OCT in the Management of Diseases of the Vitreomacular Interface (VMI)

Jay S. Duker, MD

Director, New England Eye Center
Professor and Chair
Tufts Medical Center
Tufts University School of Medicine
Boston, MA  USA
Financial Interest Disclosure

- Stockholder
  - Hemera Biosciences
  - Ophthotech
  - EyeNetra
  - Paloma Pharmaceuticals
- Research Support
  - Carl Zeiss Meditech
- Consultant
  - Alcon/Novartis
  - Allergan
  - EMD/Serono
  - Optos
  - Regeneron
  - Thrombogenics
OCT of VMI Disease

Key Concept

• With respect to diagnosis and management of diseases of the vitreomacular interface (VMI)...
  – vitreomacular traction (VMT)
  – full thickness macular hole (FTMH)
  – lamellar macular hole (LMH)
  – epiretinal membrane (ERM)…..in 2014

SD OCT = THE critical study
OCT of VMI Disease

Outline

• What do these entities have in common?
• What makes SD OCT useful for the management of these entities?
• Introduction of a new SD OCT-based classification system for these entities
• OCT-guidance in the management of these disorders
OCT of VMI Disease

Commonality of Location

- Vitreomacular adhesion (VMA)
- Vitreomacular traction (VMT)
- Macular hole
  - Full thickness (FTMH)
  - Lamellar (LMH)
- Epiretinal membrane (ERM)
OCT of VMI Disease

Commonality of Disease Pathogenesis

- Vitreomacular traction (VMT)
- Macular hole
  - Full thickness (FTMH)
  - Lamellar (LMH)
- Epiretinal membrane (ERM)

Anomalous Posterior Vitreous Detachment (PVD)
OCT of VMI Disease

Posterior Vitreous Detachment (PVD) - Background

• PVD is a normal aging process that typically occurs over decades

• Accelerated by
  – Trauma
  – Intraocular surgery
  – High myopia
  – Inflammation

• May culminate in an acute symptomatic event – complete PVD with Weiss ring formation
OCT of VMI Disease

Disease Pathogenesis - Anomalous PVD

• Interruption in the normal process of PVD can result in “anomalous” PVD
• Anomalous PVD leads to diseases of the vitreomacular interface (VMI)
OCT of VMI Disease

Disease Pathogenesis - Anomalous PVD

• *Vitreous aging* – two progressive processes
  – Liquification
  – Weakening of the vitreo-retinal adhesion

• *What causes trouble?* – two pathologic processes
  – Mismatch between two processes → traction
  – Vitreoschisis → residual vitreous on retinal surface after apparent PVD → traction and/or avascular proliferation (ERM)
OCT of VMI Disease

Molecular Structure of the Vitreous

- Vitreous gel = 99% water
- Normally avascular
- Hyalocytes – cellular component
- Macromolecules
  - Collagen fibers
  - Glycosaminoglycans (GAGs)
    - 90% hyaluronan
    - 10% chondroitin sulfate

OCT of VMI Disease

Anatomy of the Vitreous

- The organization of structural components provides the vitreous with unique optical and mechanical properties - stability and minimization of light scattering
- Vitreous fibrils splay out anterior to posterior
- Prior to PVD, fibrils do not scatter light
- Firmly attached at
  - Vitreous base
  - Optic disc
  - Blood vessels
  - Macula
Almost All Acquired Vitreomacular Interface Pathology Is the Result of Anomaly in the Normal Vitreous Aging

• Two processes occur with age:
  – progressive vitreous **liquefaction**
  – progressive **weakening of the vitreoretinal adhesion**
OCT of VMI Disease

Liquefaction

- Liquid vitreous seen in eyes by 4 yrs old
- By late teens, approximately 20% of the vitreous volume is liquid
- Liquefied lacunae increase with age in number, size, and coalescence
- By 70 years, > 50% of vitreous is liquefied
- Despite liquefaction, no PVD in most autopsy eyes < 60 years
Weakening of Vitreoretinal Adhesion

