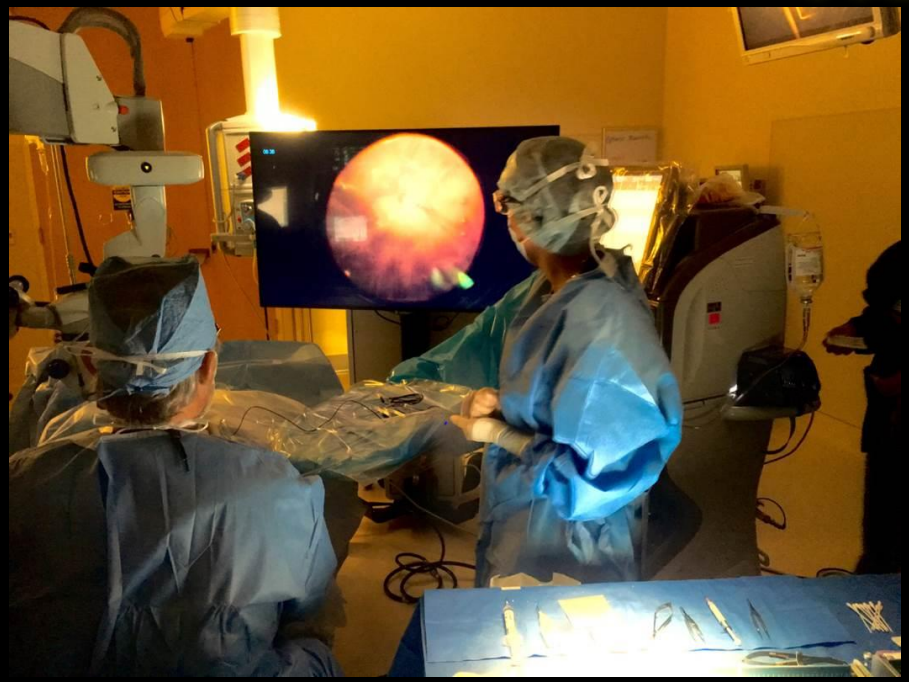
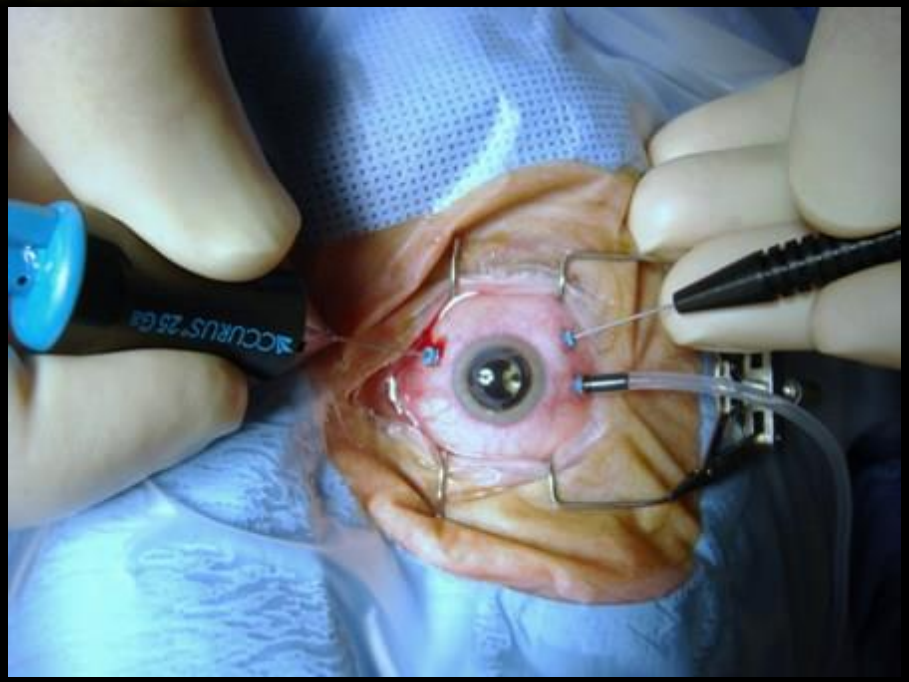
Update on Surgical Diseases of the Retina





Chandra Balaratnasingam

Lions Eye Institute

THE UNIVERSITY OF WESTERN AUSTRALIA

Financial Disclosures: Research funds received from Bayer. Consults for Apellis, Allergan, Bayer and Roche.

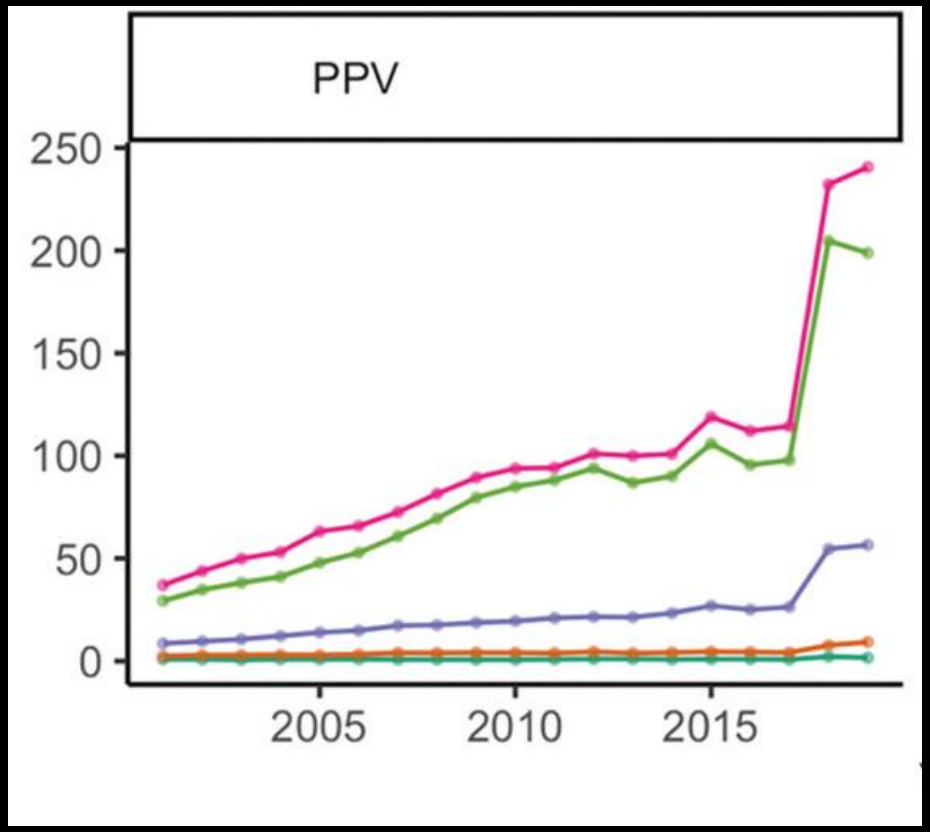
OPHTHALMIC EPIDEMIOLOGY
2023, VOL. 30, NO. 3, 293–299
https://doi.org/10.1080/09286586.2022.2093918

Taylor & Francis
Taylor & Francis Group

Nationwide Trends in Vitreoretinal Procedures within Australia

Carmelo Macri[a], Gurfarmaan Singh[a], Dinesh Selva[a,b], Christopher X Wong[b], Michelle T Sun[a,b], and Weng Chan[a,b]

[a]Discipline of Ophthalmology and Visual Science, The University of Adelaide, Adelaide, Australia; [b]Department of Ophthalmology, Royal Adelaide Hospital, Adelaide, Australia



Overview

1. Vitreous Anatomy and Vitreous Ageing

2. Technical Aspects of Vitrectomy

3. Surgical Diseases of the Macula

4. Vitreous Haemorrhage and Retinal Detachment

Vitreous Anatomy and Ageing

Vitreous Anatomy

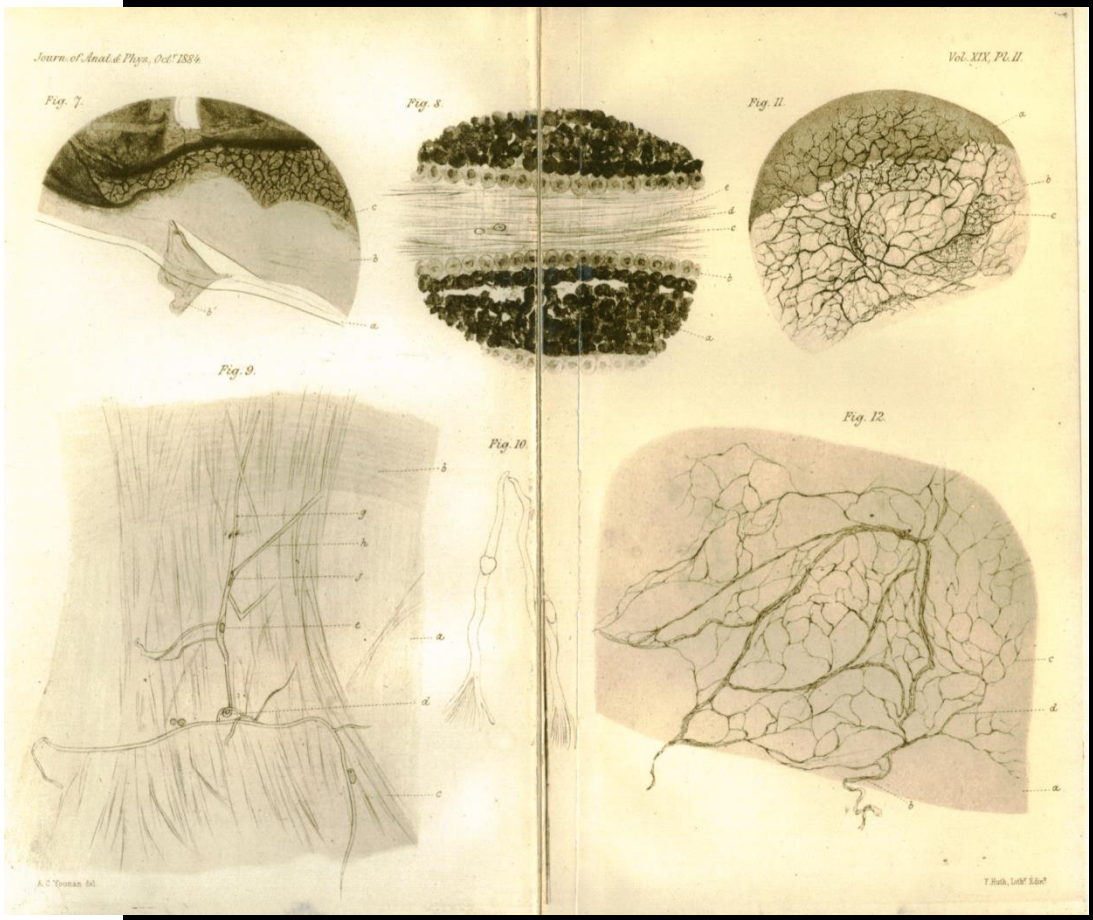
Journal of Anatomy and Physiology.

ON THE HISTOLOGY OF THE VITREOUS HUMOUR.

By Arthur C. Younan, M.B., C.M., *Vans Dunlop Scholar, University of Edinburgh.* (Plates I. and II.)

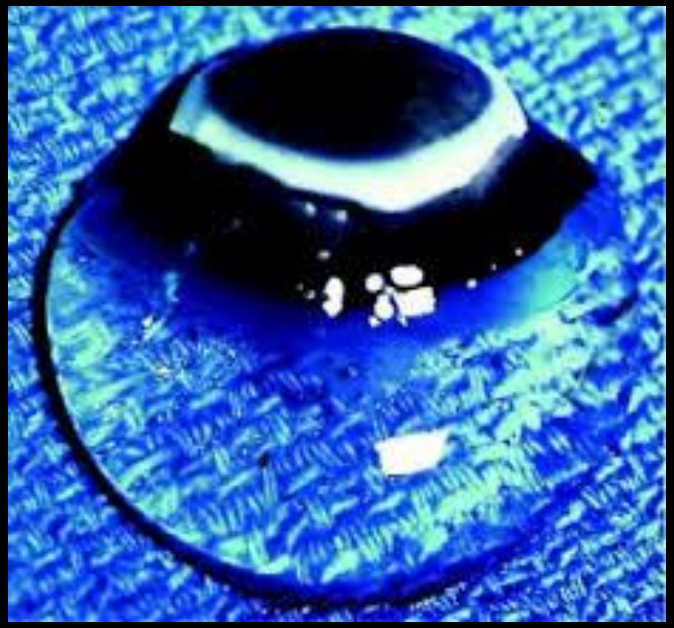
Few subjects in histology have been the occasion of so much difference of opinion as the structure of the vitreous humour of the eye. The tissue is so transparent, its structural element so delicate and difficult to observe under the microscope, that so much variance in opinion is scarcely surprising. The great diversity of views entertained by different authors is also, in part, explicable on the ground that they resorted to artificial hardening, which in great part alters both the macroscopic and microscopic appearances of the vitreous.

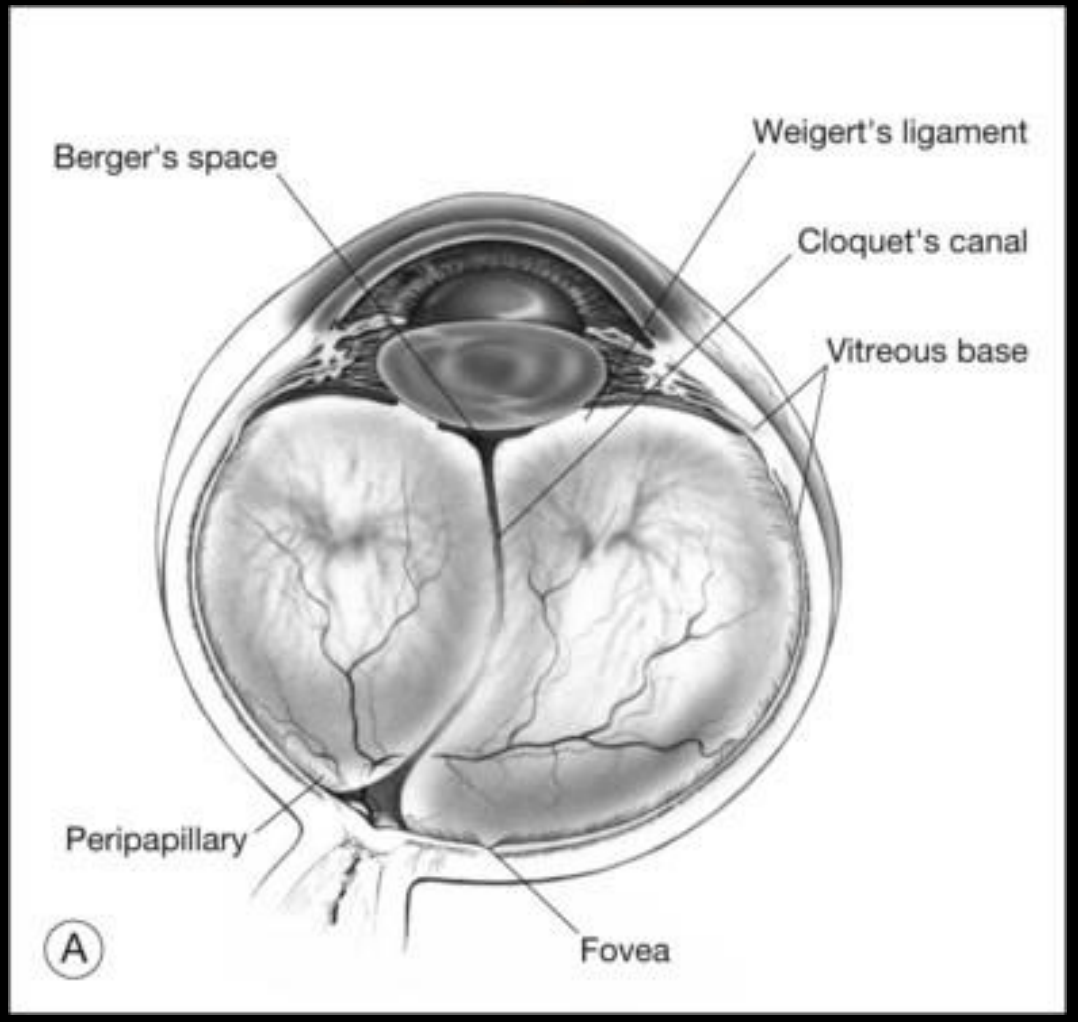
It is admitted by all that the vitreous consists of a solid and a fluid part. The nature of both has been disputed, but especially that of the solid part, and also its arrangement. Pappenheim (1842, quoted in *Op.* 1, p. 348) found that, on hardening the vitreous with carbonate of potash, the stroma appeared to be composed of laminæ running parallel with the surface, each lamina consisting of fine fibres and a homogeneous matrix. Brücke (1843, *Op.* 2, p. 346) removed the sclerotic, choroid, and retina from the eye of a sheep as far forward as the ora serrata, and placed the exposed vitreous in a concentrated solution of diacetate of lead. After some hours he made sections of the vitreous thus hardened, and observed concentric white lines parallel with the general surface, and presenting on section the appearance of finely striped agate. He found that the vitreous so prepared tore easily in the direction of the layers, which appeared to him to consist of milky transparent membranes with intervening clear spaces filled by an apparently



Published in 1884

Vitreous Anatomy

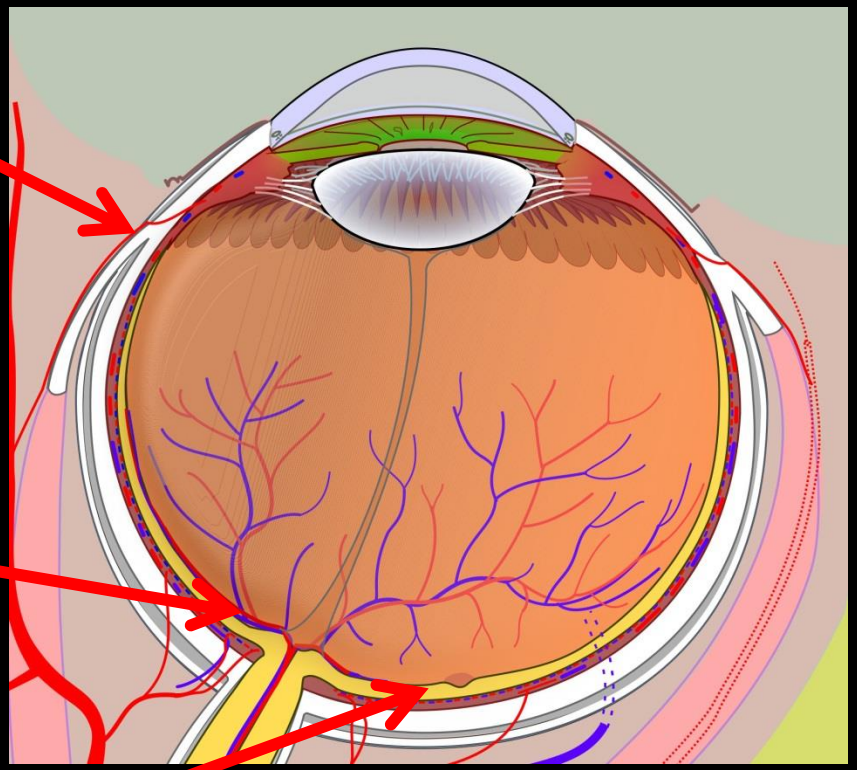




Vitreous Cavity is not a uniform structure
Comprised of canals, cisterns and bursae

Vitreous Attachments

Vitreous Base – Ring shaped area encircling ora serrata (2mm anterior and 4 mm posterior to it)



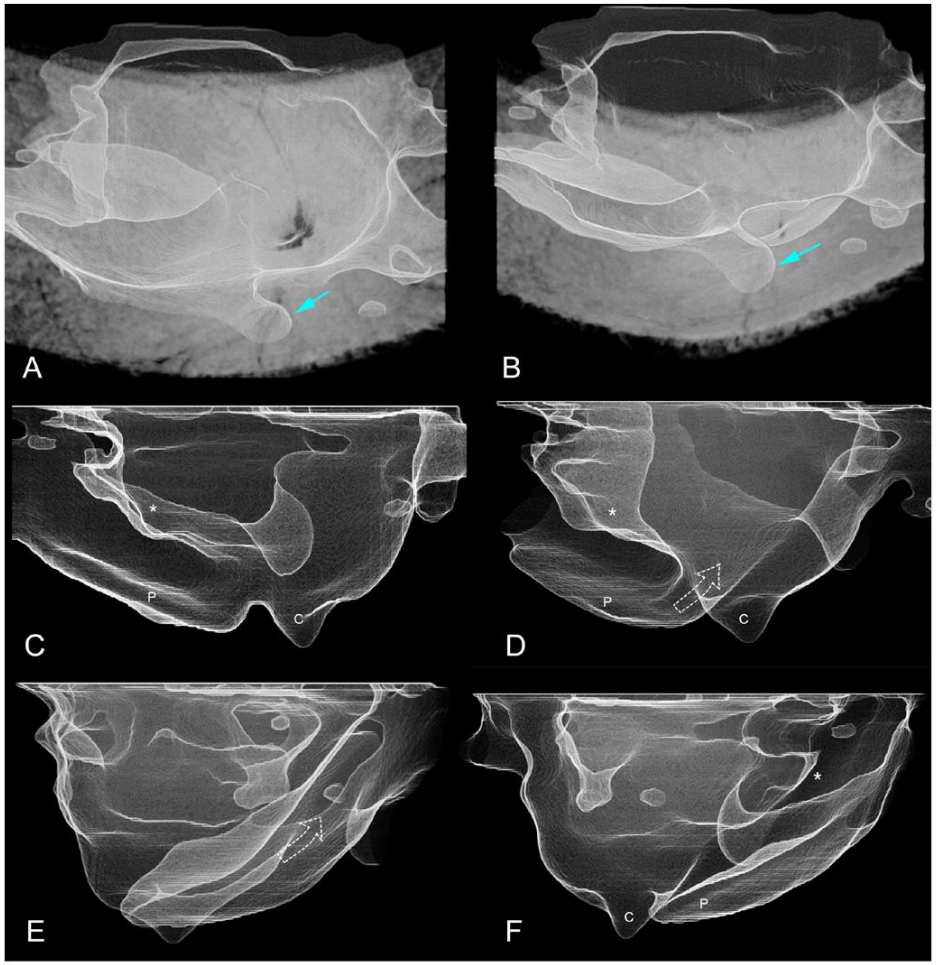
Peripheral margin of optic nerve head

Margin of fovea (perifovea)

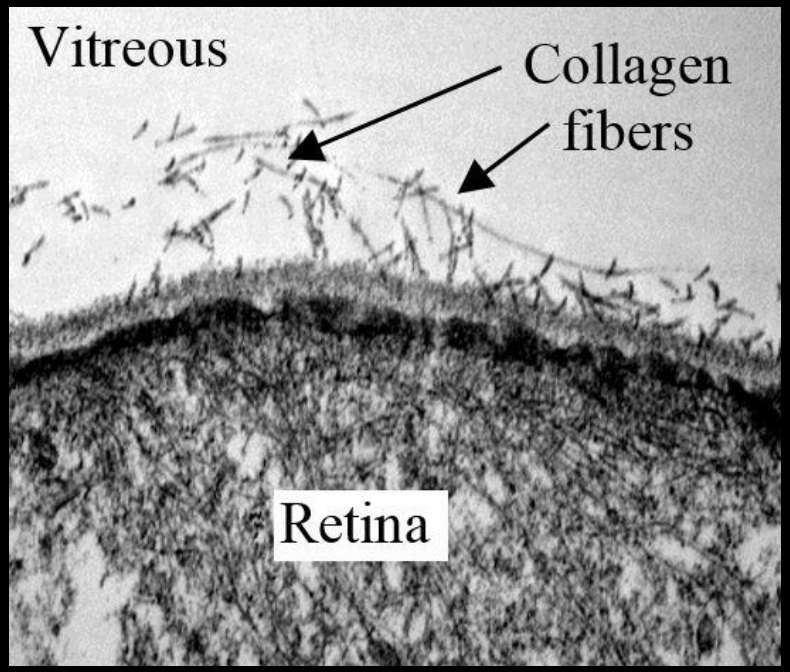
Determining posterior vitreous structure by analysis of images obtained by AI-based 3D segmentation and ultrawidefield optical coherence tomography

