BRAO IN DISGUISE: CASE AND CLINICAL CONSIDERATIONS

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Background

- Branch Retinal Occlusion (BRAO) refers to decreased arterial blood flow of the retina leading to downstream ischemic damage to the inner retinal layers[1]
- Retinal emboli are visible on fundoscopic exam in 62% of BRAO cases[1]
- Emboli commonly composed of cholesterol (Hollenhorst plaque), platelet-fibrin clot or calcium plaques
- Risk factors include hypertension, carotid stenosis, history of stroke or TIA and hypercholesterolemia [4]

Purpose

- Branch retinal artery occlusion is a common disorder of the ocular vasculature, which stems from the occlusion of a branch of the central retinal artery.
- Symptoms of BRAO include sudden, painless, severe vision loss or visual field deficit, usually unilaterally.[5]
- This is a case report of a patient who experienced visual field deficits from an old stroke in addition to a branch retinal occlusion.

Case Report

76-year-old male presents to the glaucoma clinic

Chief complaint:
- Abrupt painless vision loss OS 10 days ago
- 50% superior field vision loss OS

Past Ocular History
- Mild POAG OU, Cataracts OU
- Hx of stroke with subsequent visual field defect, subtotal left inferior homonymous quadrantanopia (~4 years ago)

Past Medical History
- Stroke, Hypertension, Hypercholesterolemia

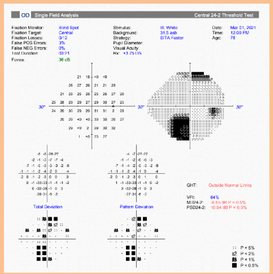
Ocular Medications

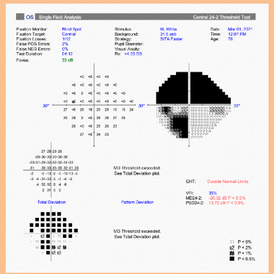
Latanoprost 0.005% OU nightly

Systemic Medications
- Atorvastatin 20mg once daily
- Aspirin 81mg once daily

Examination
- BCVA: OD: cc 20/60, PH 20/40
  OS: cc 20/30, PH 20/20
- iCare: OD: 12; OS: 12
- Pupils were equal, round and reactive to light
- SLE was remarkable for dermatochalasis, cataracts OU
- DFE was remarkable for Hollenhorst plaque along inferior arcade OS

Imaging





Discussion

Branch Retinal Arterial Occlusion

Acute onset of painless monocular vision impairment

Signs:
- Embolus visible on fundoscopic exam
- Retinal ischemia (cotton wool spots and retinal whitening[1]
- Non-perfusion of vessels on fluorescein angiography
- Retinal edema and atrophy (can be visualized with SD-OCT)[3]

Systemic Workup
- Carotid doppler ultrasound, cardiac echocardiography, brain imaging (CT or MR angiography)[2]

Treatments
- No known treatments for vision recovery
- Antiplatelet therapy (TPA) may be initiated within four hours of symptom onset

Long-term stroke prevention:
- Statin, aspirin 81mg, clopidogrel (DAPT)[2]

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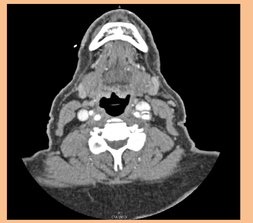
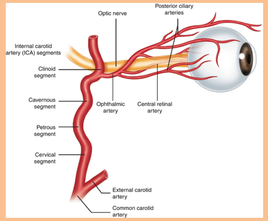
Initial Assessment





Management: Prompting systemic workup

Carotid artery Doppler ultrasound reading
- Right: Less than 50% right internal carotid artery stenosis
- Left: 50-79% stenosis in the left internal carotid artery, with presence of a plaque

CT Angiogram
- Decreased vessel lumen of the right and left carotid arteries

Treatment: Carotid Endarterectomy
- The most pertinent cause of concern is ruling out or treating a stroke in the brain

Following up:
- Routine ophthalmic examination
- Continuation on vaso-occlusive disease prophylaxis therapy (statin, baby aspirin, smoking cessation and diet control)

Conclusion

In similar cases of artery occlusion, goal is to identify etiology of embolism and then to take secondary prevention measures to decrease the likelihood of subsequent strokes and other ocular ischemic events
- Refer patient out to immediate complete vascular workup
- Continue working with primary care physician and vascular surgeon to manage patient’s vascular/stroke risk factors

Disclosures and Funding

- No relevant financial disclosures.

Two Halves Make a Whole: Management of Pituitary Macroadenoma

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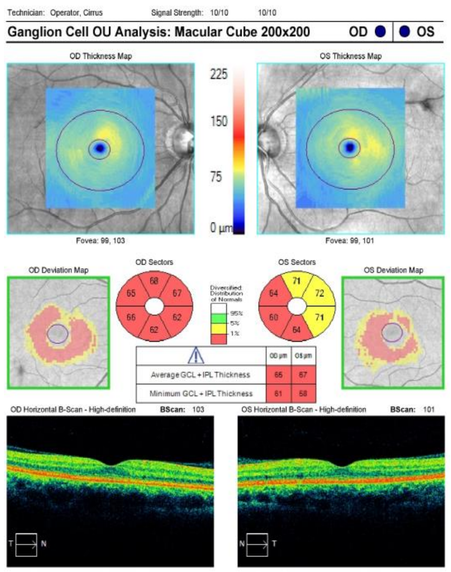
CASE HISTORY

A 47-year-old Hispanic male presents to the Miami VA eye clinic for his yearly comprehensive eye exam. The patient reports central to temporal blurry vision of the left eye that started four months ago and became worse after a COVID-19 infection one month prior. During refraction the patient was reading only the last letter of each line for the left eye. A facial amsler confirmed that the central to temporal vision of the left eye was blurry with similar complaints of the right eye starting farther temporally. A 30-2 visual field demonstrated bitemporal visual field defects. Ganglion cell analysis showed diffuse atrophy of both eyes. An MRI of the brain and orbits with attention to sella was ordered and showed a lesion consistent with a pituitary macroadenoma. Due to complaints of worsening central vision, the pituitary macroadenoma was removed by transsphenoidal resection. At the patient's follow-up, visual acuity and visual field improved.

