Retina from inside to out: Advancements in the Management of Retinal Disease

DR. KELLEN KASHIWA

Background
- PUČO ’11 grad
- Bennett Eye Institute
- Sports Vision
- Adjunct Clinical Professor with PUČO

Learning Objectives
- Diagnostics Tools
  - OCT
  - OPTOS
  - MP1
  - ERG/VEP
- Practice management
- Future Diagnostics
- Treatments
  - Common Retinal Diseases
  - Current treatments
  - Future treatments

Retinal Diagnostic Tools
- We currently use in practice
  - Heidelberg - Spectralis OCT
  - Optos
  - Nidek MP3
  - Humphrey VF
  - Diopsys ERG/VEP
- Other tools available
  - OCT-angiography
  - Retinal Function Imager
  - Metabolic Analyzer
  - Adaptive optics

Spectralis OCT
- Every patient gets an OCT baseline – Macula/Optic Nerve
- Enables great view of retinal layers
- Evaluate for CME and ERM

Question 1
- What layer is the fluid?
  A. Outer nuclear layer
  B. Outer plexiform layer
  C. Inner nuclear layer
  D. Inner plexiform layer
**Question 1**

What layer is the fluid?

- A. Outer nuclear layer
- B. Outer plexiform layer
- C. Inner nuclear layer
- D. Inner plexiform layer

**Cystoid Macular Edema**

- VA may/may not be affected 20/20 - 20/400
- Due to leaking perifoveal capillaries
- Fluid collects in OPL
- Flower Petaloid pattern on FA

**Cystoid Macular Edema**

- Causes of CME
  - Surgery
  - Inherited causes
  - Medications
  - Tumors
  - Tractional
  - Inflammatory Conditions
  - Vascular

**Surgerical Induced CME**

- POSTOPERATIVE
  - Cataract surgery
  - Penetrating keratoplasty
  - Scleral buckling
  - Laser iridotomy
  - Cryotherapy for retinal break
  - Panretinal photocoagulation
  - Topical epinephrine*
  - Nicotinic acid
  - Irvine Gass Syndrome
    - About 3-5% post cataract surgery
    - Responds well to topical NSAIDs

**Other Causes of CME**

INHERITED/DYSTROPHIES
- Retinitis pigmentosa*
- Autosomal dominant cystoid macular edema

TUMORS
- Choroidal melanoma
- Retinal capillary hemangioma

**OPTOS**

- View up to 200 degrees (82%) of the retina
- Peripheral vascular changes
- Great for peripheral retinal documentation and education
Question 2

What is the most common quadrant affected by a BRVO

A. Superior Nasal  
B. Superior Temporal  
C. Inferior Nasal  
D. Inferior Temporal

RVO vs RAO

2 possible results in retinal injury:  
1. Sick  
2. Death

Retinal Vein Occlusion = Sick  
- Signal VEGF  
- Swollen

Retinal Artery Occlusion = Death  
- Retinal Atrophy  
- Pale Retina

Retinal Vein Occlusion

<table>
<thead>
<tr>
<th>BRVO</th>
<th>CRVO</th>
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<tbody>
<tr>
<td>VA = 20/20 – Count Fingers</td>
<td>Ischemic (33%) or Non-Ischemic</td>
</tr>
<tr>
<td>Typically superior temporal quadrant</td>
<td>20/200 or worse</td>
</tr>
<tr>
<td>CME very common</td>
<td>90 day Glaucoma</td>
</tr>
<tr>
<td>Treatment</td>
<td>Treatment</td>
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</tbody>
</table>
| BVOS Study  
  - Focal laser?  
  - BRAVO Study  
  - Lucentis | CVOS Study  
  - Focal laser?  
  - CRUISE Study  
  - Lucentis |

Microperimetry

- Central visual field testing  
- Compared to HumphreyVF  
  - Real time Eye tracker compensates for eye movements  
  - Great for those with central vision loss  
  - Maps of PRL  
  - Can enable biofeedback
Question 3

What does the OCT show?
A. Cystoid Macular Edema
B. Pigment Epithelial Detachment
C. Drusen
D. Central Serous Chorioretinopathy

RPEDs vs Drusen
- Drusen – RPE detachment with NO posterior shadowing
- PEDs – RPE detachments with posterior shadowing

Dry AMD
- 4 High Risks for conversion to Wet*
  - Smoking
  - HTN
  - Focal Hyperpigmentation
  - Soft Drusen
- Who’s at risk
  - Macular Risk Test
  - Hyperope or Myope?
    - Recent study found Myopes > Risk: NSC and POAG.
    - Lower prevalence with AMD and DR
  - Vitreal component?

