Matthew Cunningham, MD, FASRS
March 2025

FINANCIAL DISCLOSURE

- Consultant: Alimera, Allergen, Alcon, Genentech, Ocuphire Pharm, Ocular Therapeutics, ANI Pharmaceuticals
- Investigator: Alimera, Genentech, Inc., Jaeb Center for Health Research, Regeneron, Novartis, Ocuphire Pharm, Parexel, Ocular Therapeutics
- Speaker: Genentech, Inc., Apellis, Astellas, Regeneron
- **None relevant to this talk**

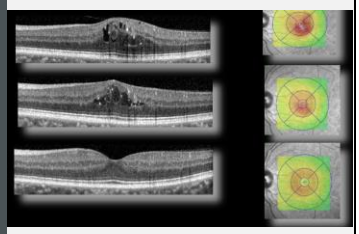
GOALS

- The course will review some current and future imaging modalities for the diagnosis of retinal disease

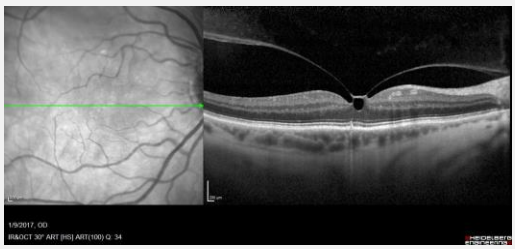
NAME ONE OPHTHALMIC IMAGING MODALITY THAT IS MOST USEFUL IN THE CLINIC?

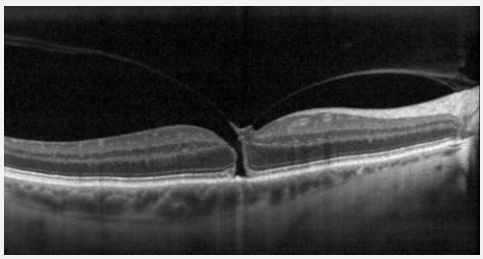
OPTICAL COHERENCE TOMOGRAPHY

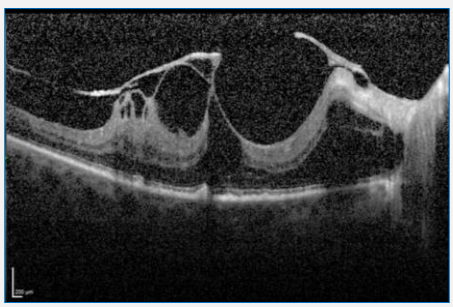
- First introduced in 1991
- Non-invasive imaging providing high-resolution cross sectional images – in vivo 'optical biopsy'
- Imaging of macula, optic nerve, retinal nerve fiber layer
- Analysis of morphology
- Quantifying changes in various disease states and monitoring progression
- Evaluation of vitreoretinal interface
- Optic disc and RNFL measurements to monitor progression and treatment response in glaucoma patients

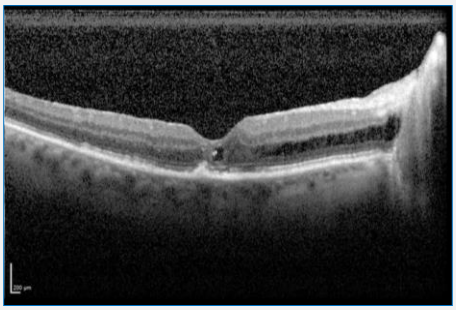


NORMAL APPEARING MACULA


1/9/2017, OD
IR&OCT 30° ART [HS] ART(100) Q: 34







ADVANCES IN IMAGING

- Intraoperative OCT
- OCT angiography
- Widefield, ultra-widefield imaging

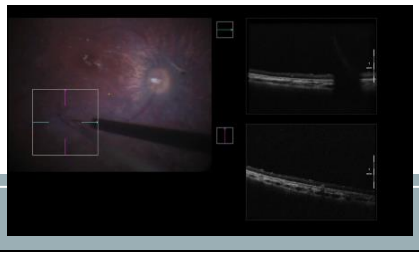
INTRAOPERATIVE OCT (IOCT)

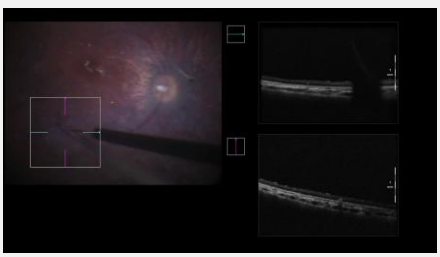
- Multiple studies show benefit of iOCT:
  - Facilitates superior precision in surgery
  - Superior endpoint visualization
  - Reduces unnecessary steps
  - Informs and changes surgical decision-making in anywhere from 10% to 40% of surgical cases
- Utilization of OCT during surgery is still low
  - About 2.5% of surgeons currently utilize iOCT, according to a recent survey.

VIDEO
COURTESY OF DR. ALEKSANDRA RACHITSKAYA

IOCT

- Visualizing subretinal instruments, subretinal bleb creation, and volume calculation
  - Gene therapy with subretinal delivery



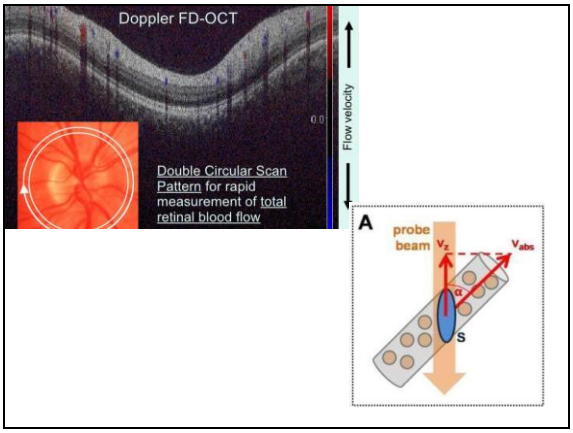


IOCT

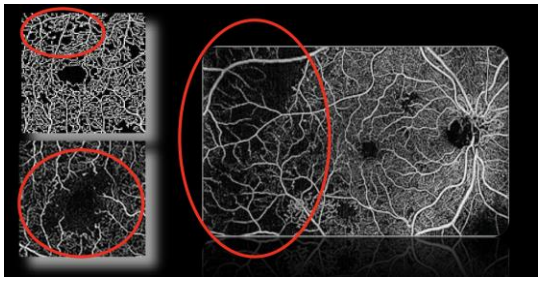
- Transitioning to a surgical cockpit with integration of technologies
- As technology and therapeutics advance, the need and adoption may increase

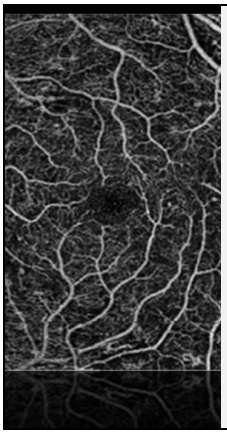
OCT ANGIOGRAPHY (OCTA)

- OCT Angiography
  - Precise location of vascular abnormalities
  - Evaluation of blood flow and volume of retinal and choroidal vasculature
  - Promise in monitoring and differentiating between chorioretinal diseases
    - AMD, CSR, PCV



OCT ANGIOGRAPHY (OCTA): DR

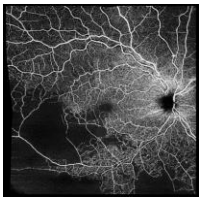




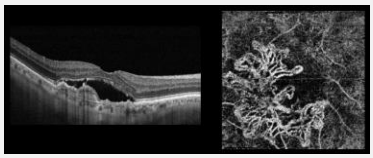
CASE: 33 YO WITH T1DM, IN HER 2ND TRIMESTER OF PREGNANCY

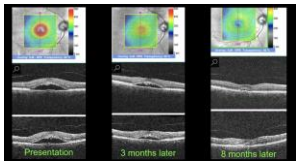
- Pregnancy
- FA dye allergy
- Rapid screening
- Unexpalined vision loss

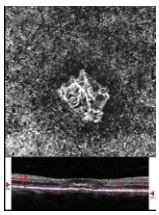
RETINAL VEIN OCCLUSION

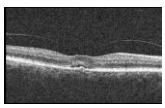


OCTA: NAMD









CASE: 37 YO MALE WITH CSR

WIDEFIELD IMAGING

CONSENSUS TERMINOLOGY

Widefield Imaging (60° to 100°)	Ultra-widefield Imaging (110° to 220°)
A single capture image with the focus on the fovea as the center extending out in all four quadrants to capture up to and including the vortex vein ampullae	A single capture image in all four quadrants that captures the retina beyond the vortex vein ampullae

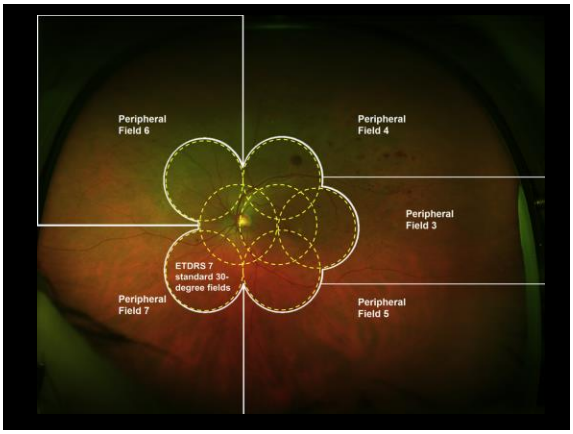
Choudhry N, et al. *Ophthalmol Retina*. 2019;3(10):843-849.

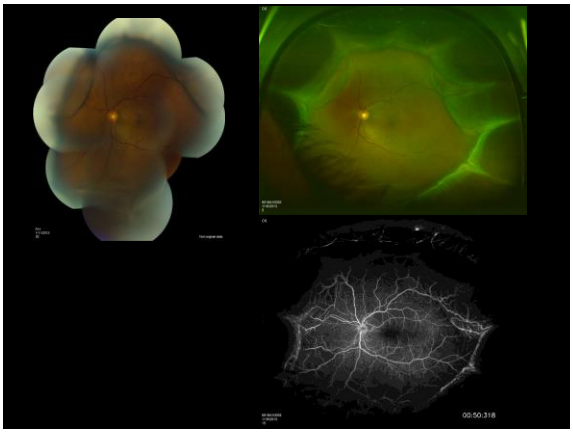
ULTRA-WIDEFILED (UWF) IMAGING PLATFORMS

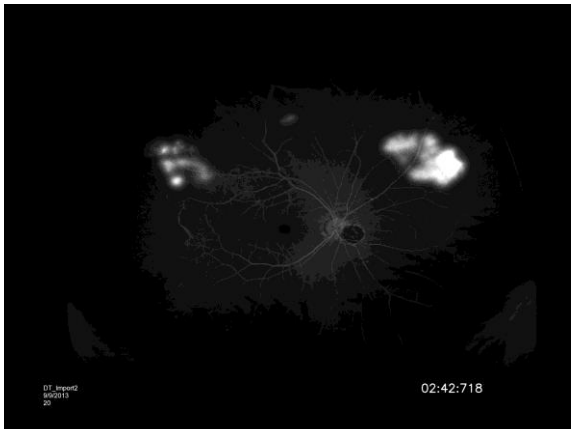
Imaging Devices	Degrees of View	% of Retina Viewed*	Lens System	Multimodal Imaging
Optomap	200°	82%	Noncontact	Color, FA, ICGA, FAF
Spectralis	150°	63%	Contact and noncontact	FA, ICGA
Clarus	133°	55%	Noncontact	Color, FA, ICGA, FAF
RetCam	130°	54%	Contact	Color, FA, ICGA

