Epiretinal Membrane Formation Following Rhegmatogenous Retinal Detachment Repair: Optical Coherence Tomography Features and Surgical Outcomes

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Conclusions

- Anatomic alteration due to epiretinal membrane (ERM) formation after RRD repair is commonly severe (Stage 4 OCT characteristics), and leads to significant worsening of logMAR visual acuity.

- ERM removal with vitrectomy and membrane peeling resulted in a significant improvement in visual acuity in eyes with history of either macula on or macula off RRD.

- Ectopic inner foveal layer (EIFL) thickness, IS/OS disruption, and microcytic changes were associated with visual acuity at 6 months post ERM peel using regression analysis. Confirmation of these associations in larger series is warranted.

Epiretinal membrane after RRD Repair

- Epiretinal membrane (ERM) formation after primary rhegmatogenous retinal detachment (RRD) repair is common, with estimates ranging from 4-13%.[1-4]
    - Several authors have described the utility of internal limiting membrane (ILM) peel during primary RRD repair to prevent later ERM formation.[5-9]
    - Preservation of IS/OS band on SD-OCT has been correlated to visual acuity improvement after membrane peel surgery.[10]
    - Macular status at time of RRD repair may determine visual potential.

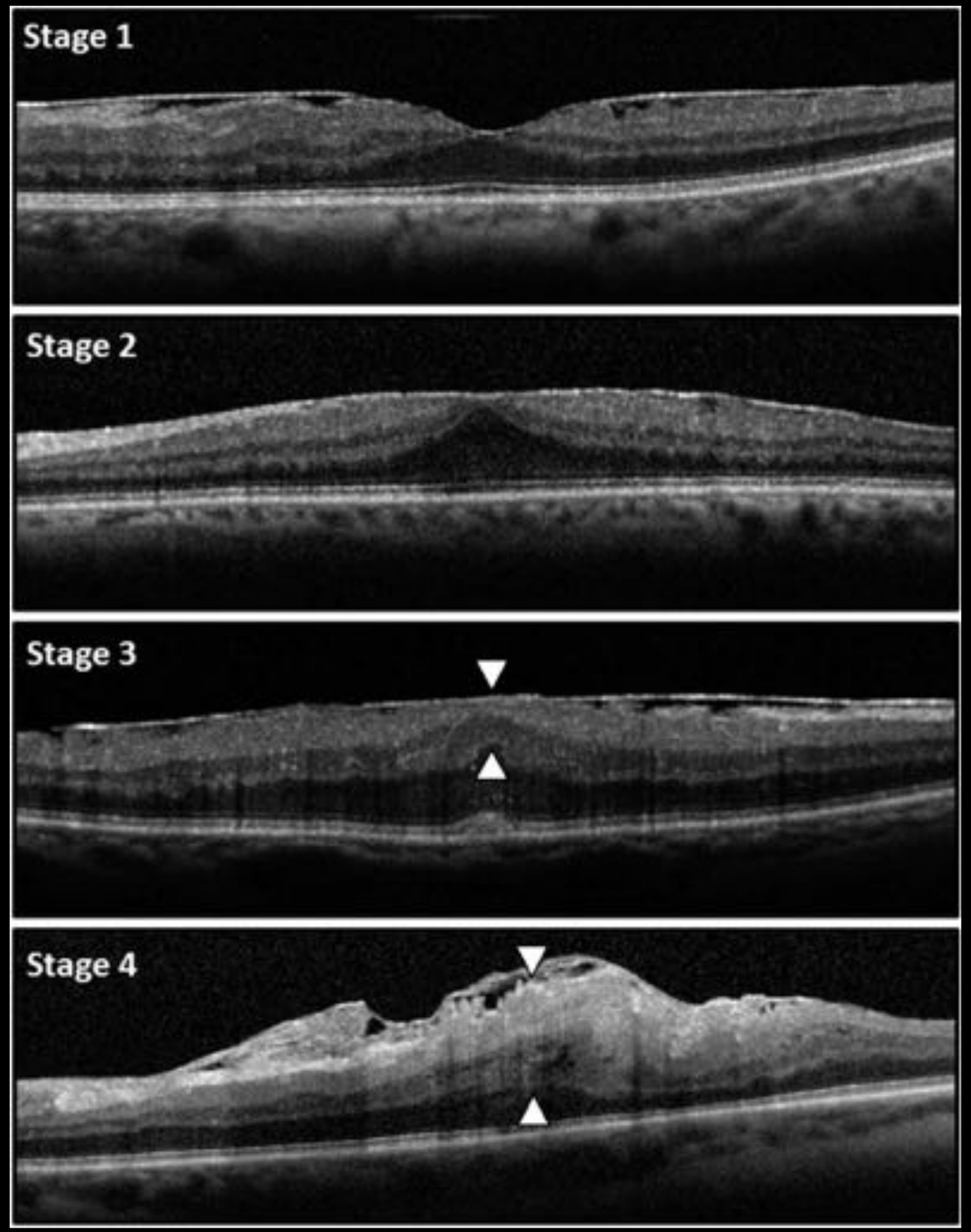
OCT Grading of ERM

- Govetto et al. described a new, SD-OCT based grading scheme for ERM in 2017.[11,12]

Insights Into Epiretinal Membranes: Presence of Ectopic Inner Foveal Layers and a New Optical Coherence Tomography Staging Scheme

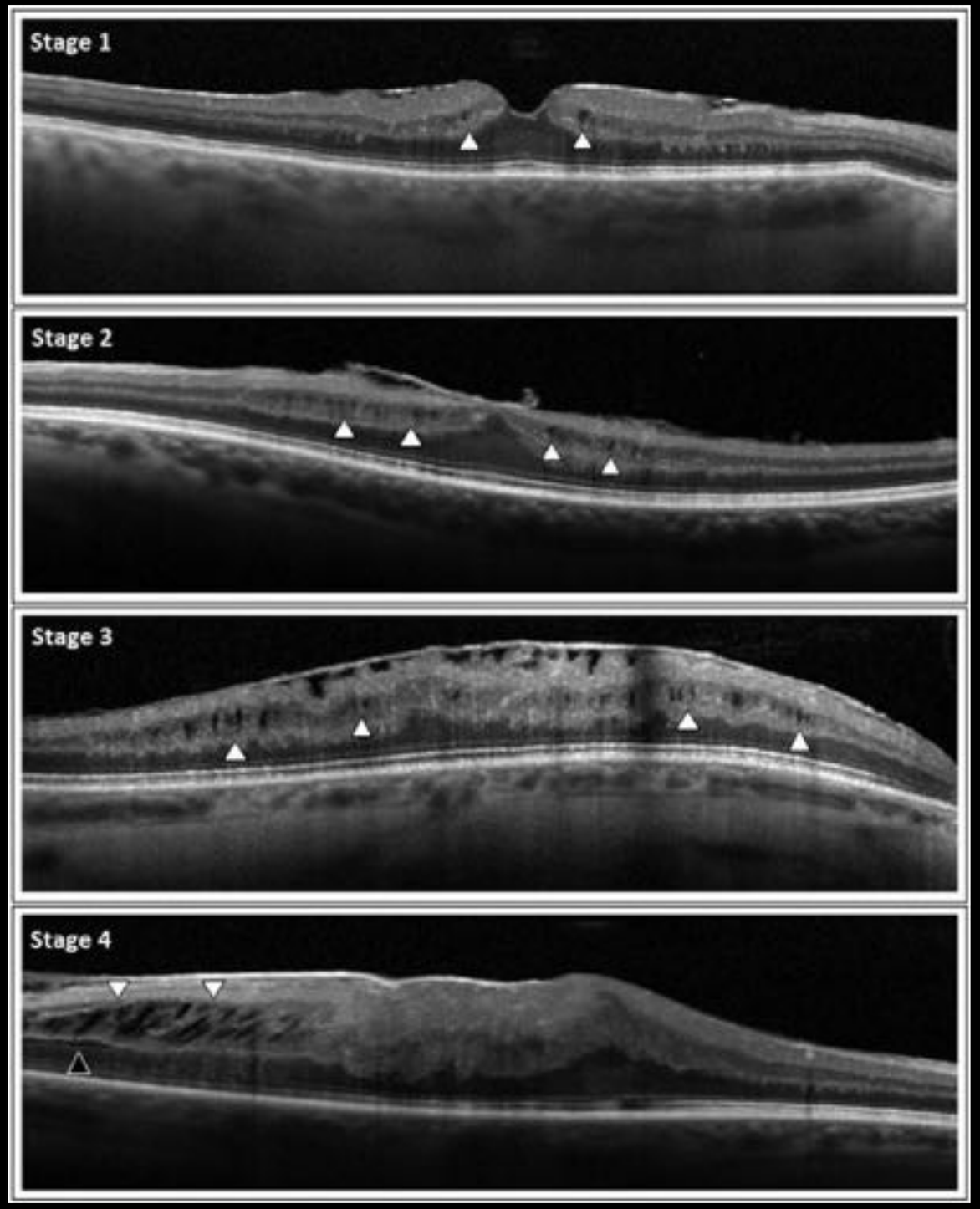
ANDREA GOVETTO, ROBERT A. LALANE, III, DAVID SARRAF, MARTA S. FIGUEROA, AND JEAN PIERRE HUBSCHMAN