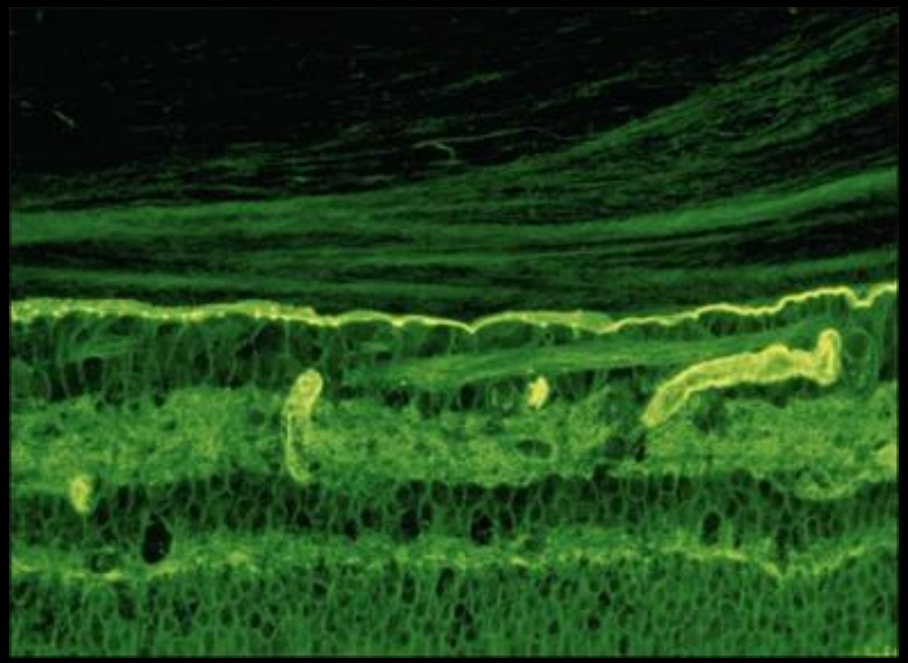
Kyoko Ohno-Matsui ,[1] Hiroyuki Takahashi,[1] Zaixing Mao ,[2] Noriko Nakao[1]

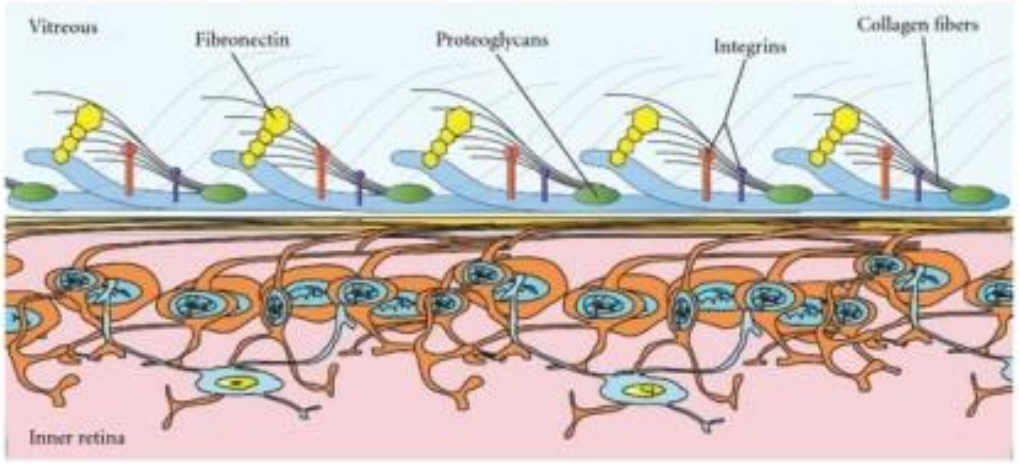
Clinical science



Histology of Vitreoretinal Interface

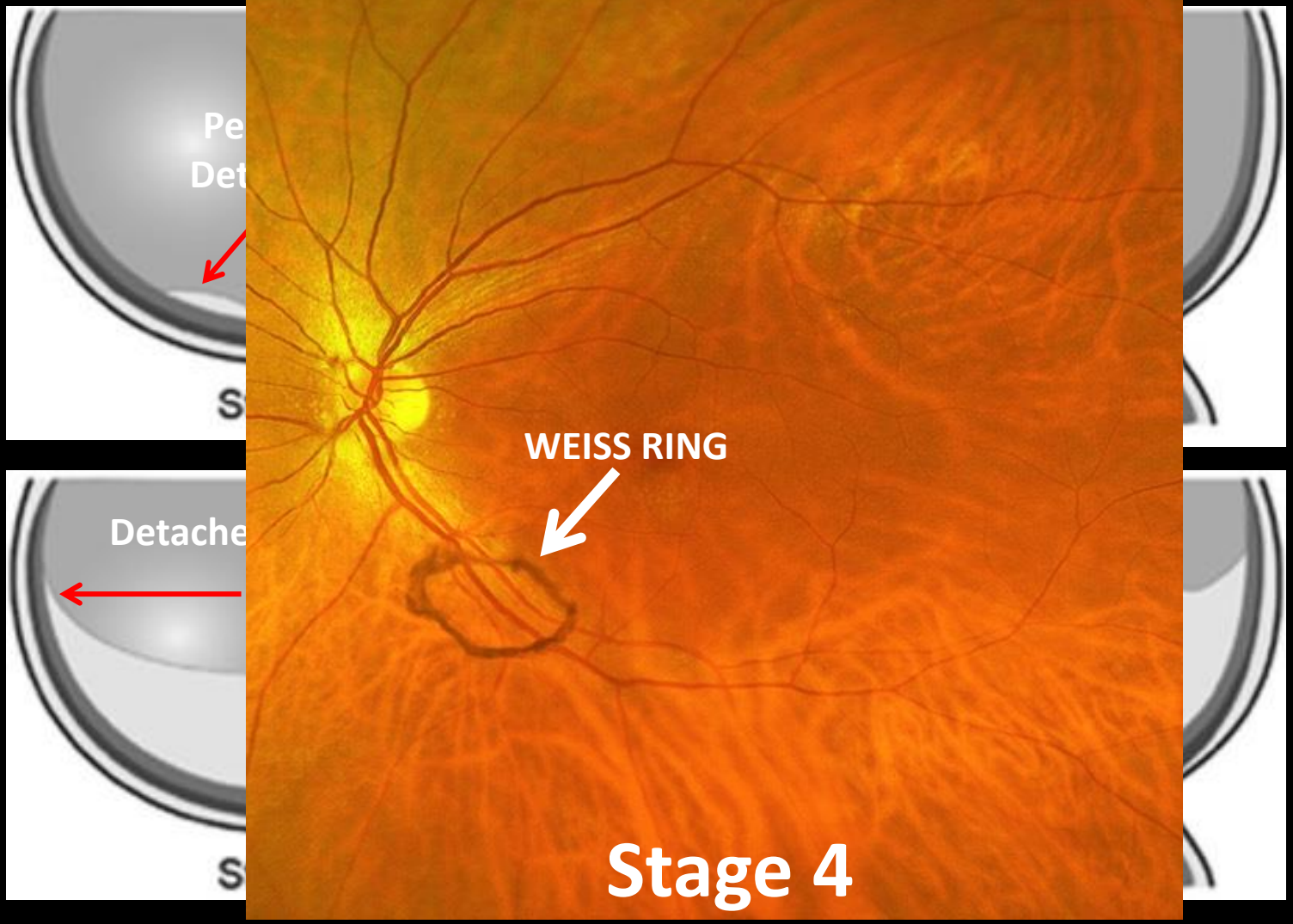






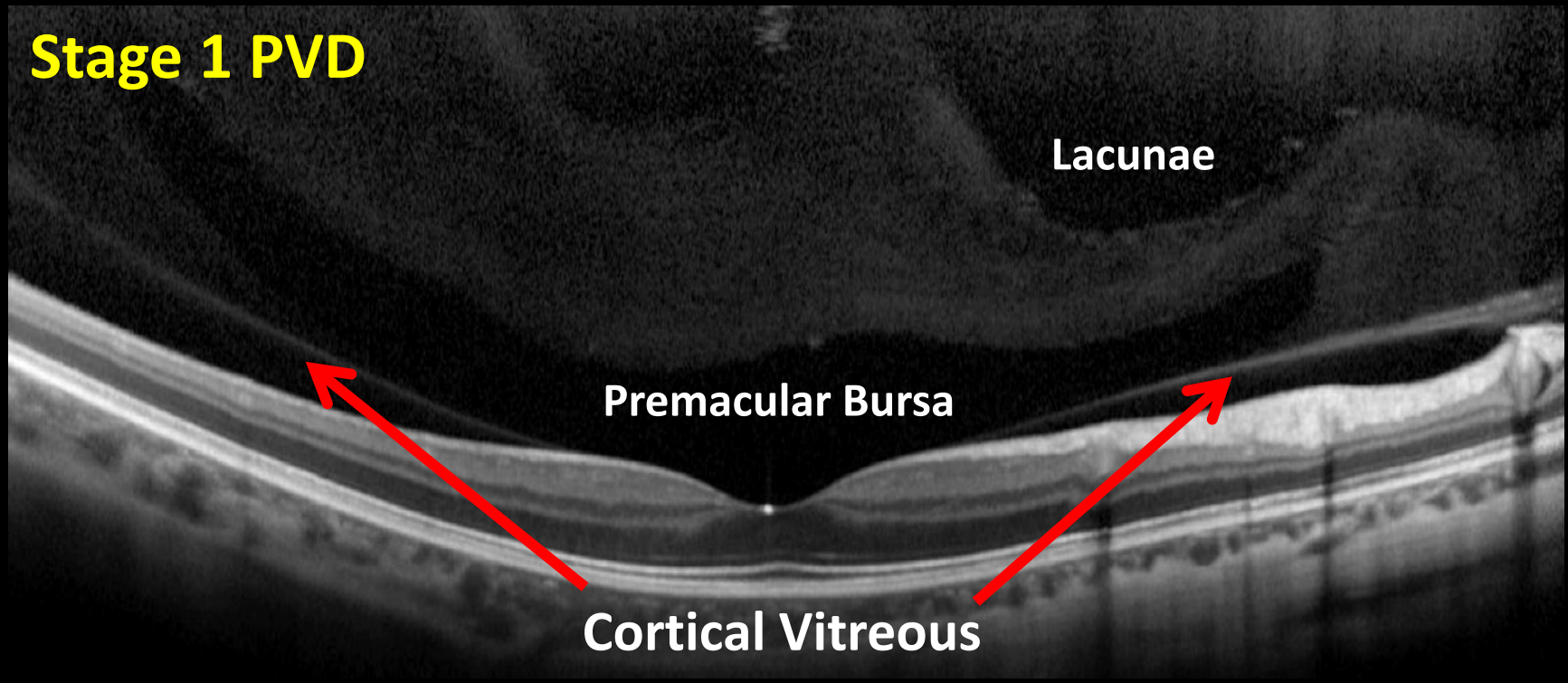
Collagen, laminin and fibronectin act as a glue that interface retina and vitreous

Vitreous Changes with Age



POSTERIOR VITREOUS DETACHMENT

Vitreous Imaging using OCT



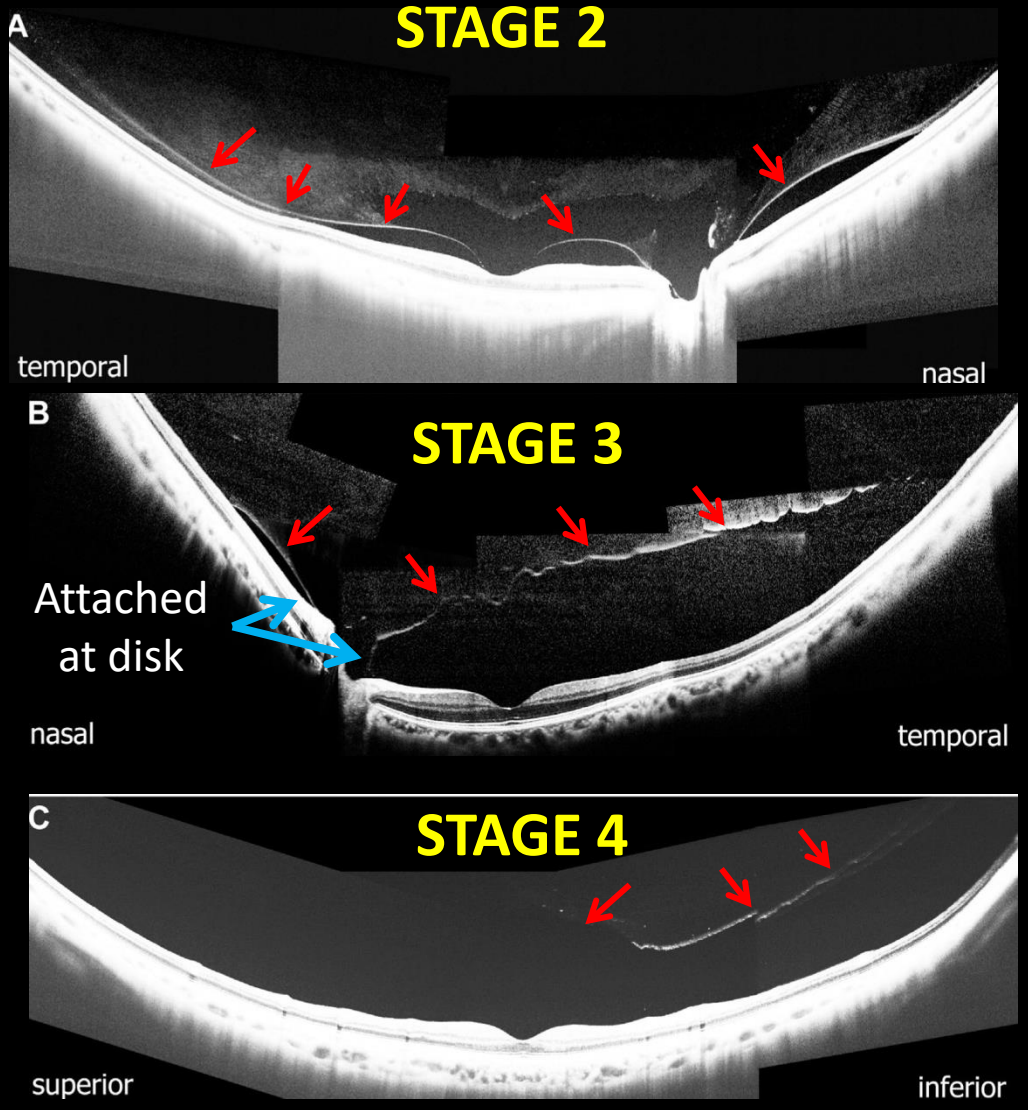
Optical Coherence Tomography

Axial resolution 4-6 microns

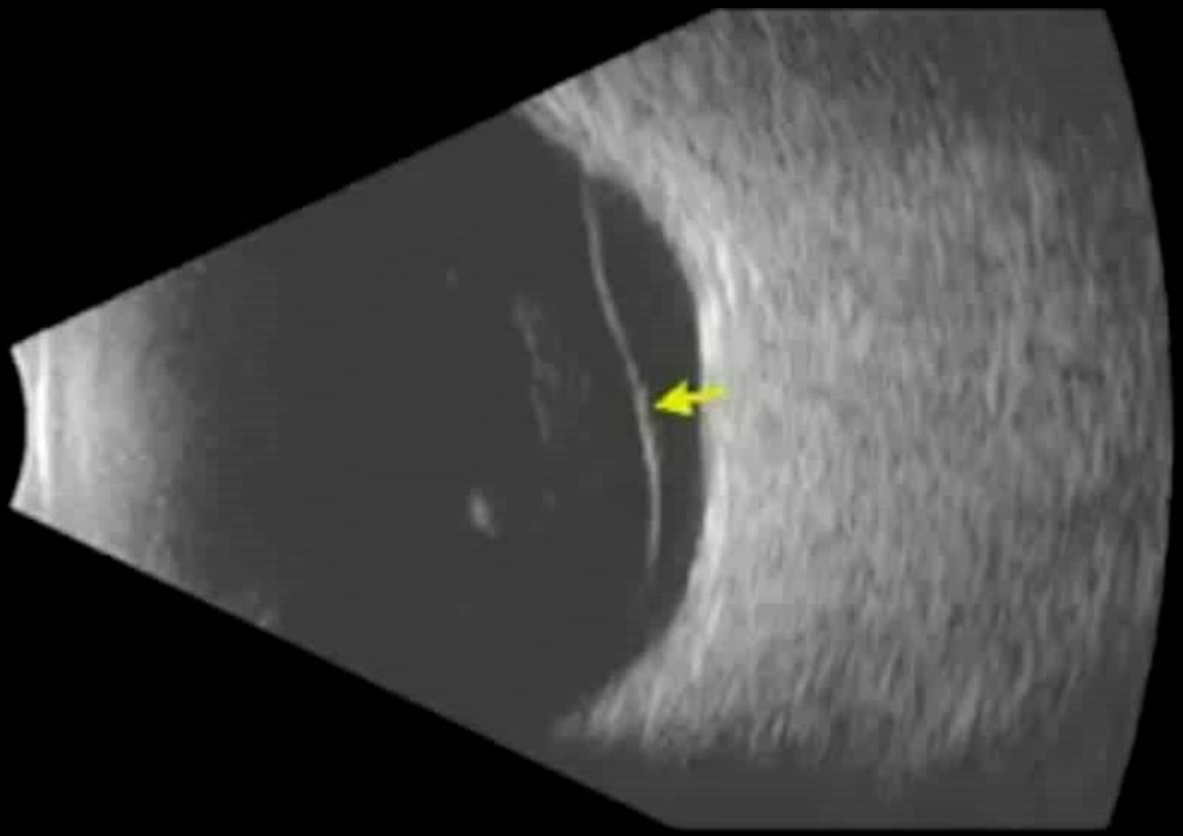
Posterior Vitreous Detachment

Epiretinal membrane
Vitreomacular traction syndrome
Macula Hole

Retinal tear
Vitreous haemorrhage
Retinal detachment



Vitreous Imaging using ultrasound



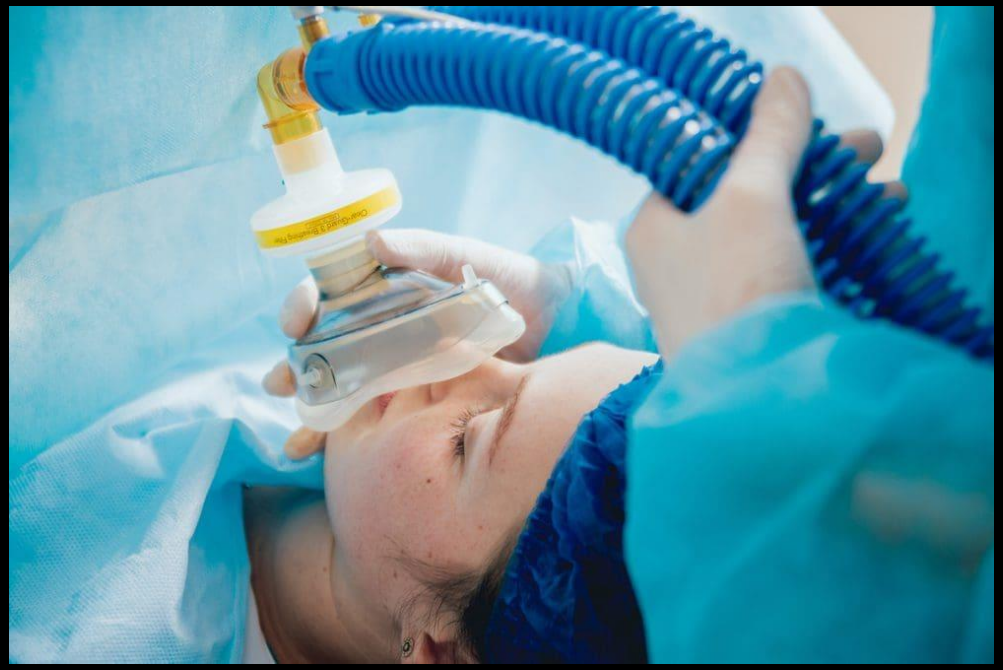
B-Scan Ultrasonography

Axial resolution 50 microns

Technical Aspects of Vitrectomy

Anaesthesia for Vitrectomy

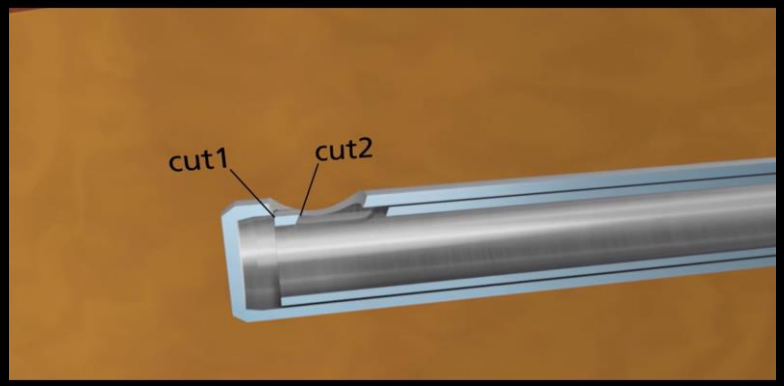
Local anaesthesia with sedation (90% of cases)
Peribulbar or Subtenon



General Anaesthesia
Reserved for long cases
Scleral buckle operations
Patient preference

Surgical time for most cases 30-40 minutes
Majority performed as day case – similar to cataract surgery

Vitrectomy – cut and aspirate



Remember - Vitreous is a semi-solid structure

If you aspirate vitreous without cutting you can induce a giant retinal tear

Vitrectomy

VITRECTOMY: A PARS PLANA APPROACH

ROBERT MACHEMER, MD

HELMUT BUETTNER, MD
BOTH BY INVITATION

EDWARD W. D. NORTON, MD

and

JEAN-MARIE PAREL
BY INVITATION
MIAMI, FLORIDA

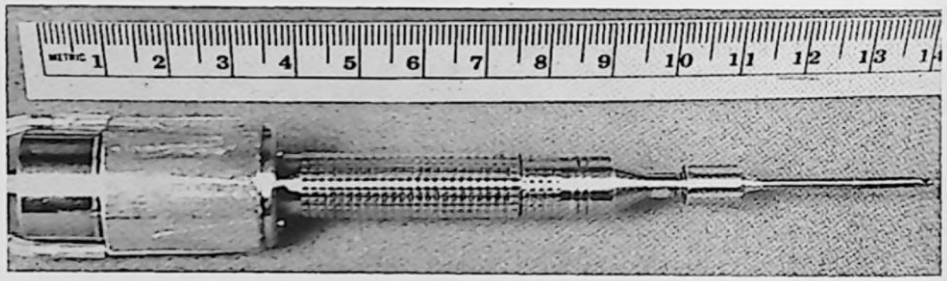
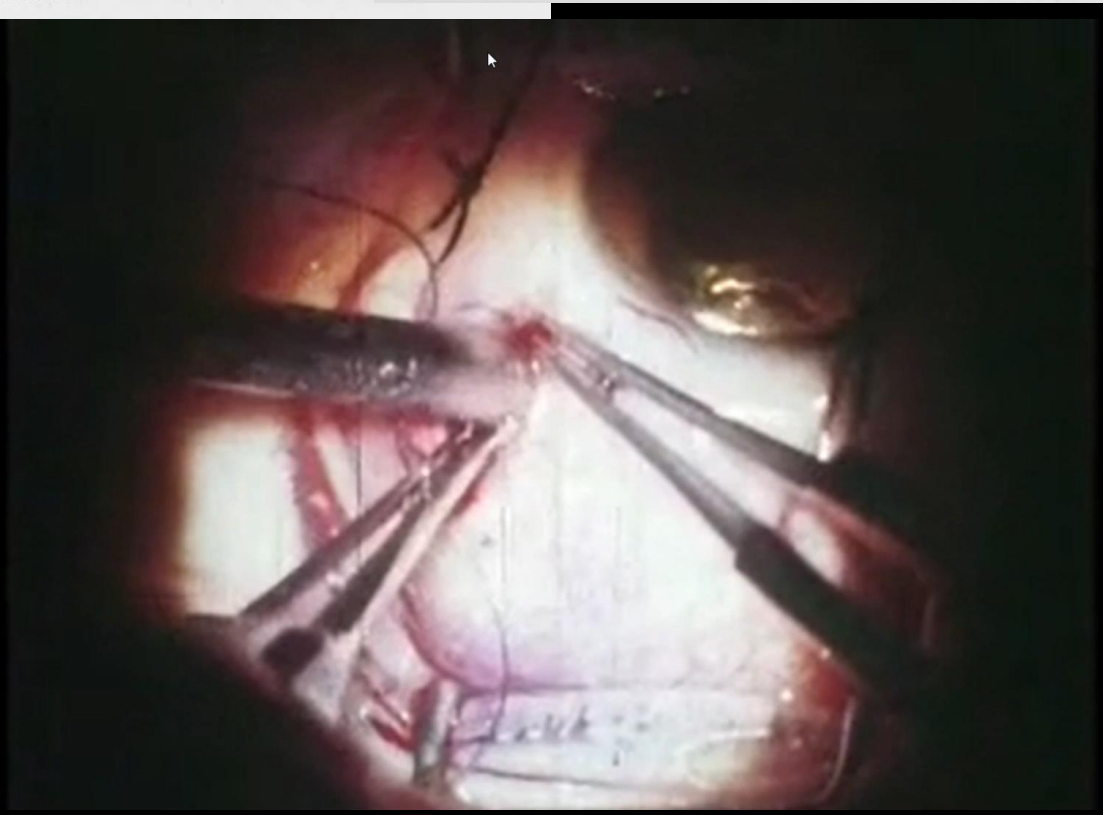


FIG 1—Vitreous infusion suction cutter with connections for suction, infusion and power supply visible on the left. Thick part contains micromotor which is attached to handle carrying removable tip.