- Progressive age-related weakening of adhesion between posterior vitreous cortex (posterior hyaloid) and internal limiting membrane (ILM)
- > 60 yrs, significant correlation between liquefaction and PVD, because at that point, the vitreoretinal adhesion becomes sufficiently weakened to allow separation
OCT of VMI Disease

Posterior Vitreous Detachment (PVD)

• Contrary to popular thought, PVD is not an acute process culmination in the formation of a Weiss ring with associated symptoms

• Rather it is a long-term, chronic process typically occurring over decades that sometimes culminates in the clinical manifestations of acute PVD
OCT of VMI Disease

Stages of Normal PVD (Johnson, Uchino)

OCT of VMI Disease

Anomalous PVD

• Interruption in the normal PVD progression
• Anomalous PVD causes pathology via two pathophysiologic mechanisms:
  – Persistent vitreous *traction* on fovea and/or optic nerve
  – Epiretinal avascular *proliferation* of fibrous tissue
OCT of VMI Disease

Anomalous PVD - Ramifications

• Traction/proliferation results in anatomic retinal changes:
  – Retinal distortion
  – Retinal thickening
  – Intraretinal cyst formation
  – Subretinal fluid
  – “Schisis” – splitting of inner/outer retinal layers
  – Macular hole formation – full and/or lamellar
OCT of VMI Disease

Anomalous PVD - Vitreoschisis

- Residual vitreous cortex left on ILM after PVD = vitreoschisis
- Common - histopathologic study by Kishi suggests that in almost half the eyes with PVD and Weiss ring, some hyaloid persists on surface of retina
- This residual hyaloid (vitreoschisis) can serve as a nidus for both epiretinal membrane proliferation (ERM) and macular hole

Most Vitreomacular Pathology: Anomalous PVD

- Retinal pathology typically develops where vitreous attached to retina most firmly
- Four areas:
  - Vitreous base
  - Along large retinal vessels
  - Optic disc margin
  - Two macular locations
    - A 500-micron radius “foveolar attachment”
    - A 1500-micron radius “foveal attachment”
Macular Complications of Anomalous PVD

• **Focal**, small (< 500 microns) vitreous adhesions → traction on foveola

• Results in focal macular pathology:
  – Vitreomacular traction (VMT)
  – Cystoid spaces
  – Subretinal fluid
  – Macular hole (FTMH)
  – Lamellar macular hole (LMH)
Macular Complications of Anomalous PVD

- **Broad**, large adhesions result in lower tractional forces
- >1500 μ vitreomacular adhesions are less likely to cause macular dehiscence
- More likely to cause diffuse disease
  - Epiretinal membrane
  - Traction macular detachment
  - Macular schisis
  - Hyaloidal thickening in diabetes
  - May be related to DME, AMD, RVO
OCT of VMI Disease

“Normal” PVD

Majority of eyes

4 stages – no macular pathology

Minority of eyes

Anomalous PVD

Etiology poorly understood
Normal process interrupted

Detached hyaloid at macula but vitreoschisis

Persistent hyaloid attachment at macula with traction

Some eyes – elements of both

ERM
LMH

VMT
FTMH
Why is OCT useful in VMI Disease?

• Cross sectional analysis of the macula
• Quantitative evaluation of macular thickness
• Widely available, non-invasive, featuring excellent resolution and reproducibility
• Ability to image “clinically invisible” structures: posterior hyaloid, vitreous adhesions, small intraretinal cysts and holes
OCT of VMI Disease

Newest OCT Systems

• Fourier Domain (FD) technology
  – Spectral Domain (SD) OCT
  – Swept Source (SS) OCT – investigational only in US

• Very high speed compared to previous Time Domain OCT devices (Stratus OCT 3)

• Each A scan information captured instantaneously

• Spectrometer and CCD camera to detect all light echoes simultaneously
OCT of VMI Disease

Spectral Domain OCT Advantages

• Faster than time domain (Stratus) means:
  – Three dimensional scanning possible
  – Precise registration from visit to visit
  – Raster scanning of macula = no “skip” areas
• Inner retinal surface better visualized
OCT of VMI Disease