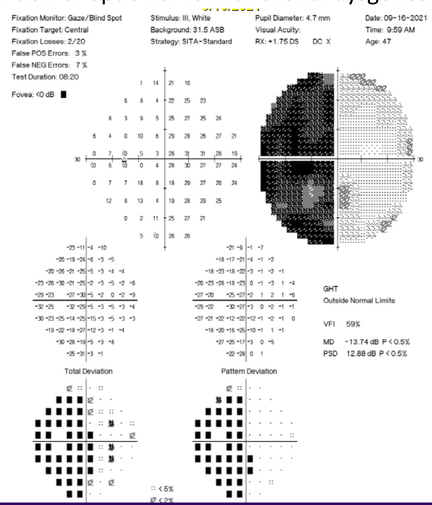
PERTINENT EXAM FINDINGS

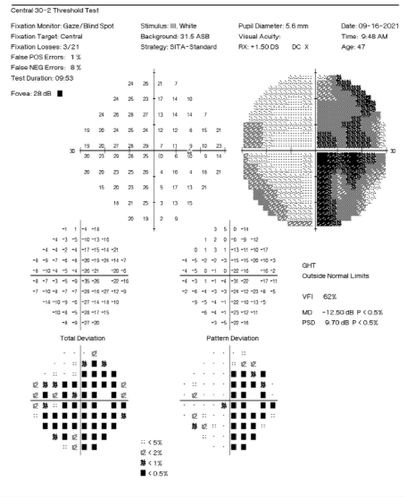
OD		OS
20/25+1	**ENTERING VISUAL ACUITY SC**	20/150 PH: 20/70+1
Equally round and reactive	**PUPILS**	Equally round and reactive
FTFC	**CONFRONTATION VISUAL FIELDS**	FTFC
full range of motion	**EXTRAOCULAR MOTILITY**	full range of motion
20/20-1	**BEST CORRECTED VISUAL ACUITY**	20/30+1
Blurry vision from left ear extending temporally	**Facial Amsler**	Blurry from nose extending temporally
	SLIT LAMP BIOMICROSCOPY	
WNL	**ANTERIOR SEGMENT**	WNL
0.40r CDR, pink and distinct margins	**DILATED FUNDUS EXAM**	0.40r CDR, pink and distinct margins

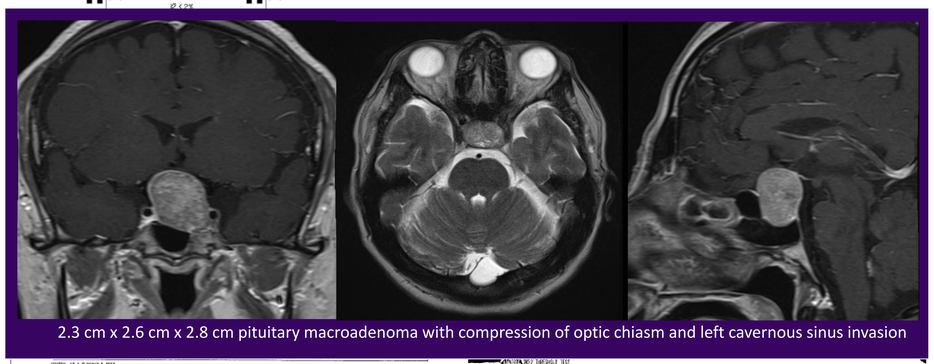


DIFFERENTIAL DIAGNOSIS

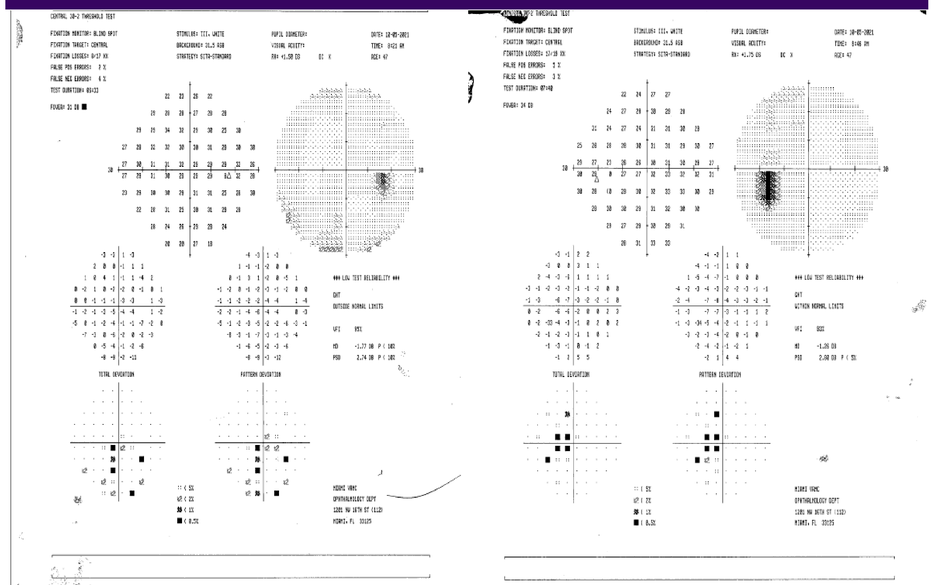
- Pituitary Adenoma:
  - Tumor of the pituitary gland leading to compression of optic chiasm superior to gland[1]
- Craniopharyngioma:
  - Outgrowth of remnant of Rathke's pouch near sella[1]
- Meningioma:
  - Neoplasm of arachnoid cells that may be in parasellar region[1]
- Anterior Communicating Artery Aneurysm:
  - Located superior to optic chiasm leading to impingement of optic nerve fibers at chiasm[1]
- Tilted Disc Syndrome:
  - Oblique insertion of optic nerve with axonal dysgenesis of nasal nerve fibers[2]







2.3 cm x 2.6 cm x 2.8 cm pituitary macroadenoma with compression of optic chiasm and left cavernous sinus invasion



DIAGNOSIS

Urgency of lab testing and imaging is based on severity of neurological or systemic symptoms.

- MRI of brain and orbits with and without contrast with attention to sella
- Blood serum levels of: Cortisol, FSH, LH, Prolactin, TSH, Free T4, ACTH, GH

Based on the MRI findings the patient was diagnosed with a bitemporal hemianopsia secondary to non-functioning pituitary macroadenoma.

DISCUSSION

Pituitary adenomas comprise 10-15% of all intracranial masses[3]. Adenomas are classified based on size and level of hormone secretion. Adenomas less than 10mm in size are categorized as a microadenoma, those larger are macroadenomas[3]. Those that do not cause elevated levels of hormones detectable in blood or produce clinical manifestations are classified as non-functioning (28-37%)[3]. The location of the pituitary adenoma inside the sella turcica forces the adenoma superiorly resulting in compression of the optic nerve and chiasm[3]. The most common hormone hypersecretions disorders are hyperprolactinemia, acromegaly, and Cushing's disease[3]. Fatigue, loss of libido, erectile dysfunction, oligomenorrhea or amenorrhea are common clinical presentations[3]. Headaches and visual changes are the most common neurological symptoms[3]. The greatest concern is pituitary apoplexy[3].