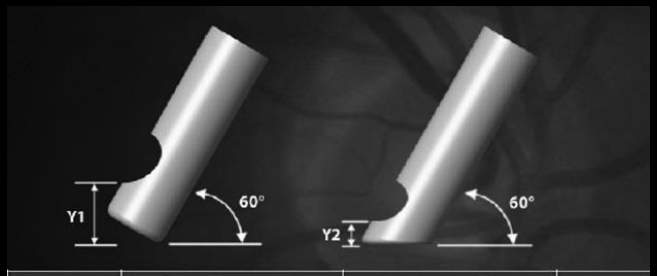
Original vitrectomy operation described in 1972

Vitrectomy in the early days

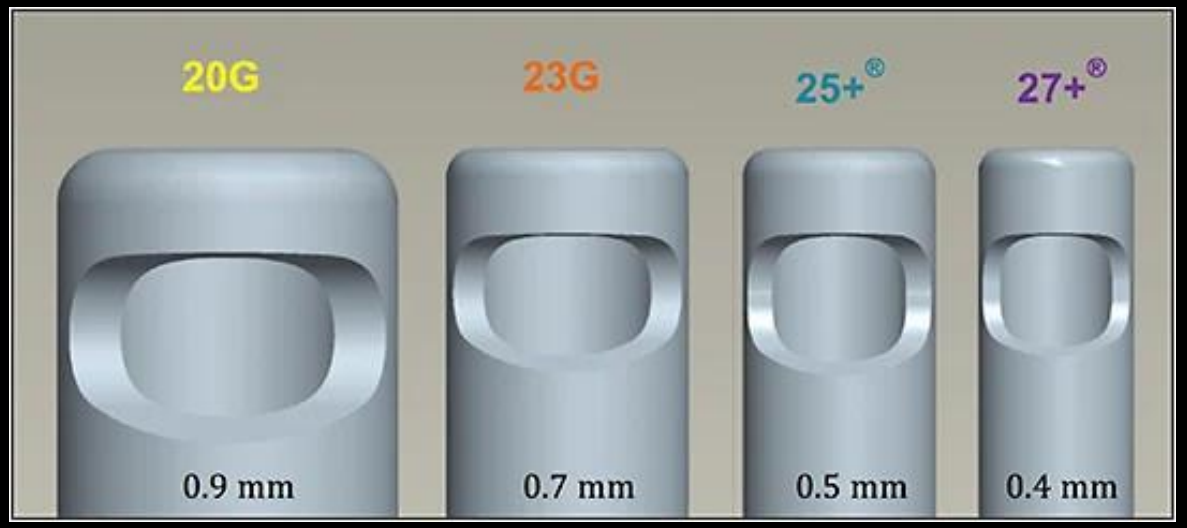
Giant Retinal Tear Surgery Using a Freeman/Schepens Inversion Table (mid 80's)

Transconjunctival Sutureless Vitrectomy

Facilitated by two major innovations

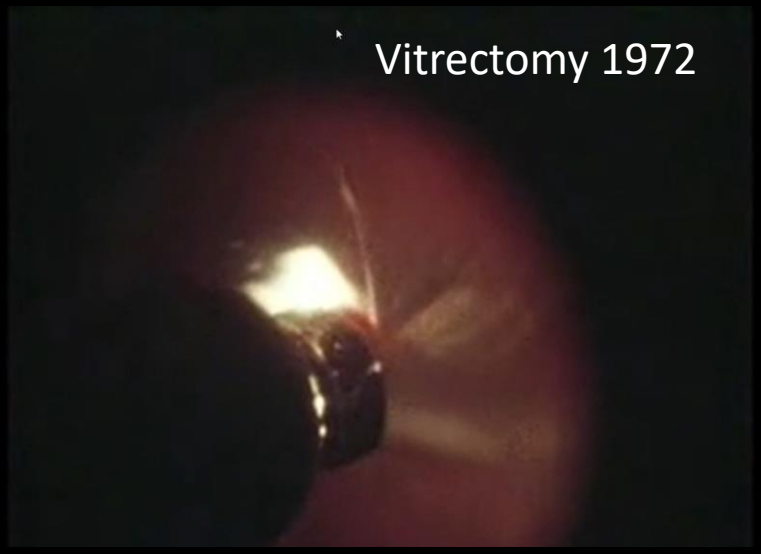


Probe	Y1 Dimension Standard Tip	Y2 Dimension Beveled Tip	% Δ
23G	.020 in	.009 in	55%
25+	.017 in	.009 in	47%
27+	.015 in	.009 in	40%

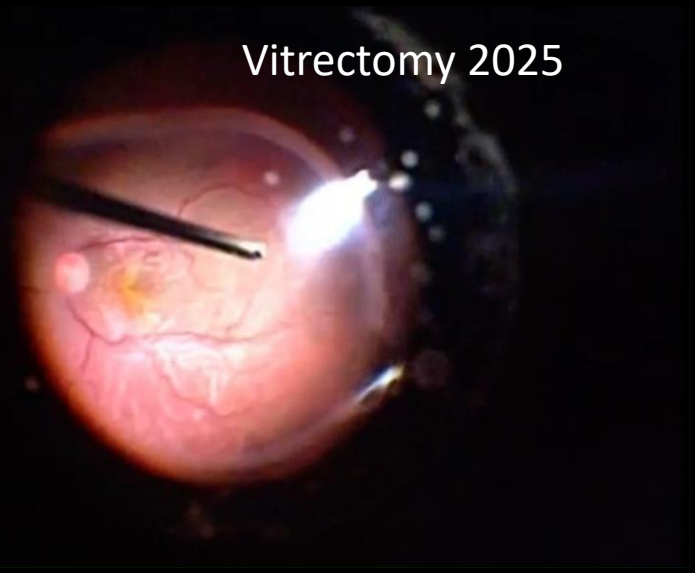


Microsurgical Instrumentation and machine fluidics

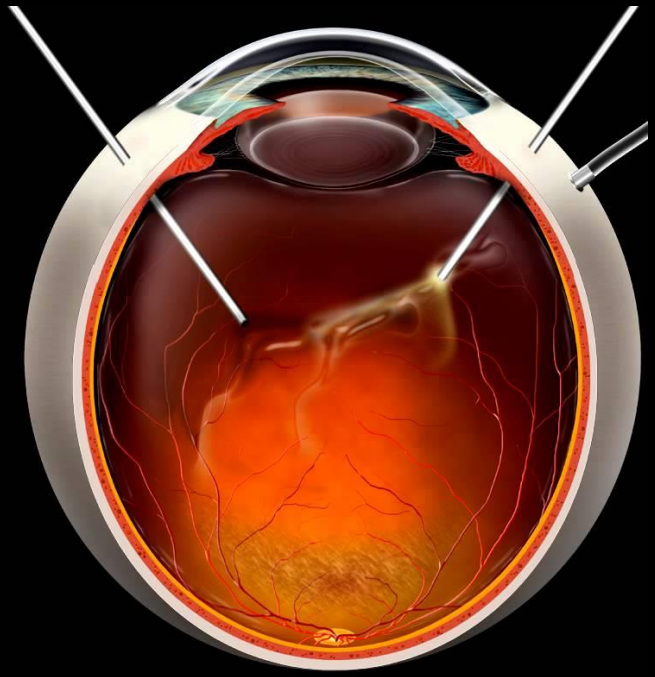
Transconjunctival Sutureless Vitrectomy

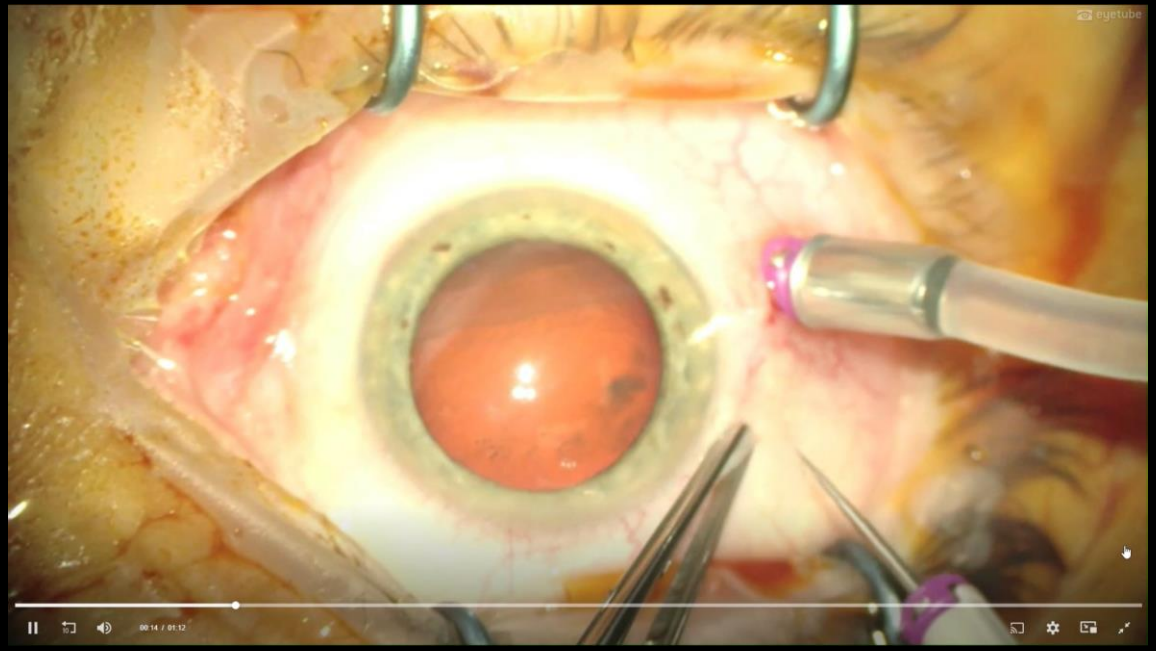


Widefield intraoperative viewing systems

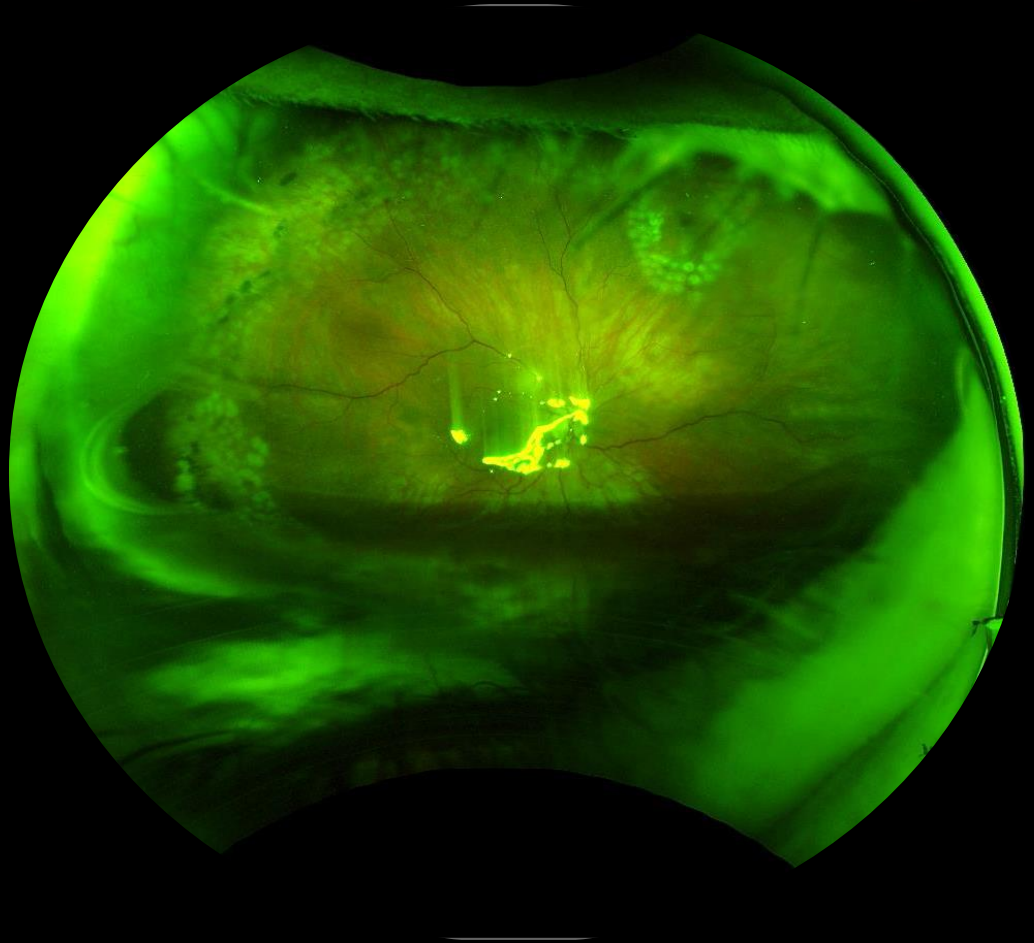


Transconjunctival Sutureless Vitrectomy





Post-Op Care - #1



Vitrectomy with Gas Tamponade

When vitreous is removed it is substituted with:

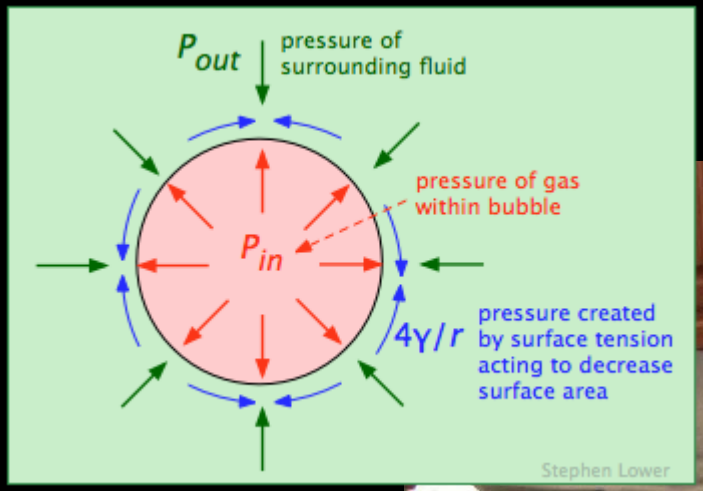
- Balanced Salt Solution - 1 week
- Gas – 2-8 weeks
- Silicone Oil – Until removal

The vision is poor during the acute period after surgery

Intraocular gas bubbles used in retinal surgery expand at high altitudes due to decreased cabin pressure (Boyle's Law), which can cause severe ocular hypertension and permanent vision loss.

Patients must not fly when gas is present in vitreous cavity

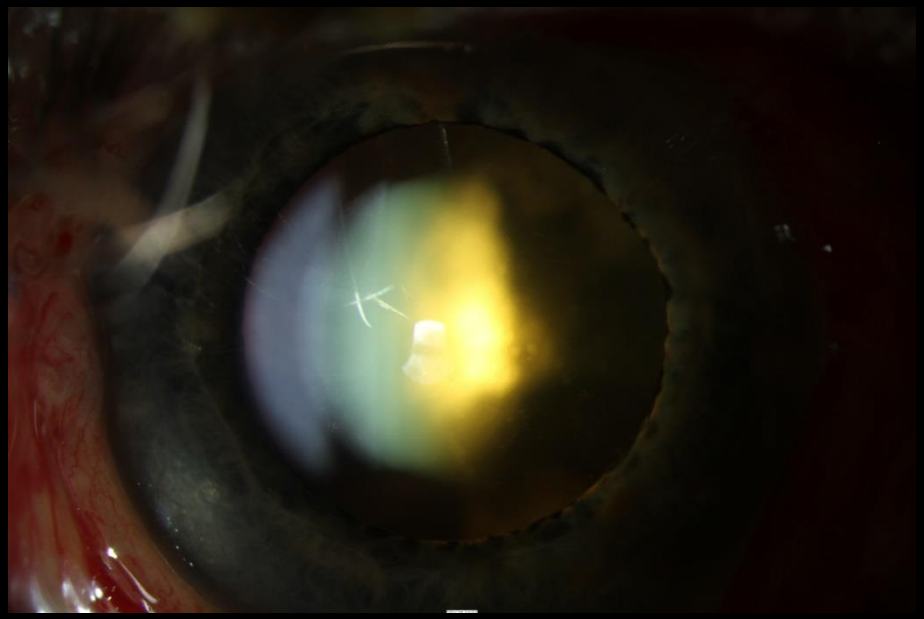
Post-Op Care - #2

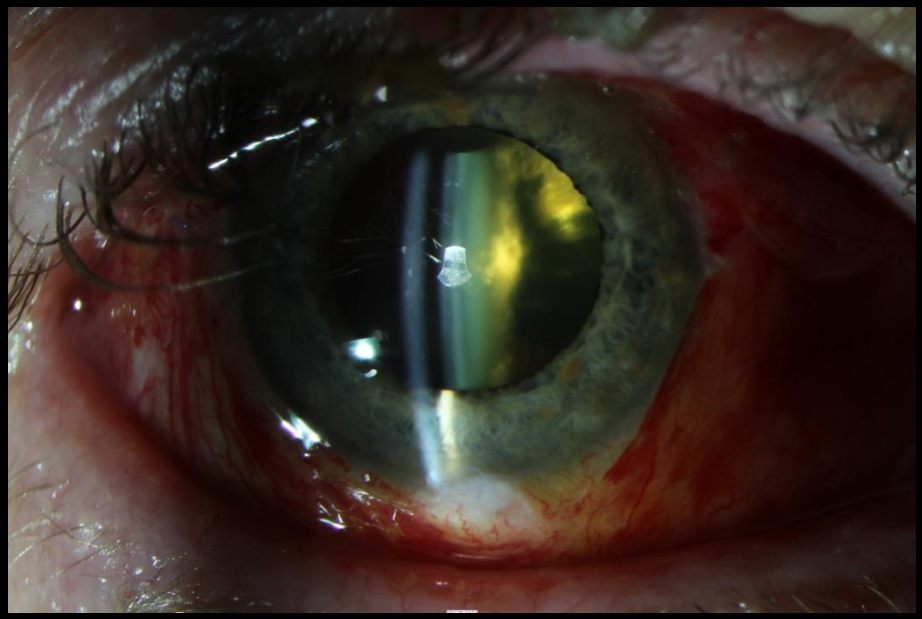


Face down posturing 1-3 days after retinal detachment and macula hole surgery

Post-Op Care - #3

Day 1 - Gas Cataract





USUALLY RESOLVES OVER 3 WEEKS.

Vitrectomy accelerates cataract development in ALL patients

Post-Op Care - #4

Eye drops for 4 weeks - Similar to cataract surgery.

Can resume normal activities within 1-2 weeks.