WIDEFIELD/UWF IMAGING

- Assessment of the periphery allows for more accurate staging
  - Diabetic Retinopathy
- Allows for superior evaluation of certain diseases:
  - Hereditary retinal disorders
  - Choroidal tumors/dystrophies
  - Peripheral degenerative patterns
- Leads to more comprehensive and accurate diagnosis, prognosis, and management



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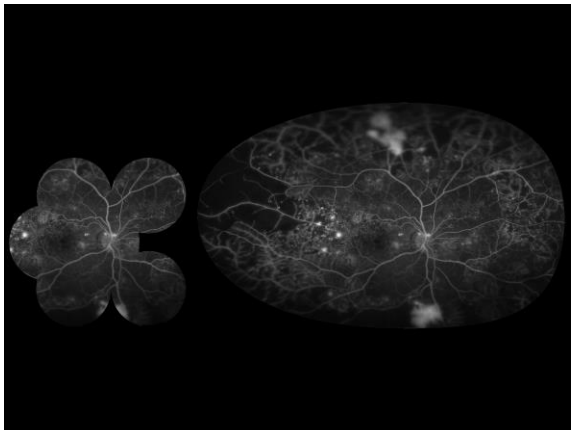
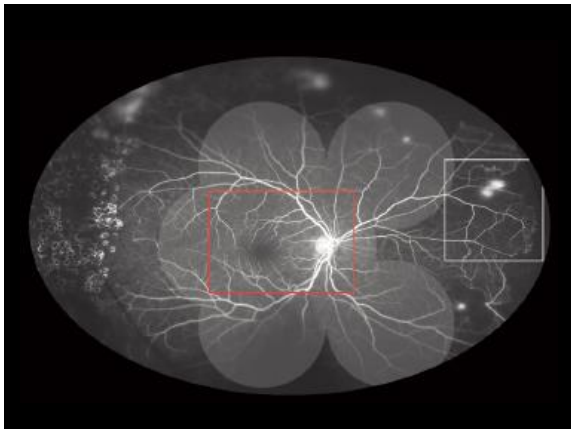
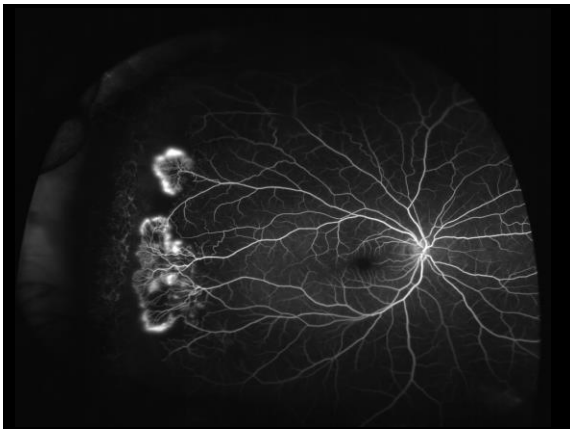
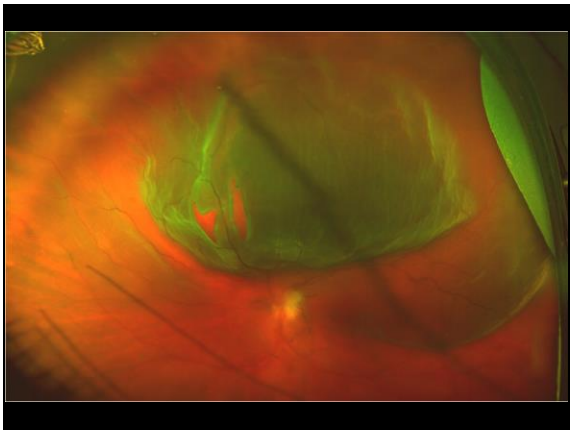
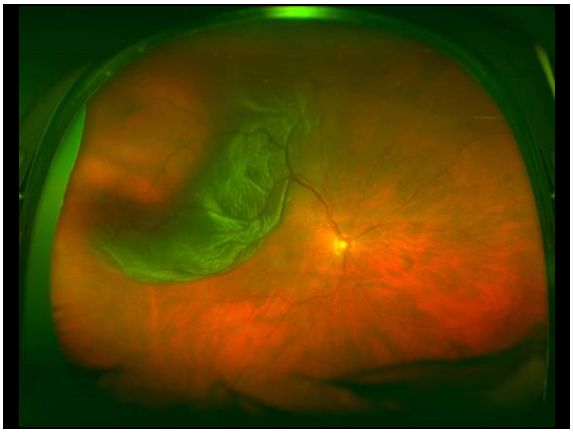




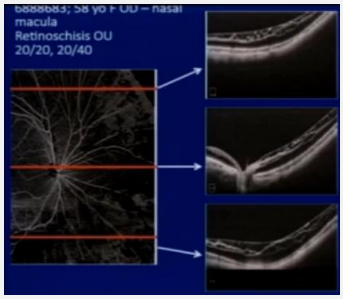






FUTURE DIRECTIONS

- Ultra Wide Field OCT



FUTURE DIRECTIONS

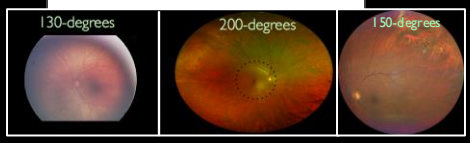
- Ultra Wide Field OCT
- OCT-A will slowly replace traditional FA
  - FA will only be done for Wide-field Studies
- Eventually… UltraWide Field OCT-A??
- OCT-A and conventional OCT will become first line imaging tool for DME
- OCT-A will replace FA for evaluation of CNVM response during anti-VEGF pharmacotherapy

PART 3: UTILIZATION OF ULTRA-WIDEFIELD IMAGING IN DIABETIC RETINOPATHY

OBJECTIVES

- Compare traditional ETDRS 7-field system and UWF imaging
- Correlate peripheral lesions on UWF with DR disease severity
- Discuss quantitative assessment of angiographic metrics
- Review real world cases of diabetic retinopathy

WHAT IS UWF?

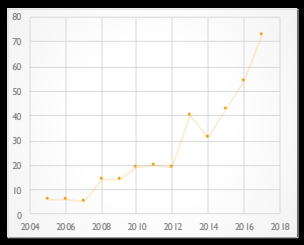


- FOV (field of view)- DRCR defined as fundus image with field of 100-degrees or more
- Anatomical landmarks- International Widefield Imaging Study Group
  - Retina up to and including the vortex vein ampullae in all 4 quadrants obtained in a single capture

Fenner B, Wong RL, Lam WC, Tan GS, Cheung GC. Advances in retinal imaging and applications in diabetic retinopathy screening: a review. Ophthalmol Ther. 2018;7(2):1-4.
Choudhry N. Classification & guidelines for wide field imaging: recommendations from the International Wide Field Imaging Study Group. Poster session presented at: 51st Annual Retina Society Meeting; 2018 Sept 12-15; San Francisco, CA.

Widefield Imaging Platforms

- Clarus 500, 700 (Carl Zeiss Meditec)- "true-color" images
- Optos (Daytona)
  - Scanning laser ophthalmoscope up to **200° in nonmydriatic eyes**
  - More than 3x ETDRS 7-field photos



THE IMPORTANCE OF THE PERIPHERY – UWF PUBLICATIONS

PUBLICATION RATE HAS INCREASED DRAMATICALLY SINCE TECHNOLOGY INCEPTION IN 2005

HOW DO STANDARD PHOTOGRAPHY AND ULTRA-WIDEFIELD COMPARE?

- To compare nonmydriatic fundus photography (NMFP) with ultra-widefield imaging (UWFI) in an ocular telehealth program for DR
- 1633 patients
- The ungradable rate per patient for DR was lower with UWFI than with NMFP
- With UWFI, the median image evaluation time per patient was reduced from 12.8 to 9.2 minutes ($P<.0001$)

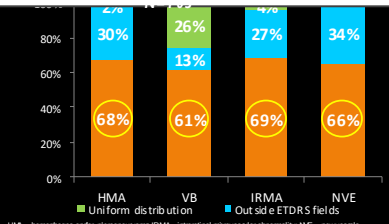
Silva PS, et al. *Diabetes Care.* 2014;37:50-55.

HOW DO STANDARD PHOTOGRAPHY AND ULTRA-WIDEFIELD COMPARE?

- To compare NMWF imaging with standard dilated ETDRS photos for DR
- 206 eyes
- Exact DR severity agreement between ultra-widefield 100-degree imaging and ETDRS photography occurred in 84%, with agreement within 1 level in 91%
- NMWF field imaging acquisition time was less than half that of dilated ETDRS photography ($P<.0001$)

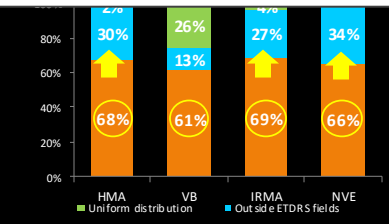
ETDRS = Early Treatment Diabetic Retinopathy Study.
Silva PS, et al. *Am J Ophthalmol*. 2012;154:549-559.

UWF VERSUS ETDRS DISTRIBUTION OF DR LESIONS



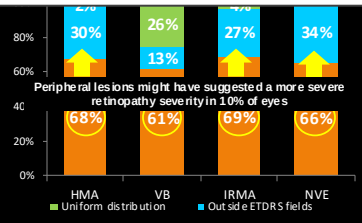
HMA = hemorrhages and/or microaneurysms; IRMA = intraretinal microvascular abnormality; NVE = new vessels elsewhere; VB = venous beading.
Silva PS, et al. *Ophthalmology*. 2013;120:2587-2595.

UWF VERSUS ETDRS DISTRIBUTION OF DR LESIONS



Silva PS, et al. *Ophthalmology*. 2013;120:2587-2595.

UWF VERSUS ETDRS DISTRIBUTION OF DR LESIONS



Peripheral lesions might have suggested a more severe retinopathy severity in 10% of eyes

Silva PS, et al. *Ophthalmology*. 2013;120:2587-2595.

BASELINE PERIPHERAL LESION EFFECT ON RETINOPATHY PROGRESSION AT 4 YEARS IN EYES WITH NO OR NPDR AT BASELINE

(by ETDRS photos at baseline and follow-up, N=109)

DR Worsening	Eyes WITHOUT Predominantly Peripheral Lesions at Baseline (N=54)	Eyes WITH Predominantly Peripheral Lesions at Baseline (N=55)	*P* Value*	*P* Value†
1 step or more	24% (13)	53% (29) 2.2-fold increased risk	.0021	.0322
2 steps or more	11% (6)	35% (19) 3.2-fold increased risk	.0036	.0316

*Chi square test
†Corrected for baseline DR severity, diabetes duration, diabetes type, and 2-year average A1C level prior to baseline.

Silva, Paolo S., et al. "Peripheral lesions identified by mydriatic ultrawide field imaging: distribution and potential impact on diabetic retinopathy severity." *Ophthalmology* 120.12 (2013): 2587-2595.

