OCT & OCT Angiography in Retinal Disease

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Financial Obligations

Resource: OCT Community for OCT and OCTA

Optical Coherence Tomography
Course Design
OCT and OCT Angiography

Both are Becoming Equally Important in Diagnosis, Management, and Treatment

Optical Coherence Tomography

- OCT is an optical signal acquisition and processing method
- Time domain OCT
  - 50 kHz of resolution
  - Depth (mics)
- Spectral domain (SD-OCT) or Fourier domain OCT
  - Spectrally encoded frequency domain OCT (SDF-D OCT)
  - 15-60 microns of resolution
  - Able to see photoreceptor morphology (translucent segments)
  - 50 times faster than time domain
- Swept source OCT
  - Time encoded frequency domain OCT
  - 1 micron of resolution

Future of OCT - intraoperative imaging, blood flow and oxygenation measurements
- May have the possibility to assess retinal pathology like a pathologist

OCT Angiography: the Next Chapter in Posterior Imaging

- Images retinal microvasculature without dye injection
- Displays structure and function from a single imaging system

4 Basic Categories: Diseases of the...

- Vitreous
- Macula, Neurosensory Retina, RPE
- Choroid
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Normal Retinal Vasculature

Superficial Capillary Plexus
Below ILM → 15 µm Below IPL

Deep Capillary Plexus
Below ILM → 70 µm Below IPL

Outer Retina
Below IPL → 30 µm Below RPE Reference

Choriocapillaris
Below RPE Reference → 60 µm Below RPE Reference

Review of Normal
25 year old man

Review of Normal
60 year old man

60 Year Old Montage OU

OCT of Vitreoretinal Interface Disorders

Learn to predict visual acuities
Poll 1 My office has:
A. OCT
B. OCT and OCT Angiography
C. No OCT instrument at this time

OCT of Vitreoretinal Interface Disorders
- Epiretinal membrane
- Vitreomacular adhesion
  - Complete VMA at birth
  - OCT reveals specific stage of vitreous separation
- Vitreomacular traction
- Pseudohole
- Lamellar hole
- Full Thickness Macular Hole

Epiretinal Membrane
- Other names: premacular fibromata, preretinal glosis, macular pucker, surface wrinkling retinopathy
- Believed to be the result of proliferation of retinal glial cells on the internal limiting membrane that escaped through breaks in the internal limiting membrane
- May create macular edema
- Arterial grid may elicit metamorphosia from surface wrinkling or macular edema
- Treatment: Monitor until severe then retinal consult, possible vitrectomy with membrane peeling

Epiretinal Membrane (ERM)
- En Face OCT of ILM
- Retina Map

Epiretinal Membrane (ERM)
- Ex Face OCT of ILM
- Raster Scan

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VMA versus VMT
Focal or Broad Attachment

Vitreomacular Adhesion (VMA)

Vitreomacular traction (VMT)

Focal versus Broad in VMA and VMT

Poll 2: Which eye has the better visual prognosis?

Vitreomacular Traction (VMT)

Focal

LIKE VMA, VMT may be subdivided into either focal or broad depending on the width of vitreomacular traction. Unlike VMA, focal or broad traction can occur unilaterally or bilaterally. In both cases, focal and broad traction are associated with similar visual outcomes. traction may be focal or broad. In focal traction, the macular hole is localized to a single point or area, while in broad traction, the macular hole is more diffuse. In both cases, focal and broad traction can be visualized on OCT scans by identifying the presence of vitreomacular bands or bands of vitreous material. Prevention of traction can be achieved through prompt treatment following the onset of a VH. In cases of VH with traction, prompt treatment with vitreomacular band separation, injection of radial vitreomacular traction, and prompt macular hole closure can reduce the risk of visual loss.
Vitreo-Macular Traction (VMT)
Focal

Vitreomacular Traction (VMT) is defined as posterior vitreous detachment with remaining vitreous attached to the retinal surface. It is an OCT finding that is almost always the result of normal vitreous separation, which may lead to pathologic conditions. Vitreomacular traction is characterized by preretinal posterior vitreous detachment accompanied by anterior traction of the fovea, which may induce deformations, focal macular holes, cystoid macular edema, and subfoveal fluid. Vitreomacular traction can be subdivided into four stages based on the appearance of the retinal surface as imaged by OCT, with stages 1-4 representing increasing severity of vitreomacular traction. Stage 1: Focal vitreomacular traction (VMT) is defined as focal posterior vitreous detachment with associated retinal changes. Stage 2: Retinal thickening is present with preservation of the fovea. Stage 3: Retinal thickening is more pronounced, and the fovea is less prominent. Stage 4: Retinal thickening is extensive, and the fovea is obscured. Full thickness macular holes are a primary cause of vitreomacular traction, and the presence or absence of vitreomacular traction is a critical factor in the diagnosis and management of macular holes. This classification system supports anatomic diagnosis and management by creating a clinically applicable system that is predictive of therapeutic outcomes and is useful for the execution and analysis of clinical trials.

Full Thickness Macular Hole

Stage 1-4 Macular Holes

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### Full Thickness Macular Hole

**Stage 0**
- Full thickness macular hole
- No lipid or VMT

**Stage 1**
- Membrane and/or lipid
- No VMT

**Stage 2**
- Membrane and/or lipid
- Thin VMT

**Stage 3**
- Membrane and/or lipid
- Thick VMT

**Stage 4**
- Macular hole
- No lipid or VMT

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### What About the Other Eye?

