Scenarios

- Inferior RD with small pseudophakic breaks
- Pseudophakic RD with early PVR
Introduction

• Current Management
• Global Trends
• Timing of Retinal Detachment Repair
• Challenges
Retinal Detachment

- Annual incidence in the U.S. ~ 36,000
- 12/100,000 (0.01% annual risk)
- 0.6% lifetime risk
- Risk factors include
  - Cataract surgery
  - High myopia
  - Lattice degeneration
  - Severe ocular trauma
Risk Factor: Cataract Surgery

- Patients s/p cataract surgery
  - 3% of the general population
  - 40% of patients with RRD\(^1\)
- 50% of RRD in 1\(^{st}\) postoperative year
- Pseudophakic RRD more advanced
  - Macula off
  - Higher incidence of PVR
- Cumulative probability within 3 yrs after ECCE: 0.81%\(^2\)

Risk Factor: High Myopia

-6.00 diopters or AL ≥ 26 mm
  • 10% of general population
  • 42% of all patients with RRD
- 5x-6x risk of RRD²
- Directly related to degree of myopia: 1 mm → 1.3x³

3 Ninn-Pedersen K, Bauer B: Arch Ophthalmol 114:382--6, 1996
Treatment Options

- Observation
- Laser Demarcation
- Pneumatic Retinopexy
- Scleral Buckling
- Pars Plana Vitrectomy
Retinal Detachment Repair

- Options for repair
  - Pneumatic Retinopexy
  - Scleral Buckle
  - Primary Vitrectomy
  - Combined Buckle/Vitrectomy

- Pre-operative factors
  - Extent of Retinal Detachment
  - Location of Retinal Breaks
  - Lens Status
  - Myopia
  - Lattice Degeneration
  - Status of Fellow Eye
  - Own experience and training
Future

- Teaching: Go pro videos

- Novel methods such as chandelier and microscope assisted surgery can be performed
Go Pro

- Worlds most versitale and affordable camera for teaching (450 dollars)
- Internal wifi, stream live footage from the Gopro to up to 20 feet away.
- Watch the live action unfolding, making it an ideal live teaching method for scleral buckles
- Fish eye 170 degreee view in 4K
- Software allows magnification
PPV vs SB/PPV

- Primary vitrectomy is a very good procedure but:
- There are many situations where combined SB/PPV is advantageous
- SB/PPV continues to be utilized in the US and internationally
Appropriate Timing of RRD Repair
Treatment

• **Prognostic Factors**
  • Initial visual acuity
  • Macula status: on/off
    • Duration of macula off status
  • Height of detachment
  • Patient age
Categorization

Often described as macula-on or macula-off

WHY?

Prognosis

• Macula-on: 80% with final BCVA of ≥ 20/40
• Macula-off: 30% with final BCVA of ≥ 20/40

• Preoperative visual acuity (VA) is the strongest prognostic indicator of postoperative visual outcome
Ross and Kozy (Ophthalmology, 1998):

- 104 patients with mac-off detachments
- 3 groups analyzed by time to surgery
- However, no final VA results differences between patients in the 1-10 day sub-groups (see chart below)

### Table 1. Recovery of Snellen Visual Acuity in the Three Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>≥20/50 (%)</th>
<th>20/60–20/200 (%)</th>
<th>&lt;20/200 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–2 days</td>
<td>52</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td>3–4 days</td>
<td>65</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>5–7 days</td>
<td>61</td>
<td>34</td>
<td>5</td>
</tr>
</tbody>
</table>
Macula-off Studies and Evidence


- 457 patients with mac-off detachments
- No prognostic difference between patients repaired within 30 days (lower LogMAR = better)
Hartz, Burton, Gottleib (Ophthalmology, 1992):

- 137 macula-on RRDS
- Comparison of emergency vs scheduled surgery
- No outcome difference (none of 18 delayed patients progressed to macula off)
- 25% more cost for emergency surgery
Macula-on Studies and Evidence