CONCLUSION

Visual symptoms are more common in non-function macroadenomas. Serum prolactin greater than 250 mcg/L is suggestive of prolactinoma with symptoms such as decreased libido, impotence, oligomenorrhea or amenorrhea. Treatment of tumors include transsphenoidal microsurgery, radiation and medical therapy. A follow-up every 3 months after treatment is recommended to assess changes to visual acuity or visual field. Optic nerve pallor is the best predictor of visual prognosis. Facial amsler may be more sensitive than confrontation fields. After treatment, visual acuity can recover faster than visual field defect

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Two May Not Always Be Better Than One

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Introduction

Nonarteritic Anterior Ischemic Optic Neuropathy (NAAION) is a condition of the optic nerve where there is hypoperfusion of blood supply through the short posterior ciliary arteries to the anterior portion of the optic nerve. NAAION accounts for roughly 95% of anterior ischemic optic neuropathies cases.[1] Occurrence in the fellow eye is estimated at around 30 to 40%, with a 5-year rate estimated to be approximately 15 to 20%. There is a 5% reoccurrence rate in the same eye.[2] A bilateral simultaneous onset of NAAION is extremely rare, with only a few cases reported.

DISCUSSION

Giant Cell Arteritis needs to be immediately ruled out in cases with nerve edema through blood panels including CBC, ESR, and CRP. Diseases that can elevate ESR levels are anemia, renal disease, obesity, tissue injury, infectious disease, and malignant neoplasms. Diabetes, hypertension, obesity, obstructive sleep apnea, and atherosclerosis can elevate CRP.[3] In addition, many patients with NAAION have underlying conditions that may warrant further investigation into other systemic conditions, including obstructive sleep apnea (up to 89%), hyperlipidemia (70%), smoking (50%), hypertension (40%), diabetes (30%), heart disease (20%), hypercoagulable conditions, and optic disc drusen. There are also risks assigned to certain medications in patients with small C/D ratios, such as amiodarone, Imitrex, phosphodiesterase-5 inhibitors, and blood pressure medications.[1]

TREATMENT CONSIDERATIONS

Treatment in NAAION is relatively controversial. Multiple studies have investigated different treatments. Optic nerve decompression surgery has been determined to cause more harm than good.[4] Oral steroids have been one of the most studied treatment options. Oral prednisolone has been studied to have positive outcomes when initiated within two weeks of onset in patients with a BCVA <20/70 or moderate to severe visual field defects. Studies have shown that it does not harm or worsen patient outcomes.[5]

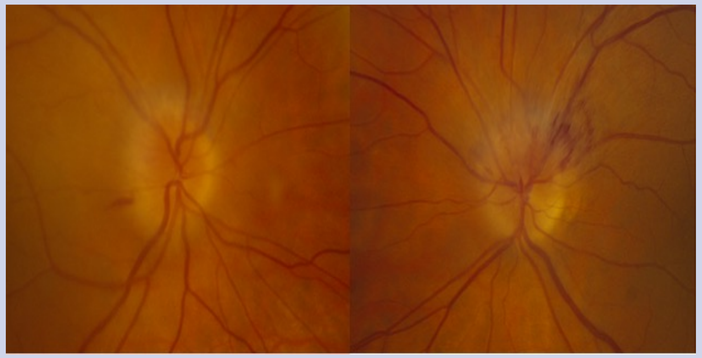
PERTINENT EXAM FINDINGS

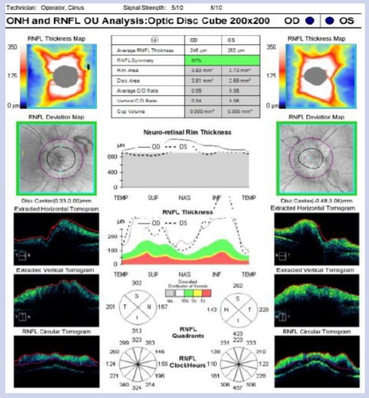
20/70	**Entering Visual Acuity**	20/30
NI	**Pinhole**	NI
FTFC	**Confrontation Visual Fields**	FTFC
9/10	**Color Vision**	10/10
PERRL (-) APD	**Pupils**	PERRL (-) APD
FROM	**EOM**	FROM
Slit Lamp Examination		
Lens: 1+ nuclear sclerotic cataract, trace posterior subcapsular cataract	**Anterior Segment Exam**	Lens: 1+ nuclear sclerotic cataract, trace posterior subcapsular cataract
Vitreous: PVD Nerve:360 Disc edema with an inferior/nasal flame hemorrhage	**Dilated Fundus exam**	Vitreous: clear Nerve: superior and nasal disc edema with superior RNFL hemorrhage

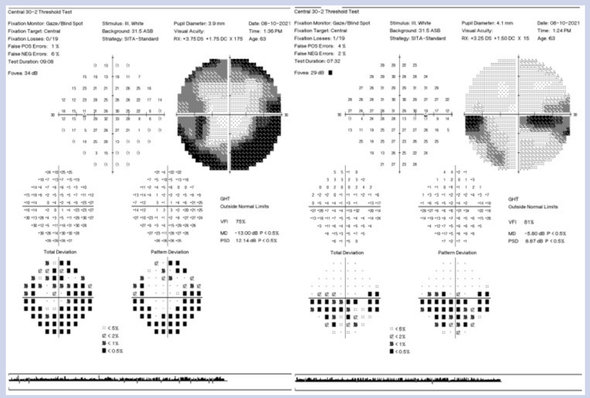
CASE HISTORY

A 63-year-old white male presents to the neuro-ophthalmology clinic with a referral from the emergency department for bilateral papilledema. He reports that he noticed a black spot in his central vision that does not move like a typical floater in his right eye. He also reported visual disturbances in his peripheral vision that remind him of Christmas tree lights when he focuses on objects. He denied pain on eye movement, scalp tenderness, jaw pain, loss of appetite, or unintentional weight loss. His past medical history is positive for diabetes, hypertension, hyperlipidemia, gout, and chronic kidney disease. His current medications include Alogliptin, Aspirin, Atorvastatin, Furosemide, Loratadine, Metoprolol, Tamsulosin, and Vitamin D.