- One eye has a full thickness macular hole
- Stage 0 macular hole
  - VMT

- Impending macular hole
  - VMT
  - Despite the name
  - Can spontaneously resolve

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### Small Full Thickness Macular Hole without VMT

- Stage 0 macular hole
- VMA
- Impending macular hole
- VMT
- Despite the name
- Can spontaneously resolve

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### Macula Hole?

**Laminar Macular Hole**
- Full thickness macular hole
- No lipid
- OCT angiography not indicated

**Machado Macular Hole**
- Full thickness macular hole
- B-scan: serous fluid
- OCT: fluid line in macular hole
- OCT angiography indicated

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Diagnosis?

Poll 5 OCT Retinal Angiography

A. Requires an injection of dye
B. Does not require dye or an injection
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OCT Angiography
A New Approach to Protecting Vision

- Non-invasive visualization of individual layers of retinal vasculature
- Pathology not obscured by fluorescein staining or pooling
- Image acquisition requires less time than a dye-based procedure
- Reduced patient burden allows more frequent imaging to better follow disease progression and treatment response

OCTA of CNV
FA of CNV

67

Enface OCT-A Slabs
Based on Retinal Anatomy

68

Normal Retinal Vasculature

69

Type 1 “Occult” CNV

70

Type 1 “Occult” CNV

New vessels develop in the choroid
New vessels located BELOW RPE and ABOVE Bruch’s membrane

71

CNV?

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71 y/o Hispanic male 20/30 History of “Dry AMD”
Multimodal imaging and OCTA

And the not so obvious ones...

Case example: 70 y/o WM, AMD

Type 1 CNV: Below RPE, Wider than Type 2, Avascular Zone Usually Not Involved

Diabetes
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29 year old man with diabetes

- Yearly diabetic exam, reports no change to vision
- Type 1 DM
- BS: 190 this AM, last HbA1c 8.6
- Vision 20/20
- Anterior segment: normal
- Posterior segment:
  - No proliferative DR
  - No haze and exudates
  - No CME
- Billed for:
  - Exam- 99214
  - Optomap, OCT-Welness, and OCT-A (Angiography)
58-year-old man with diabetes

- New patient to the practice
- BS: unsure, last HbA1C unsure
- DM meds: metformin, glyburide, Invokana
- Vision 20/20
- Anterior segment: normal
FAZ Damage – This is DR
Time to get to know your BS and HbA1c

64-year-old man with diabetes
- BS: 134 this AM, last HbA1c 8.0
- DM meds: Novolog and Amaryl
- Vision 20/20
- Anterior segment: normal

Widefield Imaging

64-year-old man with diabetes

64-year-old man with diabetes

64-year-old man with diabetes
OCT and OCT-A

- Treatment?
- Certainly useful, beneficial, essential, and important in following the patient with diabetes
- Improved HbA1c

Central Serous Retinopathy
(Neurosensory Detachment)
Central Serous Retinopathy (Neurosensory Detachment)

46 year old man

- Complains of a perfect yellow circle in the center of his OS
- The circle stays in the center of his vision even when he moves his eye
- VA 20/20 OU
- Refraction OD Plano OS +1.00 D
- Prior visit Plano OU

Photos

RPE Detachment With Clear Fluid
Central Serous Chorioretinopathy

Revised Recommendations on Screening for Chloroquine and Hydroxychloroquine Retinopathy

- Last recommendations were 2002 by the American Academy of Ophthalmology
- Improved screening tools and new knowledge about prevalence of toxicity have prompted the change
  - Other 2- and 4-year cumulative toxicity studies
  - The toxic threshold for all conditions
    - Plaquenil toxicity is not well understood

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1-1.5 MM PERIMACULAR GCC THINNING THE FIRST SIGN OF PLAQUENIL TOXICITY

WHY? THICKEST LAYER OF GANGLION CELLS AND SMALLEST GANGLION CELLS AT THAT LOCATION. VERY SENSITIVE TO TOXICITY

WHAT DO YOU SEE ON THE SCANS?

A. THINNING OF THE GCC IN THE PLAQUENIL ZONE
B. MACULAR EDEMA
C. COMPROMISED PIL
D. NOTHING OF IMPORT

DO YOU SEE ANY PROBLEM IN THE PLAQUENIL ZONE?
WHAT DO YOU SEE ON THE SCANS?
A. THE FLYING SAUCER SIGN
B. MACULAR EDEMA
C. INCREASED PERIMACULAR RETINAL THINNING
D. A AND C

THE END GAME...ONCE YOU DISCONTINUE PLAQUENIL IT STAYS AROUND A WHILE TO CREATE DAMAGE...LONG ½ LIFE

WAY OUTTA THE BARN
71 yo woman

- With Lupus and hypertension

- Mediations:
  - Colazapam
  - Plaquenil 200 mg BID, 15 years
  - 81 mg ASA
  - Prednisone
  - Losartan

- VA 20/25 OD/OS (mild cataracts)

- Patient was told to see an ophthalmologist in 2013

Questions?

Thank you!

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