 2002: 0.03% - 0.04%
- Sweden (2002): 0.1%
- Norway (2003): 0.15%

(Allen HF, Ophthalmology 1978; 85)
(Kattan HM, Ophthalmology 1991; 98)
(Bohigian G, Ophthalm Surg Lasers, 1999; 30)
Endophthalmitis and Clear Corneal Incision (CCI) Cataract Surgery

- Limbal incision: 0.062%
- Scleral incision: 0.074%
- CCI: 0.189%

(As tabulated by Taban M, Arch Ophthalmol 2005; 123)

- Fine H, Gills J: no increase in incidence

(ASCRS 2005)
Endophthalmitis Following CCI Cataract Surgery
Bascom Palmer Eye Institute (Jan 1996 – Dec 2004)

- Retrospective series, 71 patients
- Most frequently involved organism: coagulase-negative Stafilococcus (epidermidis)
- Frequently resistant to fourth generation fluoroquinolones
- Final VA: 46% > 0.5

Endophthalmitis Prophylaxis

Goals

1. Sterilize ocular surface

2. Supplement natural defenses if bacteria enters cornea or aqueous
ESCRS Endophthalmitis Study Group

- Partially masked multicenter cataract surgery study
- 2002 design
- 16,603 pts
- Topical perioperative levofloxacin 0.5%
- Intracameral cefuroxime (1 mg in 0.1 ml saline) at the end of surgery:
  - Five-fold reduction in the occurrence of postoperative endophthalmitis
- CCI and silicone IOLs as possible risk factors

(J Cataract Refract Surg, Jun 2007)

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2007 ASCRS Member Survey

• 91% used topical antibiotic prophylaxis

• 4th generation fluoroquinolones (gatifloxacin or moxifloxacin) preferred by 81%
  • 88% preoperatively
  • 98% postoperatively
  • 90% at the conclusion of surgery

• Intracameral antibiotics: 30%

(Chang DF, J Cataract Refract Surg, Oct 2007)
United Kingdom Survey

• 55% were using intracameral cefuroxime
• 48% had switched after ESCRs study
• Among non-users:
  • 68% afraid of dilution errors
  • 67% would switch if product available

(Gore D, Cataract Refract Surg, Oct 2007)
Caveats

• There has never been a randomized controlled clinical trial demonstrating the prophylactic benefit of any preoperative or postoperative topical antibiotic

• No commercially available antibiotic preparation for injection in the AC

(Chang DF, J Cataract Refract Surg, Oct 2007)
Prevention Strategies
Endophthalmitis

1. Antibiotic **selection** (type)
2. Antibiotic **dosing** regimen
3. Role of pre-op antiseptics (**the only** proven prophylaxis method until 2007)
Endophthalmitis Prophylaxis

Antibiotic selection: Ideal

• Broad spectrum antimicrobial activity, esp. gram +

• Adequate solubility to penetrate ocular tissue (bioavailability)

• Achieve aqueous and vitreous concentration > MICs potential bacterial pathogens for 24-48 hrs

• Minimum Corneal Toxicity
Antibiotic Prophylaxis

*Antibiotic selection: Practice*

- Topical use
- 3\textsuperscript{rd} Generation Fluoroquinolones
  - Ciprofloxacin, Ofloxacin: 0.197\% endoph. rate
- 4\textsuperscript{th} Generation Fluoroquinolones
  - Gatifloxacin (0.3\%) 0.015\% endoph. rate
  - Moxifloxacin (0.5\%) 0.1 \% endoph. Rate
    - Highly lipophile
    - High aqueous solubility
    - Only option for intracameral use of 4\textsuperscript{th} gen.