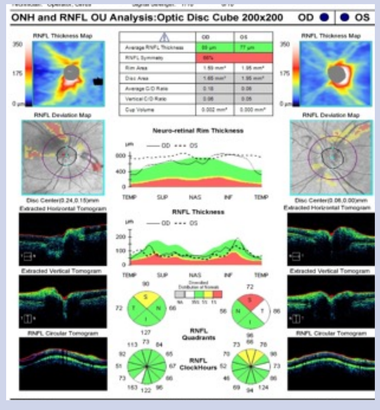
INITIAL PRESENTATION

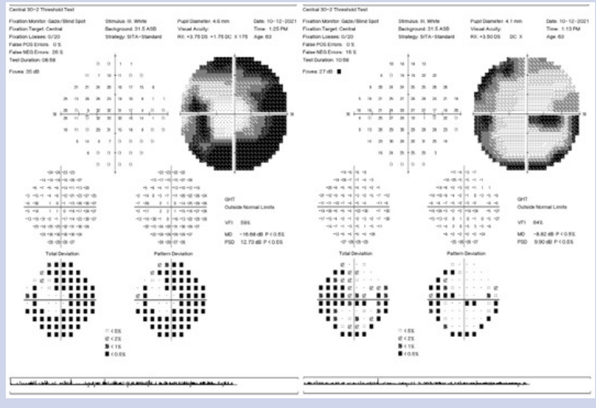






3 MONTHS FROM INITIAL PRESENTATION





Treatment

The patient was tentatively diagnosed with a simultaneous onset of Nonarteritic Anterior Ischemic Optic Neuropathy. The patient reported no symptoms of Giant Cell Arteritis. A Complete Blood Count (CBC), C-Reactive Protein (CRP), Erythrocyte Sedimentation Rate (ESR) were ordered for same-day testing. In addition, an MRI, MRV, Temporal Artery Biopsy (TBA), and Lumbar Puncture (LP) were ordered. The CBC, TBA, MRI, MRV, and Lumbar Puncture results were all within normal limits. The CRP (21) and ESR (45) came back slightly elevated, which could be contributed by his diabetes, hypertension, and renal disease. The patient was started on 40mg/day x 1 week of oral prednisolone with a taper schedule of 20mg/day x 1week, then 10mg/day until his 1-month follow-up. At the 1-month follow-up, the patient reported no changes in visual symptoms, and all preliminary testing remained stable. The visual field and OCT showed improvement, and he was instructed to continue 10mg/day of prednisolone for three more weeks. The patient's blood work was repeated and returned within normal limits. At the 3-month mark, the patient reports stable vision but noticed that he struggles with low contrast objects. Testing remained stable, and the prednisolone was tapered and stopped. Our patient was referred for a sleep study and to the low vision clinic. He was scheduled to return to the neuro-ophthalmology clinic in 3 months. The patient received a complete filter evaluation at the low vision clinic, where a yellow filter improved his low contrast symptoms, and the sleep study results are still pending.

CONCLUSION

Nonarteritic Anterior Ischemic Optic Neuropathy is the most common cause of acute optic neuropathy in individuals over 50 years old. Patients with nerve edema, peripapillary hemorrhaging, and vision reduction need an immediate workup to rule out severe life-threatening diseases. Even though there is no proven effective treatment for patients with NAAION, it is essential to identify and manage any underlying conditions and risk factors that increase the likelihood of NAAION in the fellow eye. In our patient's case, he had multiple risk factors for his simultaneous presentation, including diabetes, hypertension, hyperlipidemia, gout, chronic kidney disease, and he was taking metoprolol.

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OCULAR GRAFT VERSUS HOST DISEASE AFTER ALLOGENEIC BONE MARROW TRANSPLANT

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1

LEARNING OBJECTIVES

1. Review the presentation of ocular graft-versus-host-disease.
2. Be familiarized with diagnosis including correlation of patient's symptoms and history to examination findings
3. Outline the pathophysiology and differences in management and treatment strategies of ocular graft-versus-host-disease

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CASE PRESENTATION

A 75-year-old male with a past medical history of **non-Hodgkin's lymphoma** (10 years ago) presents to the hospital eye clinic, complaining of blurriness and irritation OD>OS

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CASE PRESENTATION

CC: Blurriness and irritation OD>OS

HPI:
- Progressively worsening blur and then irritation OD>OS onset 10 days ago
- Primary eye exam two days ago, and was referred for management of chronic dry eye
- Came to hospital eye clinic after onset for a general evaluation and to establish care, recently moved from Virginia
- Long standing history of associated pain and blurry vision
- No visual improvement since onset

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4

CASE PRESENTATION

Past Ocular History:
- Dry Eye Syndrome OU
- Presbyopia OU, wears glasses
- Cataracts OU

Past/Pertinent Medical History:
- Non-Hodgkin lymphoma
  - Treated with a hematopoietic stem cell transplant ten years' prior
- Hypertension
- Hypercholesterolemia
- Current daily smoker, one pack per day

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CASE PRESENTATION

Ocular Medications:
- Refresh Artificial Tears as needed
- Refresh Gel every night

Pertinent Systemic Medications:
- Lisinopril 10mg once daily
- Aspirin 81mg once daily
- Atorvastatin 20mg once daily

No significant past trauma, allergies, or other contributory family history.

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CASE PRESENTATION: EXAM

BCVA
OD: cc 20/50-, PH 20/NI
OS: cc 20/25, PH 20/NI

Refraction
OD: +2.50-0.50x180 20/50-
OS: +2.25-0.25x180 20/25

Pupils
PERRL, 4mm->2mm OU, no APD

Confrontation Visual Field
Full to Finger Count OD/OS

IOPs (Goldmann)
OD: 14
OS: 12

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CASE PRESENTATION: EXAM

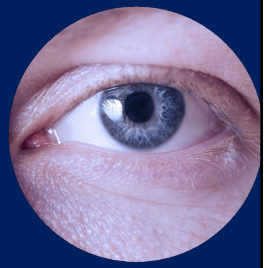
Adnexa: 1+ MGD OU

Conjunctiva/Sclera: 1+ diffuse injection OU

Cornea: punctate epithelial erosions centrally and inferiorly OD, inferiorly OS; (-)infiltrates/edema

Anterior Chamber: deep and quiet OU; (-) cells/flare

Iris: flat and intact OU



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CASE PRESENTATION: EXAM

- Lens: 1+ nuclear sclerosis OU
- Vitreous: syneresis OU
- Optic Nerve: 0.3/0.25 pink and distinct OD/OS
- Vessels: 2/3 with slight attenuation OU
- Macula: flat and intact OU
- Periphery: flat and intact OU

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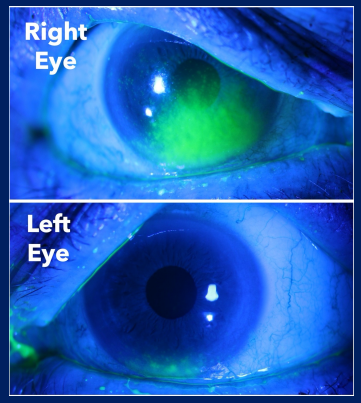