- 199 macula-on RRDs
- 85% repaired within 3 days
- Only 1 patient progressed to macula-off status (4 days after presentation)

| TABLE 2. Visual Acuity of Patients With Fovea-Sparing Rhegmatogenous Retinal Detachments |
|--------------------------------------|--------------------------------------|--------------------------------------|
|                                      | Preoperative n = 199 | Postoperative n = 172                | Postoperative Vision According to Time From Initial Evaluation to Surgery\(^a\) |
|                                      | All Patients | All Patients | < 12 h (n = 46) | 12–24 h (n = 47) | 1–3 d (n = 53) | > 3 d (n = 26) |
| Median                               | 20/25         | 20/30        | 20/25            | 20/30            | 20/30           | 20/30           |
| ≥ 20/25                              | 108 (54%)     | 77 (45%)     | 24 (52%)         | 20 (43%)         | 22 (42%)        | 11 (42%)        |
| 20/30-20/40                          | 58 (29%)      | 48 (28%)     | 12 (26%)         | 17 (36%)         | 15 (28%)        | 4 (15%)         |
| ≤ 20/50                              | 33 (17%)      | 47 (27%)     | 10 (22%)         | 10 (21%)         | 16 (30%)        | 11 (42%)        |

Postoperative visual acuities are from postoperative visits at 2 months.

\(^a\)There was no statistical difference among postoperative visual acuity outcomes by time from initial evaluation to surgery. \(P = .20\) (by median visual acuity, Kruskal-Wallis test); \(P = .33\) (by visual acuity groupings, \(\chi^2\) test).
Macula-on Progression

Ho, Fitt, Frimpong, Benson, et al (Eye, 2006):

- 82 macula-on RRDs
- Only 11 (13%) had progression of posterior border prior to surgery. 3 (3.7%) progressed to macula-off.
- Among those that progressed, average rate: 1.8 disc diameters per day (range 0.125-4.5)

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Characteristics of three patients in whom macula was detached by the time of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patient 1</td>
</tr>
<tr>
<td>Age (years)</td>
<td>59</td>
</tr>
<tr>
<td>Duration of symptom</td>
<td>1 day</td>
</tr>
<tr>
<td>Location of subretinal fluid (in clock hour positions)</td>
<td>11.30–1.45</td>
</tr>
<tr>
<td>U-tear/hole</td>
<td>1 U-tear (12.15)</td>
</tr>
<tr>
<td>Distance of subretinal fluid from fovea at presentation (in disc diameter)</td>
<td>4</td>
</tr>
<tr>
<td>Days after presentation in which macular detachment was found</td>
<td>1 (macula split)</td>
</tr>
<tr>
<td>Posturing performed</td>
<td>Yes</td>
</tr>
<tr>
<td>6/52 postoperative best-corrected visual acuity</td>
<td>6/18</td>
</tr>
</tbody>
</table>
Many observational studies have confirmed that the IS/OS junction is correlated with visual recovery after RD repair, and that ELM disruption negatively affects IS/OS junction recovery.

- Matsui et al
- Nagpal et al
- Shimoda et al
- Joe et al
- Delolme et al
- Cho et al
• Schocket et al
  • Retrospective series of 17 eyes with decrease Va after RD repair
  • Ultrahigh-resolution optical coherence tomography
  • Preop mean LogMAR Va 1.37
  • Postop mean LogMAR Va 0.48
  • Distortion of the IS/OS junction in 14 of 17 patients (82%)
  • Epi-retinal membranes in 10 of 17 patients (59%)
  • Residual subretinal fluid in 3 of 17 patients (18%)
  • Cystoid macular edema in 2 of 17 patients (12%)
IS/OS Junction after RD Repair

- **Wakabayashi et al**
  - Retrospective series of 53 eyes with mac on and mac off RRD after successful repair
  - Fourier-domain optical coherence tomography
  - Disruption of the IS/OS junction in 23 eyes (43%), all were mac off RD eyes
  - In mac off eyes, the post op BCVA correlated with the integrity of the IS/OS junction and ELM on FD-OCT, p<0.001
  - 64% of eyes with disruption of the IS/OS junction but not the ELM on OCT eventually recovered the IS/OS junction
  - Eyes with disruption of both the IS/OS junction and the ELM on OCT never recovered the IS/OS junction during the study
Background

• Retrospective, chart review study
• 35 eyes that underwent vitrectomy for RRD with SF6 tamponade and combined phacoemulsification and lens implant
• 14 mac on, 21 mac off
Background

- Exclusion: coexisting ocular disease
  - Recurrent RRD
  - ERM
  - CME
  - Persistent SRF
  - Diabetic Retinopathy
  - VH
  - Senile Cataract
Foveal Bulge

The foveal bulge was defined by the photoreceptor OS length at the central fovea being 10 mm longer than the average OS length at 250 mm temporal and nasal from the central fovea.

