

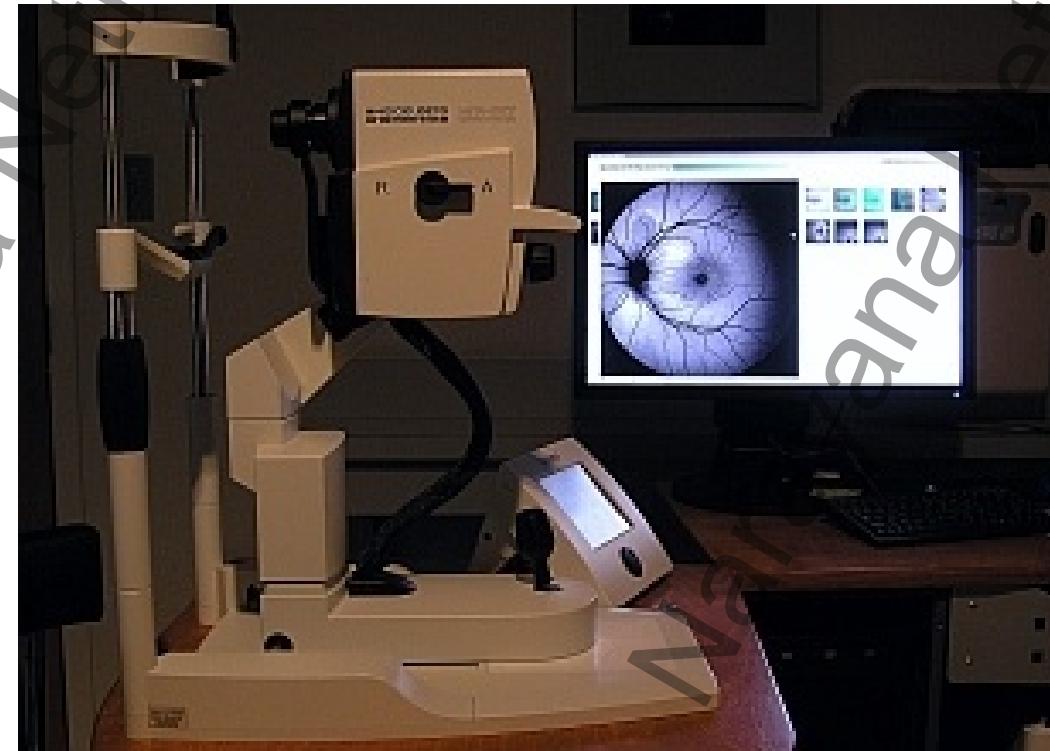


Fundus Fluorescein Angiography and Indocyanin Green Angiography



WHAT IS FFA?