- **Corneal staining:** Punctate epithelial erosions were noted on the central and inferior cornea of the right eye and inferior cornea of the left eye

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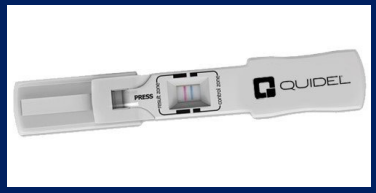
ADDITIONAL TESTING



Inflammadry
Detects matrix metalloproteinase 9
- Measuring severe ocular surface inflammation

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ADDITIONAL TESTING

Schirmer 1 Test
Wetting of paper strip after 5 minutes
- Reduced tear production

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CASE PRESENTATION

Diagnosis:

Inflammatory Dry Eye Syndrome secondary to Ocular Graft-Versus-Host Disease

…prompting additional treatment

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GRAFT-VERSUS-HOST-DISEASE (GVHD) OVERVIEW

- Common complication following allogeneic hematopoetic stem cell transplantation
- Abnormal immune response to healthy host tissue
- Characterized as acute or chronic
  - Currently defined on specific tissue involvement
  - Ocular manifestations more common in chronic form
- ~50% of individuals after allogeneic bone marrow transplant develop ocular complications

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OCULAR GRAFT-VERSUS-HOST-DISEASE (GVHD) OVERVIEW

- Involves T-cell mediated infiltration and destruction of tear producing glands
- Most common clinical manifestations include keratoconjunctivitis sicca and cicatricial conjunctivitis
- Major cause of long-term morbidity in GVHD
- Typically does not lead to permanent visual loss

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DRY EYE SYNDROME

The most frequent complication of ocular GVHD

- Symptoms:
  - dryness
  - burning
  - pain
  - itchiness
  - light sensitivity
  - fluctuating or blurred vision
- Signs:
  - Meibomian gland obstruction
  - Decreased tear production
  - Rapid tear film break up time (TBUT)
  - Punctate epithelial keratopathy

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FURTHER COMPLICATIONS OF GVHD

- Corneal ulceration
- Corneal perforation
- Filamentary keratitis
- Conjunctival scarring
- Cataract formation

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TESTING

- Schirmer testing
- Ocular Surface Disease Index (OSDI) or Dry Eye Questionaire-5 (DEQ-5)
- Fluorescein corneal staining
- Tear film breakup time

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GRADING OCULAR SYMPTOMS OF GVHD

Score	Definition
0	No symptoms
1	Mild dry eye symptoms not affecting daily activities (requiring eye drops ⩽3x per day) or asymptomatic signs of KCS
2	Moderate dry eye symptoms partially affecting daily activities (requiring drops >3x per day or punctal plugs) without vision impairment
3	Severe dry eye symptoms significantly daily activities (special eyewear to relieve pain) or unable to work because of ocular symptoms or loss of vision caused by KCS

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OCULAR GVHD DIAGNOSTIC CRITERIA AND GRADING SCALE

Ocular GVHD diagnostic criteria and grading scale according to the NIH criteria (2014)

Diagnostic Criteria	Schirmer test ≤5 mm/5 min or Schirmer test 6-10 mm/5 min due to other causes and KCS by slit-lamp examination (Preferably with confirmation of normal Schirmer test values at an established baseline)			
Severity Grade	**Score 0**	**Score 1**	**Score 2**	**Score 3**
Symptoms	KCS confirmed by an ophthalmologist in the absence of symptoms, the requirement of eye drops or ADL	Mild	Moderate	Severe
The requirement of lubricant eye drops		≤3 times/day	>3 times/day or punctal plug	Special eyewear required to relieve pain
ADL impairment		Not affected	Partially affected without new vision impairment due to KCS	Significantly affected or unable to work or loss of vision due to KCS

KCS: keratoconjunctivitis sicca, ADL: activities of daily living

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OCULAR GVHD DIAGNOSTIC CRITERIA AND GRADING SCALE

Ocular GVHD diagnostic criteria and grading scale according to the International Consensus Criteria on chronic ocular graft-versus-host disease (ICCGVHD)

Diagnosis	None (points)	Probable ocular GVHD (points)	Definite ocular GVHD (points)
Systemic GVHD (−)	0-5	6-7	≥8
Systemic GVHD (+)	0-3	4-5	≥6
Severity scale	**Schirmer test (mm)**	**CFS (points)**	**OSDI (points)**	**Conjunctival injection**
0	>15	0 (No staining)	<13	None
1	11-15	<2 (Minimal Staining)	13-22	Mild/Moderate
2	6-10	2-3 (Mild-moderate staining)	23-32	Severe
3	≤5	>4 (Severe staining)	≥33	-
oGVHD disease severity	**None**	**Mild-Moderate**	**Severe**
The total score is obtained by adding the severity score for Schirmer test + CFS + OSDI + conjunctival injection	0-4	5-8	9-11

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ACUTE GVHD GRADING CRITERIA

Clinical staging for acute conjunctival GVHD

Stage	Description
1	Conjunctival hyperemia
2	Conjunctival hyperemia with a chemotic response or serosanguinous exudates
3	Pseudomembranous conjunctivitis
4	Pseudomembranous conjunctivitis plus corneal epithelial sloughing

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CHRONIC GVHD GRADING CRITERIA

Clinical staging for chronic conjunctival GVHD

Stage	Description
1	Hyperemia of bulbar or palpebral conjunctiva in at least one eyelid
2	Fibrovascular changes of the palpebral conjunctiva along the superior border of the upper eyelid, or the lower border of the tarsal plate of the lower eyelid, with or without conjunctival epithelial sloughing, involving 25% of the total surface area in at least one eyelid.
3	Fibrovascular changes of the palpebral conjunctiva along the superior border of the upper eyelid, or the lower border of the tarsal plate of the lower eyelid, involving 25-75% of the total surface area in at least one eyelid
4	Changes as in grade 3 involving >75% of the total surface area with or without cicatricial entropion in at least one eyelid

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TREATMENT OPTIONS

- Preservative-free artificial tears
- Lubricating viscous ointment
- Autologous serum eyedrops
- Oral doxycycline
- Topical corticosteroids
- Topical immunosuppressants
- Moisture goggles

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MORE TREATMENT OPTIONS

- Punctal plugs
- Partial tarsorrhaphy
- Amniotic membrane transplantation
- Deep anterior lamellar keratoplasty
- Penetrating keratoplasty