Proposed Anatomy of Foveal Bulge

A. The thinner photoreceptor OS packing may make the IS/OS line form into an arch at the fovea like a bouquet of flowers.

B. The gradually lengthening photoreceptor OS toward the central fovea may make the IS/OS line form a bulge.

Several experimental studies have shown that there is a degeneration and dropout of photoreceptor OS, and shortening of the photoreceptor OS length that occurs immediately after retinal detachment.

No Foveal Bulge

Fig. 3. Spectral-domain optical coherence tomographic images of eyes with a macula-off RRD.

A. The SD-OCT image of a 68-year-old man 18 months after the macula-off RRD was repaired. The SD-OCT image shows a shorter foveal photoreceptor OS length and an absence of the foveal bulge (arrow), but a continuous photoreceptor IS/OS line is present in the central fovea. The BCVA was 12/20.

B. The SD-OCT image of a 56-year-old man 9 months after the macula-off RRD was repaired. The SD-OCT image shows a flat IS/OS line, that is, an absence of foveal bulge (arrow). The BCVA was 14/20.

Fig. 2. Spectral-domain optical coherence tomographic image of a 59-year-old woman with a macula-off RRD.

A. At the initial visit, the SDOCT image shows a macula-off RRD. The BCVA was 6/100.

B. Two months after successful retinal reattachment, the SD-OCT image shows the presence of a foveal bulge (arrow), although it is not as sharply peaked as in normal eyes. The BCVA was 24/20.

### OCT Characteristics


| Table 1. Patient Characteristics and OCT Findings at the Final Visit After RRD Repair |
|---------------------------------------------|---------------------------------------------|-----------|
|                              | Macula-on RRD (n = 14) | Macula-off RRD (n = 21) | P         |
| Age, years                     | 59.7 ± 6.3              | 59.4 ± 7.0              | 0.7610    |
| Follow-up period, months       | 5.4 ± 4.9               | 6.9 ± 4.6               | 0.2102    |
| LogMAR                         | −0.04 ± 0.05            | 0.17 ± 0.16             | <0.0001   |
| CFT, μm                        | 253.5 ± 31.4            | 221.7 ± 42.4            | 0.0082    |
| ONL thickness, μm              | 120.4 ± 16.7            | 103.1 ± 25.9            | 0.0153    |
| Photoreceptor IS length, μm    | 34.3 ± 2.9              | 31.8 ± 3.7              | 0.0358    |
| Photoreceptor OS length, μm    | 45.4 ± 4.1              | 36.3 ± 5.9              | <0.0001   |
| Detection of foveal bulge, n (%)| 14 (100)                | 6 (28.6)                | <0.0001   |
Foveal Bulge and Postoperative VA

Photoreceptor OS length and presence of foveal bulge strongly associated with better postoperative visual acuity

If unsure of macular status, consider OCT (often shallow macula-off RDs are mistaken as macula-on)

- May advise patient remain NPO, but also stress that retinal surgeon will determine timing of repair

- Remember that a surgeon operating emergently without the best equipment or team may not get as good of an outcome as a surgeon who is operating later in optimal and more controlled setting
• There is a legitimate, but small, concern that delay of repairing a macula on RD can progress to macula off RD

• Subretinal fluid progresses slowly, at different rates
  • Average 1.8 disc diameters per day

• Several series show that macular detachment is infrequent when delaying surgery
  • Reports range from 0-13%
Additional considerations

- Patient preference
- Medical clearance
  - Anticoagulation status
- Anesthesia availability
- Access to OR
- Cost
Challenges

- Intraoperative
  - IOL’s:
- Post operative
  - Metamorphopsia
  - ERM/PVR
Presbyopia Correcting IOLs

