The Evolution of Cataract Surgery

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What I Will Discuss

• Brief historical overview
• Recent advances
• Potential future innovations

Cataract Surgery

• Possibly the oldest surgical procedure
• Most common surgical procedure performed worldwide

Cataract Couching

• Earliest cataract procedure-Couching
• Still practiced in Sub-Saharan Africa and elsewhere

Extracapsular Cataract Extraction (ECCE)

• Jacques Daviel (1747)
  First reported cataract surgery performed through a corneal incision
  Required several unique instruments:
  corneal knife, forceps or scissors, blunted needle spatula and spoon
Intracapsular Cataract Extraction (ICCE)

- Samuel Sharp (1753)
  Introduced the concept of removing the entire lens and capsule

Further Innovations

- Intraocular Lens Implant  Harold Ridley, 1949
- Phacoemulsification  Charles Kelman, 1967
- Foldable IOL  Thomas Mazzocco, 1984
- Topical Anesthesia  Fischman 1993
- Intracameral Anesthesia  Jim Gills, 1994

New Emerging Innovations and Trends

- Endophthalmitis prophylaxis
- IOL Power Optimization
- Femtosecond Laser Cataract Surgery

Endophthalmitis Prophylaxis

Preponderance of evidence showing significant benefit of intracameral antibiotics over topical antibiotics alone

Endophthalmitis prophylaxis

- Although uncommon, visually devastating
  – Rate 0.4-2.65 per 1000
- Current usage very costly to patients and healthcare system
- Requires patient compliance
- Greater risk of bacterial resistance?
**Endophthalmitis prophylaxis**

- Intracameral antibiotics offers a higher concentration in the AC relative to topical administration
- More effective kill rate for a dose dependent abx

**ESCRS Endophthalmitis Study Group**

- Study halted prematurely given clear evidence of benefit of intracameral abx
- Endophthalmitis rate .35% for topical vs. .08% for intracameral group
- Nearly 5-fold reduction in endophthalmitis

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**ESCRS Endophthalmitis Study Group**


**Endophthalmitis Prophylaxis Kaiser Study**


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**ESCRS Endophthalmitis Study Group**

- Prospective randomized partially masked multicenter study recruited
- $2 \times 2$ factorial design, with intracameral 1mg/.1cc cefuroxime and topical perioperative levofloxacin resulting in 4 treatment groups
- N=16,603 patients

**Endophthalmitis Prophylaxis Kaiser Study**

- Retrospective study
- N=16,264
- Postoperative topical antibiotic alone vs. Intracameral +/- topical
Endophthalmitis Prophylaxis

Kaiser Study

- 10-fold decrease in endophthalmitis in intracameral antibiotic group
- Questionable benefit of additional postoperative topical antibiotics
- Conclusion: intracameral effective, topical route efficacy needs further study

Endophthalmitis Prophylaxis


- Intracameral Moxifloxacin vs topical alone
- N=2674
- 0.094 vs 0%

Endophthalmitis Prophylaxis


- Intracameral cefuroxime vs topical alone
  - N=5,119
  - 1.238 vs. 0.44%

Endophthalmitis Prophylaxis


- 11-fold decrease in endophthalmitis

Endophthalmitis Prophylaxis


- 0.422 vs 0.047%

Endophthalmitis Prophylaxis

- Compelling evidence for use of intracameral antibiotics
- Only modes of proven benefit in literature include Intracameral antibiotics and povidone iodine
- Benefit of additional topical antibiotics yet to be determined
IOL Power Optimization

ORA-
WaveTec Vision

Intraoperative wave front aberrometer

Similar technology used in LASIK/PRK surgery

IOL Power Optimization

Optiwave

Refractive

Analysis

The ORA System®

• Device attaches to operating microscope
• Provides on demand wavefront analysis
• Enables real-time surgical course correction

ORA

Introduced April 2009 as the ORange Intraoperative Wavefront Aberrometer

The reflected light from the retina (wavefront with aberrations of the eye) passes through a grating pair resulting in a diffractive fringe pattern which is translated into the refractive state of the eye using various algorithms

What Is It?
ORA

• Real-time intraoperative wavefront analysis

• Calculate IOL power in aphakic or pseudophakic setting

• Record pseudophakic refraction to guide toric lens alignment and measure residual cylindrical power

Role in post-keratorefractive surgery

• To assist in IOL power calculation when unable to measure corneal power

Real-time aphakic refractive measurement to assist in IOL power selection

Limitations in Refractive Outcomes in Cataract Surgery

• IOL Power Formulas
  — Very limited following keratorefractive surgery

  Many formulas/methods:

<table>
<thead>
<tr>
<th>Formula/Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double K</td>
<td>Contact Lens Osr-refraction method</td>
</tr>
<tr>
<td>Hoffer Q</td>
<td>Topographic based post Zerk adjustment</td>
</tr>
<tr>
<td>Haigis L</td>
<td>Net Corneal Power Measurement</td>
</tr>
<tr>
<td>Masket</td>
<td>Shammas</td>
</tr>
<tr>
<td>Koch</td>
<td>Latkany</td>
</tr>
<tr>
<td>Wang</td>
<td>Central Ring Topographic method</td>
</tr>
<tr>
<td>Clinical History</td>
<td>Bypass regression and theoretical preoperative IOL calculations in favor of intraoperative wavescan measurements</td>
</tr>
</tbody>
</table>

Assists in toric lens alignment

- Post-myopic LASIK/PRK, predicted within ±0.50 D of emmetropia
  - ORA (older version) 39%
  - IOLMaster 27%
  - Avg K method 24%
  - ASCRS calculator 18%

Published Data

Percent of Patients Within .5D of Intended Target

- All Patients
- Post Myopic Treatment
- Post RX

Femtosecond Cataract Surgery

- Technology borrowed from LASIK surgery
  - Alcon LenSx
  - OptiMedica Catalys
  - LensAR
  - Technolas

Femtosecond LASER

- Ultra-short pulse laser
- Pulses are too brief to transfer heat to the material being cut
- No damage to surrounding tissue
- Cuts material by ionizing it at the atomic level
- Extremely precise

ORA-Conclusions
Femtosecond Cataract Surgery

- Femtosecond laser-assisted cataract surgery functions:
  - LRI
  - Anterior capsulotomy
  - CCI (phaco incision)
  - Sideport incision
  - Nuclear fragmentation

The Future.....

Nuclear Fragmentation

Emerging Lens Technology

The Future

- Smaller incisions, quicker recover
- Greater access to ophthalmic care
Thank You!