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TREATMENT SUMMARY

Level	Recommended measure
1	Education and counseling Environmental management Elimination of offending systemic medications Preserved tear substitutes, allergy eye drops
2	Unpreserved tears, gels, ointments Steroids Cyclosporine A Secretagogues Nutritional supplements
3	Tetracyclines Autologous serum tears Punctal plugs (after control of inflammation)
4	Topical vitamin A Contact lenses Acetylcysteine Moisture goggles Surgery

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FUTURE DIAGNOSTICS

- Meibography
- Tear Interferometry
- Tear Film Osmolarity

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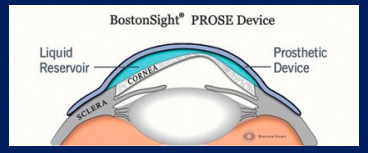
FUTURE TREATMENT



Contact lenses (PROSE)

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CONCLUSION

- Ocular GVHD is a complex and challenging condition to diagnose and manage
- Early diagnosis is essential to reduce or even prevent severe complications
- Multidisciplinary approach is important to determine when systemic, topical or other therapy options are best

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QUESTIONS?

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Lamellar Hole-Associated Epiretinal Proliferation

Characteristics & Potential Implications on Prognosis & Management of Lamellar Macular Hole

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Learning Objectives

1. Review normal vitreous physiology and interaction with the retina.
2. Contrast the physiologic versus pathologic vitreous aging process.
3. List the spectrum of vitreomacular interface (VMI) disorders that can arise from anomalous posterior vitreous detachment.
4. Understand the pathogenesis of VMI disorders.
5. Outline the characteristic appearance of full-thickness macular hole (FTMH) versus lamellar macular hole (LMH).
6. Contrast pathogenesis, clinical characteristics, and SD-OCT appearance of tractional versus degenerative LMH.
7. Understand the differences in appearance, development, and prognosis in epiretinal membrane (ERM) versus lamellar hole-associated proliferation (LHEP).

Case Report

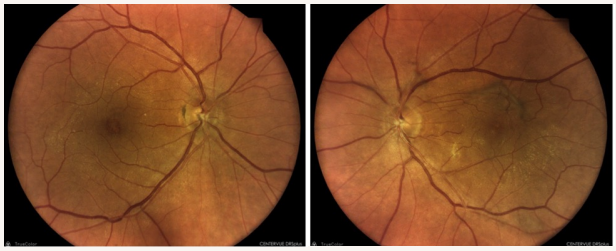
- **69-year-old** white male with complaints of **blurry vision/disturbances** OD
  - Gradually worsening x 3-4 months
  - Objects appear to "jump down and to the right, then disappear"
- Ocular history
  - Longstanding **macular hole** OD, **VMT** OS x 10 years
  - Co-managed with retina specialist, last visit 2 weeks prior
  - Surgery *not recommended*
- Medical history
  - Hypertension, depression/anxiety
  - Amlodipine, buspirone (anxiolytic), Celexa, Effexor

Preliminary Testing

	OD	OS
Entering VA	20/80 $^{-2}$ (cc)	20/20 $^{-2}$ (cc)
Amsler Grid	Central scotoma	Central metamorphopsia
Pupils	Round, reactive, no APD	Round, reactive, no APD
CVF	FTFC	FTFC
EOMs	FROM	FROM
Cover Test	Orthophoria (distance) 2 XP' (near)	

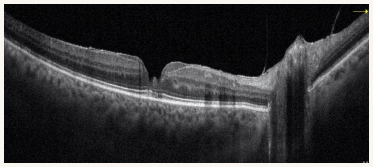
Anterior Segment

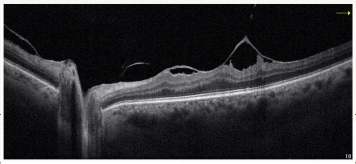
	OD	OS
Adnexa	Normal	Normal
Eyelids	Clear	Clear
Conjunctiva	Pinguecula nasal/temp	Pinguecula nasal/temp
Cornea	Clear	3+ edema
Anterior Chamber	Deep & quiet	Deep & quiet
Iris	Flat & intact	Flat & intact
Lens	1+ Nuclear sclerosis	1+ Nuclear sclerosis



Fundus Photography

OD





OS

OCT

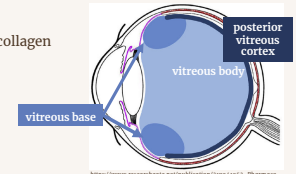
Review of Vitreous Physiology[1]

Type II collagen
- Strength & impact resistance
- Densely packed at vitreous base

Hyaluronic acid
- "Scaffolding" - separates & suspends collagen
- Highest concentration in PVC
- Synthesized by **hyalocytes**

Collagen-hyaluronic acid complex
- Balances gel vs. water content
- Optical clarity, strength + elasticity

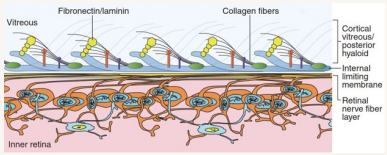
Extracellular matrix composed of ~98% water and 2% macromolecules



https://www.researchgate.net/publication/327041953_Pharmacokinetic_aspects_of_retinal_drug_delivery

The Vitreoretinal Interface[1]

- Vitreous cortex – ILM junction
- **ILM** = retinal basal membrane = Müller cell footplates
- Adhesion of collagen to ILM mediated by **fibronectin** + **laminin**
  - Strength of adhesion increases from posterior pole to vitreous base



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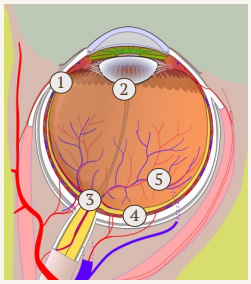
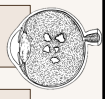
Sites of Vitreoretinal Adhesion[1]

① vitreous base (*strongest*)
② posterior lens capsule
③ optic disc
④ macula
⑤ blood vessels (*weakest*)



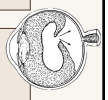
Vitreous Aging[2]

Synchysis
- Disruption of collagen-hyaluronic acid complex
- Liquefaction of gel vitreous

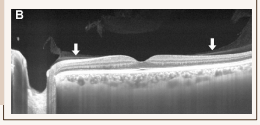


Syneresis
- Increased cross-linking between collagen fibrils
- Collagen clumping with adjacent lacunae

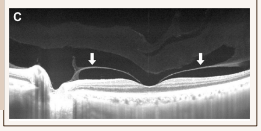
Detachment
- Vitreoretinal adhesions weaken
- Separation of vitreous cortex from ILM
- Vitreous collapses anteriorly