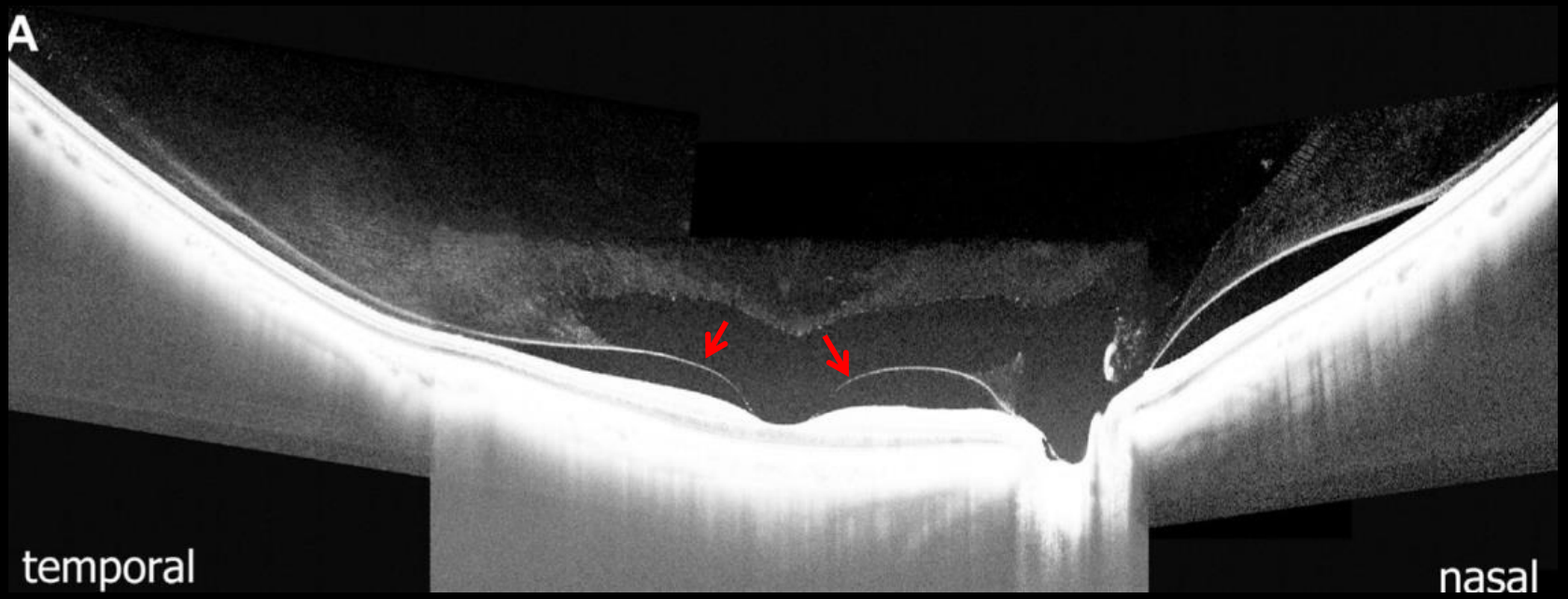
Surgical Diseases of the Macula

Macula Hole

Epiretinal membrane

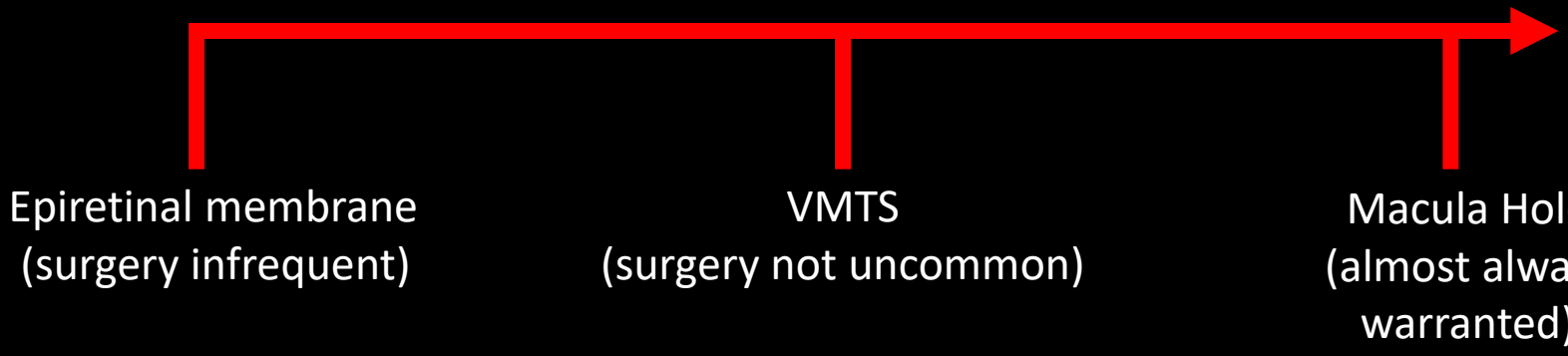
Vitreomacular traction syndrome

Surgical Diseases of the Macula



Due to anomalous stage 2 Posterior Vitreous Detachment

Surgical Diseases of the Macula

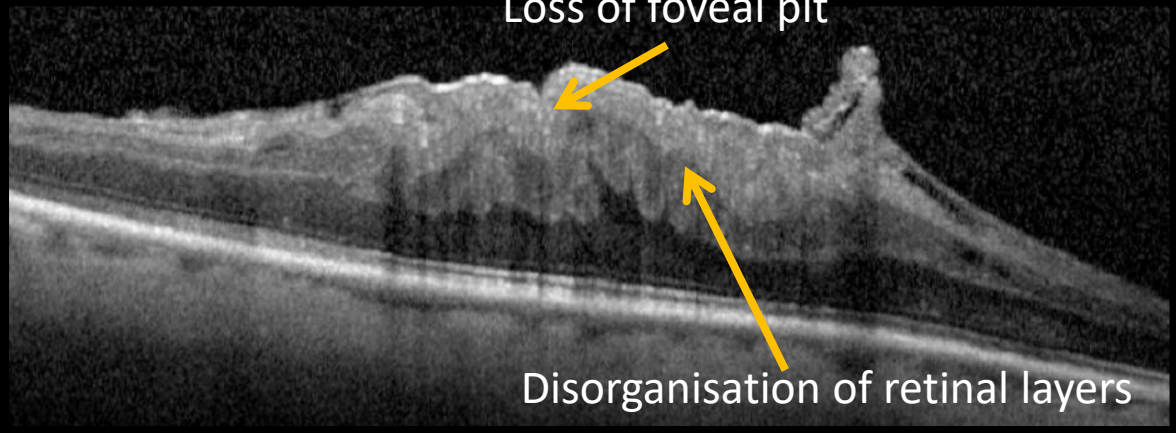


Think of these diseases as a spectrum

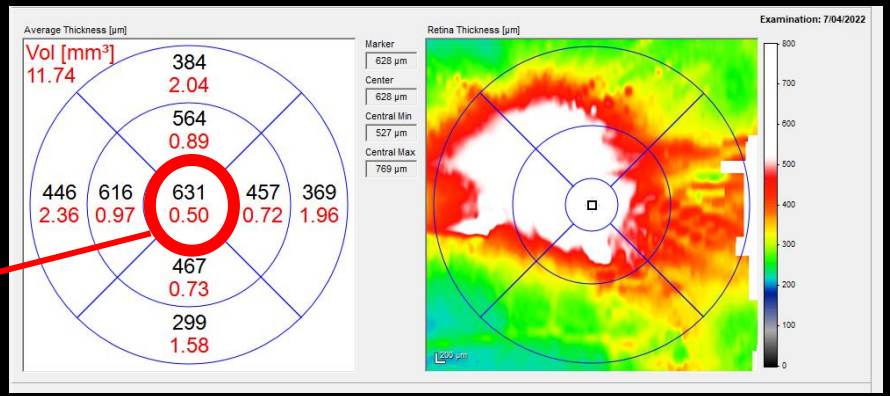
Epiretinal membrane

Extremely common – 5% cumulative incidence after age 50 years and 20% after age 75 years

Symptoms – reduced visual acuity, central visual blur, monocular diplopia and/or metamorphopsia.

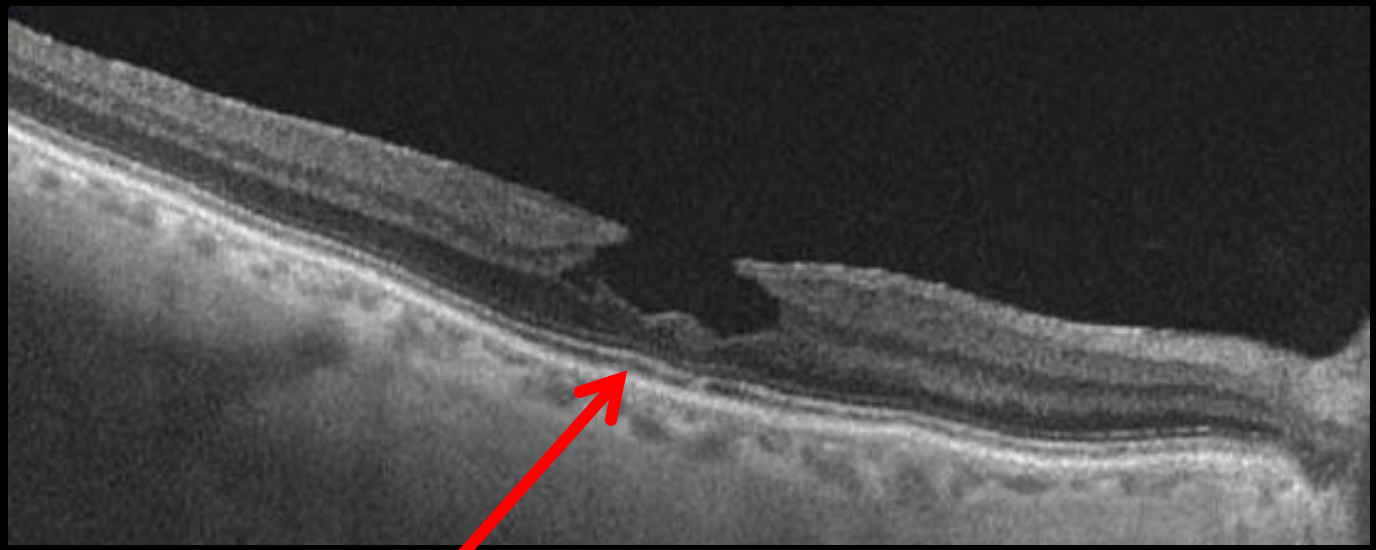


Increased Thickness Should be 250



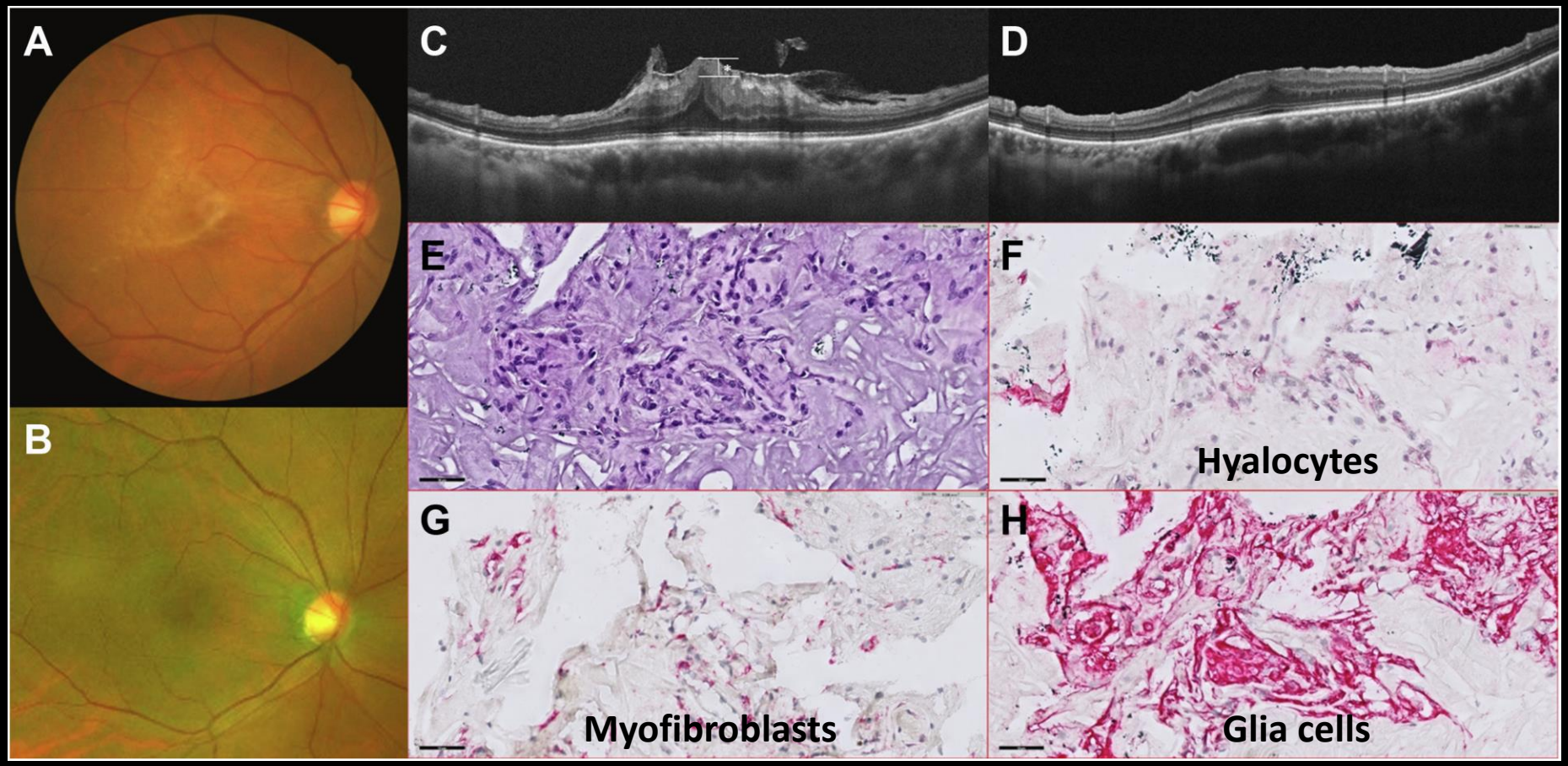
Lamellar Hole

Not a true hole. A Form of Epiretinal Membrane.



Inner Retinal Defect (NOT full-thickness)

Histology of Epiretinal Membrane



Ophthalmology 2022 1291421-1428DOI: (10.1016/j.ophtha.2022.06.040)

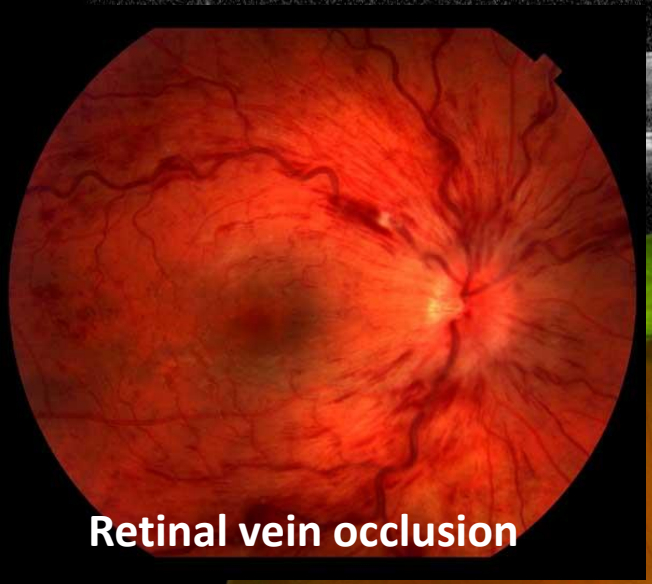
Mostly comprised of contractile elements from glia cells – relevance for understanding natural course

Epiretinal Membrane

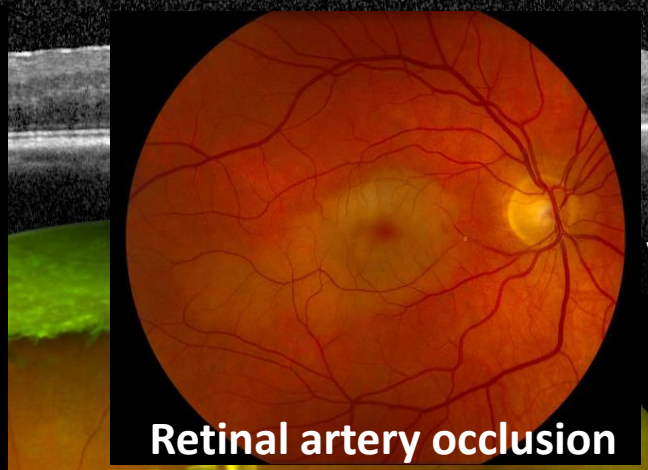
Always examine periphery (almost 8% associated with retinal tears)

Secondary Epiretinal Membranes are very common

Often due to retinal vascular diseases



Retinal vein occlusion

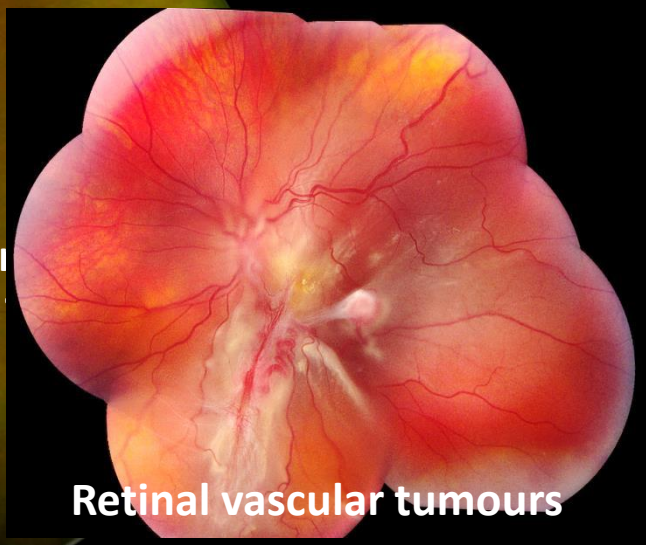


Retinal artery occlusion

VA – 6/7.5

Diabetic retinopathy

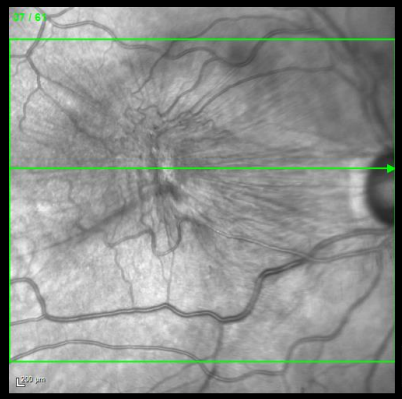
Hor

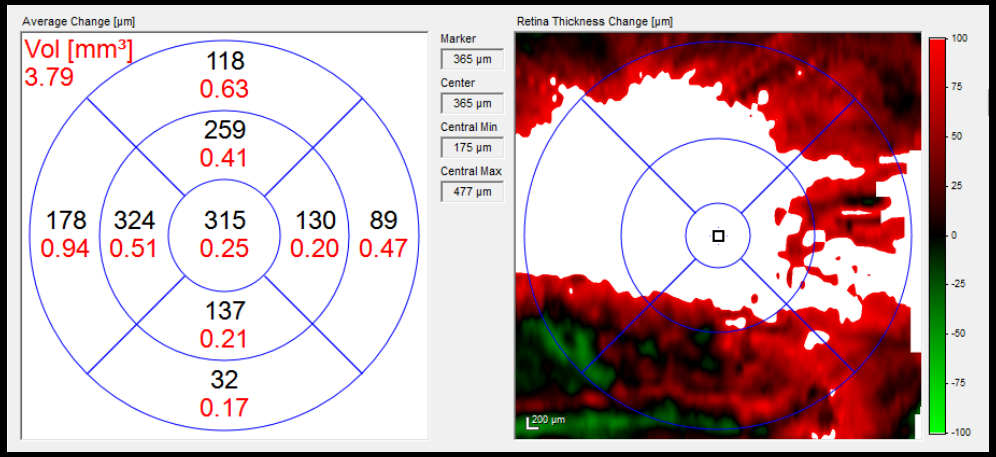


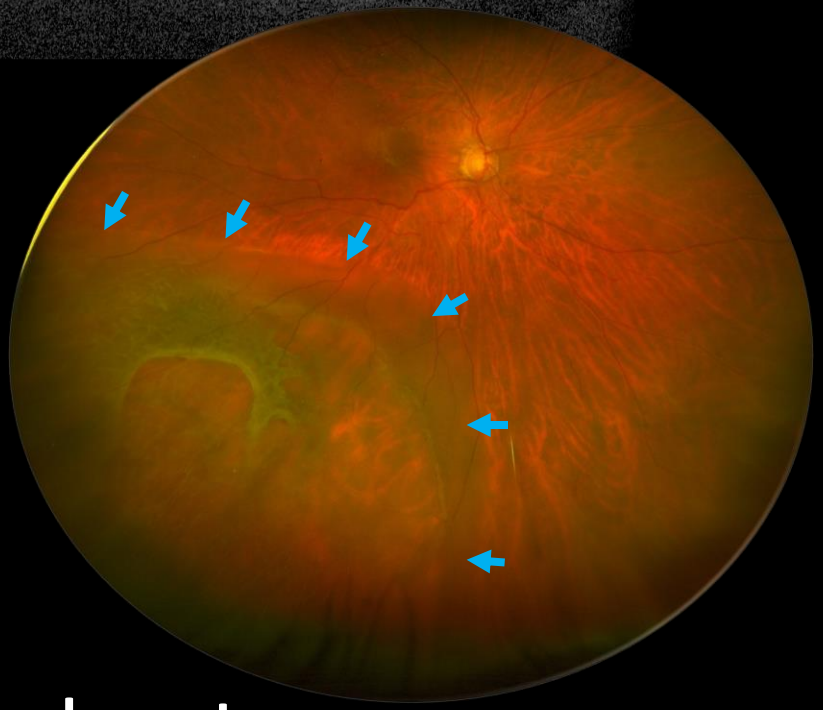
Retinal vascular tumours

Epiretinal Membrane

74 yo female
Poor vision right eye 6 months
VA – CF OD



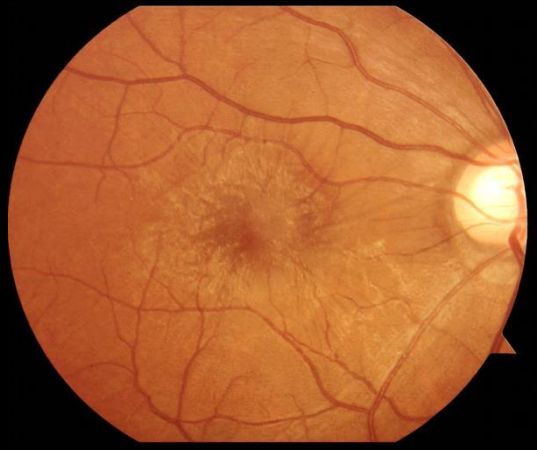


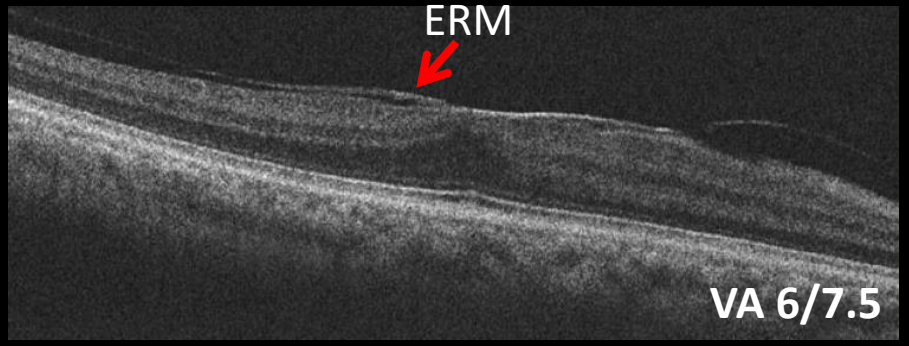


Can be secondary to a Retinal detachment

Management of Epiretinal membrane

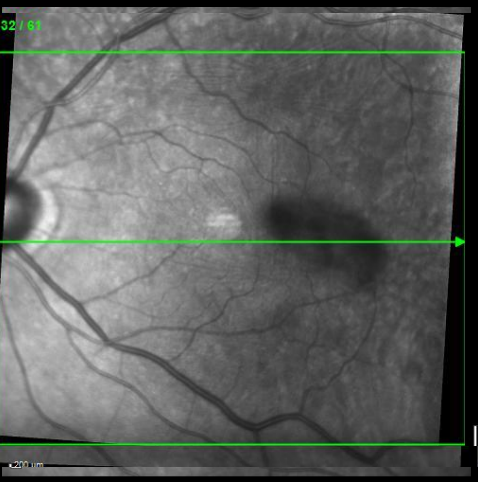
If Asymptomatic and good vision no treatment required but <u>observe every 6-12 months initially</u>.