- Utility of this grading system in guiding expectations for idiopathic epiretinal membrane,[13] but has not been studied in ERM following RRD repair.



- Stage 1: Mild ERM with preservation of foveal depression.
- Stage 2: Foveal depression is lost, but all retinal layers are easily identified.
- Stage 3: Presence of **ectopic inner foveal layers** (EIFL, white arrows) across the foveal floor. Foveal depression is lost, but all retinal layers remain identifiable.
- Stage 4: Severe alteration in anatomy with foveal disorganization. EIFL (white arrows) is present. Retinal layers are not identifiable.

Image source: Govetto A, Lalane RA, Sarraf D, Figueroa MS, Hubschman JP. Insights Into Epiretinal Membranes: Presence of Ectopic Inner Foveal Layers and a New Optical Coherence Tomography Staging Scheme. *Am J Ophthalmol*. 2017;175:99-113.



- **Microcystic macular changes** may be present in any stage
  - Round, small, hypo-reflective spaces, typically in the inner nuclear layer
  - Previously associated with concurrent glaucoma

Image source: Govetto A, Su D, Farajzadeh M, et al. Microcystoid Macular Changes in Association With Idiopathic Epiretinal Membranes in Eyes With and Without Glaucoma: Clinical Insights. *Am J Ophthalmol.* 2017;181:156-165.

Purpose

- To describe OCT features of ERM following prior RRD repair, and to report surgical outcomes of pars plana vitrectomy (PPV) and membrane peeling surgery in this patient population.
    - Retrospective, single-center, consecutive case series of 57 eyes of 57 patients
    - Eyes were identified from surgical CPT coding data in years 2015-2018 and confirmed with review of surgical operative reports.
    - Exclusion criteria: proliferative vitreoretinopathy or use of silicone oil at time of initial RRD repair; follow-up of less than 6 months; history of ERM prior to RRD repair; or history of wet AMD, vein occlusion, diabetic retinopathy, or cystoid macular edema.