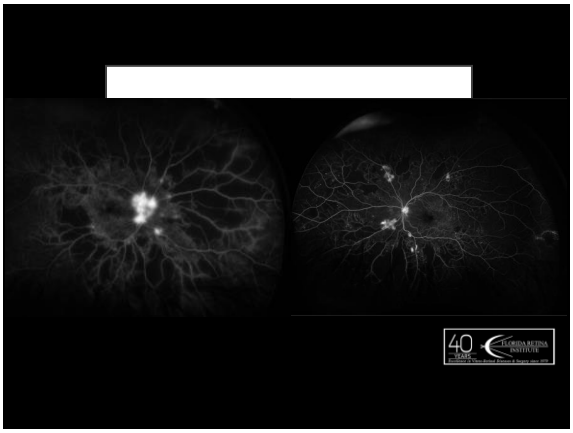
PROTOCOL AA – DRCR.NET

- Longitudinal study compare modified ETDRS 7-field photos and UWF for determining DR severity, assess the type, location and severity of peripheral lesions identified on UWF imaging outside ETDRS images and assess their impact on DR progression.
- 366 subjects (766 eyes) were imaged with color optomap imaging
- **Results:**
  - **DR severity by ETDRS photos and masked UWF images match exactly in 59% and are within 1 step in 96%**

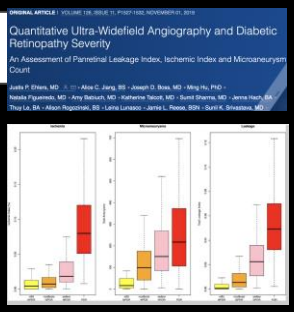
Aiello LP, et al. Diabetic Retinopathy Study Research Group. Comparison of Early Treatment Diabetic Retinopathy Study standard 7-field imaging with ultrawide-field imaging for determining severity of diabetic retinopathy. *Ophthalmology*. 2019;126(12):1689-1694. doi:10.1016/j.ophtha.2019.07.013

Worsening severity of DR 2 or more steps in 11% eyes

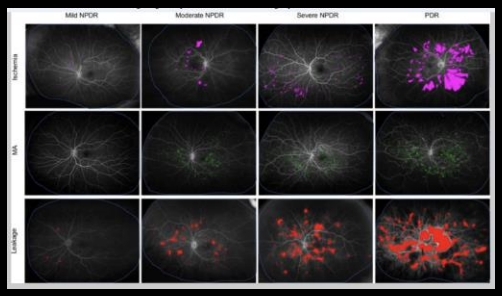
QUANTIFYING PERIPHERAL RETINAL ISCHEMIA



Ophthalmology



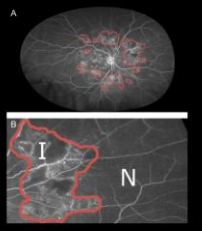
- Investigate relationship DR severity & quantitative angiographic metrics
- 339 eyes
- Panretinal leakage index, panretinal ischemic index, panretinal MA count- strongly associated with retinopathy severity
- Significant portion of patients had anterior or panretinal findings → highlights importance of UWF imaging



Ehlers JP et al. Quantitative UWF Angiography and DR Severity: An Assessment of Panretinal Leakage Index, Ischemic Index and MA count. Ophthal. 126(11): 1527-1532, 2019.

PERIPHERAL RETINAL ISCHEMIA & MACULAR EDEM

- Determine relationship between retinal ischemia (RI) and DME in patients with DR using UWF angiography
- 122 TREATMENT NAÏVE eyes
- 76 eyes (62%)
- Significant correlation DME and RI
- RI 3.75 times more likely having DME than those without RI



Wessel MM, Nair N, Aaker GD, et al. Peripheral retinal ischaemia, as evaluated by ultra-widefield fluorescein angiography, is associated with diabetic macular oedema. Br J Ophthalmol. 2012;96(5):694-698. doi: 10.1136/bjo.phthalmol-2011-300774.

RECALCITRANT DM

Characterization of Ischemic Index Using Ultra-widefield Fluorescein Angiography in Patients With Focal and Diffuse Recalcitrant Diabetic Macular Edema

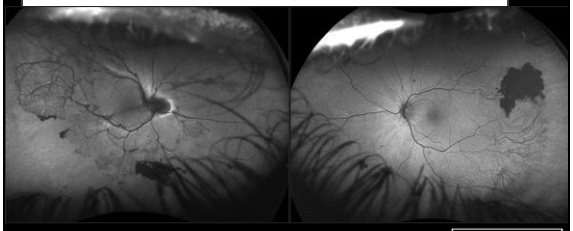
Ravi D. Patel · Leonard V. Messner · Bruce Teitelbaum · Kimberly A. Mitchell · Seema M. Hariprasad

Published: February 28, 2013 · DOI: https://doi.org/10.1016/j.ajo.2013.01.007

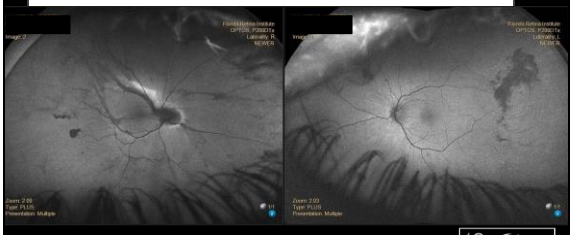
American Journal of Ophthalmology

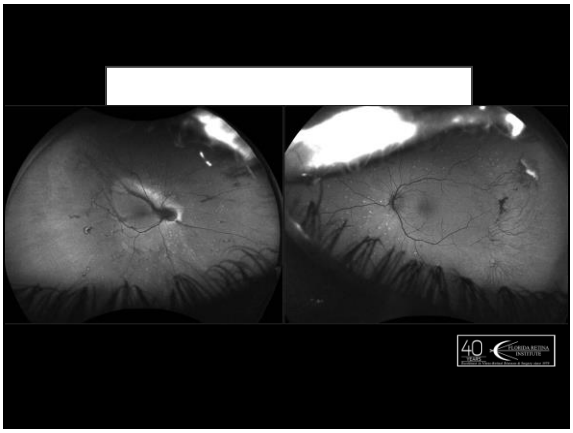
- Nonperfusion in focal and diffuse recalcitrant DME
- 148 eyes of recalcitrant DME for > 2 years
- Larger areas of retinal nonperfusion and greater severity of DR were found to have most recalcitrant DME
- Areas of untreated retinal nonperfusion may generate biochemical mediators that promote ischemia and recalcitrant DME

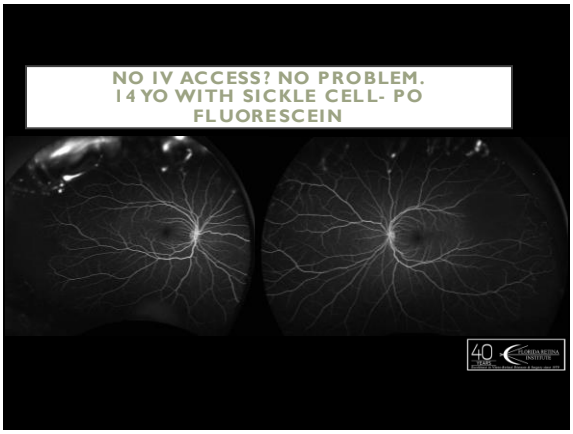
DON'T UNDERESTIMATE AUTOFLOURESCENCE!

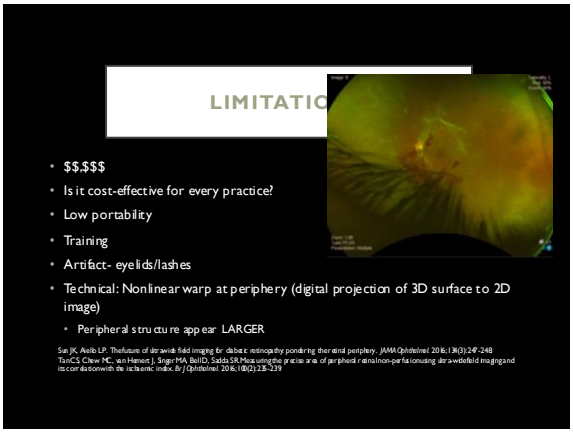


S/P ANTI-VEGF X 1 OU






NO IV ACCESS? NO PROBLEM.
14 YO WITH SICKLE CELL- PO
FLUORESCEIN


LIMITATIO
$$,$$$
Is it cost-effective for every practice?
Low portability
Training
Artifact- eyelids/lashes
Technical: Nonlinear warp at periphery (digital projection of 3D surface to 2D image)
Peripheral structure appear LARGER
Sie JK, Avelis LP. The future of ultrawide field imaging for diabetic retinopathy pondering the retinal periphery. JAMA Ophthalmol 2016;134(2):247-248
Tan CS, Chew MC, van Hemert J, Singer MA, Bell D, Sadda SR. Measuring the precise area of peripheral retinal non-perfusion using ultra-widefield imaging and its correlation with the ischemic index. Br J Ophthalmol 2016;100(2):235-239

HOW DOES UWF APPLY TO CLINICAL PRACTICE?

- Our conventional thinking of DR is changing
- New insights on treatment selection, planning, and outcomes
- Clinical trial protocols: PRP, anti-VEGF, combination guided by UWF FA

Muqit MM, Young LB, McKenzie R, et al. Pilot randomised clinical trial of Pascal TargETEd Retinal versus variable fluence PANretinal 20 ms laser in diabetic retinopathy: PETER PAN study. Br J Ophthalmol. 2013;97(2):220-227.
Wang Y, Muqit MMK, Stanga PE, et al. Spatial changes of central field loss in diabetic retinopathy after laser. Optom Vis Sci. 2014;91:111-120
Boynton GE, Stem MS, Kwark L, et al. Multimodal characterization of proliferative diabetic retinopathy reveals alterations in outer retinal function and structure [published online ahead of print January 16, 2015]. Ophthalmology. doi: 10.1016/j.ophtha.2014.12.001.
Leicht SF, Kernt M, Neubauer A, et al. Microaneurysm turnover in diabetic retinopathy assessed by automated RetmarkerDR image analysis – potential role as biomarker of response to ranibizumab treatment. Ophthalmologica. 2014;231(4):198-203
Suner IJ, Peden MC, Hammer MK, et al. RaScaL: A pilot study to assess the efficacy, durability, and safety of a single intervention with ranibizumab plus peripheral laser for diabetic macular edema associated with peripheral non-perfusion on ultrawide-field fluorescein angiography [published online ahead of print November 26 2014]. Ophthalmologica. doi 10.1159/000367902

HOW DOES UWF APPLY TO MY CLINICAL PRACTICE?

- Improve clinical efficiency
- Difficult view/patient cooperation
- Counseling patients

- New data will help answer
  - Frequency of obtaining FA
  - Duration of follow up with more peripheral findings
  - Treatment plan based on metrics

FUTURE DIRECTIONS

- Integration of UWF in EMR
- Improved telemedicine platforms
- Improved teleretinal screening programs
  - Efficiency in capturing, storing, annotating and sharing images
  - **Improve risk assessment & triage in eyes otherwise wouldn't have peripheral retina evaluated**

Patel SN. Ultra-widefield retinal imaging: an update on recent advances. Ther Advances in Ophthal. 2020.

CONCLUSIONS

- 80% retinal surface imaged in a quarter-second
- Clinically- visualizing retinal periphery provides important information in detection and management of DR
- Research implications- Better understanding disease mechanisms
  - Peripheral changes with progression of DR
  - Peripheral findings with recalcitrant DME

OCT Interpretation for the Busy Provider

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Florida Retina Institute

New Orleans Academy of Ophthalmology
February 2025

Financial Disclosures

- Consultant:
  - Alimera, Allergen, Alcon, Genentech, Ocuphire Pharm, Ocular Therapeutics, ANI Pharmaceuticals
- Investigator:
  - Alimera, Genentech, Inc., Jaeb Center for Health Research, Regeneron, Novartis, Ocuphire Pharm, Parexel, Ocular Therapeutics
- Speaker:
  - Genentech, Inc., Apellis, Astellas, Regeneron
- **None relevant to this talk**

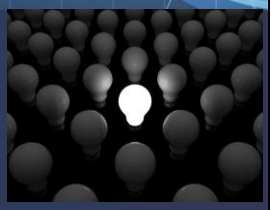
- My Other Financial Disclosures

Road Map

- Basics of OCT
- Progression of OCT technology
- "Anatomy" of an OCT scan
- Interpret

Basics of OCT Technology

- An image is created by:
  - Measuring the "time-delay" of light reflected from each optical interface of the imaged tissue
  - Light is too fast to measure an actual time delay with a detection device
  - So how is it done?