2005
- 2.9 million CE/IOL
- 2.5% multifocal IOL
- ~72,000 cases/yr

2013
- 3.9 million CE/IOL
- 22% multifocal IOL
- ~740,000 cases/yr
Premium IOLs

• Premium IOLs
  • Presbyopia Correcting IOLs
    • Accomodative IOLs
      • Crystalens and Crystalens HD
    • Multifocal IOLs
      • ReStor
      • ReZoom
      • Technis
  • Astigmatic Correcting IOLs
    • Toric IOLs
  • Phakic IOLs
    • Verisyse (attaches front of iris) PMMA
    • Visian Implantable Collamer Lens (ICL) (positioned behind iris)

• As population ages, we will see more of these IOLs
  • Prevalence AMD 0.2 % age 55-64; 13% age 85 and older
FDA Approved Premium IOLs

- **ReZoom®**
  - Multifocal
  - Refractive
  - 6mm optic
  - Acrylic

- **ReSTOR®**
  - Multifocal
  - Diffractive
  - 6mm optic
  - Acrylic

- **Tecnis MF®**
  - Multifocal
  - Diffractive
  - 6mm optic
  - Acrylic / Sil

- **Crystalens®**
  - Accommodative
  - 4.5-5mm optic
  - Silicone
Issues for the Retinal Surgeon

- Centration
- Condensation
- Lens Material
- Macula Work
Issues: Centration

- Multifocal IOLs require correct centration upon the entrance pupil
- Mechanisms of decentration:
  - Displacement by air during air-fluid exchange
  - Displacement during gas lavage (especially non-valved systems)
  - Slight shifts in capsular bag with anterior vitrectomy
- Precautions / Solutions:
  - Do slow, deliberate gas/air exchange
  - Do not tilt the eye
  - Use valved, small-gauge trocar systems
Issues: Condensation

- Can be issue in pseudophakic eye with silicone lens and posterior capsulotomy
- Mechanism: Access to posterior surface of IOL allows water condensation on cool, non-biologic surface
- Precautions / Solutions:
  - Coat the posterior surface of IOL with viscoelastic
  - Place infusion line through ice bath to condense water in line rather than in eye
  - Consider irrigating contact lens system in conjunction with warmed saline solution
Issues: Lens Material

- Can be issue with silicone lenses, especially with posterior capsulotomy
- Mechanism: Silicone oil droplets bind to silicone polymers of IOL
- Precautions / Solutions:
  - Avoid silicone oil placement in eyes with silicone lenses
  - Overly symptomatic patients may require IOL explant
  - Remind referring doctors not to place silicone lenses in diabetic eyes or highly myopic eyes/hx of tear, detachment in other eye
Issues: Macula Work & Visualization

- For macula – altered depth perception and image jump can be observed as changes in optical power occur between optical or diffractive zones.
- For periphery – smaller optic IOL can cause image jump at the lens edge.
- Precautions / Solutions:
  - More deliberate peeling
  - Smaller-diameter circular movements to minimize traversing IOL zones
  - Judicious use of elevated IOP if forceps trauma causes bleeding
Issues: Z-Syndrome

- Unique to Crystalens
  - Anterior flexion at one hinge while posterior flexion occurs at other hinge due to asymmetric forces
  - Most frequently due to capsular contraction
  - No reported cases with VR surgery but could theoretically could happen during AFX
The Ideal IOL (Retina Perspective)

- Does not compromise contrast sensitivity or light transmission in patients with macular disease
- Allows excellent viewing of the macula and retinal periphery in the clinic and OR
  - Optic size
  - Optic material
  - Optic design

The Ideal IOL (Retina Perspective)

• Large optic preferred
  • Allows larger anterior capsulotomy
  • Improved viewing area
  • Better stereopsis

• Material/ design
  • Minimize capsular opacification
  • No interaction with surgical adjuvants (gas, silicone oil)

Retinal Aniseikonia

- Metamorphopsia or dysmetropsia can occur from retinal pathology
- Occurs with macular hole, ERM, macular edema
- Can occur after RD repair (SB, PPV, PR)
- Often significantly interferes with binocular function
Metamorphopsia

- Okamoto et al
  - 129 eyes that had undergone successful retinal reattachment surgery
  - 50/129 (39%) eyes had metamorphopsia
  - 18/50 had changes on OCT (ERM, disruption of the IS/OS junction, CME, macular hole, or subretinal fluid)
  - 32/50 had no OCT findings
  - Metamorphopsia is significantly associated with mac off detachment vs mac on (p<0.001)
Metamorphopsia