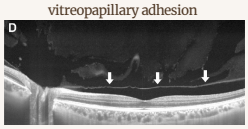
Stage 1 — Perimacular dehiscence



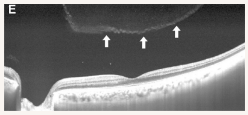
Stage 2 — Perifoveal dehiscence



Stage 3 — Vitreofoveal detachment with vitreopapillary adhesion

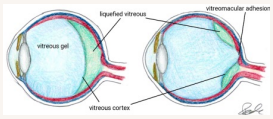


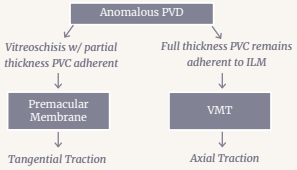
Stage 4 — Complete detachment[2]

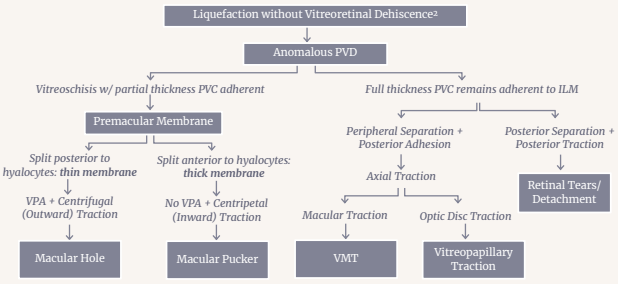


Anomalous Posterior Vitreous Detachment[2]

- Disruption in normal vitreous aging
- Liquefaction outpaces normal weakening of VRA
- Anterior migration of vitreous body despite persistent retinal adhesion

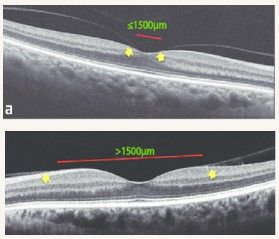






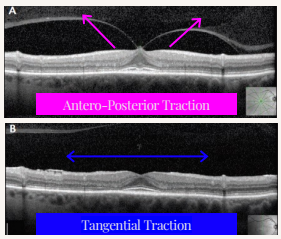
Vitreomacular Adhesion (VMA)

Incomplete PVD + **normal fovea**



Vitreomacular Traction (VMT)[2]

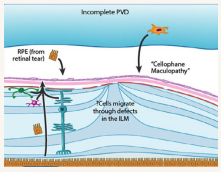
Incomplete PVD + **disruption of fovea**



Premacular Membranes

- Inciting factors: mechanical traction, hyperglycemia, trauma
- Proliferation & trans-differentiation of cells on ILM surface

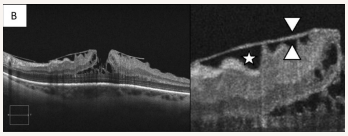
1. Intraretinal glial cells migrate anteriorly through breaks in the ILM
2. Remnant cortical vitreous cells from anomalous PVD + vitreoschisis
3. RPE cells migrate anteriorly from retinal tear



Typical Epiretinal Membrane[3]

Fibrocellular proliferation of **thin**, highly **contractile** membrane on inner retina

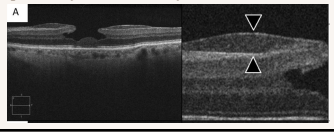
- Histopathology: primarily **myofibroblasts** with contractile properties
- Tractional stress induces chronic **inflammation** & **cytokine** production
  - Fibroblast growth factor, nerve growth factor
    - Stimulate proliferation of residual PVC cells



Lamellar Hole-Associated Epiretinal Proliferation (Atypical Epiretinal Tissue)[4]

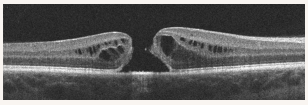
Fibrocellular proliferation of **thick**, **non-contractile** membrane on inner retina

- Histopathology: primarily **gliotic tissue** from **Müller cells**
- Microbreaks in ILM → migration/ proliferation of intraretinal glial cells
- Manifestation of chronic, severe gliosis
  - Increases local inflammation and neurodegeneration
- May occur **independently** or **concurrently** with ERM



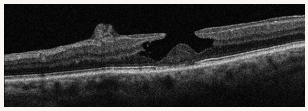
Full-Thickness Macular Hole (FTMH)[5]

Full-thickness **foveal break** of the neurosensory retina extending from **ILM** to **RPE**



Lamellar Macular Hole[7]

Partial-thickness **foveal break** of the inner neurosensory retina not extending to the RPE



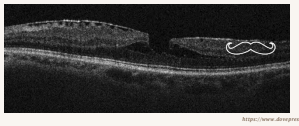
Tractional LMH

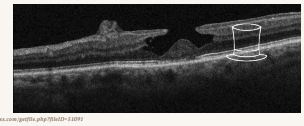
- *Displaced retinal tissue*
- Significant schisis between OPL and HFL
  - No disruption of Henle's fibers
- Associated with tractional ERM

Degenerative LMH

- *Loss of retinal tissue*
- Intraretinal cavitations between IPL and HFL
  - Disruption of Henle's fibers
- Slow, chronic retrograde degeneration of foveal PR, bipolar, & horizontal cells
  - Worse VA than tractional
- Associated with **LHEP** (in 98.5%)

Tractional	Degenerative[7]
Thick, **contractile ERM**	**Non-contractile** epiretinal **proliferation**
Eccentric to the fovea	Located at **foveal edges**
Sharp schisis between ONL and OPL	**Round-edged** intraretinal cavitation
Inner/outer retinal diameter <1:2	Inner/outer retinal diameter >1:2
Intraretinal **cystoid spaces**	**Foveal bump**
Intact ellipsoid zone	**Disruption** of **ellipsoid** zone





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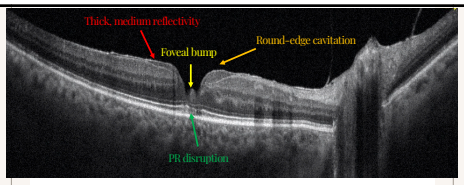
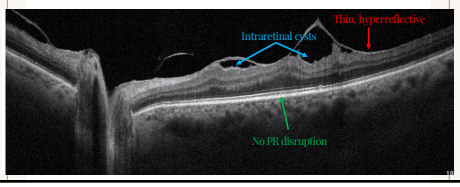
Our Patient





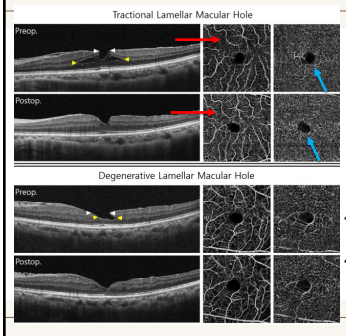
Optical coherence tomography angiographic findings of lamellar macular hole: comparisons between tractional and degenerative subtypes