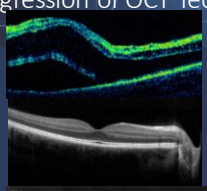


Basics of OCT Technology

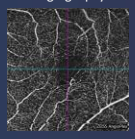
Special Mirrors + Different strategies of detecting the light that returns from striking retina + Complex Math

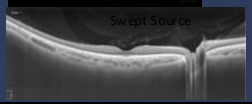
= "Time-delay" that creates the image

Progression of OCT Technology



OCT Angiography





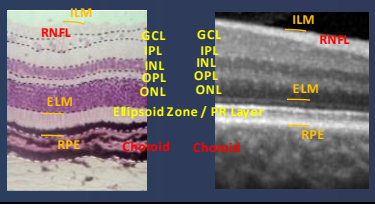
Swept Source

Road Map

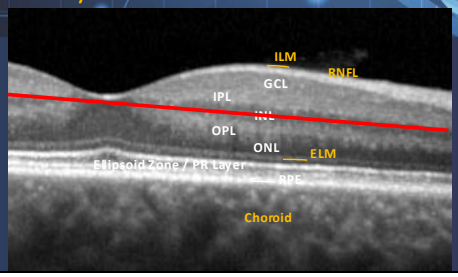
- Basics of OCT
- Progression of OCT technology
- **"Anatomy" of an OCT scan**
- Interpret

"Anatomy" of an OCT scan

- Modern OCT technology allows for a significant approximation of retinal anatomy



"Anatomy" of an OCT scan



Road Map

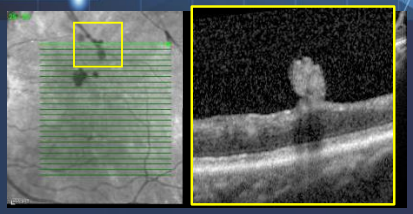
- Basics of OCT
- Progression of OCT technology
- "Anatomy" of an OCT scan
- **Interpret**

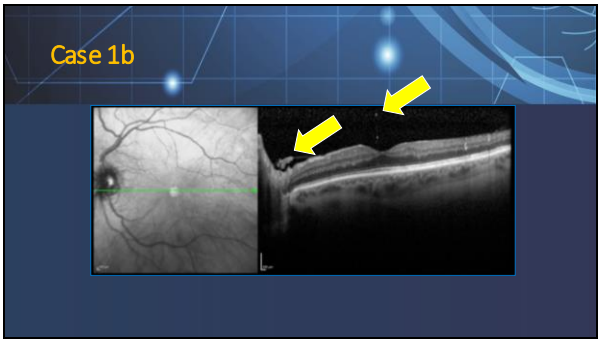
Interpret

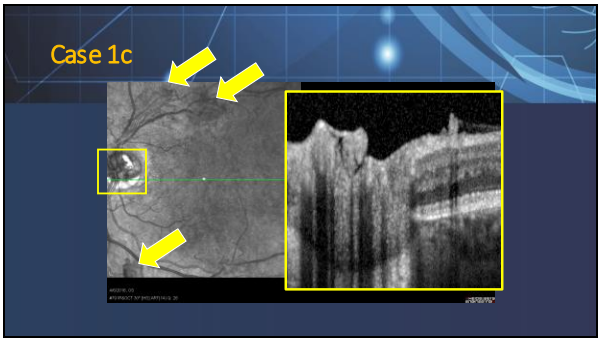
- OCT can be a valuable diagnostic tool
  - Knowledge of retinal anatomy
  - Patient's visual complaint
  - Knowledge of disease process

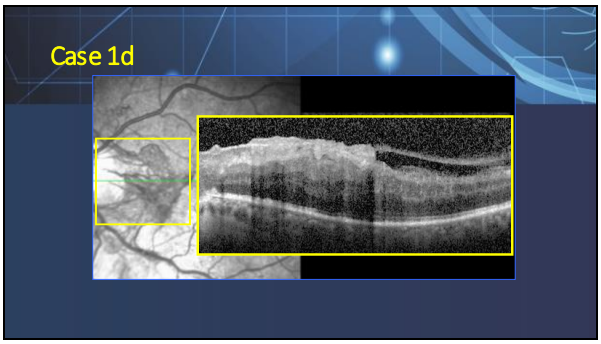
We will do a few OCT cases.

Case 1a




Case 1b

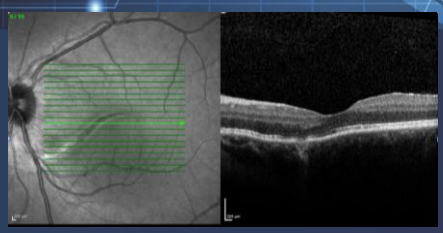

Case 1c


Case 1d

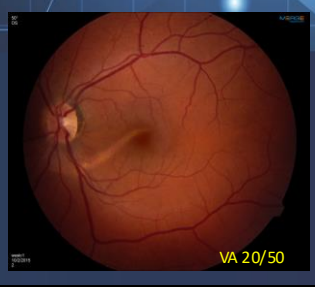
Case 1a - 1d
Retinal Neovascularization

- Grows in response to retinal ischemia
- Causes
  - Diabetic retinopathy
  - Retinal vein occlusion
  - Sickle cell retinopathy
  - Ocular ischemic syndrome

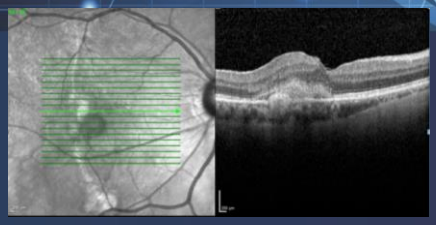
Case 2a



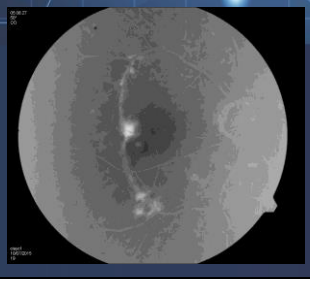
Case 2a



Case 2b



Case 2b

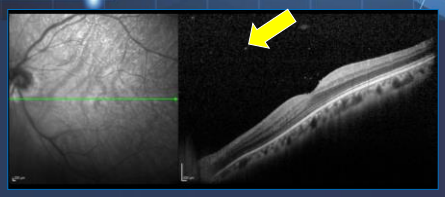


Case 2a & 2b

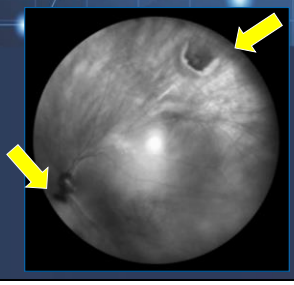
Choroidal Rupture
Choroidal Rupture with CNVM

- Anteroposterior deformation of globe from injury
  - Ball, assault, and thrown object most common causes
- If in macula, only 22% regain vision 20/40 or better
  - 16% risk for CNVM if involves macula

Case 3

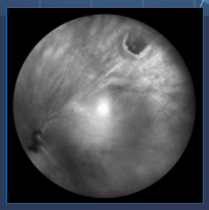


Case 3

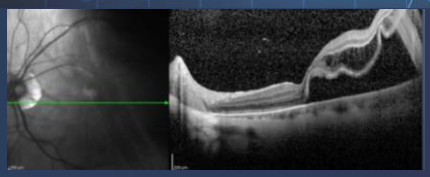


Case 3
PVD with Retinal Tear

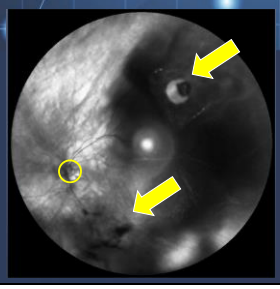
- PVD alone
  - 15% risk for tear
- PVD with vitreous hemorrhage
  - 70% risk for tear
- Untreated tear – 50% risk for retinal detachment
- Treated - < 5% risk for retinal detachment



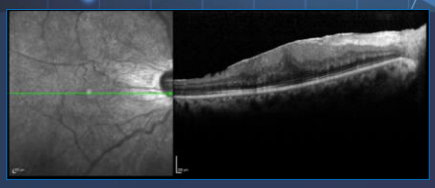
Case 4



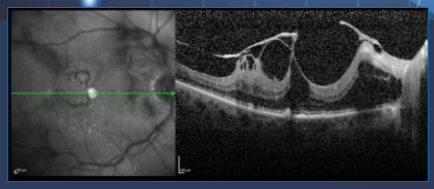
Case 4



Case 5a

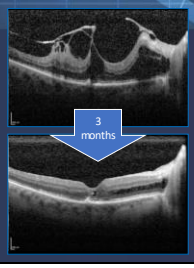


Case 5b

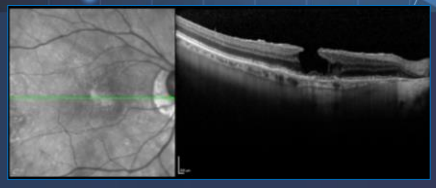


Case 5a & 5b
Epiretinal Membrane

- Prevalence of ERM
  - 2% of people > 50 yo
  - 20% of people > 75 yo
- 90% stay stable
- 10% worsen, requiring surgery
- Vision recovery incomplete
  - Can take 6 to 12 months after surgery

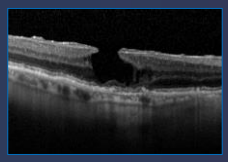


Case 6

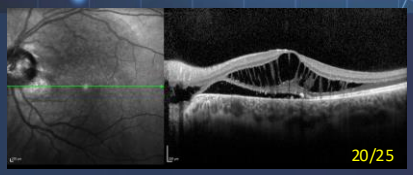


Case 6
Lamellar Macular Hole

- Thought to be an abortive process for FTMH formation
  - Usually associated with ERM contraction
- Most patients retain vision of 20/40 or better
  - Controversial whether surgery is recommended

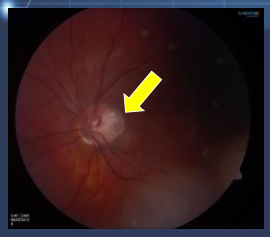


Case 7



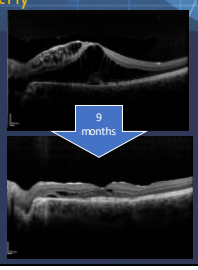
Case 7

Case 7

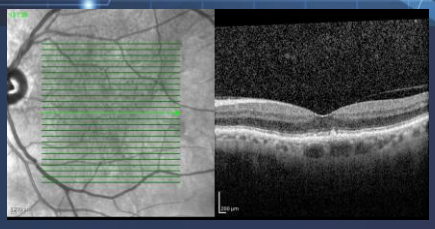


Case 7
Optic Disc Pit Maculopathy

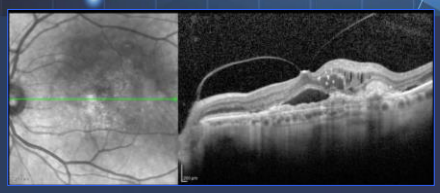
- Rare congenital disc anomaly
  - 1 in 11,000
  - Usually unilateral
- Progressive vision loss from maculopathy
  - 80% chance for vision 20/200 or worse
  - Controversial management
- Controversial source of fluid
  - Cerebrospinal fluid?
  - Fluid from vitreous?
  - Fluid from disc vessels?