Baseline characteristics

	Number	Percentage
Male Female	37 20	64.9% 35.1%
Age	62 ± 8 years	
Right eye Left eye	40 17	70.2% 29.8%
Follow-up:		
Time interval between RRD repair and ERM peel	269 ± 199 days Range: 56-1162 days	
Time interval from ERM peel to final follow-up	22 ± 12 months Range: 6-53 months	
Macular status at RRD repair:		
Macula on Macula off	14 43	24.6% 75.4%
Method of RRD repair:		
PPV PPV/SBP	30 27	52.6% 47.4%
Lens status at ERM peel:		
PCIOL ACIOL Phakic	53 1 3	93.0% 1.7% 5.3%
Characteristics of RRD:		
3 or more retinal breaks Vitreous hemorrhage Chronic (>2 weeks duration) RD involving >2 quadrants Prior cryotherapy Giant retinal tear Choroidal detachment History of uveitis	17 15 11 6 2 0 0 0	32.1% 26.3% 19.3% 1.2% 3.5% 0 0 0

	Number	Percentage
ERM Stage:		
Stage 1	3	5.3%
Stage 2	10	17.5%
Stage 3	8	14.0%
Stage 4	36	63.2%
Microcystic changes:		
Present	39	68.4%
Absent	18	31.6%
IS/OS disruption:		
Present	34	59.6%
Absent	23	40.4%
EIFL thickness, mean	376.2 ± 145.1 microns	
CF thickness, mean	559.3 ± 168.4 microns	

Visual acuity outcomes

Timepoint	Pre-op RRD repair	3 months post RRD repair	Visit prior to ERM removal	6 months post ERM removal	Final follow-up
LogMar acuity, mean	1.32±0.93	0.84±0.50	0.99±0.51	0.46±0.41	0.42±0.40
Snellen acuity, mean	20/418	20/138	20/195	20/58	20/53
P value: Post RD repair		0.0005			
Post RD repair to Pre-op ERM			0.0009		
Post ERM, 6 months				<0.0001	
Post ERM, final					<0.0001
Pre-op RD to Final					<0.0001
Percentage of eyes 20/40 or better	24.6%	10.5%	7%	38.6%	49.1%
P value: Post RD repair to Pre-op ERM			0.02		
Post ERM, 6 months				0.0001	
Post ERM, final					0.0001
Pre-op RD to Final					0.011

Visual acuity outcomes

Timepoint	Post RD repair	Pre-op ERM peel	Post ERM peel, final
Macula on, visual acuity P value	0.82±0.52	0.96±0.40 0.24	0.29±0.14 <0.0001
Macula off, visual acuity P value	0.85±0.50	1.00±0.54 0.02	0.46±0.45 <0.0001
Macula on versus off, visual acuity P value	0.796	0.071	0.163
EIFL thickness, mean		376.2±145.1	179.9±96.1 <0.0001
CF thickness, mean		559.3±168.4	359.8±82.0 <0.0001