**TABLE 2.** Logistic Regression Analysis of the Presence or Absence of Metamorphopsia Score and Independent Variables in Patients With Rhegmatogenous Retinal Detachment

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>0.00</td>
<td>0.03</td>
<td>.79</td>
</tr>
<tr>
<td>Surgical procedures (scleral buckling/vitrectomy)</td>
<td>0.00</td>
<td>0.66</td>
<td>.98</td>
</tr>
<tr>
<td>Number of retinal tears</td>
<td>0.08</td>
<td>0.17</td>
<td>.85</td>
</tr>
<tr>
<td>Circumferential dimension of retinal tears (degrees)</td>
<td>0.00</td>
<td>0.02</td>
<td>.67</td>
</tr>
<tr>
<td>Area of retinal detachment (degrees)</td>
<td>0.00</td>
<td>0.01</td>
<td>.89</td>
</tr>
<tr>
<td>Macular status (on/off)</td>
<td>0.35</td>
<td>0.62</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

β = partial correlation coefficient; SE = standard error.

*Significant at P < .05.

Retinal Aniseikonia

- Up to 35% of patients complain of aniseikonia after successful RD repair
  - Can be related to difference in central retinal thickness between operated and fellow eye
  - Due to misalignment or abnormal spatial distribution of photoreceptors after reattachment
  - Aberrant photoreceptors results in image size difference in visual cortex perception
    - Compression of photoreceptors $\rightarrow$ macropsia
    - Stretching of photoreceptors $\rightarrow$ micropsia
Retinal Aniseikonia

FIGURE 5. Misalignment of photoreceptors results in simultaneous variation of image size perception by the visual cortex. The distribution of reattached retinal photoreceptors may be stretched because of the swelling photoreceptor cells or enlargement of the inter-photoreceptor space. The photoreceptors’ density on a normal retina (Left) is compared with that on reattached retina (Right). Lower density and fewer numbers of photoreceptors in the reattached retina perceived the same image size (yellow E). Thus, fewer signals were conducted from the separated and stretched photoreceptors of reattached retina, which led to a smaller image being perceived by visual cortex (micropsia).
Aniseikonia Following Pneumatic Retinopexy for Rhegmatogenous Retinal Detachment

Hsin-Nung Lee, Keng-Hung Lin, Hin-Yeung Tsai, Ying-Cheng Shen, Chun-Yuan Wang, and Richard Wu

American Journal of Ophthalmology

November 2014

Table 1. The correlation between postoperative aniseikonia and preoperative macular status in patients with rhegmatogenous retinal detachment treated with pneumatic retinopexy.

<table>
<thead>
<tr>
<th></th>
<th>Macula-Off RD N = 17</th>
<th>Macula-On RD N = 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aniseikonia, n (%)</td>
<td>15 (88.2%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td>Non-aniseikonia, n (%)</td>
<td>2 (11.8%)</td>
<td>10 (76.9%)</td>
</tr>
</tbody>
</table>

RD = retinal detachment.
P value < .01.
## Retinal Aniseikonia

<table>
<thead>
<tr>
<th></th>
<th>Macropsia</th>
<th>Micropsia</th>
<th>No Aniseikonia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mac On (54%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPV</td>
<td>2.7%</td>
<td>13.5%</td>
<td>83.8%</td>
</tr>
<tr>
<td>SB</td>
<td>5%</td>
<td>30%</td>
<td>65%</td>
</tr>
<tr>
<td><strong>Mac Off (46%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPV</td>
<td>57.1%</td>
<td>7.1%</td>
<td>35.6%</td>
</tr>
<tr>
<td>SB</td>
<td>28.6%</td>
<td>28.6%</td>
<td>57.1%</td>
</tr>
</tbody>
</table>

**Trends:**
- Mac off more likely to have micropsia
- Mac on more likely to have macropsia
OCT OD
OCT OS
Comparison

RIGHT EYE

LEFT EYE
Unintentional Macular Displacement

- Definition
  - Inadvertent displacement of the fovea/macula from its position overlying the RPE after RRD repair

Of course in this situation it is due to PVR / multiple surgeries.