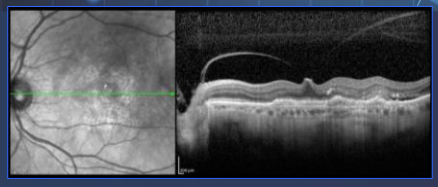
Case 8a



Case 8b

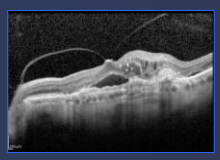


Case 8b

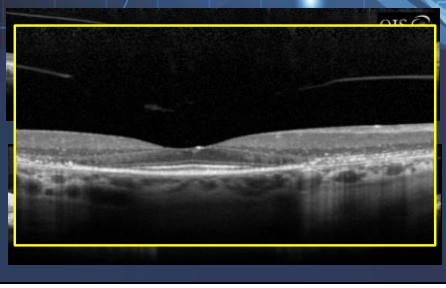


Case 8a & 8b
Age Related Macular Degeneration (AMD)

- Prevalence 1.6%
- Annual loss of GDP
  - Wet AMD – $5.4 billion
  - Dry AMD – $24.4 billion
- When legally blind from AMD
  - 90% wet AMD
  - 10% dry AMD

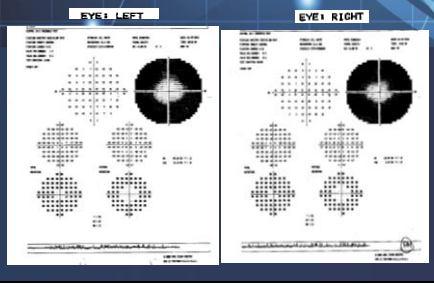


Case 9



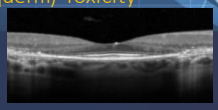
Case 9

Case 9



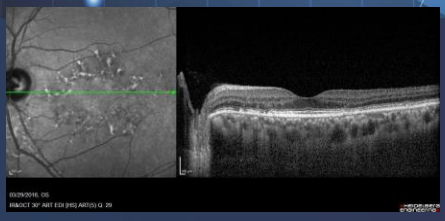
Case 9
Hydroxychloroquine (Plaquenil) Toxicity

- New guidelines
  - Maximum dose <5.0mg/kg Real Body Weight
- Risk factors
  - Dose
  - Duration
  - Renal disease
  - Tamoxifen use

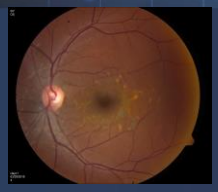


Case 10

Case 10

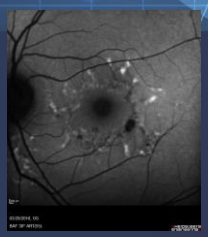


Case 10

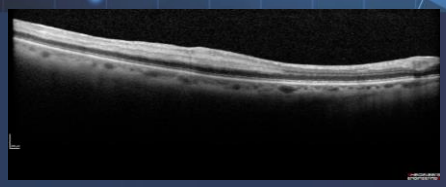



Case 10
Stargardt's Disease

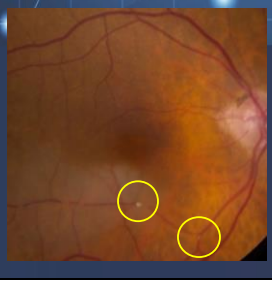
- Autosomal Recessive
  - Most common juvenile macular dystrophy
- Typical Findings
  - Atrophy
  - Yellow flecks
  - Dark choroid on FA
    - ~60 to 80%
- Usual vision loss
  - 20/50 to 20/200
  - Rare to get CF / HM vision



Case 11

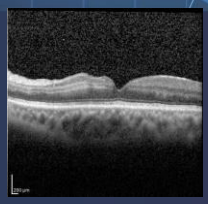


Case 11

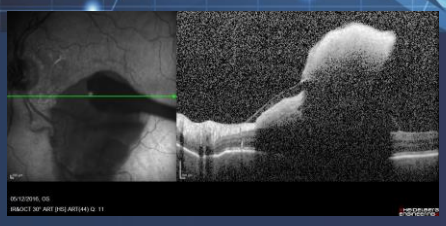


Case 11
Branch Retinal Artery Occlusion (BRAO)

- 75% present with
  - Vision 20/40 or better
- Causes
  - Emboli – 62%
  - Vasospasm
  - Vasculitis
- Risk for retinal neovascularization
  - < 1%

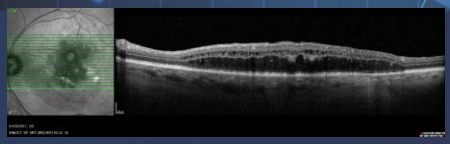


Case 12a

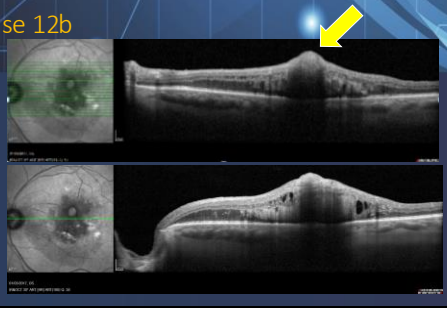


Case 12a

Case 11b

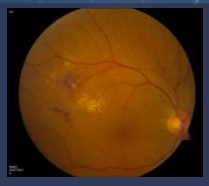


Case 12b

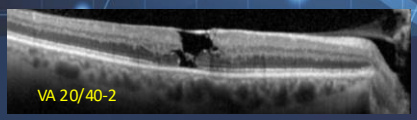


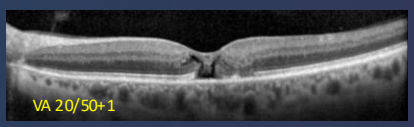
Case 12a & 12b
Retinal Artery Macroaneurysm (RAMA)

- Risks
  - > 60 yrs old
  - HTN
  - Female
- Vision loss from:
  - Multi-layered hemorrhage due to rupture
  - Macular edema / exudate
  - Thrombosis leading to ischemia

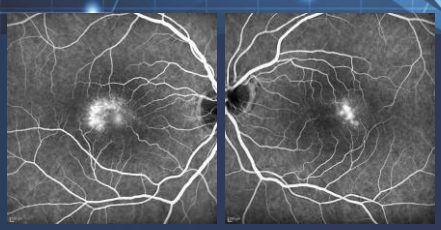


Case 13



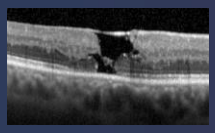


Case 13



Case 13
Juxtafoveal Telangiectasia (JXT or JFT)

- Muller cell dysfunction leads to parafoveal
  - Greying of retina
  - Crystals
  - Telangiectasias
  - Right-angle vessels

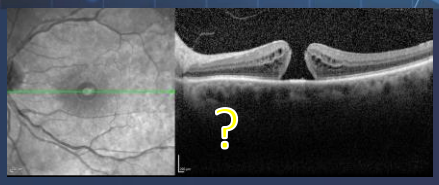


- Cystoid cavities on OCT
- 1/3 risk for CNVM

Conclusions

- OCT imaging is a powerful tool in the evaluation of the retina
- OCT is a great teaching tool for patients and staff

Questions



Thank you!

Top Left to Bottom Right: Abdallah M. Jeroudi, MD; Alexander C. Barnes, MD; Benjamin J. Thomas, MD; S.K. Steven Houston III, MD, FASRS; Matthew A. Cunningham, MD, FASRS; Jonathan A. Staman, MD; Jaya B. Kumar, MD, FASRS; Tomas A. Moreno, MD; James A. Staman, MD; Raul J. Moreno, MD; Elias C. Mavrofrides, MD; Thomas A. Barnard, MD.

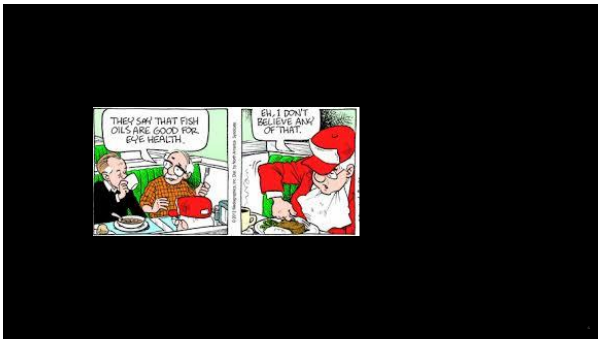
Ocular Tumor Review

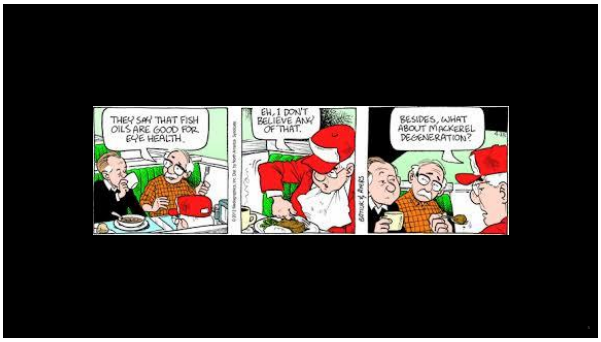
Matthew Cunningham, MD, FASRS
Florida Retina Institute
New Orleans Academy of Ophthalmology
February 2025

Financial Disclosures

- Consultant: Alimera, Allergen, Alcon, Genentech, Ocuphire Pharm, Ocular Therapeutics, ANI Pharmaceuticals
- Investigator: Alimera, Genentech, Inc., Jaeb Center for Health Research, Regeneron, Novartis, Ocuphire Pharm, Parexel, Ocular Therapeutics
- Speaker: Genentech, Inc., Apellis, Astellas, Regeneron

- **None relevant to this talk**





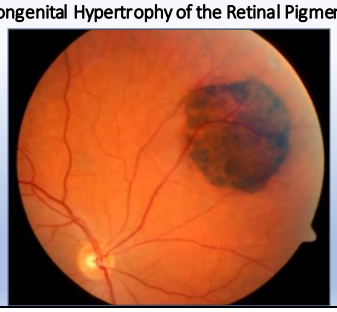
Goals and Objectives

- Goals:
  - Review the features and treatment for a variety of ocular tumors

Goals and Objectives

- At the conclusion of this presentation, the learner will be able to:
  - Identify Common Ocular Tumors and their Treatments

Congenital Hypertrophy of the Retinal Pigment Epithelium



- Common benign lesion
- Focal area in which the RPE cells are taller and more densely packed with melanosomes

Systemic Association

Familial Adenomatous Polyposis (FAP)

- AD inheritance
- Adenomatous polyps throughout rectum & colon
- Starts to develop in adolescence (15-40 yrs)
- If untreated – all pts will develop colorectal cancer

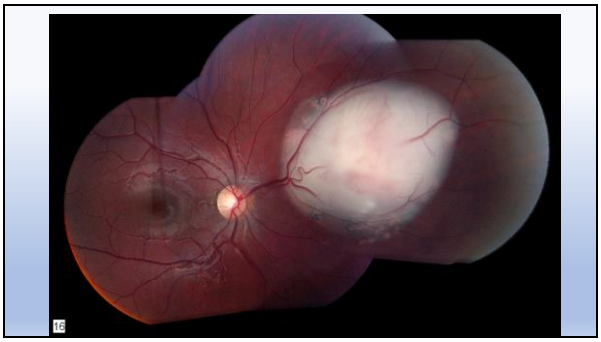
>80% of patients with FAP have atypical CHRPE lesions

RPE hamartomas with FAP (Gardner's or Turcot's syndrome)

What's This?