SD OCT – Advantages

• Inner retinal surface better visualized
• Better delineation of fine vitreous structures, tiny retinal cysts /schisis cavities and epiretinal membranes
• Confirmation of full thickness vs lamellar holes
• 3D scanning/video - ? assist in pre-op surgical planning
OCT of VMI Disease

Surgical Success in Macular Diseases

• Anatomic success (structure) vs Visual success (function)
• Not always congruent
  – gross structure vs cellular function
  – photoreceptor dysfunction not quantifiable
  – effect of retinal thickening on vision not linear
  – Better resolution with SD OCT assists – IS/OS disruption, ELM disruption
OCT of VMI Disease

Practical Considerations

• Highest quality line (B) scan preferable
• Oversampling 20 x preferable (Cirrus 5 line raster – one line)
• EDI will slightly diminish view of vitreous
• Examination of entire cube
  – FTMH v LMH
  – Evaluation of areas of non-foveal involving traction
OCT of VMI Disease

Classification System – VMI Disease

- Why do we need a new classification system?
  - There is none!
  - Recent SD OCT findings ➔ better understanding of pathogenesis of these diseases
  - OCT findings predictive of surgical outcomes
  - New therapies – ocriplasmin (Jetrea)

- International panel convened in 2012

# OCT of VMI Disease

## 2012 International Panel

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Location</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jay Duker, MD</strong></td>
<td>New England Eye Center</td>
<td>Boston, Massachusetts</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Peter Kaiser, MD</strong></td>
<td>Cole Eye Institute</td>
<td>Cleveland, Ohio</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Susanne Binder, MD</strong></td>
<td>Rudolf Foundation Clinic</td>
<td>Vienna, Austria</td>
<td>Austria</td>
</tr>
<tr>
<td><strong>Alain Gaudric, MD</strong></td>
<td>Lariboisière Hospital</td>
<td>Paris, France</td>
<td>France</td>
</tr>
<tr>
<td><strong>Marc de Smet, MD, PhD</strong></td>
<td>Montchoisi Clinic</td>
<td>Le Mont-sur-Lausanne, Switzerland</td>
<td>Switzerland</td>
</tr>
<tr>
<td><strong>Elias Reichel, MD</strong></td>
<td>New England Eye Center</td>
<td>Boston, Massachusetts</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Peter Stalmans, MD</strong></td>
<td>UZ Leuven</td>
<td>Leuven, Belgium</td>
<td>Belgium</td>
</tr>
<tr>
<td><strong>SriniVas Sadda, MD</strong></td>
<td>Doheny Eye Institute</td>
<td>Los Angeles, California</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Jerry Sebag, MD</strong></td>
<td>VMR Institute</td>
<td>Huntington Beach, California</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Richard Spaide, MD</strong></td>
<td>Vitreous-Retina-Macula Consultants</td>
<td>New York, New York</td>
<td>USA</td>
</tr>
</tbody>
</table>
OCT of VMI Disease

Goals of the Classification Scheme

Simple and Objective

Easy to use and remember

Based on OCT
No: symptoms
No: signs

Applicable to clinical practice
Useful for clinical trials
Predictive of surgical outcomes

Allows us to speak a “common language”
OCT of VMI Disease

Anatomic Classification Based on OCT

Finding

• Vitreomacular Adhesion (VMA)

Diseases

• Vitreomacular traction (VMT)
• Full-thickness macular hole (FTMH)
• Lamellar macular hole (LMH)
• Epiretinal membrane (ERM)
OCT of VMI Disease

One Finding – Four Diseases

- Vitreomacular Adhesion (VMA)
- Vitreomacular Traction (VMT)
- Full-thickness macular hole (FTMH)
- Epiretinal Membrane (ERM)
- Lamellar Macular Hole (LMH)
Vitreomacular Adhesion (VMA)

- Posterior vitreous cortex (posterior hyaloid) visible on or above retinal surface
- Posterior vitreous cortex detached from inner retina at some point in the perifoveal area
- Persistent macular attachment, some part of which is attached within a 3-mm radius of fovea
- No anatomic retinal changes on OCT
OCT of VMI Disease

