OCT of Vitreomacular Interface Disorders

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Age-related changes of vitreous gel

- Loss of interfibrillar hyaluronan
- Degenerative breakdown of the collagen network
- Liquefied lacunae increase with age in number, size, and coalescence

Vitreoretinal Adhesion

- There is progressive age-related weakening of the adhesion between the posterior vitreous cortex (posterior hyaloid) and the internal limiting membrane (ILM)

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- Alcon (C)
- Alimera (C, R)
- Allegro (C, S)
- Bayer (C)
- Genentech (C, R)
- InSitu Therapeutics (C, S)
- Kanghong Biotech (C)
- National Eye Institute (R)
- National Institute of Health (R)
- Novartis (C)
- Ophthotech (C, S)
- Onyx (C, S)
- Regeneron (C, R)
- Research to Prevent Blindness (R)
- SKS Ocular (S)
- Thrombogenics (C)

Posterior Vitreous Detachment

- Natural with aging (common over 50 years of age)
- Characterized by
  - Synchisis: vitreous gel liquefaction
  - Syneresis: separation of the vitreous at the vitreoretinal interface

Normal Vitreous Aging

Stage 1 – Vitreomacular adhesion (VMA)

Stage 2 – Separation from macula

Stage 3 – Separation for entire posterior retina except optic nerve

References:
Complete PVD is rare

Liquefaction without vitreoretinal dehiscence

Goals of the Classification Scheme

- Simple, easy to use, easy to remember
- Objective – no symptoms, no clinical findings
- Based on OCT alone
- Applicable to clinical practice
- Helpful in predicting surgical outcomes
- Useful for clinical trials
- Allow retina community to speak a “common language”
Vitreomacular adhesion (VMA)

- Exclusively an OCT “finding”
  - No symptoms
  - No clinical findings
- Due to age-related changes of the vitreous
- Rarely pathologic
- Common

Swept Source

- Focal versus Broad
  - < 1500 = focal
  - ≥ 1500 microns

*Why 1500 microns?*
- Known site of strong VM adhesion by histology
- Pre-existing cut-off employed by reading centers
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 affects, if present, may be due to VMA or the secondary disease or both

Isolated Focal VMA

Otherwise normal macula = Isolated focal VMA

Concurrent Focal VMA

Concurrent focal VMA (associated with CSC)

Clinical Course of VMA

- Asymptomatic
- Spontaneous Resolution
- VMA
- VMT
Vitreomacular Traction (VMT) – International Classification

- Definition = VMA with ANY abnormal macular retinal architecture
- OCT diagnosis
- “symptomatic VMA” = VMT

Isolated Focal VMT

- VMT = VMA with retinal architectural changes

Isolated Focal VMT

- VMT = VMA with retinal architectural changes
Isolated Focal VMT

- VMT = VMA with retinal architectural changes

Isolated Broad VMT

Pathology at the vitreoretinal interface

- Growth factors at the vitreoretinal interface
  - Laminin, fibronectin, and others
- May contribute to fibrocellular proliferation at the retinal surface in the presence of vitreous remnants

“Vitreoschisis”: collagen and cells left firmly attached to the ILM
VMT Becomes ERM

- 52 year old high myope
- VA = 20/25
- Mild metamorphopsia

VMT Becomes ERM

- 2 years later
- Worsening symptoms
- VA = 20/50

Epiretinal Membrane

- Cellular proliferations on a layer of native vitreous collagen
- The ILM and/or vitreous collagen serves as a scaffold for cellular proliferation
- Adhesion of vitreous collagen transmits tangential tractional forces to the retina
Vitreomacular traction syndrome (VMTS)

- Characteristic clinical appearance at macular surface (wrinkling, tightening, thickening)
- Typically has double membrane due to hyaloidal splitting or surface proliferation
**Full Thickness Macular Hole**

- A full-thickness defect of retinal tissue involving the anatomic fovea
  - First described in 1869 following ocular trauma by Knapp

**Pseudohole**

- Steepened foveal contour, small foveal aperture
- Thickening of macular edges (without thinning of foveal center)
- Reduced macular diameter

**OCT in vitreoretinal interface disorders**

- Differentiate macular holes, lamellar holes, and pseudoholes

**OCT of Pseudohole**

- Steep profile consistent with Allen and Gass' hypothesis of centripetal ERM constriction
Lamellar Hole

- Gass definition: aborted macular hole
- Complete PVD - pulls off inner retinal tissue leaving outer retina (photoreceptors) intact
- Vision usually good - 20/20 to 20/30
- Usually stable
Lamellar Hole

Gass Classification

Stage 1

Stage 2

Stage 3/4

“Stage 1a Macular Hole” = VMT

“Stage 2 Macular Hole” = FTMH

UHR-OCT Courtesy of Jay Duker, MD

“Stage 1a Macular Hole” = VMT

“Stage 2 Macular Hole” = FTMH

UHR-OCT Courtesy of Jay Duker, MD
“Stage 2 Macular Hole” = FTMH

“Stage 3 Macular Hole” = FTMH
Swept Source

Stage 3 Macular Hole

“Stage 4 Macular Hole” = FTMH
Stage “0” hole = VMA

- Stage 0 macular hole has a 42% risk of going to full thickness macular hole
- If contralateral eye does not have a stage 0 only 3% risk

OCT for Macular Hole

- Diameter of macular hole associated with initial closure rates
  - Prognosis better for eyes with small diameter macular holes
  - Late re-opening of macular holes with larger diameter more common

Size for FTMH

- Size (not stage) most important variable to predict anatomic success (eg Stage 4 holes can be small)

  SMALL: < 250 microns near 100% closure
  MEDIUM: > 250 < 400 about 95% closure
  LARGE: ≥ 400 microns about 75% closure

FTMH International Classification System

- Based on size of full thickness defect
  - VMT = present or absent
  - Primary versus secondary

- Note:
  - No stages
  - No “idiopathic”. Now referred to as Primary. Due to VMA → VMT
FTMH Subclassification – Small (< 250 microns)

FTMH Medium (251 – 400 microns)

FTMH Large (> 401 microns)

FTMH – VMT Present or Absent

Small FTMH – VMT present

Small FTMH – VMT released
FTMH Primary vs Secondary

- Primary = due to VMA leading to VMT (formerly "idiopathic" macular hole)
- Secondary
  - Not initiated by VMA or VMT
  - Secondary to preexisting or concurrent condition or disease

Secondary FTMH

- Pre-existing or concurrent condition or disease without evidence of VMT
  - Trauma
    - Blunt trauma
    - Lightning strike
    - Surgical procedure
  - Myopia
  - Macular schisis
  - MacTel Type 2
  - Choroidal neovascularization (CNV) treated with anti-VEGF

OCT of the Vitreomacular Interface

- OCT is invaluable for evaluation of the vitreomacular interface
- Diagnosis and management will be altered based on OCT findings
- OCT can visualize subtle findings that may be impossible to see clinically

Thank you...