Choroidal Nevus

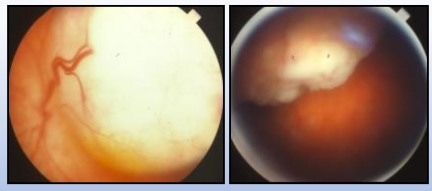
- Most common intraocular tumor
- Proliferation of choroidal melanocytes
- Present in ~ 7.9% of Caucasians
- Growth is rare after puberty



Retinoblastoma

- The most common primary intraocular malignant tumor in children
- Affects 1 in 15,000 live births
- Current treatments include chemotherapy, laser, radiotherapy, and enucleation
- Advanced tumors respond poorly to traditional chemotherapy and laser treatments
  - (25-75% failure rates)

Retinoblastoma – life threatening disease

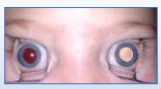


Most common intraocular malignancy in children / dx=18 month
300 new cases of retinoblastoma diagnosed each year in the US

Presenting Signs & Symptoms

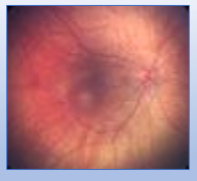
- Leukocoria – 50-60%
- Strabismus – 20%
- Red, painful eye – 7%
- Well baby examination – 3%
- Other – 10%

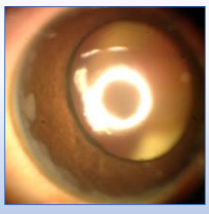
Leukocoria



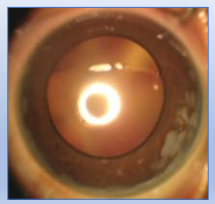
Leukocoria with Large Macular RB OS

Early Macular RB OD





Anterior
Segment Seeding



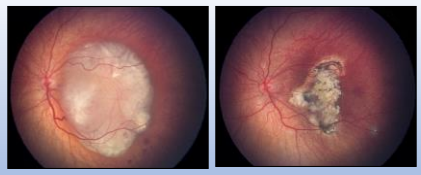
Systemic Chemotherapy/Laser Tumor Ablation

- Reduce tumor volume to allow more focal tumor treatment – never a stand-alone treatment
- Chemotherapy usually involves carboplatin, etoposide, and vincristine (with/without cyclosporine)
  - 6-9 cycles of chemotherapy given every 3/4 weeks
  - Dramatic reduction averaging >50% decrease in volume after 3 sessions

Large Macular Retinoblastoma

Before treatment

4 mos after chemoreduction/laser

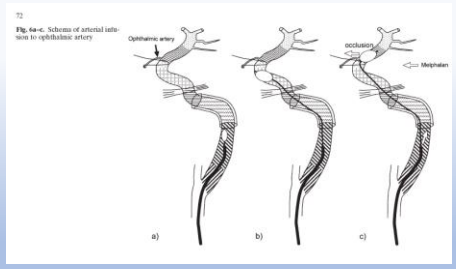


Systemic Chemotherapy Complications

- Increasing reports of adverse systemic findings
- Ototoxicity
- Secondary acute myelocytic leukemia (AML)
- Neutropenia/thrombocytopenia/anemia

Intra-arterial infusion of chemotherapy

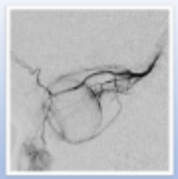
- Initiated in Japan and now being used in USA (Miami, New York, Philadelphia)
- Initially used mostly on eyes with poor prognosis ('salvage' therapy)
- Now used as primary treatment
- Drugs used: melphalan, topotecan, carboplatin



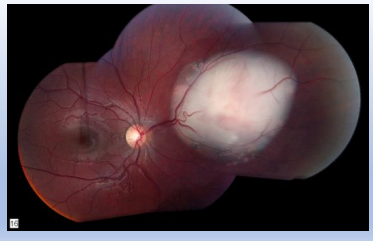
Yamane T, Kaneko A, Mohri M. The technique of ophthalmic arterial infusion therapy for patients with intraocular retinoblastoma. *Int J Clin Oncol* 2004;9:69-73.

Intra-arterial Ophthalmic Chemotherapy Procedure

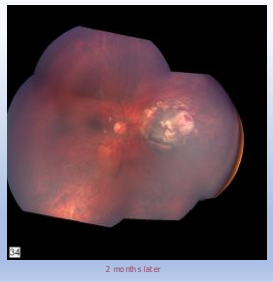
- Infusion is performed in a pulse-injection fashion over a 30-minute period
- Ophthalmic examinations, tumor laser ablation, retinal photography, and ultrasonographic imaging are performed at 3 weeks, 6 weeks then every 3 months
- Treatment strategy evolving



Retinoblastoma
Initial Presentation

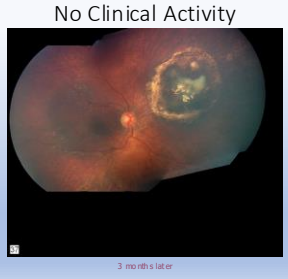


Residual Tumor Activity



2 months later

Retinoblastoma:
No Clinical Activity



3 months later

What's This?

Melanocytoma

- Benign melanocytic uveal tumor
- Composed of large, plump magnocellular nevus cells that are heavily pigmented
- Can present in all age groups and races
  - African-Americans
  - Females

What's This?

Choroidal Metastasis

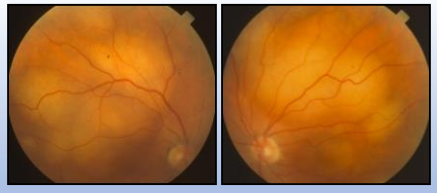
- Most common site for uveal metastases -90%
- Estimated incidence of 30,000 cases/year
- Choroidal melanoma 2,500 cases per year
- Primary site
  - Breast (women)
  - Lung (men)

Clinical Findings

- Creamy-white, placoid choroidal lesion
- Fast growing
- Usually found in the posterior pole
- Exudative RD common
- Tumors may metastasize elsewhere

Lung CA with Choroidal Metastasis

Breast CA with Choroidal Metastasis



Metastatic Prostate Cancer

Metastatic Breast Cancer

Choroidal metastasis are often associated with exudative RD

Choroidal metastasis from Lung CA

Special Testing

OCT

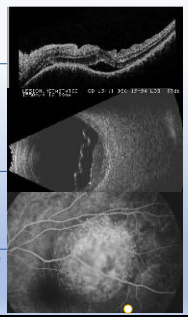
- Dome shaped elevation of retina and RPE with adjacent subretinal fluid
- Can detect retinal edema, RPE thickening and RPE detachment

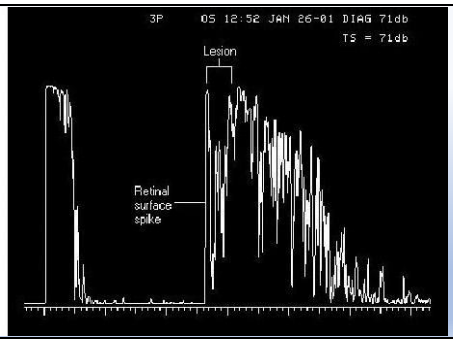
B Scan

- Shows diffuse choroidal thickening
- Moderately high internal acoustic reflectivity

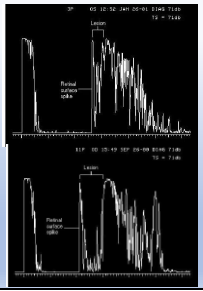
FA

- Shows early hypofluorescence and diffuse late staining





A-scan of Met vs CM



- A-Scan Ultrasound of a metastatic choroidal mass. Notice the moderate-high reflectivity and internal disorganization.
- A-Scan Ultrasound of a primary choroidal melanoma. Notice the low-moderate reflectivity and greater internal organization of the lesion.

Treatment & Management

- Observation
- Radiotherapy
- TTT (transpupillary thermotherapy)
- Systemic therapy
- Enucleation

Initial Presentation

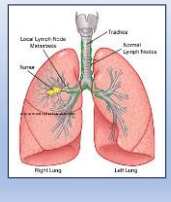
After EBRT

Metastatic Tumors

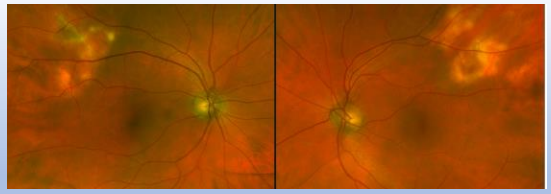
- Breast cancer is the most common tumor to metastasize to the eye - followed by lung cancer
- 85% of patients with breast cancer metastases will have a known history of breast cancer
- Breast cancer metastases tend to be bilateral and multiple
- 40% of these patients have a brain metastasis

Metastatic Tumors

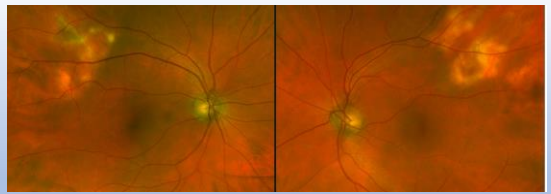
- Lung cancer metastasis rarely bilateral and multifocal
- They often produce pain
- Lung cancer metastasis 70% of patients don't know they have cancer
- Chest x-ray very important



What's this?

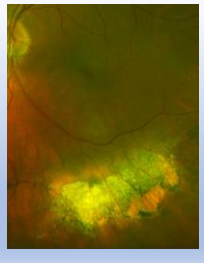


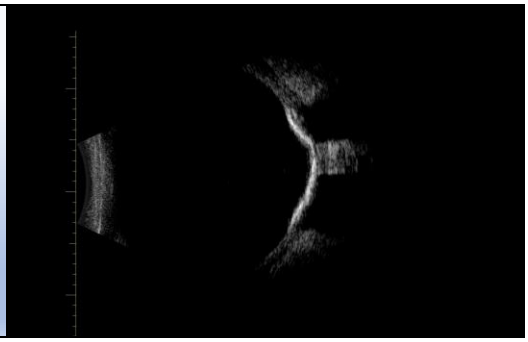
Sclerochoroidal Calcification

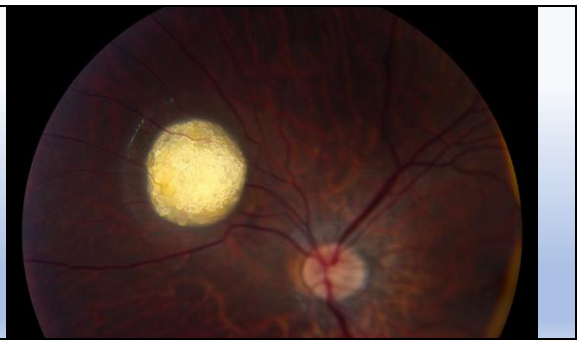


Sclerochoroidal Calcification

- Yellow-white subretinal lesions
- Idiopathic
- Usually in mid-periphery of the fundus near arcades
- Typically asymptomatic
- Found in older white patients
- Ultrasound shows high acoustic reflectivity
- May be related to calcium deposited at the sites of insertions of the oblique extraocular muscles