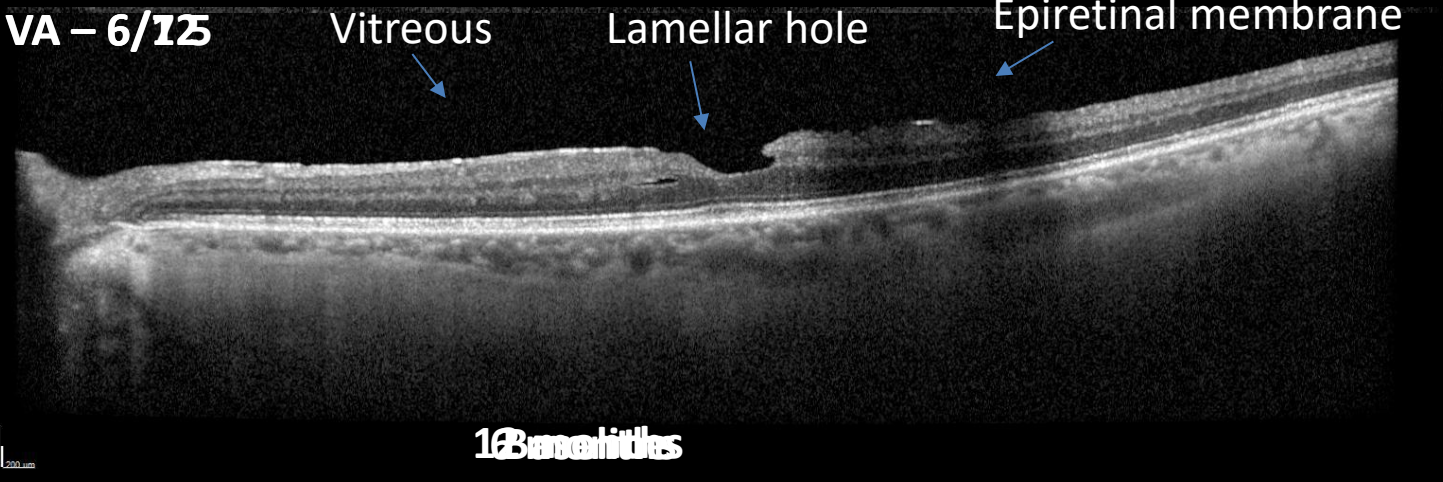




Most epiretinal membranes can be safely monitored and won't require surgery.

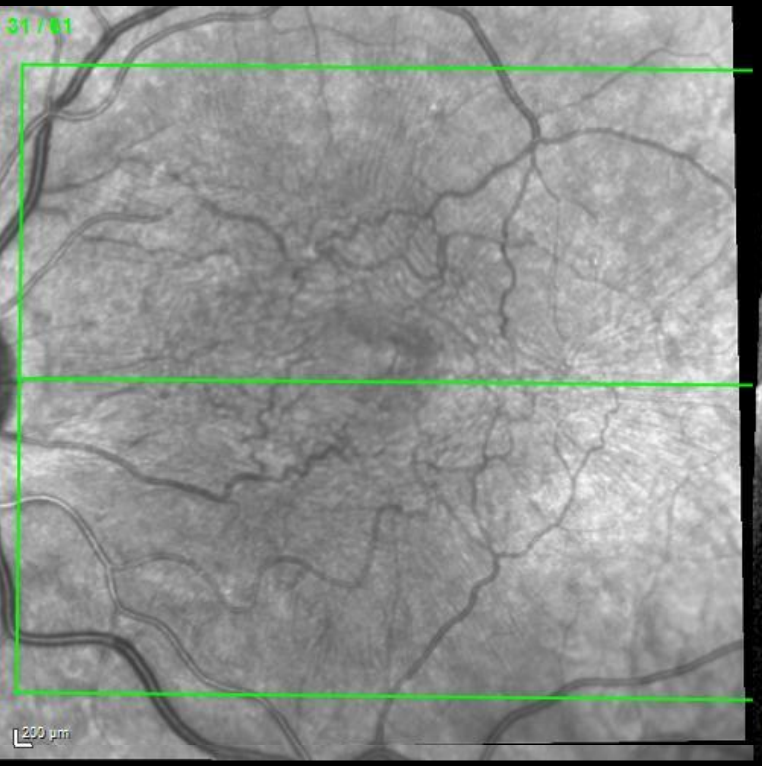
Epiretinal Membrane

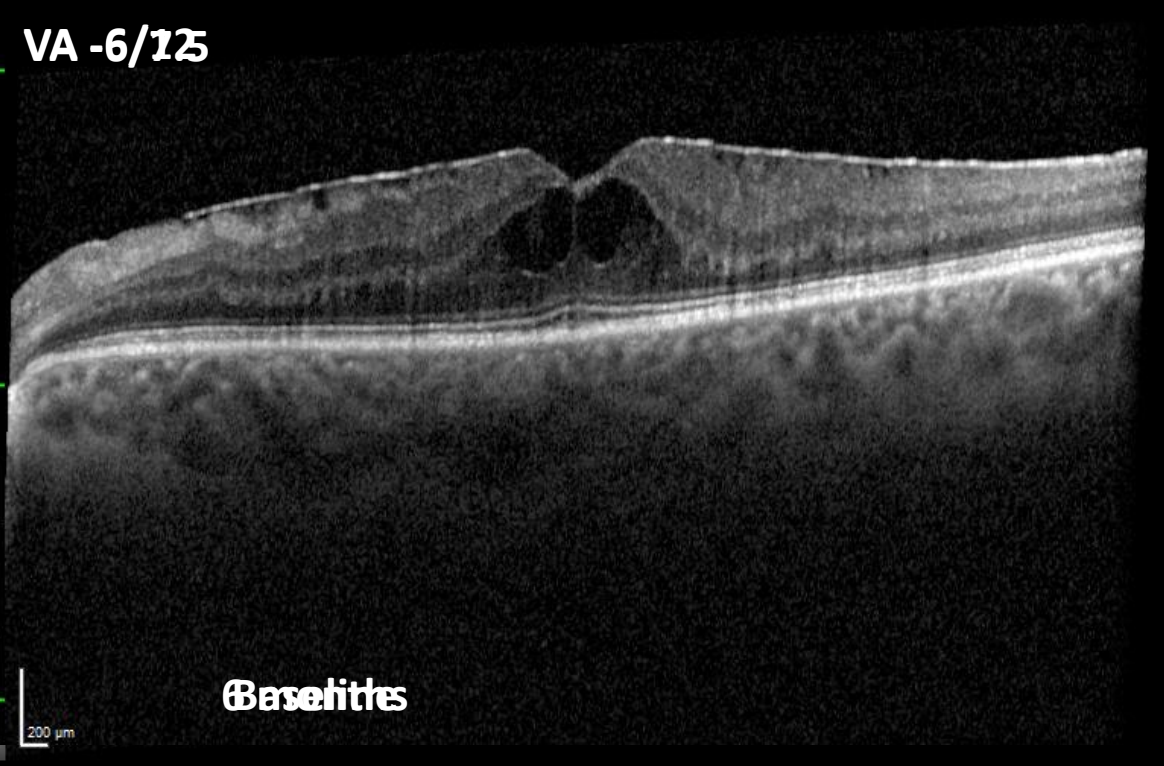




Can resolve (sometimes) without treatment

Epiretinal membrane





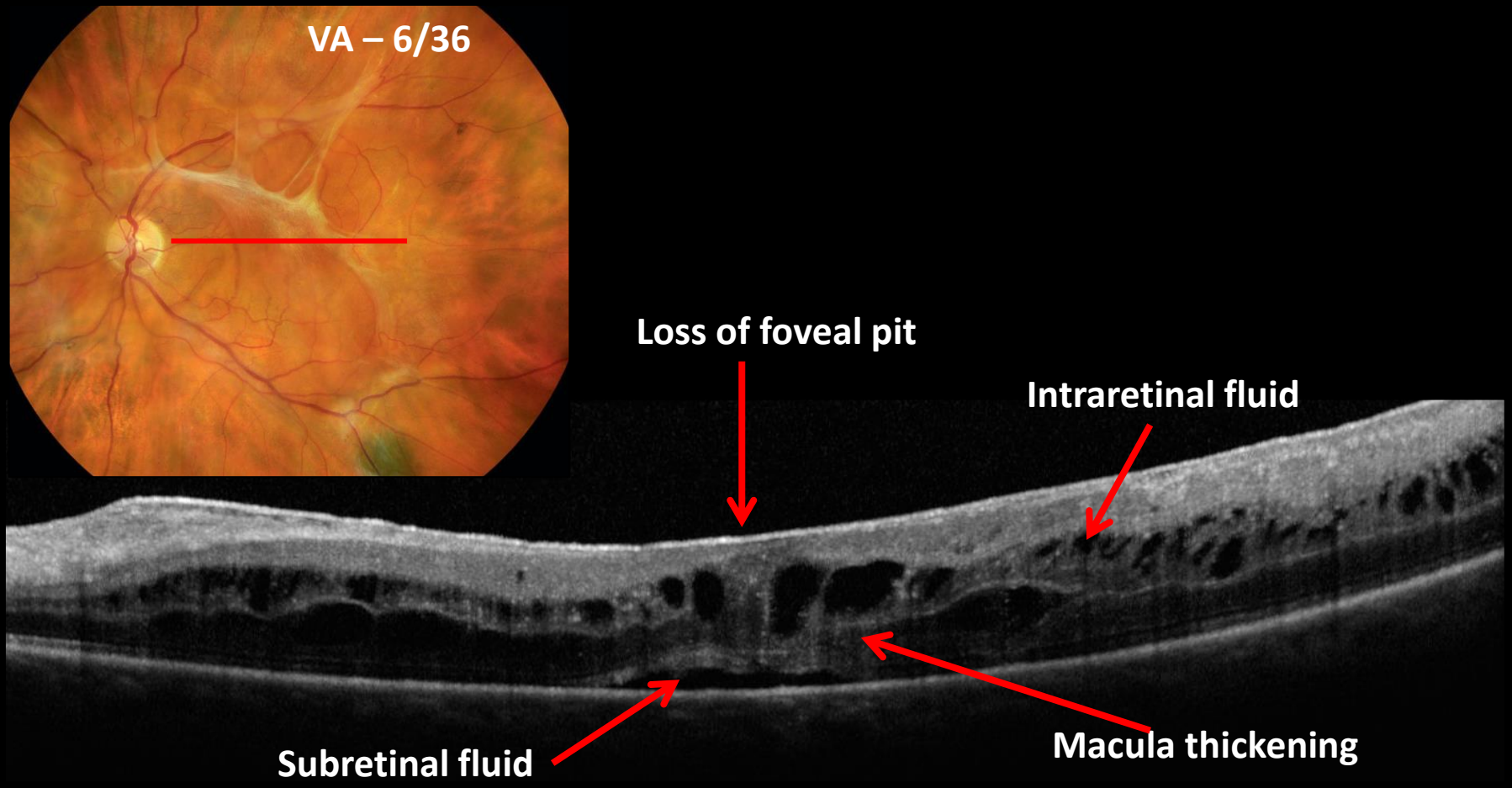
Can contract over time

(Remember they are comprised of glia cells with contractile properties)

Epiretinal membrane

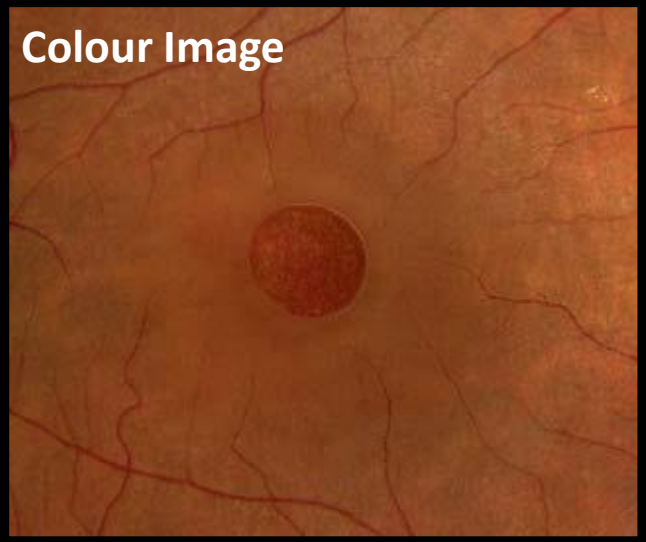
Management

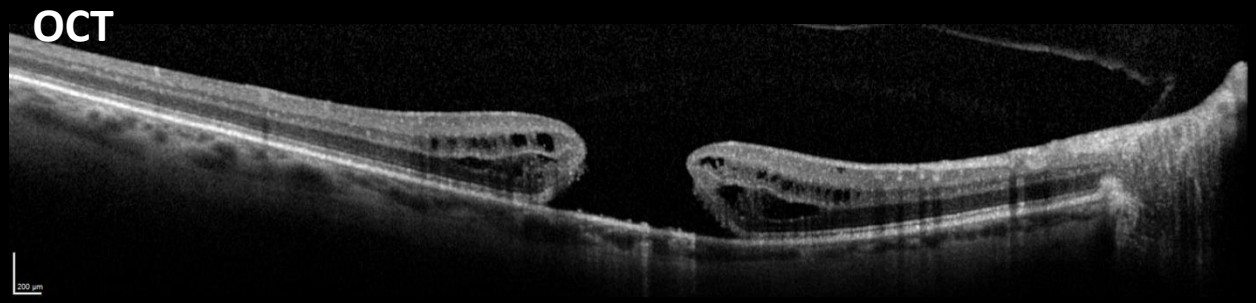
If Symptomatic and poor vision <u>vitrectomy</u> indicated



Full Thickness Macular Holes

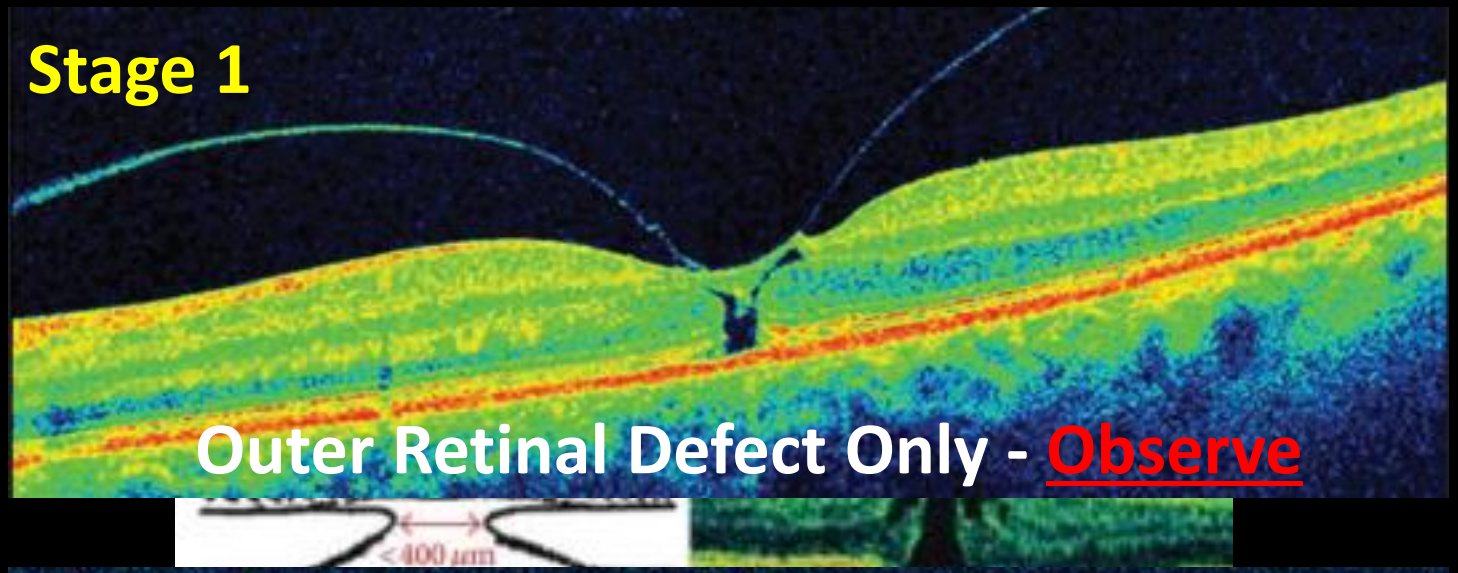
Defect of all retinal layers from the internal limiting membrane to the retinal pigment epithelium





Refer to be seen within 2-4 weeks – almost always require surgery

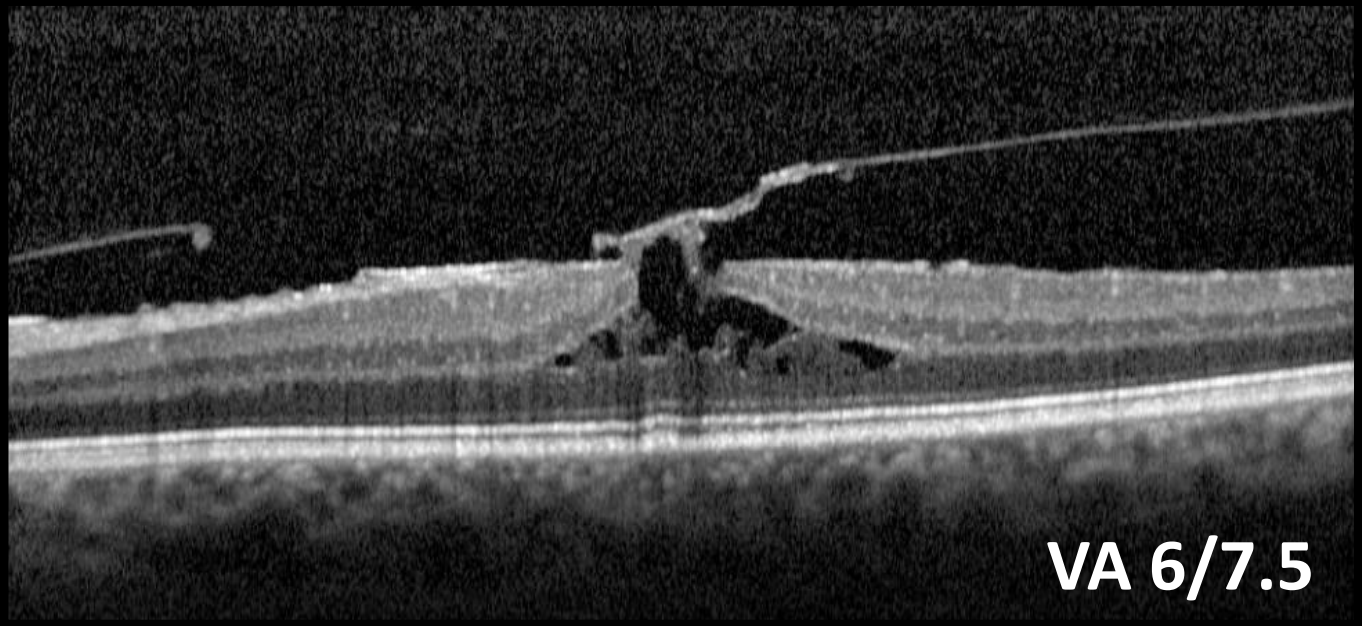
Macular Holes



Vitreomacular Traction Syndrome

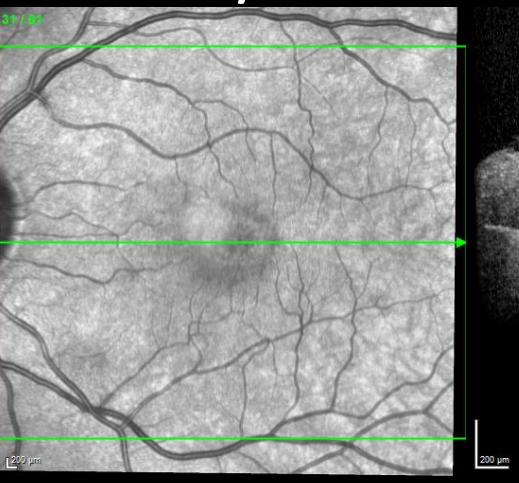
Management

If Asymptomatic and good vision no treatment required but observe every 3 months initially.