Future Dry AMD treatments
- Stem cell therapy
- Apl-2
- Zimura
- Oracea
- Metformin

ERG
- Objectively detects characteristic visual function changes — leading to timely diagnosis
- Assess disease severity, evaluate therapeutic effects and adjust treatment plan

<table>
<thead>
<tr>
<th>Electrodiagnostic Test</th>
<th>Area tested</th>
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<tbody>
<tr>
<td>Full-Field ERG</td>
<td>Entire retina - the rod and cone system</td>
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<tr>
<td>Flicker ERG</td>
<td>Central retina function – Cone system</td>
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<tr>
<td>Multifocal ERG</td>
<td>Ganglion cell function</td>
</tr>
<tr>
<td>Pattern ERG</td>
<td>RPE function</td>
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<tr>
<td>EOG</td>
<td>RPE function</td>
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</tbody>
</table>
Diopsys

- ERG/VEP
- 5 different tests
- Pattern ERG
- Flicker ERG

Flicker ERG

- Type of Full-Field ERG
- Retina is stimulated with a flash of light
- Objectively measures the function of cone and bipolar cells
- Results can help show functional loss and recovery
- Helpful in predicting eyes that may develop ischemia

Pattern ERG

- Primarily used for functional evaluation of ganglion cell in the central retina
- Can identify dysfunction years before structural testing will show damage
- A study found reduced magnitude on pERG in diabetic patients without retinopathy vs normal
  - Also found further reduction in magnitude with increasing retinopathy

VEP

- Objective measurement of optic nerve head function
- Low contrast / High contrast sensitivity to evaluate the magno/parvo cellular pathway

VEP

- Amblyopia
- Glaucoma
- Optic neuritis

Q5: What layer is the fluid
**What layer is the fluid**

- A. Sub RPE
- B. Outer plexiform layer
- C. Inner plexiform layer
- D. Sub retinal

**Sub Retinal Fluid**

- Over 60 years old – Most likely Wet AMD
- Other causes
  - Inflammatory
  - Infectious
  - Neoplastic
  - Vascular
  - Congenital abnormalities
  - Drug induced

**OCT-angiography**

- Non-invasive imaging
- Generates 3D maps of microvasculature flow patterns
- OCT-A can evaluate retinal layers and can help visualize small vascular details that can be difficult detecting on FA

**OCT-Angiography**

- Evaluates from the retinal capillary plexus to the choroidal vasculature
- Not obscured when FA testing
- Allows for tracking progression
Current treatments for Wet AMD

- Current Anti-VEGF
  - Avastin – 4wk
  - Lucentis – 4wk
  - Eylea – 8wk
  - Beovu – 12 wk

- Future Anti-VEGF
  - Port delivery system (Lucentis)
  - Gene therapy
  - Topical drops
  - Oral tablet
  - Radiation therapy

Anti-VEGF injections complications

- Corneal changes
  - First 6 months of anti-VEGF treatments may show
  - Stromal edema
  - Endothelial cell density changes
  - Descemet folds

- RNFL changes
  - IOP spike ~12%
    - IOP >30mmHg 5 mins post injection
    - Studies show resolution after 30 mins
  - Healthy patient can withstand IOP spike
  - May predispose some patients to AION and BRVO/CRVO

Retinal Function Imager

- Capillary perfusion maps, measure blood flow velocity and determine metabolic function including blood oximetry
- Beneficial for clinical diagnosis and assessing treatment response

Calculation of Blood Flow Velocity

- Poor venous flow and neurosensory retinal fluid and active RPED?
- What’s your diagnosis?
  - A – Wet AMD
  - B - Polypoidal
  - C - CSR
  - D - CME

Central Serous Chorioretinopathy

- Type A; Males; >40 YO
- Signs
  - Serous elevation of macula
  - Loss of FLR
  - May be recurrent in 50%
- Treatment
  - Most self-limiting
  - Topical/Oral NSAIDs
  - Focal laser photocoagulation
  - Repair RPE site at leakage
Metabolic Analyzer

- OcuMet Beacon
  - Novel medical device to assess retinal mitochondrial dysfunction
  - Takes an infrared fundus image that highlights the acquisition area for the retinal metabolic image
  - Beneficial for quantifying therapeutic effectiveness and disease detection

Diabetic Macular Edema

- Injections
  - Anti-VEGF
    - Lucentis approved for DME – 2012
  - Avastin
  - Anti-Inflammatory
    - SubTenon Kenalog
    - InVit Triscence

Adaptive optics

- Adaptive optics imaging systems use active optical elements to compensate for aberrations in the optical path between the object and the camera
- AO allows direct visualization of individual rods and cones photoreceptor cells, RPE cells and white blood cells

Rtx1 – Adaptive Optics

- Scan can be beneficial for diabetic retinopathy changes
- Can reveal microscopic hemorrhages, non-flowing blood cells, edematous cyst walls and modified arteriolar structure
What is the leading cause of vision loss in RP?
A – RPE loss
B – Optic nerve fiber layer loss
C - ERM
D - CME

Many Variants
- AD, AR, X-linked
- Triad
  - Bone Spicules
  - Arteriole Attenuation
  - Waxy Optic Nerve
- Hearing Loss???
  - Usher's Syndrome

Other Signs
- ERM
- Macular Hole
- Cystoid Macular Edema

Stem cells
Retinal Implant
Electrical current stimulation
Retinal Prothesis
- Argus II
- FDA Approval
Questions

- Mahalo
- Any specific questions
  - Kellen.kashiwa@gmail.com
  - 808-398-3766