Vitreomacular Adhesion (VMA)

- Exclusively an OCT finding
  - No: symptoms
  - No: clinical findings
  - Must be present on at least one OCT B scan (line scan) through the fovea
  - Perifoveolar PVD

- Due to age-related changes of the vitreous
- Rarely pathologic
- Extremely common
OCT of VMI Disease

Two VMA Subclassifications

- **Size of Adhesion:**
  - **Focal**
    - <1500 µm or less
  - **Broad**
    - >1500 µm
    - Roughly parallel to retinal pigment epithelium (RPE) and may include focal areas of cortex dehiscence

- **Other macular disease:**
  - **Primary**
    - Isolated – no other macular disease
  - **Concurrent**
    - Other macular disease present
OCT of VMI Disease

**Isolated versus Concurrent**

- **Isolated** = isolated finding on OCT in absence of posterior segment disease
- **Concurrent** = associated with a posterior segment disease
  - VMA may or may not be directly attributable to concurrent disease
  - Visual/anatomic effects, if present, may be due to VMA or the secondary disease or both
  - Does release of VMA affect underlying disease?
OCT of VMI Disease

Concurrent Focal VMA

Concurrent focal VMA (associated with CSCR)
OCT of VMI Disease

Vitreomacular Traction (VMT)

• Definition = VMT is VMA (perifoveolar PVD) with ANY abnormal macular retinal architecture
• OCT diagnosis
• “symptomatic VMA” = VMT
OCT of VMI Disease

VMT Definition

- Posterior vitreous cortex (posterior hyaloid) visible on or above retinal surface. May be thickened.
- Posterior hyaloid detached from inner retina at some point in the perifoveal area
- Persistent macular attachment within a 3-mm radius of fovea
- Anatomic retinal changes on OCT
  - ALWAYS pathological
  - May or may not be symptomatic
OCT of VMI Disease

Two VMT Subclassifications

• **Size of Adhesion:**
  - **Focal**
    - ≤1500 μm
  - **Broad**
    - >1500 μm
    - Roughly parallel to RPE and may include focal areas of cortex dehiscence

• **Other macular disease:**
  - **Isolated**
    - No concurrent macular disease
  - **Concurrent**
    - Other macular disease present (e.g. wet AMD, RVO, DME)
OCT of VMI Disease

Vitreomacular Traction (VMT)

• VMT = VMA with retinal architectural changes

isolated focal VMT

isolated broad VMT
OCT of VMI Disease

AMD With Concurrent VMT

Concurrent Broad VMT in AMD (note vitreoschisis)

Cysts due to traction or CNV?
OCT of VMI Disease

Full Thickness Macular Hole (FTMH)

- Full thickness retinal defect involving the fovea
- OCT invaluable to diagnose and manage
OCT of VMI Disease

Three FTMH Subclassifications

- **Size** of defect
- **VMT** = whether present or absent
- **Primary** versus **secondary**

**Note:**
- Not a staging system – descriptive based on OCT
- No more “idiopathic MH.” Now referred to as “Primary.” Due to VMA → VMT
Small = Full thickness $\leq 250 \, \mu m$

Medium = Full thickness $> 250 \, \mu m$ and $\leq 400 \, \mu m$

Large = Full thickness $> 400 \, \mu m$
OCT of VMI Disease

Aperture Size Predicts Surgical Outcome

- Based on OCT
- Horizontal line roughly parallel to RPE measuring the smallest hole diameter in a foveal B scan
- Don’t measure at inner retina – photoreceptor tips - mid retina

- OCT caliper function used to measure hole at narrowest width

192 microns
OCT of VMI Disease

Small (< 250 microns)

Medium (251 – 400 microns)

Large (> 400 microns)
OCT of VMI Disease

FTMH Subclassifications – VMT Present or Released

- FTMH with VMT present
- FTMH with VMT released
  - Under Gass classification – this would have been a stage 4 macular hole regardless of size