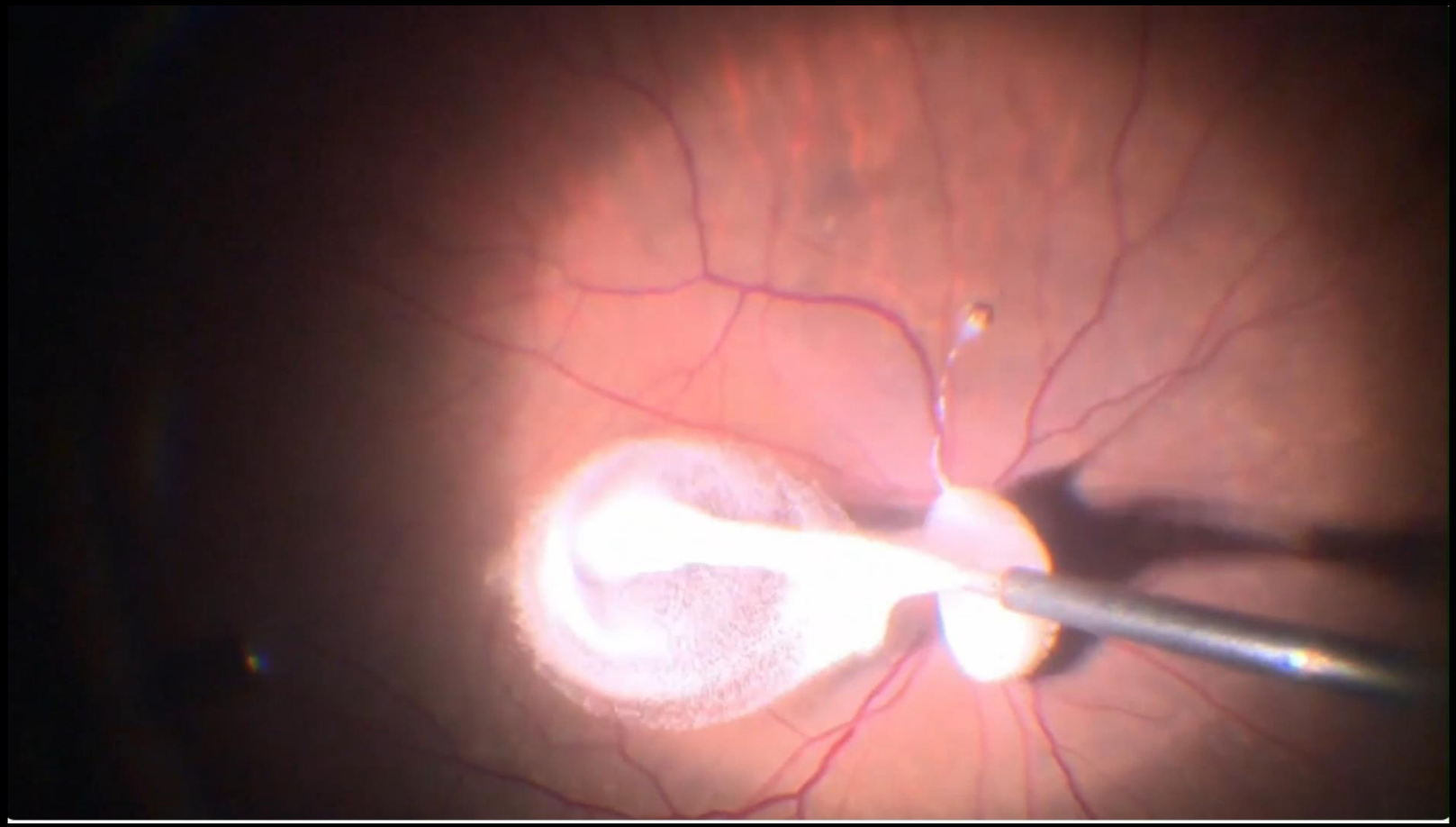
Vitreomacular Traction Syndrome

VA – 6/36

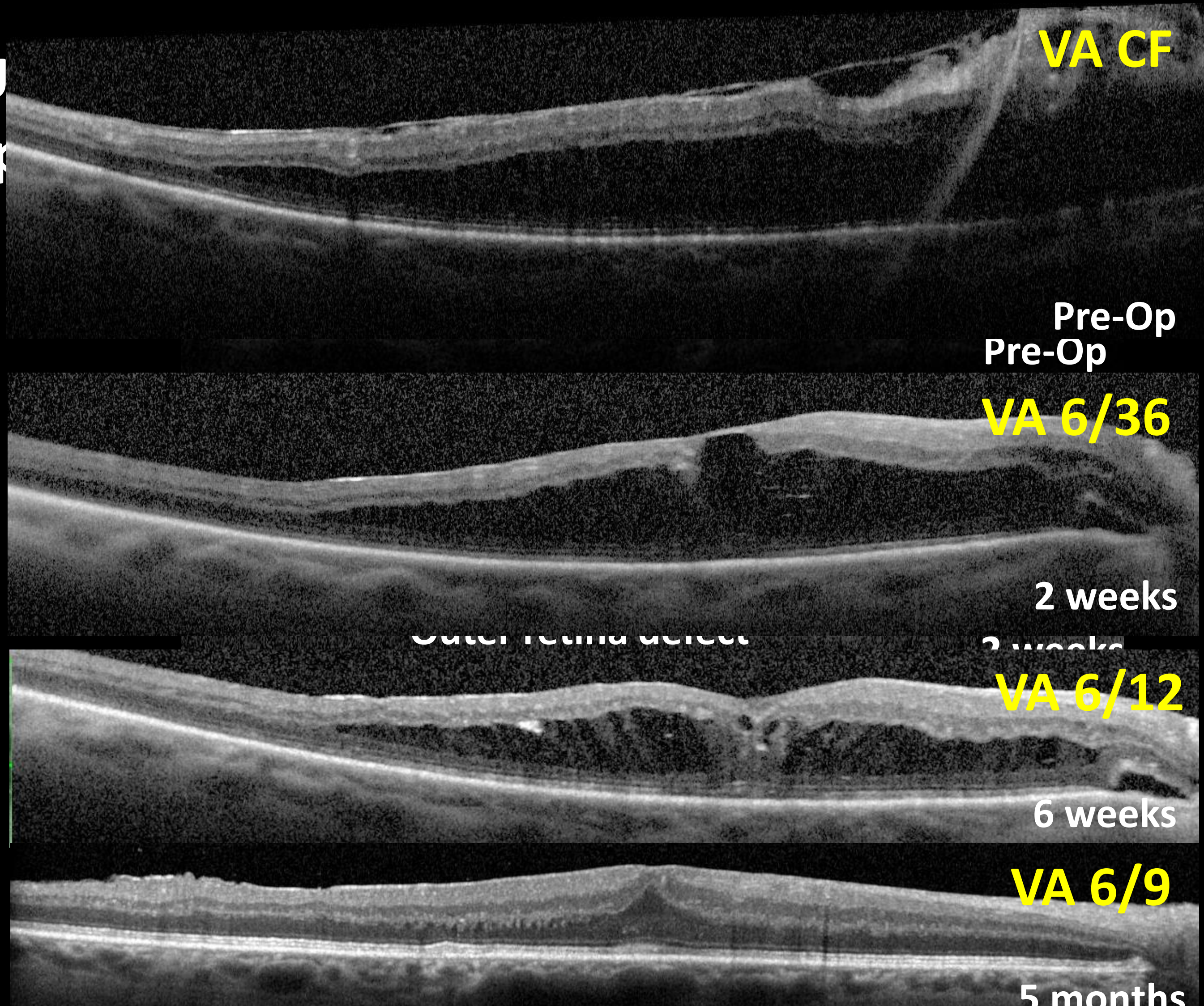


Monitor for progressive vitreomacular traction and formation of a macula hole

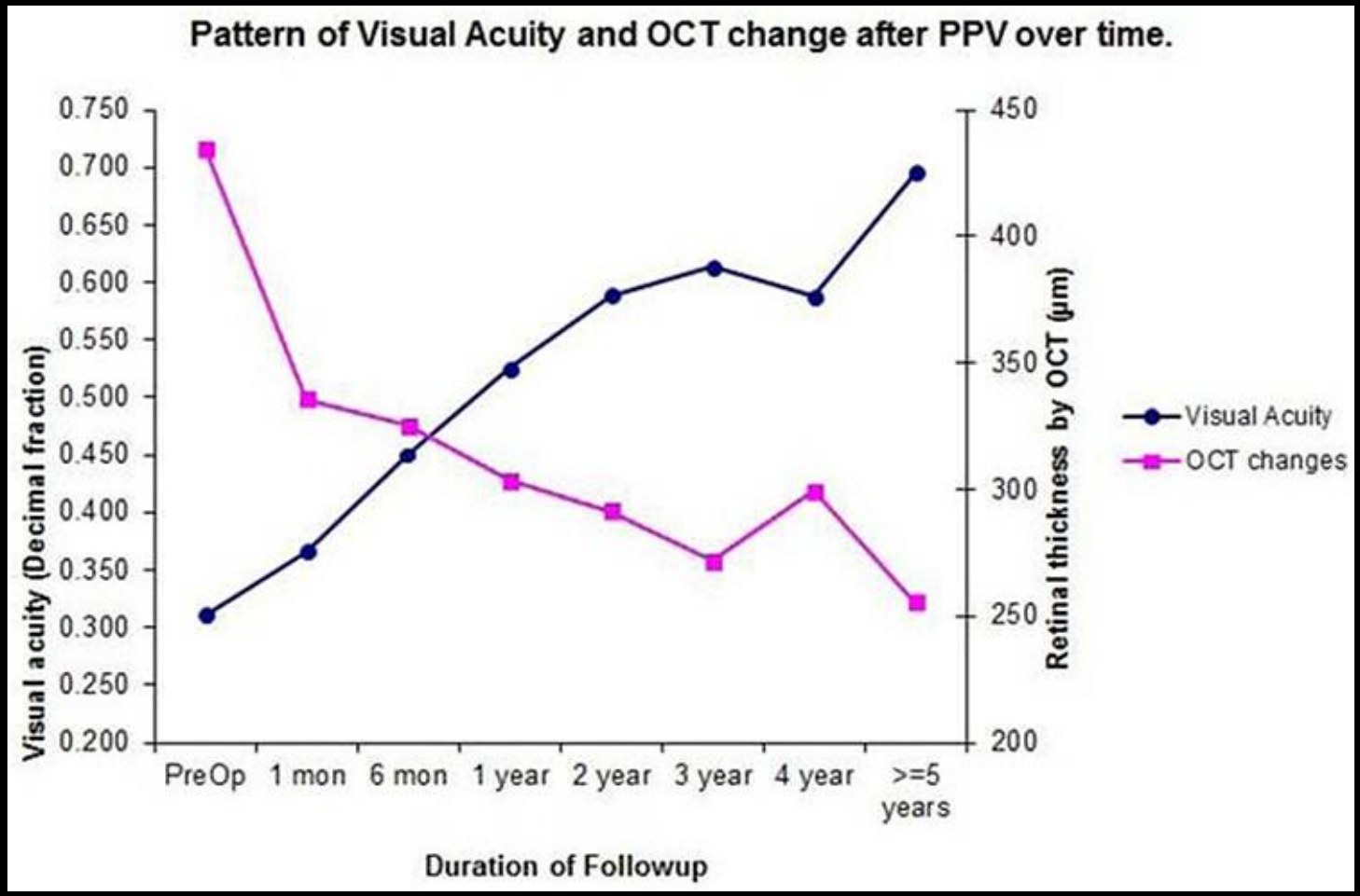
Macular hole, ERM and VMTS and repaired using a similar operation



Post-vitrectomy change following macular surgery



Vision and macular thickness changes post-vitrectomy



(2023). *Clinical Ophthalmology*, *17*, 693–700. https://doi.org/10.2147/OPTH.S401017

Surgical macular diseases (summary)

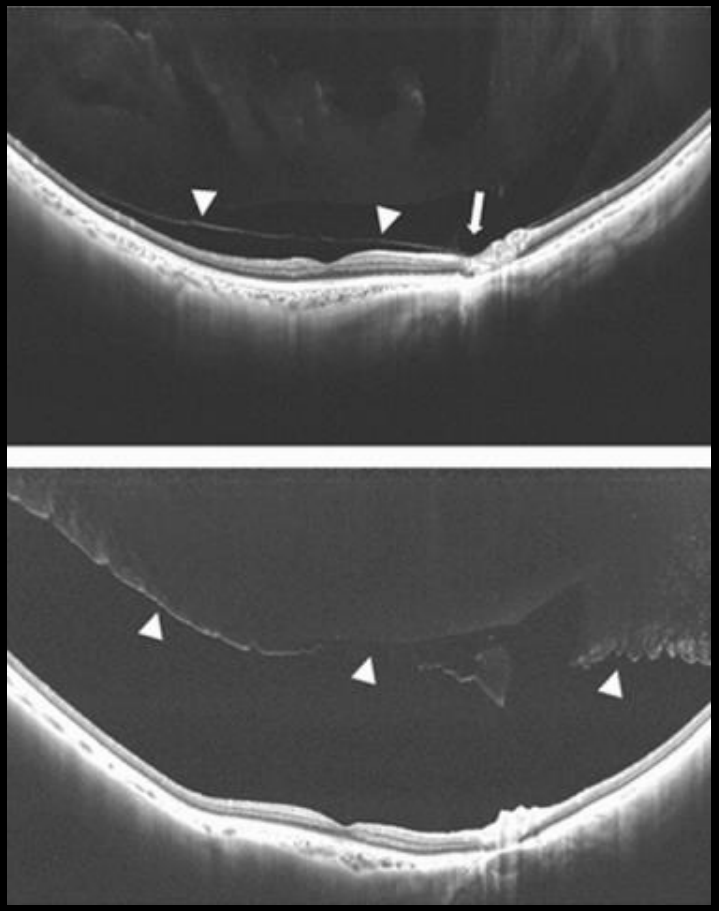
- All macular holes require referral within 4 weeks for consideration for surgery

- ERM and VMTS that are asymptomatic can be observed but check retina carefully for tears, retinal detachment and secondary retina diseases

- Contraction of ERM and VMTS over time should be referred within 2 months for surgical assessment.

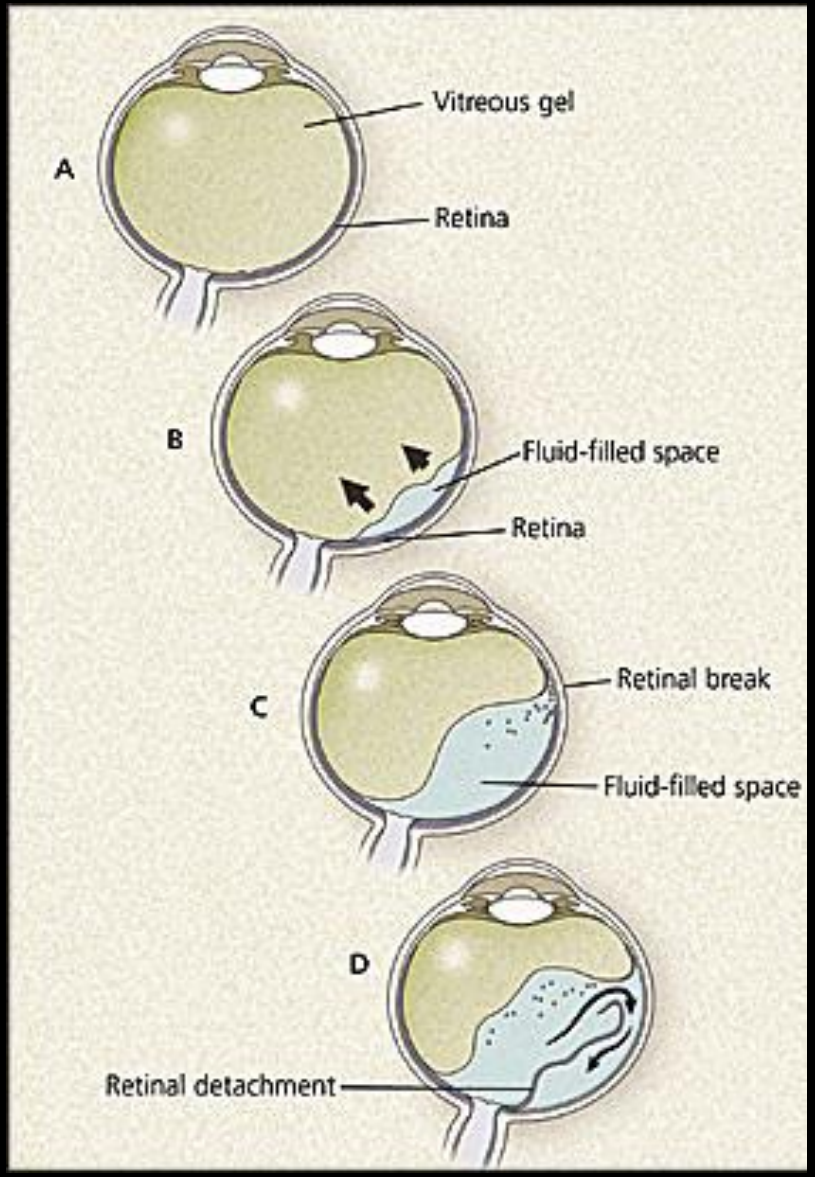
Vitreous Haemorrhage and Retinal Detachment

Vitreous Haemorrhage and Retinal Detachment

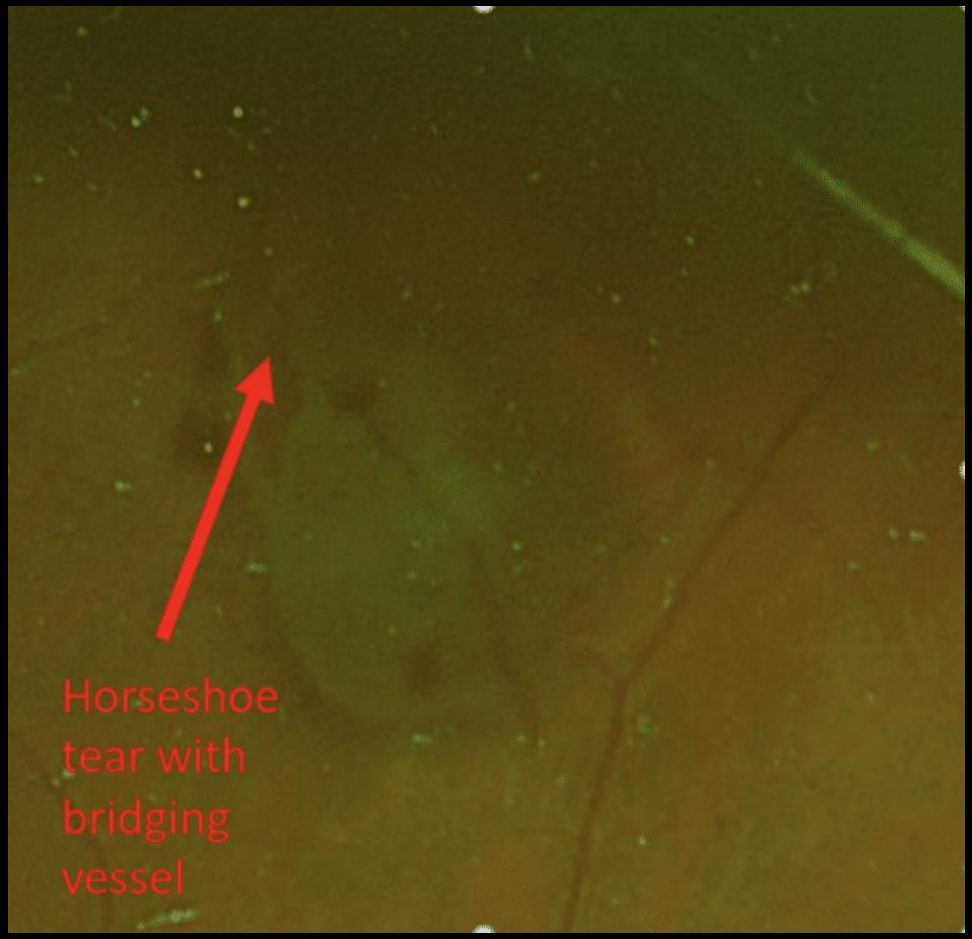


Due to anomalous stage 3 and 4 Posterior Vitreous Detachment

Role of vitreous in tears and detachment

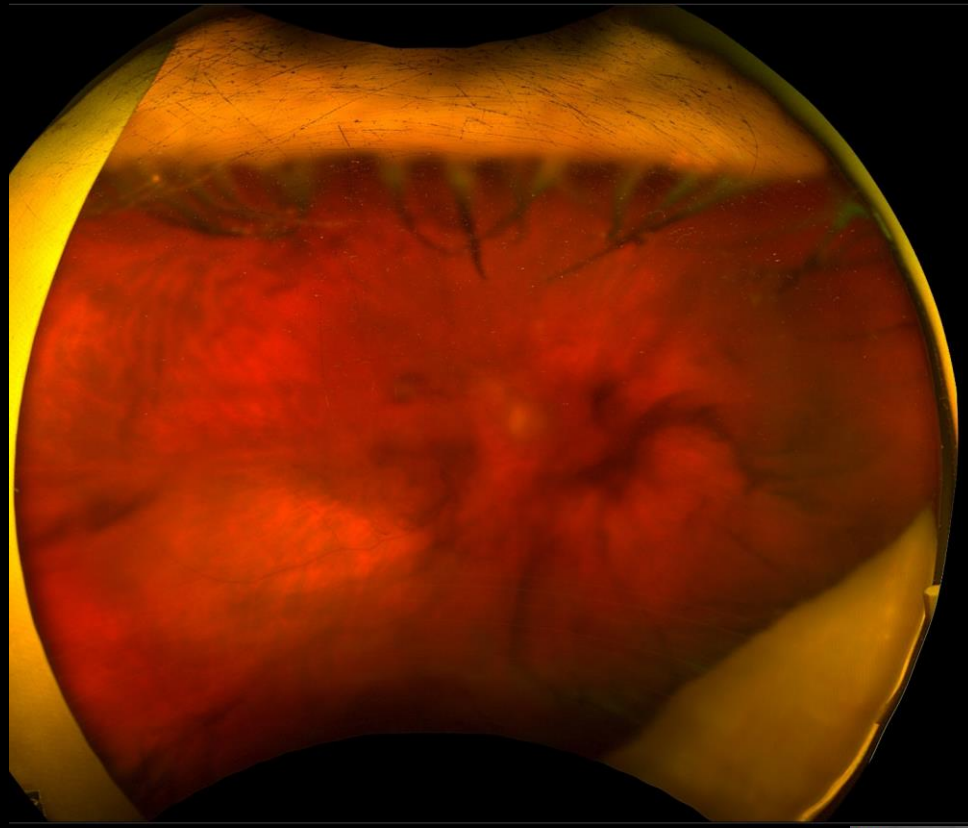


Vitreous haemorrhage

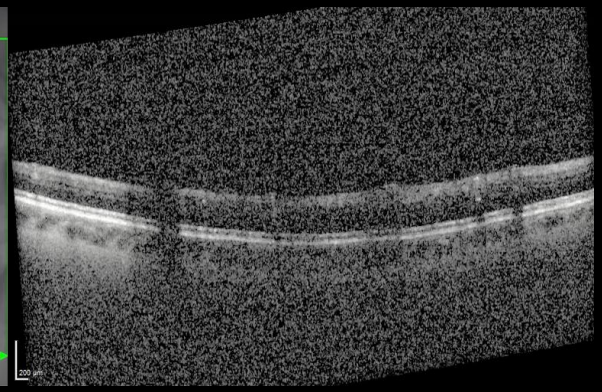


Vitreous haemorrhage due to a PVD is associated with a retina tear in >50% of cases.

Vitreous haemorrhage



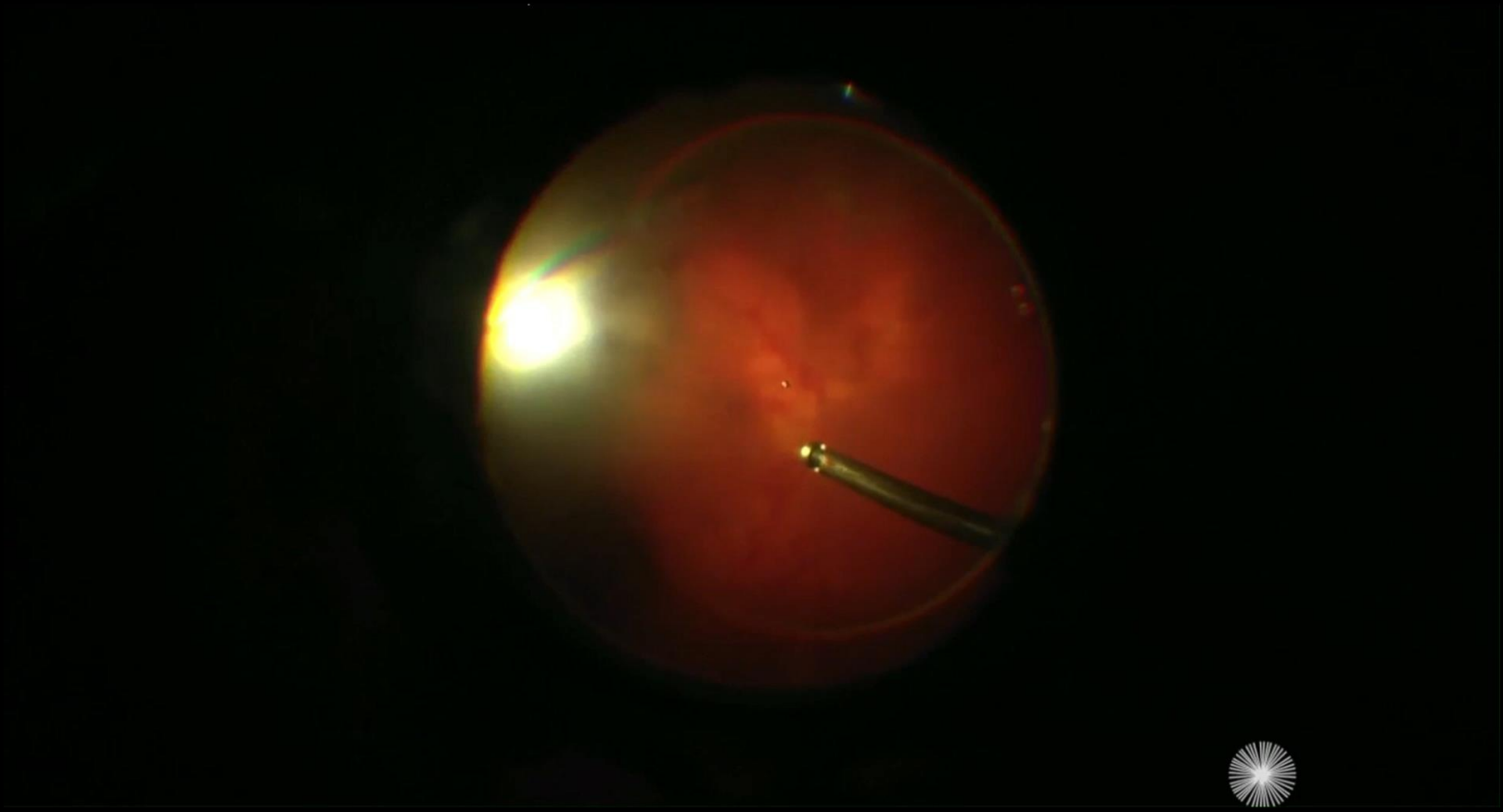
76 yo female
Right vision loss over 2 days
VA – 6/36 OD



Vitreous haemorrhage

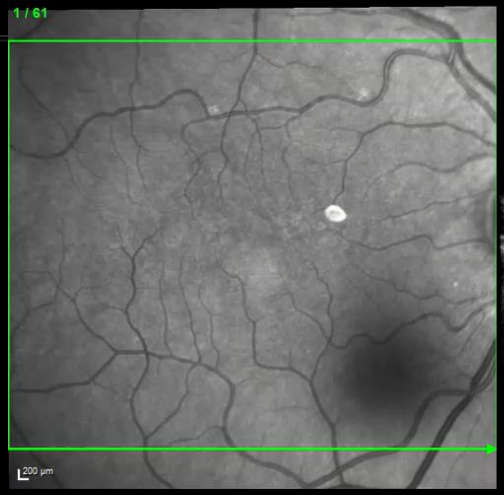
- The advent of micro-incisional vitrectomy techniques has reduced the threshold for surgical intervention

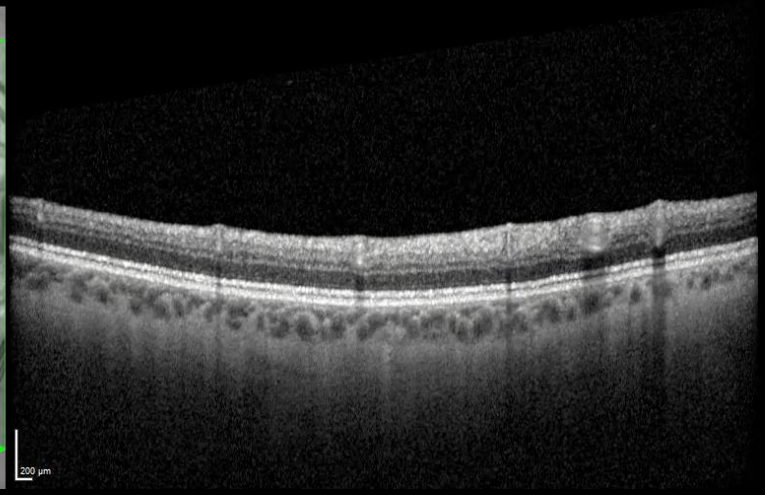
- Vitrectomy surgery for management of vitreous haemorhhage will: (1) allow identification of retinal tears and minimize risk of retinal detachment; (2) facilitate quicker visual recovery.