(Jensen MK, J Cataract Refract Surg, Sep 2008)
Antibiotic Prophylaxis

Antibiotic selection: Practice

- Intracameral use:

- ESCRS:
  - Cefuroxime (1mg in 0.1 mL normal saline)

- 4th Generation Fluoroquinolone:
  - Moxifloxacin 0.5% (250µg/0.050 mL)

(J Cataract Refract Surg, Jun 2007)

(Lane SS, J Cataract Refract Surg, Sep 2008)
**MRSA**

- Introduction of penicillin: 1940
- **Methicillin-Resistant** *Staphylococcus Aureus*
- First identified in the 1960s
- In late 1970s: resistant to β-lactam compounds and other antibiotics
- MRSA now indicates resistance to all β-lactam antibiotics
- Traditionally confined to health care facilities
- Presently becoming a dominant pathogen in community-associated infections


*(Asbell PA, J Cataract Refract Surg, May 2008)*

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International SOI Meeting - 2009
MRSA

• Continues to evolve
  • expanding resistance to a broad variety of antimicrobial agents
• Sensitive to trimethoprim and aminoglycosides
• Also MR-coagulase-negative *Staphylococcus* (epidermidis) (MR-CNS) are increasing in frequency

(Hori Y, J Cataract Refract Surg, Mar 2009)
**Staph: EVS (1996) vs Today**

- **EVS:** Coagulase-negative *Staphylococcus epidermidis* was most frequent organism

- **Methicillin-resistant *Staphylococcus aureus* (MRSA):**
  - 1996 (EVS): 1.9%
  - 1998: 4.1%
  - 2006: 16.7%

MRSA and Fluoroquinolones

• MRSA: only 15.2% susceptible to fluoroquinolones
• Resistant to ALL fluoroquinolones
  • 81.8% of MR-CNS
  • 100% of MRSA

(Hori Y, J Cataract Refract Surg, Mar 2009)
MRSA Today

The prudent course would be to consider the possibility of methicillin or multidrug resistance with any *S. Aureus* ocular infection, even in the absence of recognized risk factors

*(Asbell PA, Am J Ophthalmol, Jun 2008)*
MRSA and Aminoglycosides

• Most frequent community-acquired MRSA are susceptible to tetracycline and aminoglycosides

• Ocular surface MRSA nearly universally susceptible to aminoglycosides (vancomycin and gentamicin)
  (Kotlus BS, Am J Ophthalmol, Nov 2006)
  (Moshirfar M, J Cataract Refract Surg, Mar 2006)
MRSA and Aminoglycosides

- The activity of netilmicin against gentamicin and tobramycin –resistant MRSA isolates was found to be more potent than those of gentamicin and tobramycin
  
  (Ida T, Antimicrobial Agents and Chemotherapy, May 2002)
  

- Netilmicin:
  - Derivative of gentamicin
  - Activity superior to that of ofloxacin against gram – and gram+
  - Activity on gentamicin-resistant bacteria

  (Sloane H, Can J Ophthalmol, Jan 1981)
MRSA and Endophthalmitis

• 18% of culture-positive cases of post-cataract endophthalmitis

• Advisable to obtain microbial cultures in cases of ocular surface infection when first-line treatment fails

• May be resistant in vitro to all generations of fluoroquinolones

(Deramo VA, Am J Ophthalmol, Mar 2008)
Endophthalmitis Prophylaxis

Top Recommendations

1. Apply an antiseptic such as **povidone iodine** to lids and ocular surface prior to sx.
2. Apply a draping technique that **sequesters the lid & lashes** during surgery
3. Stromal **hydrate** all clear corneal wounds
4. Consider **intracameral** antibiotic

Courtesy of Frank J. Bucci, Jr.

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Endophthalmitis Prophylaxis

Top Recommendations

5. Best available topical **fluoroquinolone** immediately post op to replenish aqueous and corneal levels (depot effect)

6. Use best available fluoroquinolone 4 x day for at least 1 week post op

7. Be suspicious of **MRSA** (blefaritis, nosocomial, old age…) and promptly adopt adequate **aminoglycoside**

8. Avoid extended low frequency dosing of fluoroquinolone as this facilitates the development of resistant organisms

*Chang DF, J Cataract Refract Surg, Dec 2007*

*Courtesy of Frank J. Bucci, Jr.*
Conclusions

• 2,500,000 cataract surgery cases per year in Europe

• Incidence rate of 0.3% (without use of perioperative antibiotics)

• 7,500 cases per year…

(J Cataract Refract Surg, Jun 2007)

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Conclusions

• Prevention of endophthalmitis requires sound prophylactic procedures
• Recent studies provide better information on use of antibiotic supplements
• Remember that normal patient’s bacterial flora – the main culprit – is rapidly changing
• MRSA is emerging as a frequent pathogen
• Aminoglycosides (i.e., netilmicin) are safer than any fluoroquinolone with MRSA
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