![Image: Large FTMH - VMT present, 440 microns]
![Image: Medium FTMH - VMT released, 225 microns]
OCT of VMI Disease

FTMH Subclassifications – Primary vs Secondary

Primary
• Due to VMA → VMT
• No more “idiopathic”

Secondary
• Not initiated by VMA → VMT
• Secondary to preexisting or concurrent condition or disease, including several conditions

- Trauma (blunt, lightning strike)
- Myopia
- Macular edema
- Macular schisis

- ERM
- Choroidal neovascularization (CNV)
- Surgical procedure
OCT of VMI Disease

Case Example

- 49-year-old high myope
- VA = 20/20 OD, 20/50 OS
- Recent onset central distortion OS
- Note: No VMA/T seen
OCT of VMI Disease

Secondary FTMH

- 2 weeks later
- VA worse
- VA = 20/60
- Small FTMH – not VMA/VMT related
One month post-op
VA = 20/20

OCT of VMI Disease
OCT of VMI Disease

VMT v Stage 1 Macular Hole?

- This is VMT
- New classification = no “stages” for macular hole
OCT of VMI Disease

Stage 1 Macular Hole vs Isolated Focal VMT

- VMT can affect inner retina or outer retina
- Which is more likely to progress to FTMH?
OCT of VMI Disease

Old Stages (Based on Gass)                         New Intl Classification (OCT)

Old          NEW

Stage 0 macular hole  VMA in contralateral eye
Stage 1 macular hole  VMT
Stage 2 macular hole  FTMH
                      Small or medium +/- VMT
Stage 3 macular hole  FTMH
                      Medium or large +/- VMT
Stage 4 macular hole  FTMH
                      VMT released, small, medium, large
OCT of VMI Disease

OCT to Assist FTMH Management – Face Down

• Kelly and Wendel
  – Success rate 40%
  – Original report 1 week face down
• Some advocate up to 6 weeks!
• Recent studies suggest limited or no face down positioning with high closure rates
OCT of VMI Disease

Face Down Positioning

• Amount of face down recommended highly variable with no controlled study
• Possible to image macula through gas bubble immediately following surgery
• Theoretically, if hole is closed, no further position may be necessary
OCT of VMI Disease

- Small, primary macular hole OD
- VMT released
- VA = 20/50
OCT of VMI Disease

Macular Hole post-op day 1
OCT of VMI Disease

- 6 month post-op
- VA = 20/30
- 20/20 at one year
• 83-year-old woman
• VA = 20/200
• Large FTMH, VMT released
• ICG assisted ILM peel, 15% C$_3$F$_8$ gas
OCT of VMI Disease

- Post-op day 1
- Hole clearly open
- 6 more days face down

- 3 month post-op
- Hole closed
- VA = 20/100
OCT of VMI Disease

Importance of Contralateral VMT

- 57-year-old woman
- CC: decreased vision, left eye x 1 month
- Contralateral eye
- VA = 20/30 OD
- Normal OCT without VMA = 3% risk of FTMH
OCT of VMI Disease

- Contralateral eye
- 6 mos post-PPV OS
- VA= 20/30 OD
- Now has broad, isolated VMA
OCT of VMI Disease

- 6 mo later
- VA= 20/30 OD
- Isolated focal VMA
OCT of VMI Disease

- 2 years later
- VA = 20/30 OD
- Now isolated focal VMT
OCT of VMI Disease

- 4 years post-PPV OS
- VA= 20/30 OD
- Increasing metamorphopsia
- Dx: focal, isolated VMT
OCT of VMI Disease

- 5 years post-PPV OS
- VA= 20/80 OD
- Despite release VMA/VMT - macular hole occurred – small primary FTMH with no VMT

Small, primary FTMH, no VMT
OCT of VMI Disease

- 1 week post-PPV OD
- VA= 20/50 OD
OCT of VMI Disease

Lamellar Macular Hole

- OCT Expanded definition – loss of inner retinal tissue leaving outer retina (photoreceptors) intact
- Multiple etiologies: (resolution of VMT, ERM, CME, high myopia)
- May be accompanied by inner and/or outer retina schisis
- Surgery possible
OCT of VMI Disease