Joon Hyung Yeo[1,4], Richul Oh[2,4], Joo Yong Lee[3], June-Gone Kim[3], Young Hee Yoon[3] & Yoon Jeon Kim[3]✉

	Tractional	Degenerative
FAZ area	Smaller	**Larger**
Foveal VD	Higher	**Lower**
Parafoveal VD	**Lower**	**Lower**
VDI	**Lower**	**Lower**

FAZ = foveal avascular zone, VD = vessel density, VDI = vessel density index

- **Superficial capillary plexus** (SCP) runs through the NFL, GCL, and IPL
- Disruption of the VMI may affect superficial retinal vasculature
- Mechanism of disruption may provide insight about pathophysiology of LMH[8]



- In tLMH, microvascular structure was restored 6 months after surgery
  - NOT in dLMH
- Smaller foveal and parafoveal VD highly correlated with BCVA in dLMH
- Hypoperfusion to photoreceptors[8]

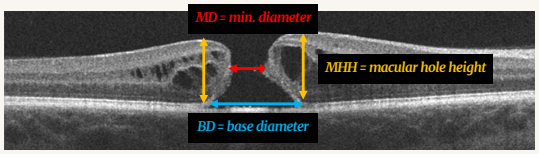
Management Options

- Observation
- ~~Jetrea (ocriplasmin)~~
- Pars Plana Vitrectomy

Management of Full-Thickness Macular Hole[6]

	Gass Stage 1	Gass Stage 2	Gass Stage 3	Gass Stage 4
Regression Rate	50%	15%	<5%	<<5%
Progression Rate	40% to FTMH	75%	50%	20%
PPV	Commonly monitored	~100% success ? ILM peel	~90% ILM peel likely	90-95% ILM peel necessary 75% no ILM peel

Macular Hole Indices[6]



Macular hole index (MHI)= BD/MHH	Considers axial + tangential traction
Hole forming factor (HFF)= $\frac{(\text{nasal + temp MHH})}{BD}$	Considers axial + tangential traction
Diameter hole index (DHI)= MD/BD	Considers tangential traction only Max traction when min diameter = base diameter
Tractional hole index (THI)= MHH/MD	Considers A-P > tangential traction **Strong correlation with 3-month post-op VA**

Management of Lamellar Macular Hole[9]

- Typically, anatomically and functionally stable
  - 13-21% enlarge in diameter after 18-24 months
  - **Monitored →** rarely progress to FTMH
- tLMH: better post-surgical outcomes
  - Release of traction restores normal anatomy

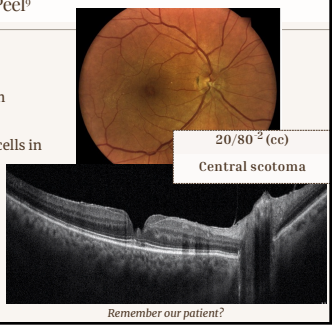
<u>No consensus on when to initiate treatment</u>

Worsening VA/metamorphopsia
Increased central thickness on OCT
Enlargement of hole

Pars Plana Vitrectomy with ILM Peel[9]

Mechanism
- Release of traction
- Stimulation of fibroglial proliferation
  - "Plugs" the hole
  - Hyperplastic RPE and fibroglial cells in spontaneously closed MHs

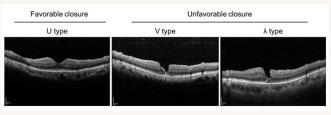
Indications
- Symptomatic VMT
- Tractional LMH
- Stage 2 or greater FTMH
- Highly variable treatment outcomes



Remember our patient?

Potential Post-Surgical Outcomes[11]

- Inadvertent ILM disruption during ILM peel → damage to Müller cells
  - May lead to FTMH development
- Possible factors increasing risk of surgical failure:
  - ***Location of ERM***
  - ***Presence of LHEP***



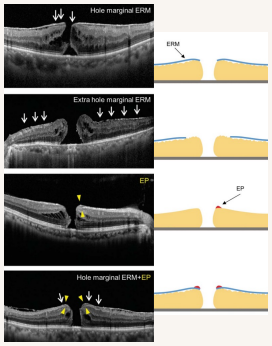
Surgical outcomes of lamellar macular holes with and without lamellar hole-associated epiretinal proliferation

Jaesang Ko,[1,2] Gyu Ah Kim,[1] Sung Chul Lee,[1] Jihwan Lee,[1] Hyoung Jun Koh,[1] Sung Soo Kim,[1] Suk Ho Byeon[1] and Christopher Seungkyu Lee[1]

LHEP is associated with....[11]

- *Worse preoperative visual acuity*
- *Larger hole diameter*
- *Thinner retina*
- *Higher incidence of ellipsoid disruption*

LHEP influence on rate of macular hole closure remains ***controversial***

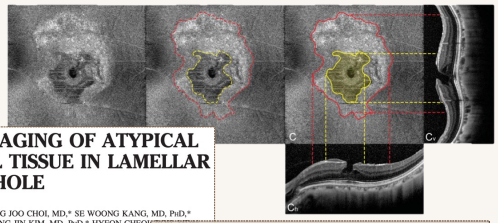


ASSOCIATION BETWEEN EPIRETINAL MEMBRANE, EPIRETINAL PROLIFERATION, AND PROGNOSIS OF FULL-THICKNESS MACULAR HOLE CLOSURE

JEE MYUNG YANG, MD, PhD,* SANG UK CHOI, MD,* YOON JEON KIM, MD, PhD,* RYUL KIM, MD, PhD,† DONG KEON YON, MD,‡ SEUNG WON LEE, MD, PhD,§ JAE IL SHIN, MD, PhD,§ JOO YONG LEE, MD, PhD,* JUNE-GONE KIM, MD, PhD*

HM-ERM + EP

- ↑ risk of unfavorable closure & surgical failure
- Mechanical damage & chronic inflammation of cells participating in hole healing[12]



EN-FACE IMAGING OF ATYPICAL EPIRETINAL TISSUE IN LAMELLAR MACULAR HOLE

JUN SOO EUN, MD,*† YOUNG JOO CHOI, MD,* SE WOONG KANG, MD, PhD,* KYUNG JUN CHOI, MD,* SANG JIN KIM, MD, PhD,* HYEON CHEOL

Factors associated with ΔBCVA:

- **Maximum diameter** of LMH
- **Area of LHEP** on en-face OCT
  - Correlates with extent of foveal cavitation
  - <1.12 mm² associated with improved BCVA[13]

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