How often does it occur following RRD repair?
- 43 consecutive patients with RRD 1+ quadrants
  - Repaired PPV/20% SF6
- Used FAF to detect retinal displacement
  - Pre op, POD 1&10, POM 1, 3 & 6
  - Hyper-AF lines adjacent to imaged vessels
- Used synoptophore to measure deviation
43 consecutive patients with RRD 1+ quadrants
  - 27 of 43 eyes with displacement by FAF (63%)
    - Seen POD 10
  - Associated with:
    - Macula OFF status
    - Increased with # quadrants involved
  - Synoptophore results
    - 16 (59.3%) with 1 to 5 deg extorsion
    - 13 (48.1%) with 1 to 4 deg vertical deviation

None of the patients complained of diplopia.
27 of 43 eyes with displacement by FAF (63%)

Why? – they think

- Slight residual subretinal fluid
- Gas
- Upright positioning

Yet again = None of the patients complained of diplopia.
Unintentional Macular Displacement

- Definition
  - Inadvertent displacement of the fovea/macula from its position overlying the RPE after RRD repair

Does intraocular tamponade play a role?
23 consecutive patients with RRD
- Repaired 20g PPV/6% C3F8 vs SO
- Immediate face down positioning
- Used FAF to detect retinal displacement
  - 10 of 14 (71%) of gas eyes slipped down
  - 2 of 9 (22.2%) of oil eyes slipped up
- Tested macular fixation
  - Gas shift of fixation 1.17+/-.75 deg
  - Oil shift of fixation 0.8 /-.47 deg

No patient complaints / symptoms discussed.
Unintentional Macular Displacement

- Definition
  - Inadvertent displacement of the fovea/macula from its position overlying the RPE after RRD repair

Has anyone reported it being clinically apparent to the patient?
Macular displacement following rhegmatogenous retinal detachment repair

Edward Lee,¹ Tom H Williamson,¹ Pirro Hysi,² Manoharan Shunmugam,¹ Mahmut Dogramaci,¹ Roger Wong,¹ D Alistair H Laidlaw¹

- 32 fovea involving RRD repaired with vitrectomy or buckle
- Used FAF to detect displacement
  - 23 of 32 (72%) with displacement
- Asked about symptoms
  - Of pts with displacement, 83% with “distortion”
    - 45% with narrowing or smaller image perception in involved eye
    - No one with diplopia

Displacement + stretch of portions of macula = symptoms
Update on PVR Treatment and Prevention
Update on PVR Treatment and Prevention
PVR Prevention

- Triamcinolone
- 5FU/heparin
- 13 cis Retanoic Acid
- Daunorubicin
Kirin et al

First large-scale genome-wide association study
British, Dutch and Croatian populations
Significant association for missense (Glu to Ala) coding SNP located within the *CERS2* gene
*CERS2* codes for a ceramide synthase protein CerS2 that mediates apoptosis of mammalian photoreceptors and RPE cell lines
Combining all of the SNPs identified in the discovery phase accounts for 27.4% of the liability of RRD, suggesting a polygenic component.
## Inflammatory Cytokines and Growth Factors Associated with PVR

<table>
<thead>
<tr>
<th>GTG Pathogenic PVR Molecules</th>
<th>Function</th>
<th>Study Finding Genetic Risk to Some Haplotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAX</td>
<td>Apoptosis Regulation</td>
<td>YES</td>
</tr>
<tr>
<td>Bcl-2</td>
<td>Apoptosis Regulation</td>
<td>YES</td>
</tr>
<tr>
<td>CTGF</td>
<td>Growth Factor</td>
<td>None</td>
</tr>
<tr>
<td>EGF</td>
<td>Growth Factor</td>
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</tr>
<tr>
<td>FGF2</td>
<td>Growth Factor</td>
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<tr>
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<td>Growth Factor</td>
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<tr>
<td>IFN – gamma</td>
<td>Inflammatory Cytokine</td>
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</tr>
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<td>IGF1, IGF2</td>
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<td>IGF-IR</td>
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<td>Lysyl oxidase (LOX)</td>
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<tr>
<td>MCP1</td>
<td>Inflammatory Chemokine</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GTG Pathogenic PVR Molecules</th>
<th>Function</th>
<th>Study Finding Genetic Risk to Some Haplotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIF</td>
<td>Inflammatory Chemokine</td>
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<tr>
<td>MDM2</td>
<td>Regulator of p53</td>
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</tr>
<tr>
<td>MMP2</td>
<td>Matrix Metalloproteinase</td>
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</tr>
<tr>
<td>MMP9</td>
<td>Matrix Metalloproteinase</td>
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<tr>
<td>NF kappa, B1, B1A, B1B</td>
<td>Cytokine Signaling</td>
<td>None</td>
</tr>
<tr>
<td>p53</td>
<td>Tumor Suppressor</td>
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<tr>
<td>PDGF alpha</td>
<td>Growth Factor</td>
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</tr>
<tr>
<td>PDGFR alpha</td>
<td>Growth Factor Receptor</td>
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</tr>
<tr>
<td>Robo1</td>
<td>RPE Cell Adhesion</td>
<td>YES</td>
</tr>
<tr>
<td>SMAD3</td>
<td>Signal Transducers</td>
<td>None</td>
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<tr>
<td>SMAD7</td>
<td>Signal Transducers</td>
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<tr>
<td>TGF beta 1</td>
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<tr>
<td>TGF beta 2</td>
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<td>TNF</td>
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<tr>
<td>TNFR2</td>
<td>Inflammatory Cytokine Receptor</td>
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</table>
Regulators of Apoptosis: P53, Bax and BCL-2