- 50-year-old man
- VA = 20/40
- Lamellar hole secondary to ERM
OCT of VMI Disease

- 53-year-old man
- Moderate myope
- VA = 20/40 OD
- Tx - observation
1 year later
VA= 20/60 OD
PPV, ERM peel, ILM peel, gas performed
OCT of VMI Disease

- 1 mo post-op
- VA = 20/40 OD
OCT of VMI Disease

“Normal” PVD

Majority of eyes

Minority of eyes

Detached hyaloid at macula but vitreoschisis

4 stages – no macular pathology

Etiology poorly understood Normal process interrupted

Persistently hyaloid attachment at macula with traction

Some eyes – elements of both

ERM

LMH

VMT

FTMH
OCT of VMI Disease

Vitreomacular Adhesion (stage 1 PVD)

Normal PVD – no macular pathology

Vitreomacular Traction

Severe Vitreomacular Traction

Macular Hole
OCT of VMI Disease

What to do?

Severe Vitreomacular Traction

Macular Hole
OCT of VMI Disease

In 2014 - Three Choices

Watch & Wait

VMT/Macular Hole

Intervention

Vitrectomy

Ocriplasmin
OCT of VMI Disease

Watch and Wait – VMT

- Reasonable to watch and wait when VA good and symptoms minimal
- Fellow eye involvement with a VMI disease makes prognosis worse
- PVD expected to occur in about 1/3 of eyes
- PVD may not normalize anatomy in all eyes, however

4 months later
OCT of VMI Disease

Vitrectomy For VMT

<table>
<thead>
<tr>
<th>Study</th>
<th>Disease State</th>
<th>N</th>
<th>VA Improvement (post-op)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witkin AJ, et al(^1)</td>
<td>VMT</td>
<td>20</td>
<td>+10 letters</td>
</tr>
<tr>
<td>Larsson J.(^2)</td>
<td>VMT</td>
<td>11</td>
<td>+15 letters</td>
</tr>
<tr>
<td>Rouhette H, et al(^3)</td>
<td>VMT</td>
<td>29</td>
<td>+15 letters</td>
</tr>
<tr>
<td>Davis RP, et al(^4)</td>
<td>VMT</td>
<td>36</td>
<td>&gt; 50 % improved</td>
</tr>
</tbody>
</table>

OCT of VMI Disease

FTMH – Watch and Wait

• Rare recommended
• Only small primary FTMH (< 250 microns aperture size) and traumatic secondary FTMH should be considered for observation
• If observation selected, close follow up with OCT imaging recommended
• Consider intervention for
  – Enlarging holes
  – Worsening vision
  – Stability with symptomatic decreased vision
OCT of VMI Disease

PPV for FTMH

• To Summarize:
  – Surgery works
  – Anatomically and visually
  – Really well

• Downsides:
  • Cataract
  • Face down
  • 1-2% risk
### OCT of VMI Disease

#### Selected PPV for FTMH Papers

<table>
<thead>
<tr>
<th>Study</th>
<th>Disease State</th>
<th>N</th>
<th>VA Improvement (post-op)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nadal J, et al1</td>
<td>Macular Hole</td>
<td>208</td>
<td>+ 25 letters</td>
</tr>
<tr>
<td>Haritoglou C, et al2</td>
<td>Macular Hole</td>
<td>99</td>
<td>+ 25 letters</td>
</tr>
<tr>
<td>Ezra E, et al3</td>
<td>Macular Hole</td>
<td>59</td>
<td>+15 letters</td>
</tr>
<tr>
<td>Mester V, et al4</td>
<td>Macular Hole</td>
<td>47</td>
<td>+20 letters</td>
</tr>
</tbody>
</table>

Ocriplasmin (Jetrea) – Truncated Form of Plasmin

- Manufactured with recombinant technology
- Targets fibronectin, laminin, and collagen
- Cleanly separates vitreous from ILM
- Induces both liquefaction and vitreous detachment

OCT of VMI Disease

Pharmacologic Vitreolysis w/ Ocriplasmin - Theoretical Treatment Benefits

- Office-based, single-step, intravitreal injection
- More convenient
- Less invasive: No cataract, ? fewer complications
- Atraumatic posterior vitreous separation
Primary Outcome: VMT Resolution at Day 28 - An OCT Outcome!