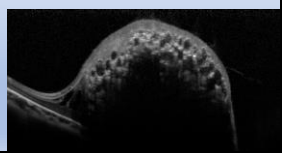






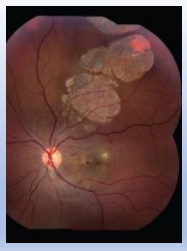
Astrocytic Hamartoma

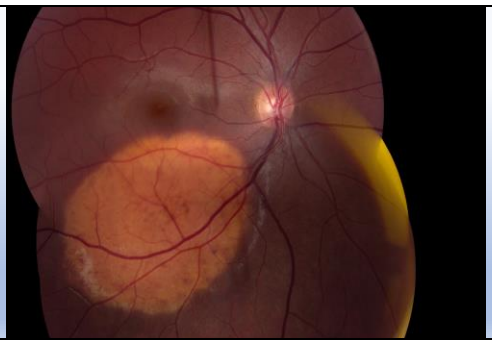
- Arises from the supportive glial cells of the sensory retina (astrocytes)
- May present as strabismus or leukocoria if the lesion occurs in or adjacent to the macula
- Clinical presentation varies widely, ranging from flat, translucent, noncalcified intraretinal patches to nodular, opaque, white inner-retinal lesions to a large, yellow-whitish, calcified, multinodular mulberry-like tumors
- OCT typically shows
  - Dome-shaped
  - hyper-reflective
  - Moth-eaten appearance
  - Posterior shadowing



Astrocytic Hamartoma

- Main ocular manifestation of tuberous sclerosis
- In tuberous sclerosis, may present with achromic patches

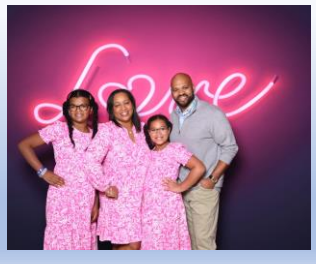




Choroidal Osteoma

- Osseous choristoma
- Orange-Yellow-White with well-defined borders
- Overlying RPE depigmentation/atrophy
- Usually near optic disc
- High acoustic reflectivity on ultrasound
- Possible vision loss due to:
  - Choroidal neovascularization
  - Subretinal fluid
  - Atrophy of overlying retina

Thanks for your attention!



Circumscribed Choroidal Hemangioma

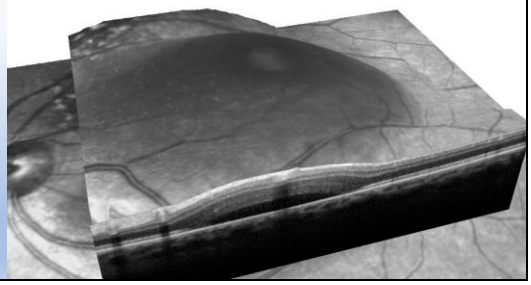
- Rare, benign, intraocular tumors of the choroid
- Often mistaken for choroidal metastases and melanomas
- Characteristic appearance consists of an indistinct round-to-oval, orange-pink swelling at the posterior pole, often involving the optic disc, macula, or both
- Likely congenital -- macular hemangiomas are usually associated with amblyopia, most likely occurring as a result of hyperopia

Circumscribed Choroidal Hemangioma

- May remain asymptomatic throughout life
- However, visual symptoms may present between the second and fifth decades
  - Caused by secondary, exudative retinal detachment and macular edema.
- If left untreated, many patients eventually develop severe retinal detachments with secondary neovascular glaucoma

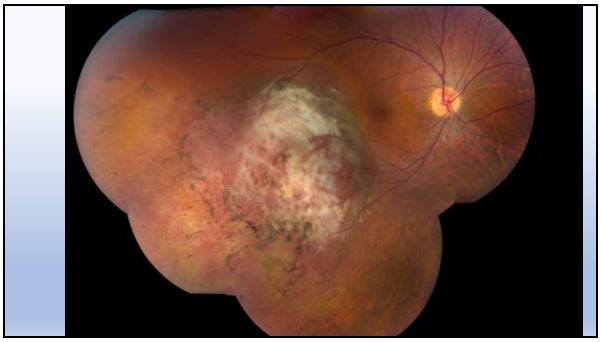
Diagnostic Features

- Ultrasonography shows acoustic solidity with a high internal acoustic reflectivity
  - Also typically shows no vascular activity
- Fluorescein angiography shows a highly vascularized choroidal lesion that typically fills rapidly, simultaneously with the normal choroidal vessels
- OCT can identify and quantify any associated macular edema and exudative retinal detachments



Treatment

- Indicated for symptomatic patients due to:
  - Exudative retinal detachment
  - Macular edema
  - Severe exudative retinal detachment threatening to cause neovascular glaucoma
- PDT has been an effective treatment
- Other treatment modalities include:
  - Anti-VEGF therapy
  - External beam or proton beam radiotherapy
  - Transpupillary thermotherapy or laser photocoagulation

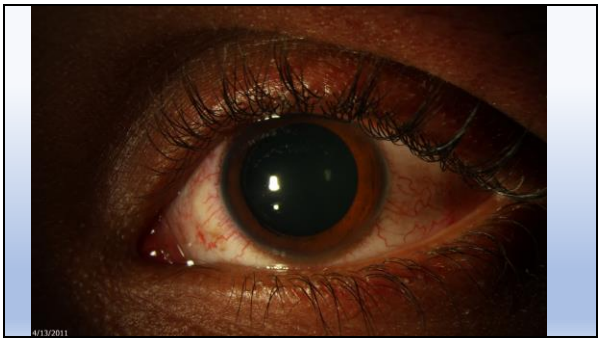


Sturge–Weber Syndrome

- Sporadic neurocutaneous disorder
- Characterized by:
  - Facial capillary malformation (port-wine stain)
  - Leptomeningeal angioma
  - Vascular ocular abnormalities
- Diagnosed clinically in the presence of the facial cutaneous changes with neurological changes and/or ocular manifestations

Sturge–Weber Syndrome

- Ocular manifestations include:
  - Glaucoma (71%)
  - Conjunctival or episcleral hemangiomas (69%)
  - Diffuse choroidal hemangiomas (55%)
- Only 8% of children born with facial port-wine stains are associated with Sturge–Weber syndrome, however, the association is more common if the facial nevus involves the eyelids.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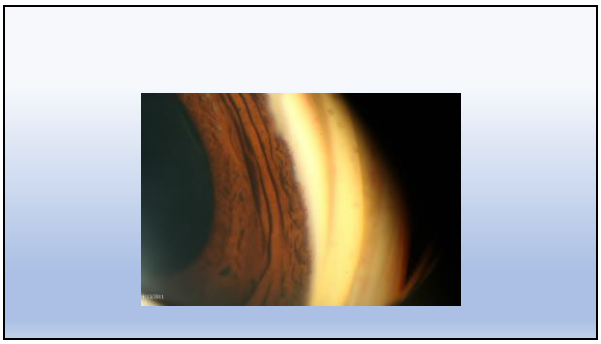
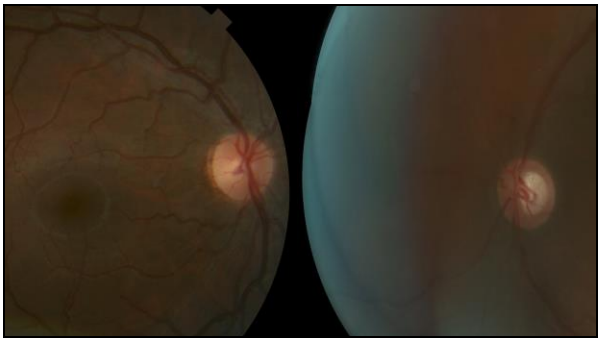
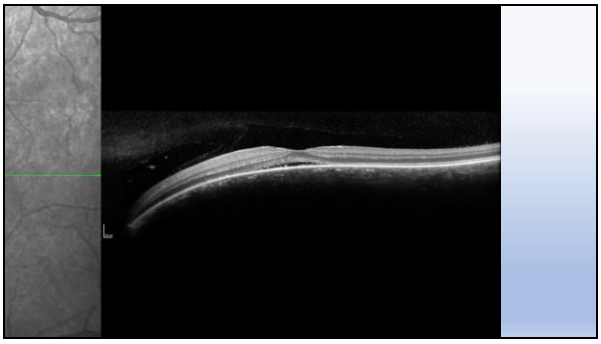
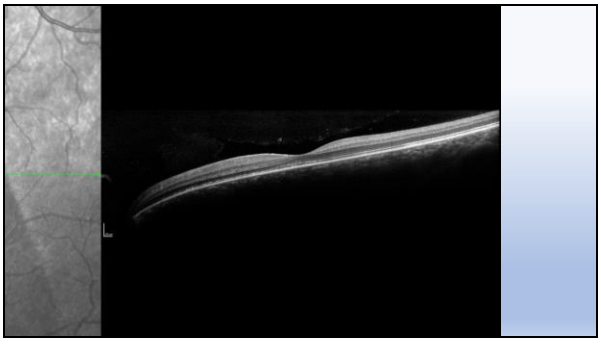


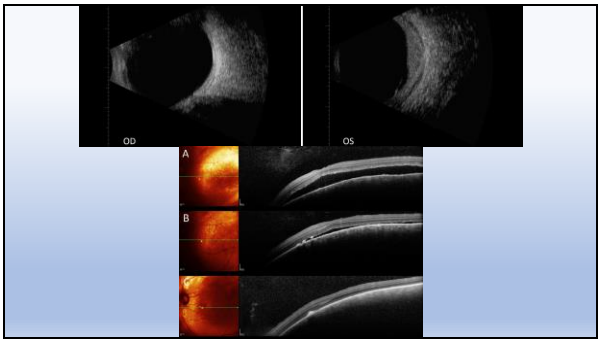


Diffuse Choroidal Hemangioma Treatment

- The main objective of treating diffuse choroidal hemangiomas is to prevent or treat severe retinal detachment, thereby avoiding secondary glaucoma and loss of the eye
- Because of the large size of the hemangioma, external beam radiotherapy or proton beam radiotherapy is commonly used.
- Anti-VEGF treatment may be utilized for small exudative detachments



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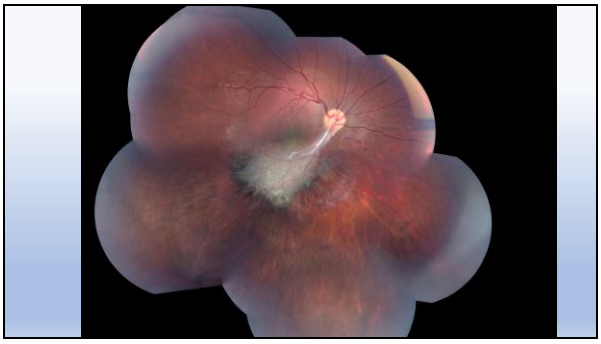
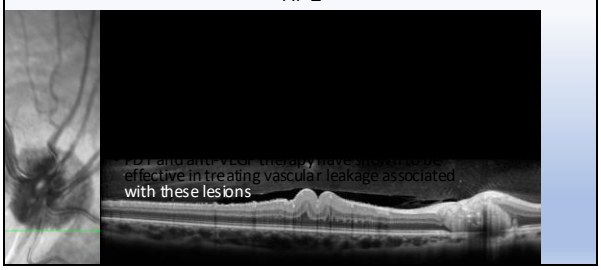
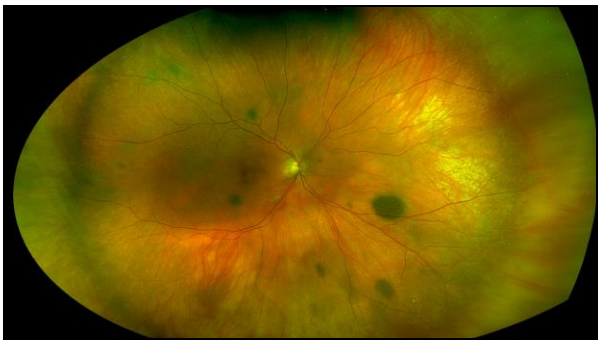