- Pastor-Idoate et al
  - Study patients underwent primary RRD surgery with at least 6 months follow up
  - 134 patients with PVR grade C or higher
  - 416 patients without PVR
  - Statistically different distribution of p53 codon 72 polymorphisms in PVR vs RD groups

- An analysis of the same Retina 4 data by Pastor-Idoate et al also found associations with Bax and BCL-2
Robo1

- Transmembrane receptors involved in neurogenesis
- Huang et al
  - Robo1 expression found in human PDR and PVR tissue
  - Robo1 siRNA treated cloned human RPE cells showed reduced adhesion, migration and proliferation
  - Injection of Robo1 siRNA treated RPE cells vs. control RPE cells into a rabbit model resulted in delayed onset of PVR in the Robo1 siRNA treated group
Rojas et al

- 450 patients with primary rhegmatogenous RD
- 138 cases: PVR grade C1 after 3 months
- 312 controls: No PVR after 3 months
- Identified 1 SNP within the TNF locus that is associated with PVR
- Sanabria Ruiz-Colmenares et al
  - Study patients underwent primary RRD surgery with at least 6 months followup
  - 31 patients with PVR grade C or higher
  - 27 patients without PVR
  - 46 normal controls
  - Analyzed SNPs of TNF-α, TGF-β1, IL-10, IL-6, IFN-γ
  - Statistically different distribution of TGF-β1 codon 10 polymorphisms in PVR vs. RD groups
TGF-B Inhibitor

- **Nassar et al**
  - TGF-β receptor 1 inhibitor LY-364947
  - Inhibits proliferation and transdifferentiation of RPE cells in vitro
  - Rabbit models of PVR: pars plana incision, excision of prolapsed vitreous and injection of autologous blood in the vitreous cavity
  - Injection of LY-364947 alone and with vitrectomy resulted in a reduction in severity of PVR and TRD in rabbit models
Conclusion

• Retinal detachment repair continues to evolve
• Vast experience and expertise of retina community allows to achieve favorable outcomes in many of our patients
• New lens technology adds to the complexity of surgical repair
• Patient expectations have to be managed in the pre operative and post operative period
Thank you!
Intraoperative air condensation on silicone IOL

Capsular fibrosis and phimosis

Silicone oil irreversible adherence to a silicone IOL
Vitreoretinal Surgery

- Detailed macular work not limited by any of the three optic styles
- Lim, et al.: No difference between monofocal, multifocal IOL
  - Image quality
  - Stereopsis
  - Contrast
- Optic size
  - Capsular opacification
  - Image jump
- Optic material
  - Silicone oil contraindicated in an eye with a Crystalens
  - Silicone oil safe to use with Acrylic optics

Scenarios

Inferior RD with small pseudophakic breaks

Pseudophakic RD with early PVR
Conclusion

- Retinal detachment repair continues to evolve
- Vast experience and expertise of our group allows us to achieve favorable outcomes in many of our mutual patients
- New lens technology adds to the complexity of surgical repair
- Patient expectations have to be managed in the pre operative and post operative period