Time to Response in Pts w/ Pharmacologic VMT Resolution

% Patients With VMA Resolution

Days Post-Injection

Primary Endpoint

Ocriplasmin (N=464)
Vehicle (N=188)

VMA = vitreomacular adhesion.
*Proportion of patients with VMA resolution relative to Day 28.
OCT of VMI Disease

VMT Resolution
OCT of VMI Disease

Pts w/ FTMH Closure at Day 28

No PPV

OCT of VMI Disease

Pts w/ FTMH Closure at Day 28

Patients With FTMH Closure, %

<table>
<thead>
<tr>
<th>Group</th>
<th>≤ 250 µm</th>
<th>&gt; 250 µm to ≤ 400 µm</th>
<th>&gt; 400 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo (n=47)</td>
<td>16.0</td>
<td>5.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Ocriplasmin (n=106)</td>
<td>58.3</td>
<td>36.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>

p<0.001

No PPV

Case #1

- 70-year-old woman
- VA = 20/60
- Severe metamorphopsia and worsening vision
OCT of VMI Disease

Case #1

- 1 day post-ocriplasmin
- c/o decreased vision, flashes, decreased color vision
- VA = 20/100
OCT of VMI Disease

Case #1

- 1 week post-ocriplasmin
- VA = 20/60
- Symptoms better
OCT of VMI Disease

Case #1

- 8 weeks post-ocriplasmin
- VA = 20/50
- No metamorphopsia
OCT of VMI Disease

Case #1

- 4 months post-ocriplasmin
- VA = 20/40
- No metamorphopsia
OCT of VMI Disease

Baseline VA=20/200

Patient case images courtesy of J. Sebag
OCT of VMI Disease

7 Days Postinjection VA=20/40 - 2

Patient case images courtesy of J. Sebag
OCT of VMI Disease

15 Months Post-injection

Patient case images courtesy of J. Sebag
FTMH Closure W/ PPV in Nonresponders

92.3%* 93.1%*

*Excludes those patients without evaluable postvitrectomy OCT for macular hole status (n=3 for ocriplasmin and n=1 for placebo).

OCT of VMI Disease

Ocriplasmin Pearls

- VMT must be present! Check OCT day of injection
- Size of adhesion important: < 1500 microns does best
- Size of hole important: < 250 microns does best. > 400 microns – forgetaboutit
- Presence of an epiretinal membrane (ERM) is a relative contraindication
- Symptoms of PVD common immediately after tx
- If PPV necessary, no indication of increased risk, decreased success
OCT of VMI Disease

Summary

- Diseases of the VMI (FTMH and VMT) are due to anomalous PVD
- OCT is THE critical test to manage these patients
- Observation indicated for mild to moderate cases of VMT
- Macular holes are rarely observed
- PPV has a high success rate in both groups
- Ocriplasmin is the first FDA-approved pharmacologic treatment for “symptomatic VMA” – i.e. VMT and FTMH with VMT
- As in all therapies, case selection for ocriplasmin very important
Case # 2

- 66-year-old woman
- VA = 20/40 OD, severe metamorphopsia
- OS normal
- Diagnosis?
- Management?

Courtesy of Nadia Waheed, MD
Case # 2

- 1 week post-ocriplasmin
- VA = 20/30
- Symptoms better

Courtesy of Nadia Waheed, MD
Case # 2

- 3 weeks post-ocriplasmin
- VA = 20/25

Courtesy of Nadia Waheed, MD
Case # 3

- Pre-tx VA = 20/50

Courtesy of Andre Witkin, MD
• 2 weeks Post-tx VA = 20/25

Courtesy of Andre Witkin, MD