VA – 6/6

2-weeks Post-Op





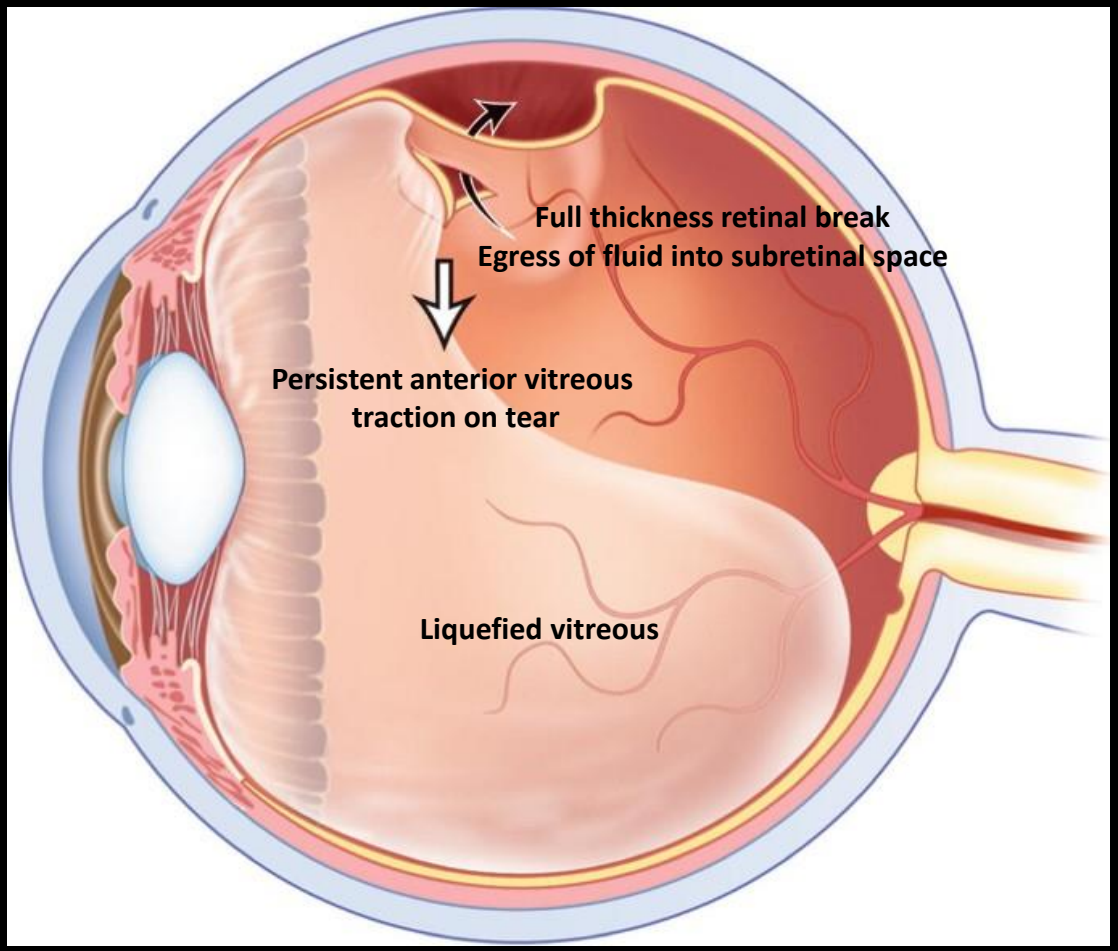
Acute Retinal Detachment

Almost always symptomatic
Floaters, photopsiaes, FIELD DEFECT

Almost always associated with
HORSE SHOE TEAR

Ophthalmic Emergency and Patients should be referred for evaluation within 24 hours

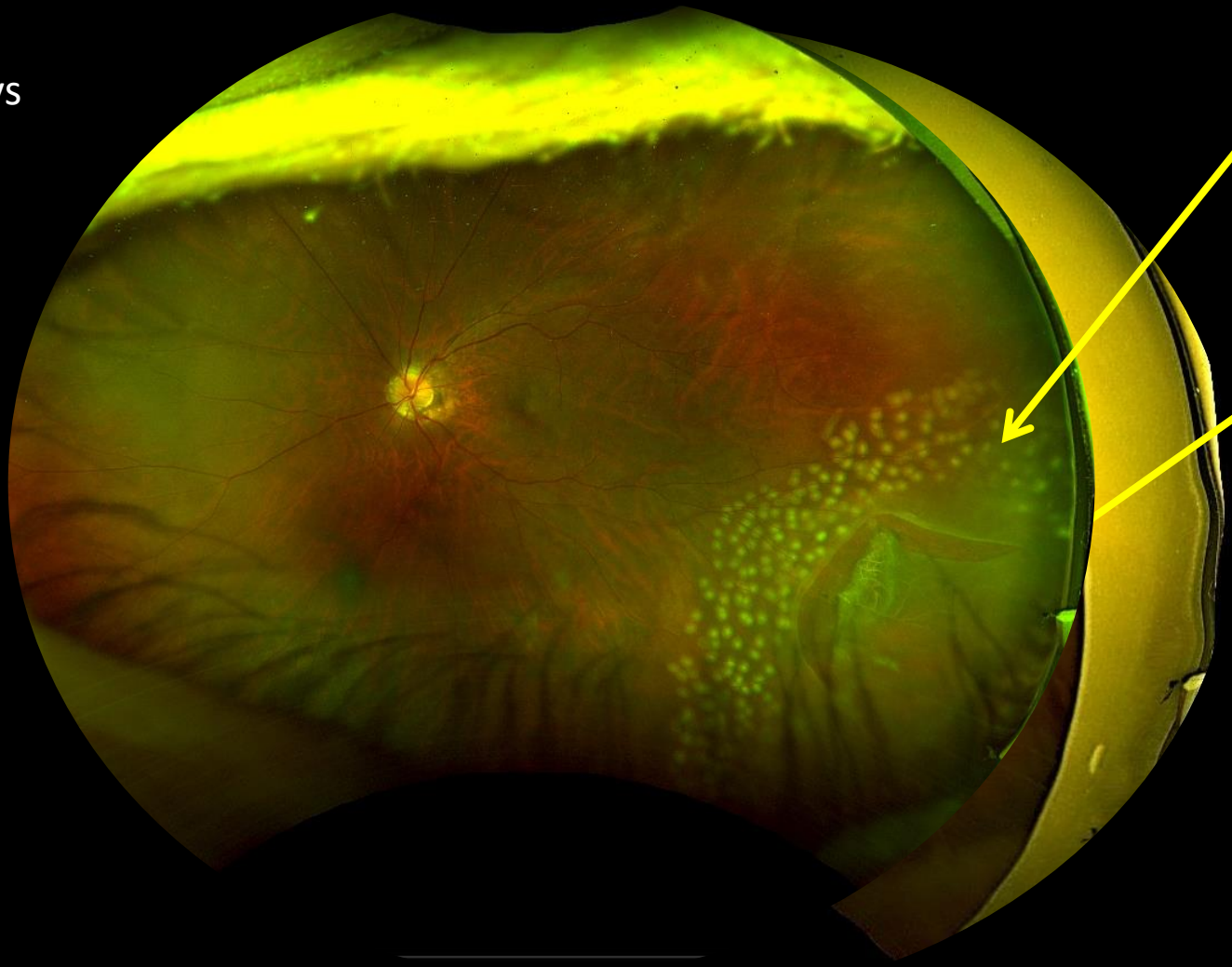
Retinal Detachment Pathophysiology



3 factors are required for the formation of a retinal detachment

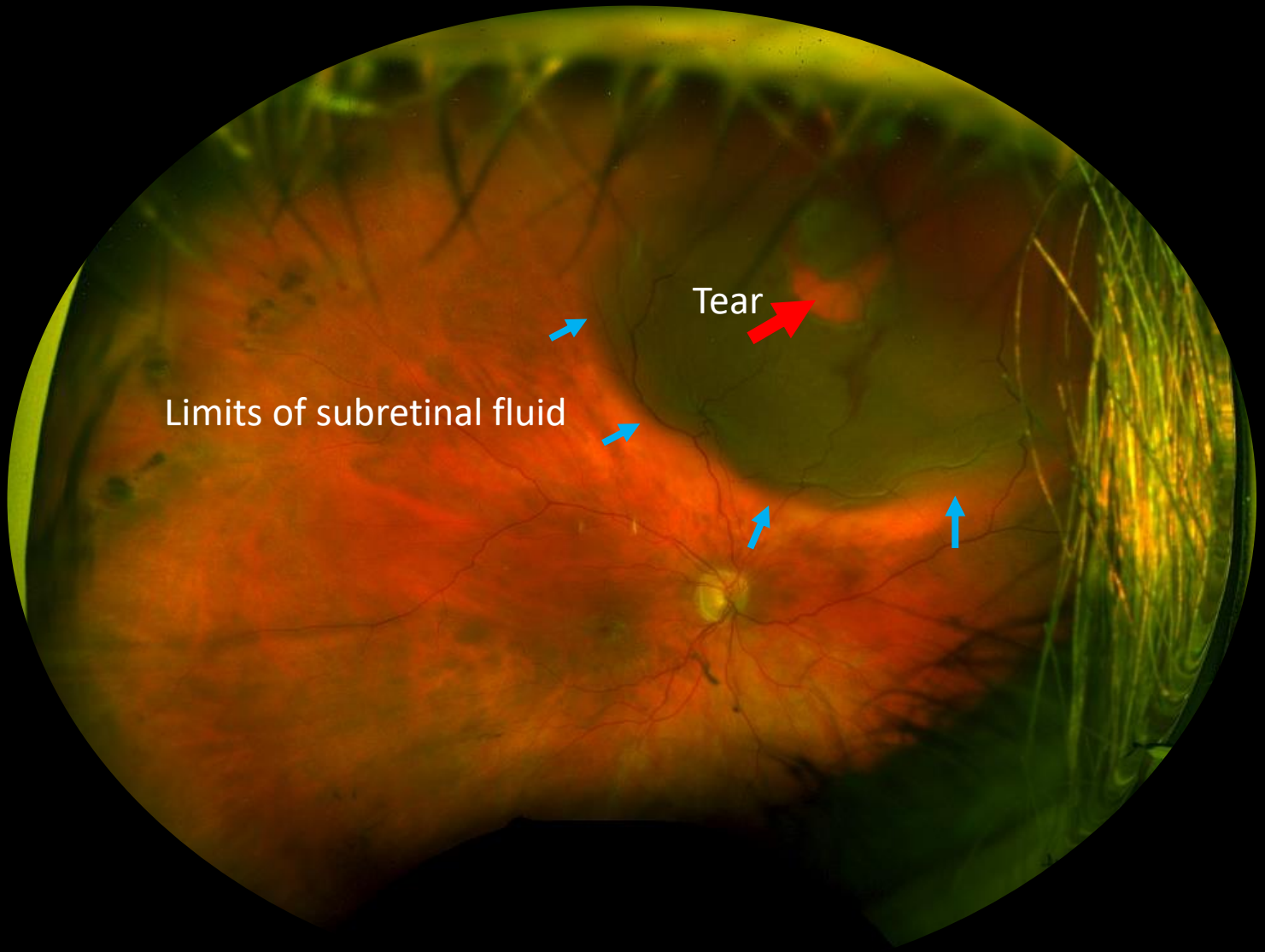
Retinal Tear without detachment

68 yo male
Floaters 3 days

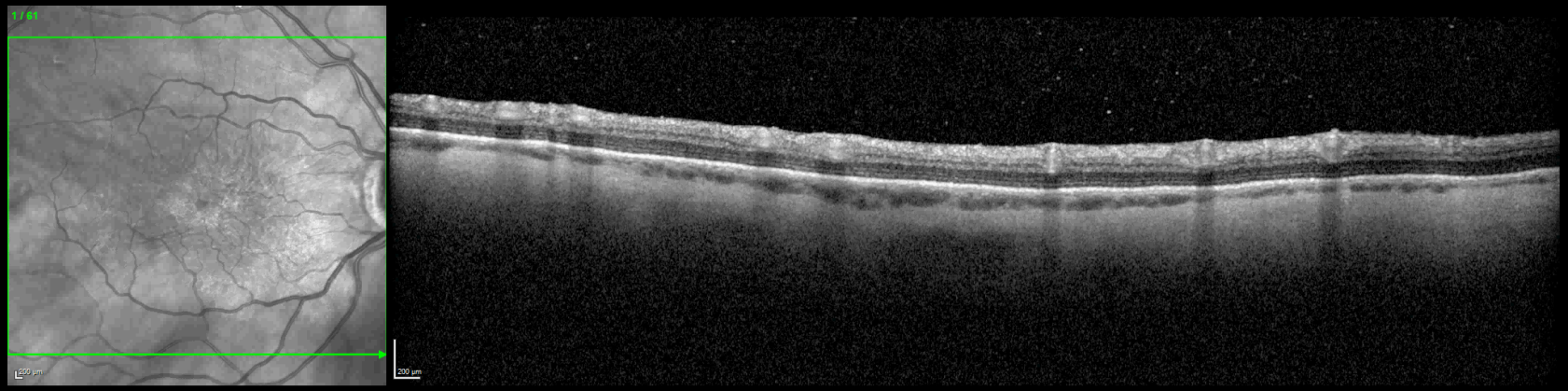


Retinal tears without persistent anterior vitreous traction may not lead to a retinal detachment

Retinal Detachment



Retinal Detachment

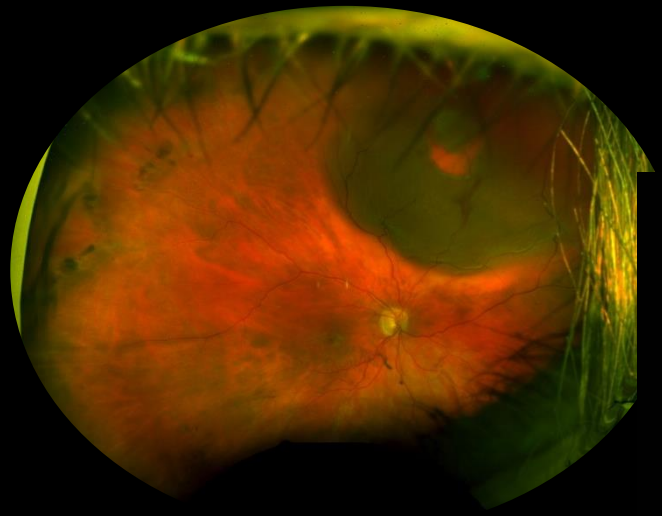


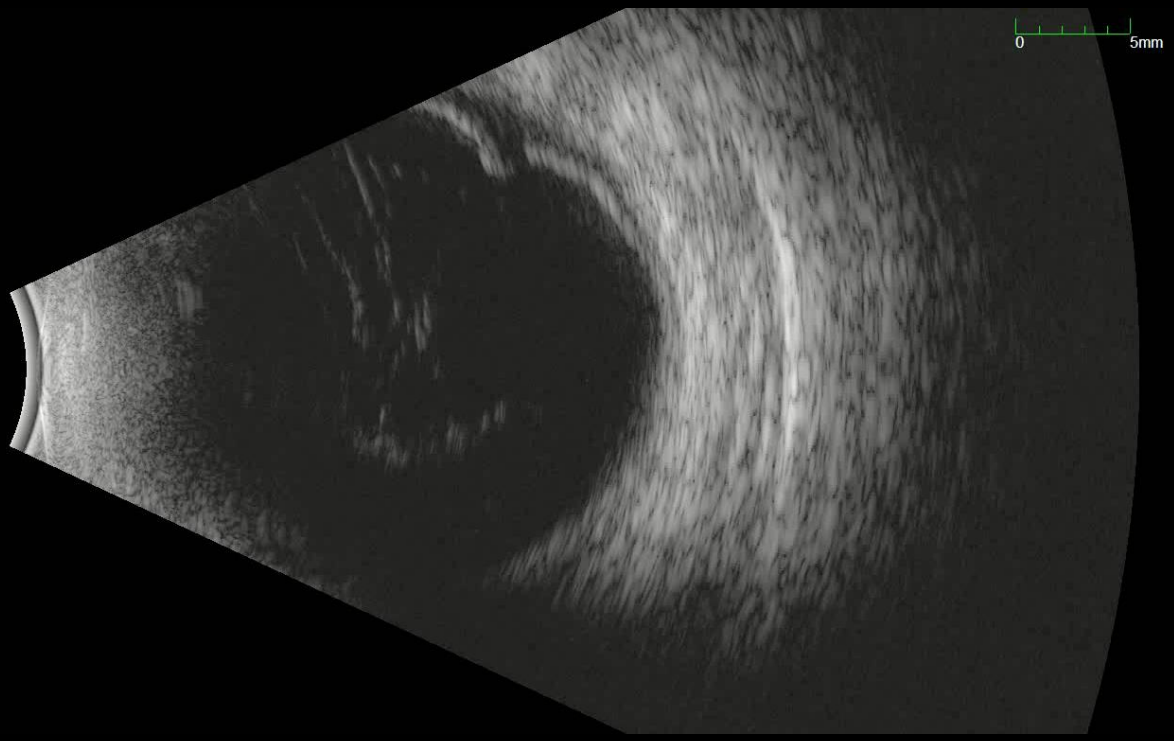
The most important determinant of long-term visual outcome is detachment of the macula on presentation.

Management of Retinal Detachment

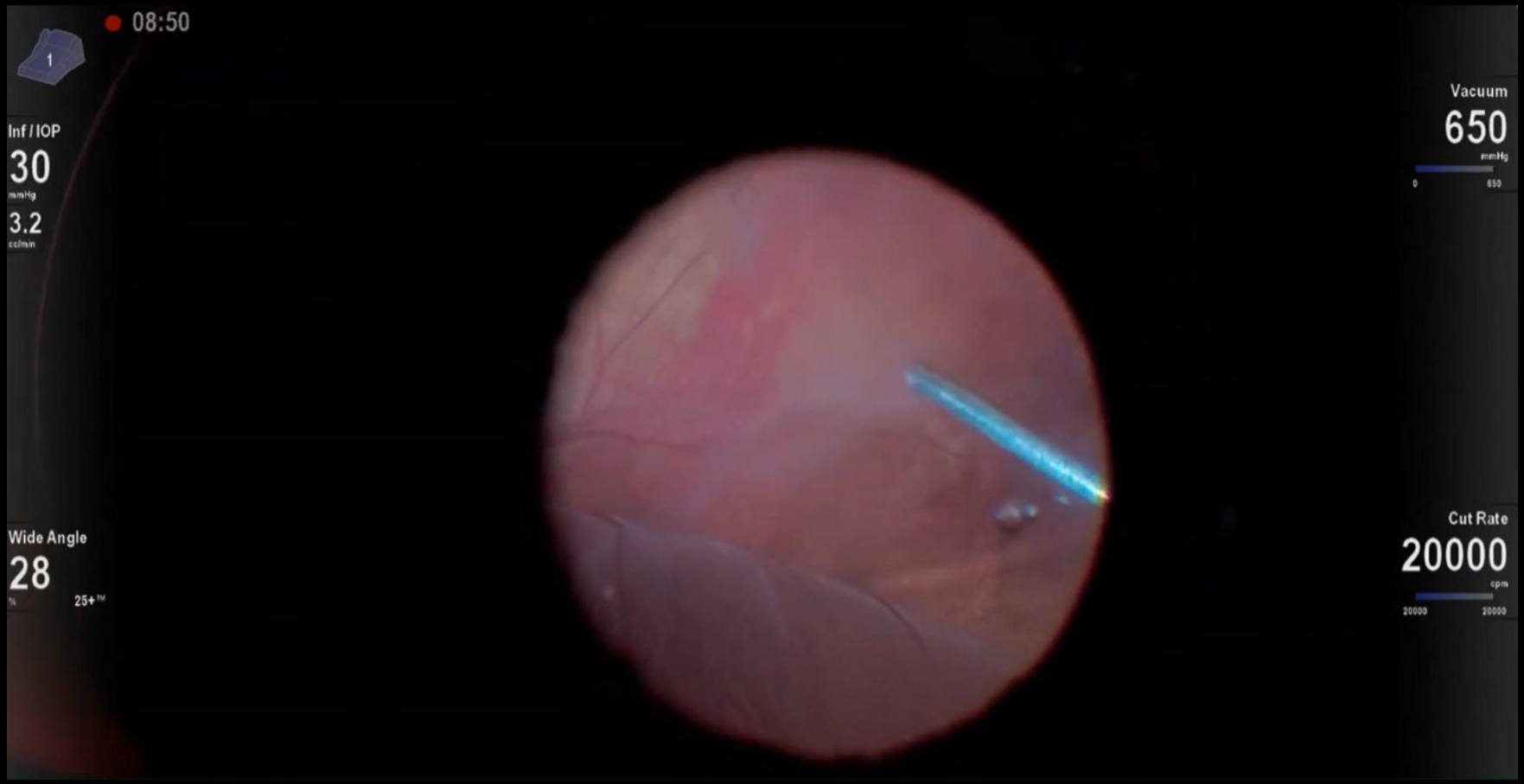
- All retinal detachments need to be referred for review within 24-48 hours.
- Macula-on retinal detachments will typically have surgery within 24 hours.
- Macula-off retinal detachments will typically have surgery within 72 hours.