Visual acuity outcomes

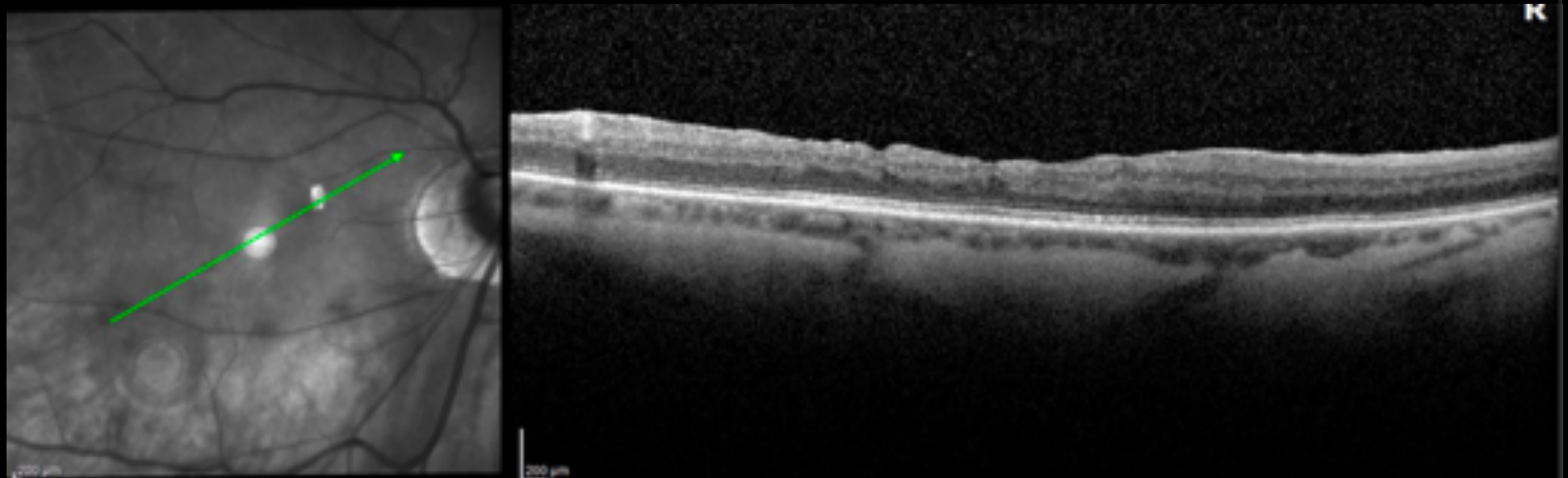
Timepoint	Pre-op ERM peel	Post ERM peel, 6 months	Post ERM peel, final
Stage 1 P value	0.62±0.35	0.22±0.07 0.14	0.25±0.13 0.12
Stage 2 P value	0.74±0.45	0.41±0.33 0.029	0.37±0.35 0.017
Stage 3 P value	0.83±0.52	0.39±0.66 0.008	0.39±0.66 0.007
Stage 4 P value	1.14±0.49	0.50±0.38 <0.001	0.45±0.36 <0.001
No microcystic changes P value	0.83±0.54	0.61±0.58 0.022	0.50±0.49 0.0002
Microcystic changes, any stage P value	1.07±0.48	0.39±0.28 <0.0001	0.38±0.36 <0.0001
P value, microcystic changes versus no microcystic changes	0.11	0.06	0.311
Microcystic changes, stage 1 or 2 P value	0.80±0.48	0.40±0.41 0.05	0.39±0.43 0.04
Microcystic changes, stage 3 or 4 P value	0.91±0.54	0.39±0.25 <0.0001	0.38 ±0.35 <0.0001
No IS/OS disruption P value	0.70±0.33	0.29±0.17 <0.0001	0.25±0.15 <0.0001
IS/OS disruption, any stage P value	1.20±0.51	0.58±0.48 <0.0001	0.53±0.47 <0.0001
P value, IS/OS disruption versus no IS/OS disruption	<0.001	0.007	0.008

Regression analysis: visual acuity at 6 months post ERM peel

OCT Feature	***P value, Regression***
CFT, pre-operative	0.20
CFT, post-operative	0.015*
EIFL thickness, pre-operative	0.056
EIFL thickness, post-operative	0.007*
Microcystic changes, presence	0.019*
IS/OS disruption, pre-operative	0.002*
Macular status at time of RRD repair	0.40

Case examples

Stage 4 ERM with EIFL, microcystic changes
VA: 20/400



6 months post peel
VA: 20/40

Limitations

- Retrospective series of single center.
- Only eyes with ERM after primary RRD were assessed, and findings may not be applicable in recurrent RD or eyes with silicone oil. All eyes had prior history of PPV, and thus results may not be applicable in setting of primary scleral buckle or pneumatic retinopexy.
- OCT measurements of EIFL are subjective and may be difficult in Stage 4 ERM.
- Strengths: Multiple OCT features assessed, and 94.7% of eyes were pseudophakic at time of ERM peel for visual acuity assessment.

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