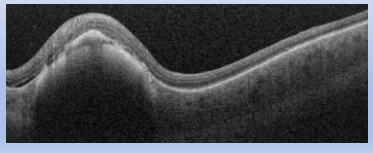
Combined Hamartoma of the retina and RPE





Bilateral Diffuse Uveal Melanocytic Proliferation (BDUMP)

- Paraneoplastic
- Multiple round or oval choroidal lesions
- Exudative retinal detachments
- Traditional tx aimed at addressing the underlying malignancy



Optimizing Intravitreal injections

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Financial Disclosures

- *Consultant:* Alimera, Allergan, ANI, Apellis, EyePoint, Genentech, Astellas, , Ocular Therapeutics, Regeneron
- *Speaker Contracted by Ineligible Company:* Allergan, ANI, Apellis, EyePoint, Genentech, Astellas, Regeneron
- *Independent Research Contractor:* Allergan, Apellis, Ashvatha ,EyePoint, Genentech, Astellas, , Kodiak, Optos, Regeneron, Rezolute, Valo
- **Individual Stocks and Stock Options (privately held):* Aviceda, Inflammasome, Nanoscope, Olives BioTherapeutics

Steps involved in Intravitreal injection

- Eye/lid Prep
- Anesthesia
- Syringe or Applicator
- Needle
- Injection location
- Post injection assessment

Prep: Bactericidal solution

- Povidone Iodine 5%: Gold standard causes corneal irritation
- Chlorhexidine 0.5%-0.1 % Used as an alternate varying reports if as safe
- Hypochlorous acid



Prep

- Povidone Iodine (PI) : Gold standard, causes corneal irritation

Prep

- Chlorhexidine 0.5%-0.1 % Used as an alternate to Povidone Iodide (PI) varying reports if as safe as (PI) in terms of preventing endophthalmitis

Prep

- Hypochlorous (HA):
- Hejkal and Avery Stuies showed both PI and HA gave significant reduction in Colony Forming Units from baseline. HA may be more effective than PI.

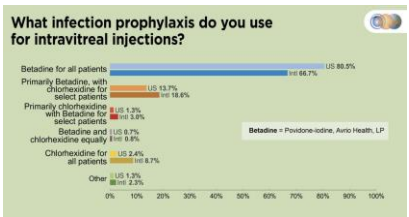
Hejkal TW, Maldey LA, Kaddoura L. Hypochlorous Acid 0.01% vs Povidone-Iodine 5% for Ocular Antisepsis. J Vitreoretin Dis. 2022 May 25;6(2):132-137. doi: 10.1177/24742642211013222. PMID: 37008664 PMCID: PMC9976015

Eye prep: Location

- Providone iodine to the whole surface
- Providone iodine just to injection site
- Chlorhexadine to whole eye
- Chlorhexadine to injection site
- Hypochlorous acid to whole eye
- Hypochlorous acid to injection site

Hejkal TW, Maldey LA, Kaddoura L. Hypochlorous Acid 0.01% vs Povidone-Iodine 5% for Ocular Antisepsis. J Vitreoretin Dis. 2022 May 25;6(2):132-137. doi: 10.1177/24742642211013222. PMID: 37008664 PMCID: PMC9976015

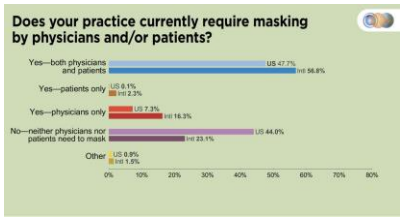
2023 PAT Survey



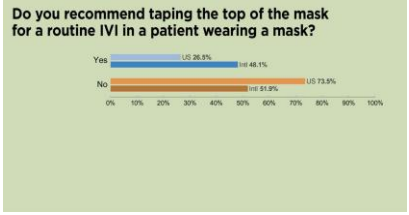
Other preventive measures

- Masks
- Gloves
- Lid speculum/manual lid retraction
- No talking

2023 PAT Survey



2023 PAT Survey



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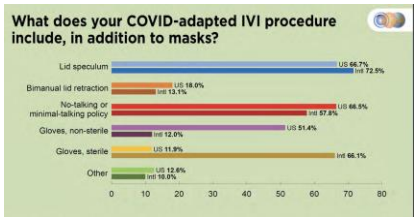
2022 PAT Survey



Anesthesia

- Local: 1 or 2 percent lidocaine
- Topical : 4% lidocaine solution,
- Gels: (lidocaine gel), (chloroprocaine) (? Safety)
- Freeze Gun
- Pledgets or Q tips

Anesthesia

- Topical tetracaine, proparacaine:
- Act quickly usually first given prior to other anesthesia

Anesthesia

- Local: 1 or 2 percent lidocaine
- With or without epinephrine
- Usually given subconjunctivally after topical anesthetic

Anesthesia

- Pledgets or Q tips 4% lidocaine with q tips or pledgets
- Usually placed under lid with eyes closes 3-5 minutes can repeat

Anesthesia : Gels

- Gels (Lidocaine Hydrochloric ophthalmic gel 3.5%)
- (chloroprocaine hydrochloride ophthalmic gel 3%)
- There have been associations with increased risk of endophthalmitis with gels
- The Barrier study disputes this theory

Barrier study

- chloroprocaine) compared with tetracaine ophthalmic solution 0.5% and their effects on the bactericidal action of povidone-iodine 5% (PVI).[1]
- chloroprocaine group was non-inferior to tetracaine, with a higher mean percent reduction in colony forming units than PVI.[1]

	Chloroprocaine	Tetracaine
Baseline CFU	41.9	38.9
Post-PVI CFU	8.7	10.8
Mean reduction	79.3%	72.1%
Difference	-7.2; 90% CL -13.56 to 3.28	

Reference: 1. Ilyas H, Castine R. The Effects of Low Viscosity Preservative-Free Chloroprocaine Ophthalmic Gel 3% versus BAK-Containing Tetracaine 0.5% on the Bactericidal Action of Povidone-Iodine. Clin Ophthalmol. 2024;18:825-831 https://doi.org/10.2147/OPTH.S454496 [Ilyas p830/sec

Anesthesia

- Freeze Gun: Newly approved FDA device for anesthesia in patients allergic to lidocaine

OcuCool, non-pharmacological cooling anesthesia in 10 sec

- Non-invasive cooling anesthesia in 10 sec
- Automatic monitoring of contact quality
- Multiple timers to prevent excessive cooling
- Handheld: 1 pound
- Battery operation: + 50 cooling anesthesia cycles with full change

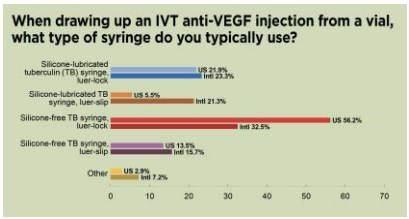
Syringe or Applicator

- Syringe: regular of Luer lock
- Syringe solution: Prefilled or draw up (filter needle size 18 or 19 gauge)
- Applicator what gauge and what type syringe Fluocinolone or axitinib
- Actuator type dexamethasone implant), Fluocinolone implant,

Syringe or Applicator

- Syringe: regular of Luer lock
- Luer lock better for more viscous medication

2024 PAT Survey



Filter Needle

- Filter needle size:18 gauge or 19 gauge).
- August 2023: "immediately discontinue use of any injection kits that contain the 19-gauge filter needle and use injection kits with the 18-gauge filter needle, which are already in distribution for pegcetacoplan"

Extended-release implant: Applicator Injector style

- Plunger injector syringe Can shoot up to 3 implants

Applicator

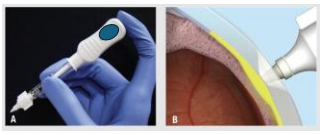
Actuator type:
- Dex implant
- Fluocinolone implant

Pressdown to engage

Slide to engage

Suprachoroidal injector

- SCS triamcinolone and Rgx 3-14 Potential space can be painful



Supero-temporal quadrant is the thinnest

Needle

- Gauge: 29,30,32
- 29 gauge hollowed out (pegcetacoplan)
- Filter needle incorporated needle (faricimab)




Injection location

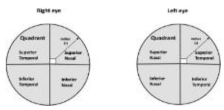
- Which quadrant, safety
- Which quadrant less painful

Injection location

- Which quadrant?

Injection location: Safety

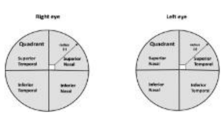
- Which quadrant, safety
- Superior temporal quadrant safer than inferotemporal quadrant[1]
  - Less chance for endophthalmitis



Jonna, Gowtham & Roth, Daniel &Fine, Howard &Wheatley, H. & Premer, Jonathan & Kheterpal, Arvin & Cohen, Suzanne &Feuer, William. (2015). Inferior Intravitreal Injection Site Associated with Higher Incidence of Post-injection Endophthalmitis. International Eye Science. 15.750-4.10.3980/j.issn1672-5123.2015.502.

Injection location : Comfort

- Comfort: Superior temporal most painful [2]
- Inferior nasal has the least pain fibers[2]



[2]Karimi S, Mosavi SA, Jadidi K, Nikkhah H, Kheiri B. Which quadrant is less painful for intravitreal injection? A prospective study. Eye (Lond). 2019 Feb;33(2):304-312 doi: 10.1038/s41433-018-0208-y. Epub 2018 Sep 10. PMID: 30202072; PMCID: PMC6367313

Injection location: Preference

- In the United States 70% of physicians injected inferotemporal[1]
- In Mexico supero-temporal :63.2% (84/133) preferred to perform in the supertemporal quadrant, followed by 34.6% (46/133) in the inferotemporal[2]

1. Chaturvedi R, Wannamaker KW, Riviere PJ, Khanani AM, Wykoff CC, Chao DL. Real-World Trends in Intravitreal Injection Practices among American Retina Specialists. Ophthalmol Retina. 2019 Aug;3(8):656-662. doi: 10.1016/j.oret.2019.03.023. Epub 2019 Apr 4. PMID: 31133544; PMCID: PMC6684447.

2. Henaine-Berra A, Flores-Peredo V, Lopezcarasa-Hernandez G, Martinez-Castellanos MA, Mira-Lorenzo X, Solis-Vivanco A, Garcia-Aguirre G; Mexican Retina Association. Survey of Intravitreal Injection Techniques Among Retina Specialists in Mexico. Clin Ophthalmol. 2020 Nov 26;14:4089-4098. doi: 10.2147/OPTH.S285955. PMID: 33273805; PMCID: PMC7705264.

Post injection assessment

- Count fingers 53% Mexico
- Check pressure using Goldman or Tonopen 31% in US
- Use of NSAID 14% in US

Eye prep: Washout

- Whether or not to wash out prep;
- Although 85% in US wash out povidone Iodide
- In the Hejkal study: After saline rinse of the eye that was treated with PI, 17 of 40 eyes (42%) had an increase in CFUs compared with the posttreatment swab.[1]

1. Hejkal TW, Maloley LA, Kaddoura L. Hypochlorous Acid 0.01% vs Povidone-Iodine 5% for Ocular Antisepsis. J Vitreoretin Dis. 2021 May 21;6(2):132-137. doi: 10.1177/24741264211013622. PMID: 37008664; PMCID: PMC9976015

Conclusion

- Even though retina specialists perform many intravitreal injections there is still significant variability in terms of available options and the mechanics of this commonly performed procedure