Management of Retinal Detachment





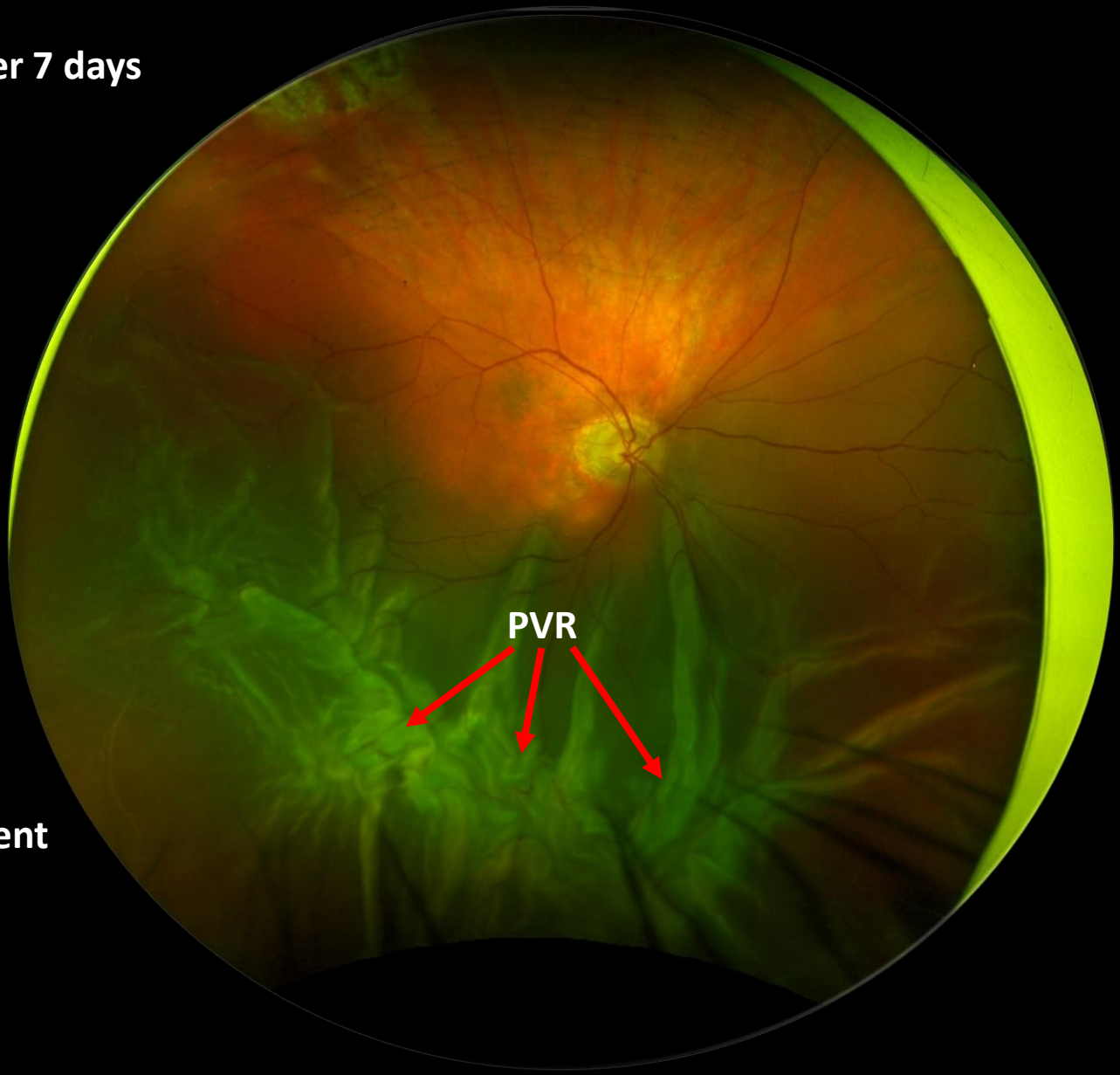
Most retinal detachments after age 45 years will manifest a posterior vitreous detachment → Vitrectomy surgery.


08:50
1
Inf / IOP
30
mmHg
3.2
cc/min
Wide Angle
28
%
25+™
Vacuum
650
mmHg
0
650
Cut Rate
20000
cpm
20000
20000

54 yo male
Right vision loss over 2 days
VA – 6/6 OD

1 week

52 yo male
Right vision loss over 7 days
VA - HM



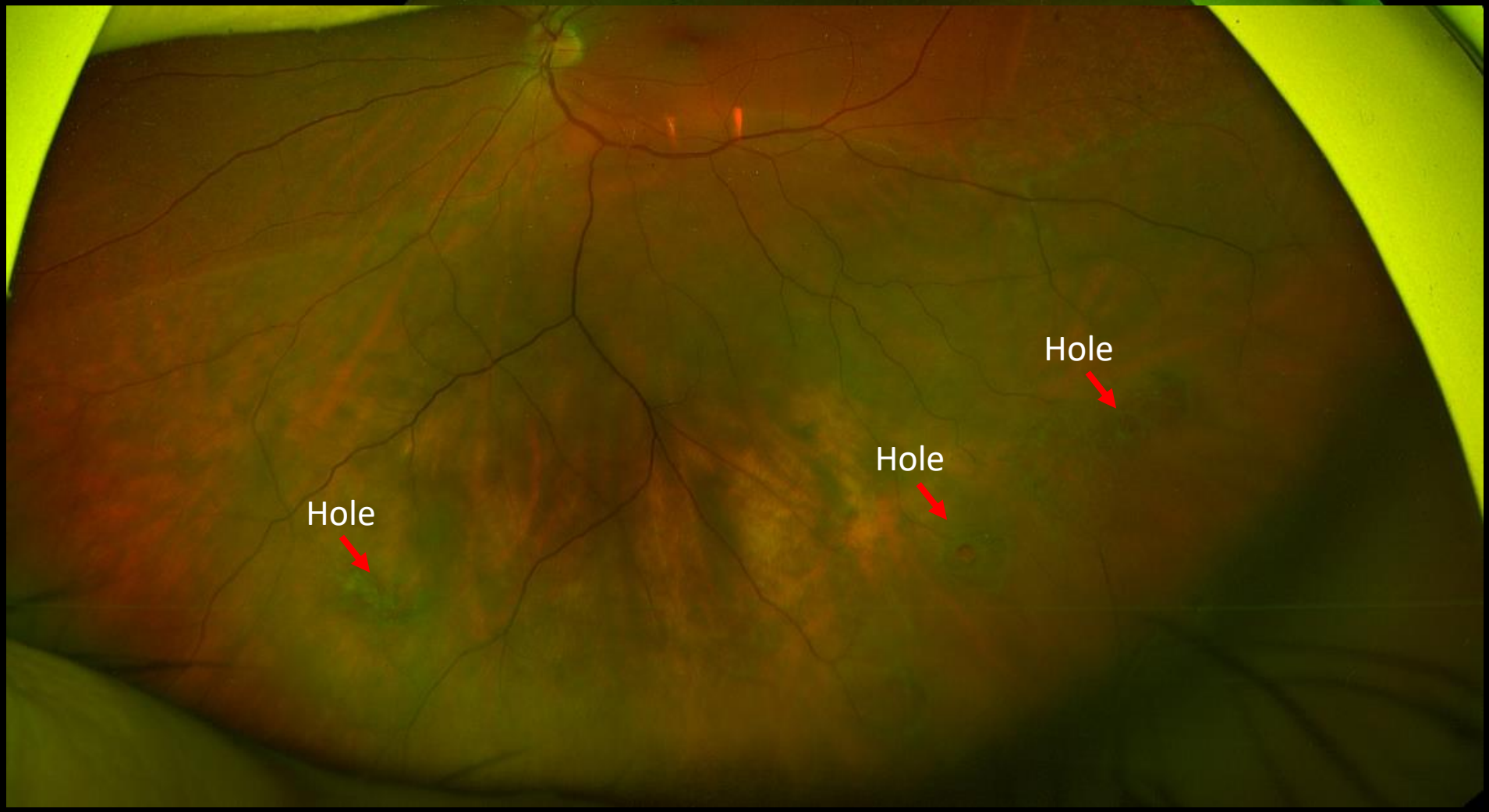
Retinal re-detachment

1 week

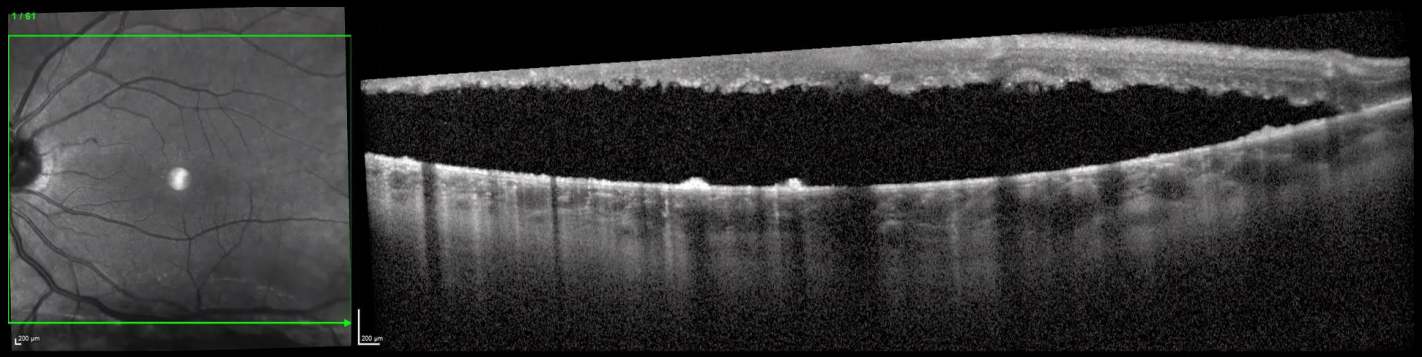
90% of retinal detachments can be fixed with 1 operation

i.e. 10% require more than 1 surgery

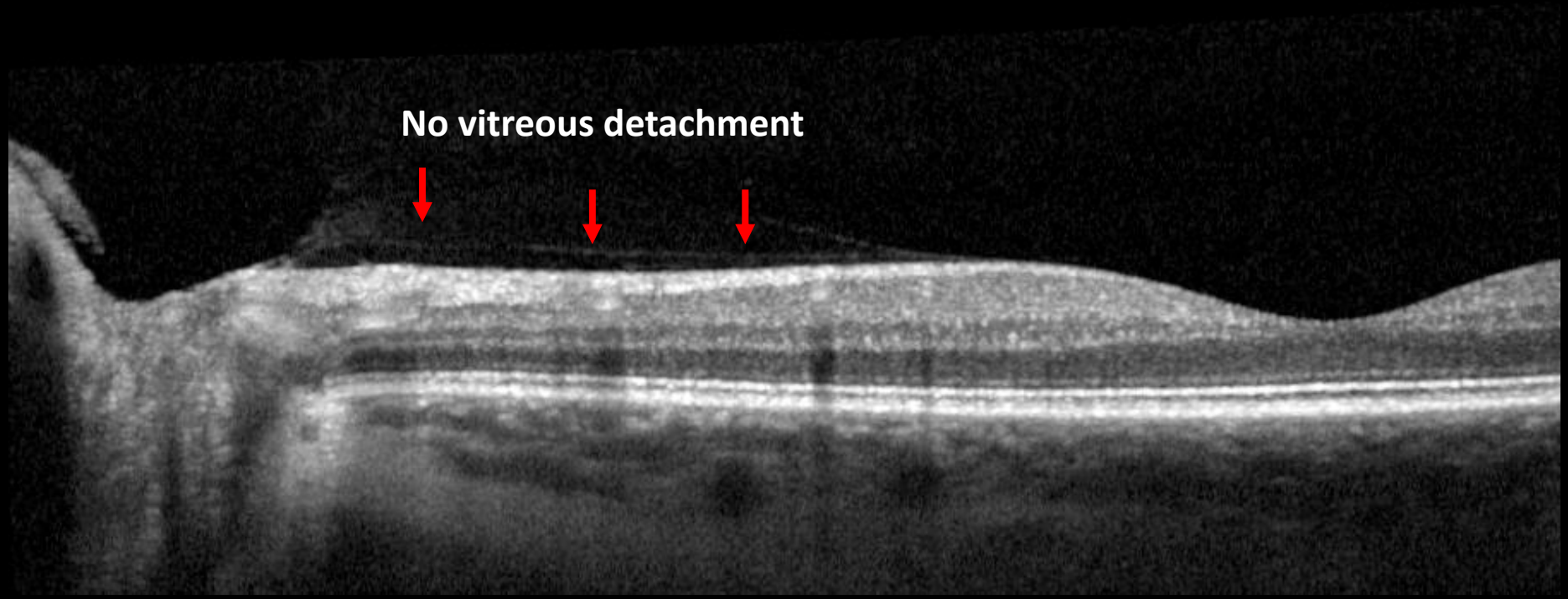
42 yo male
Asymptomatic
VA – 6/6 OU



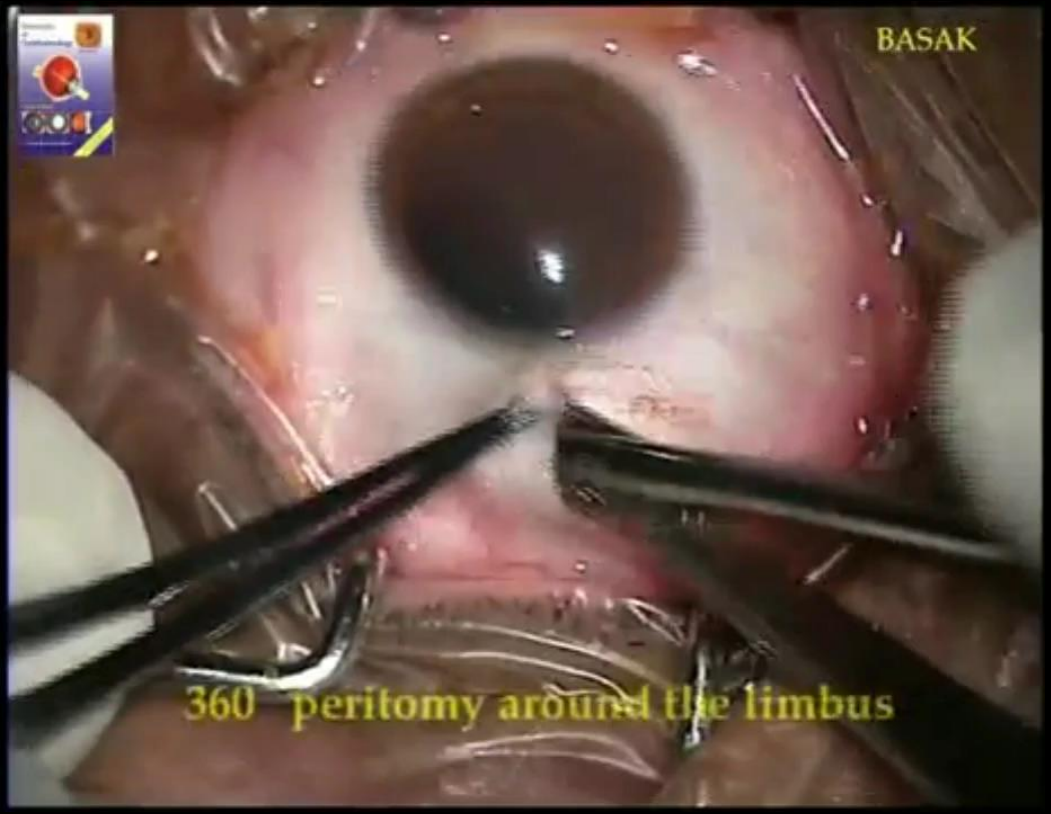
42 yo male
Asymptomatic
VA – 6/6 OU



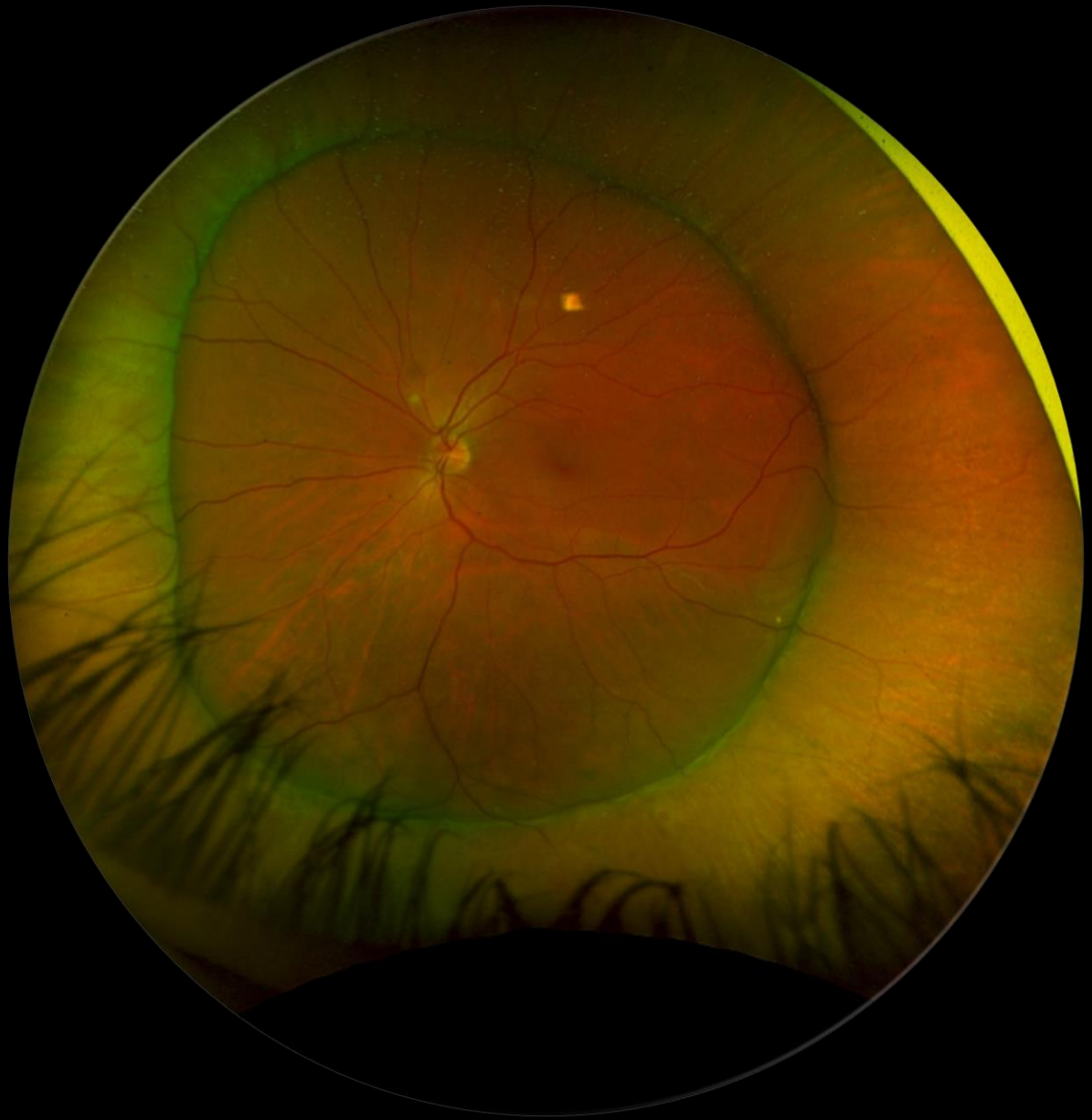
42 yo male
Asymptomatic
VA – 6/6 OU



Scleral buckle is favoured for retinal detachments without a PVD



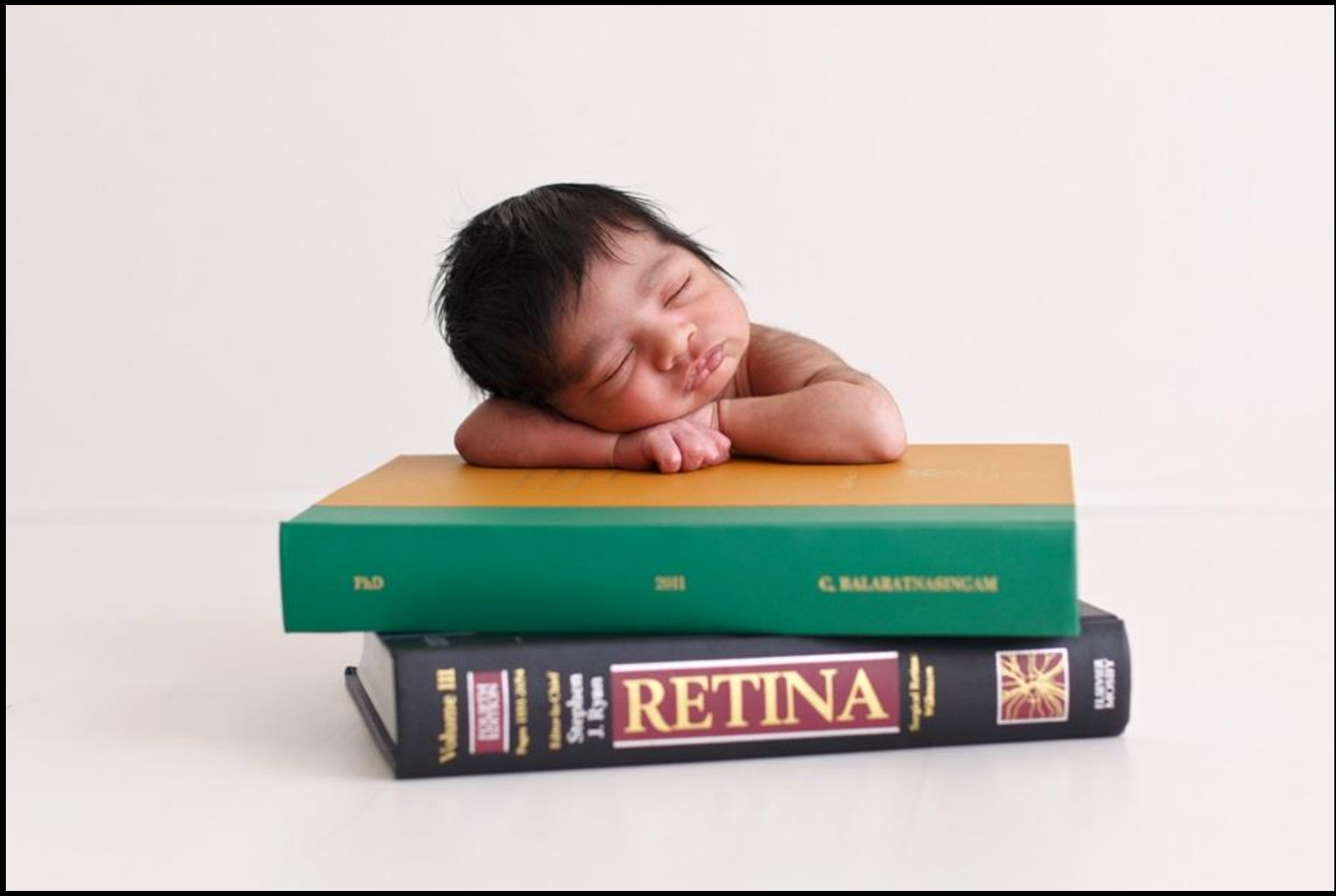
Scleral buckle is an extraocular procedure



Retinal detachment (summary)

- Refer acute RD within 24 hours.
- Anatomic success 90% after 1 surgery.
- Vitrectomy is most common surgery for retinal detachment.

Questions?


PhD
2011
C. BALARATNASINGAM
Volume III
Stephen J. Ryan
RETINA