Used to study the retinal vasculature and perfusion



A/
A



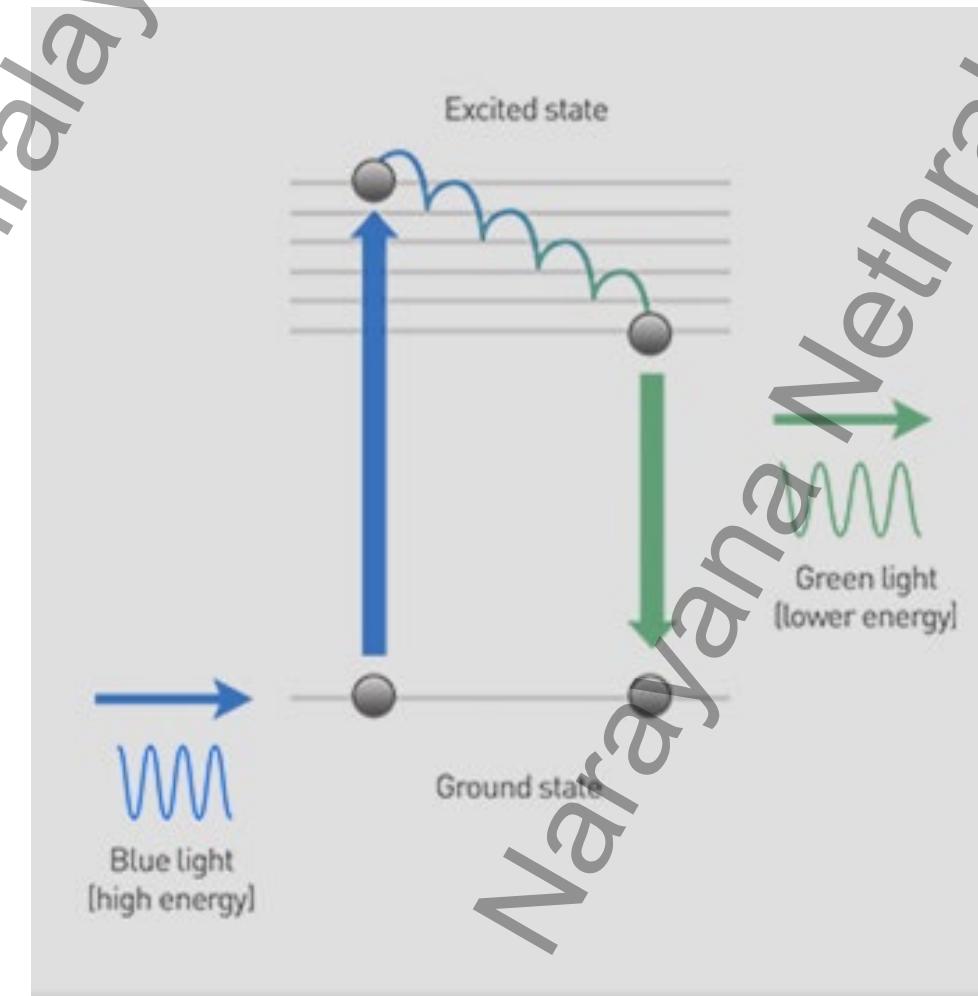
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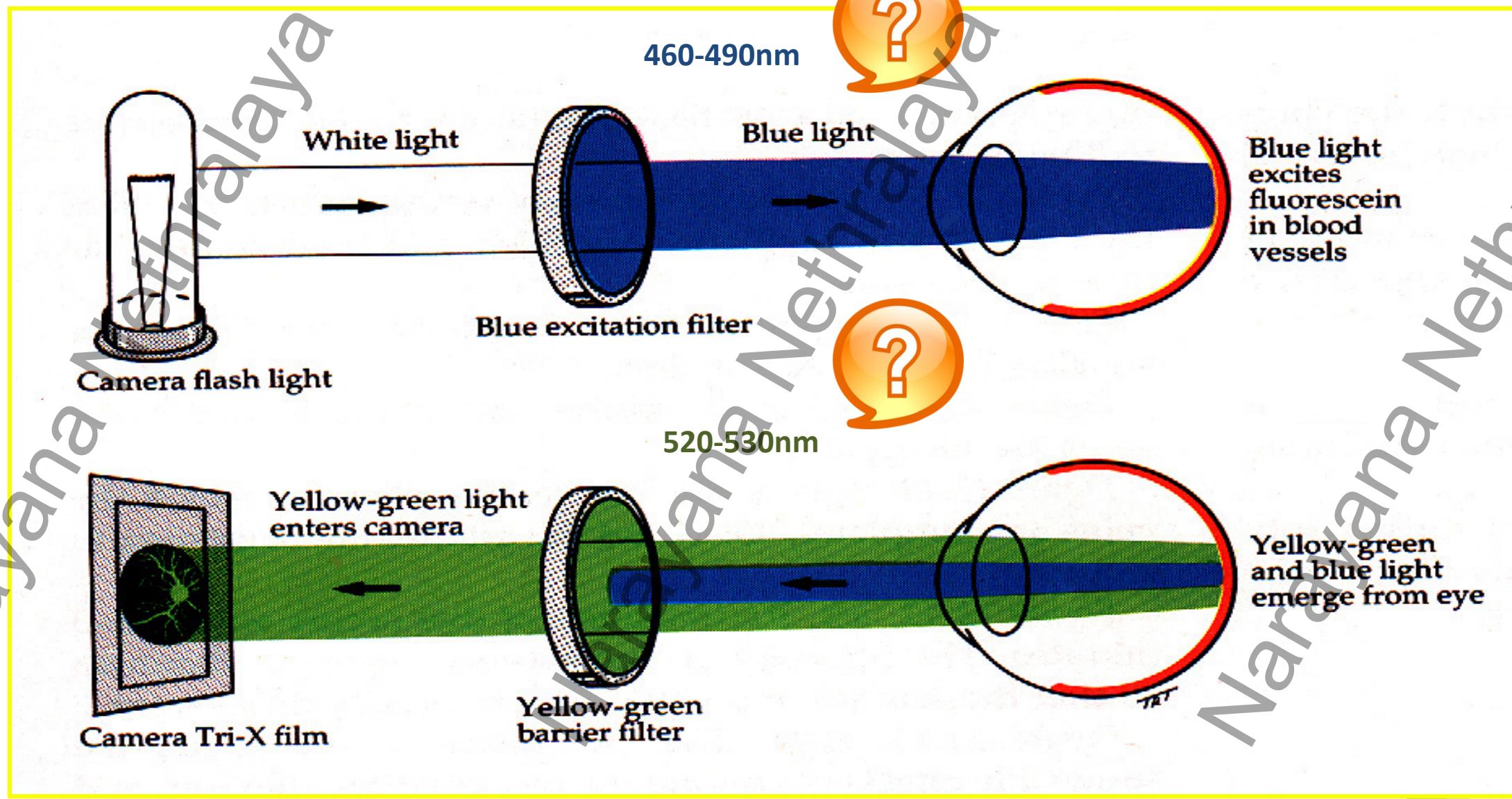
PRINCIPLE

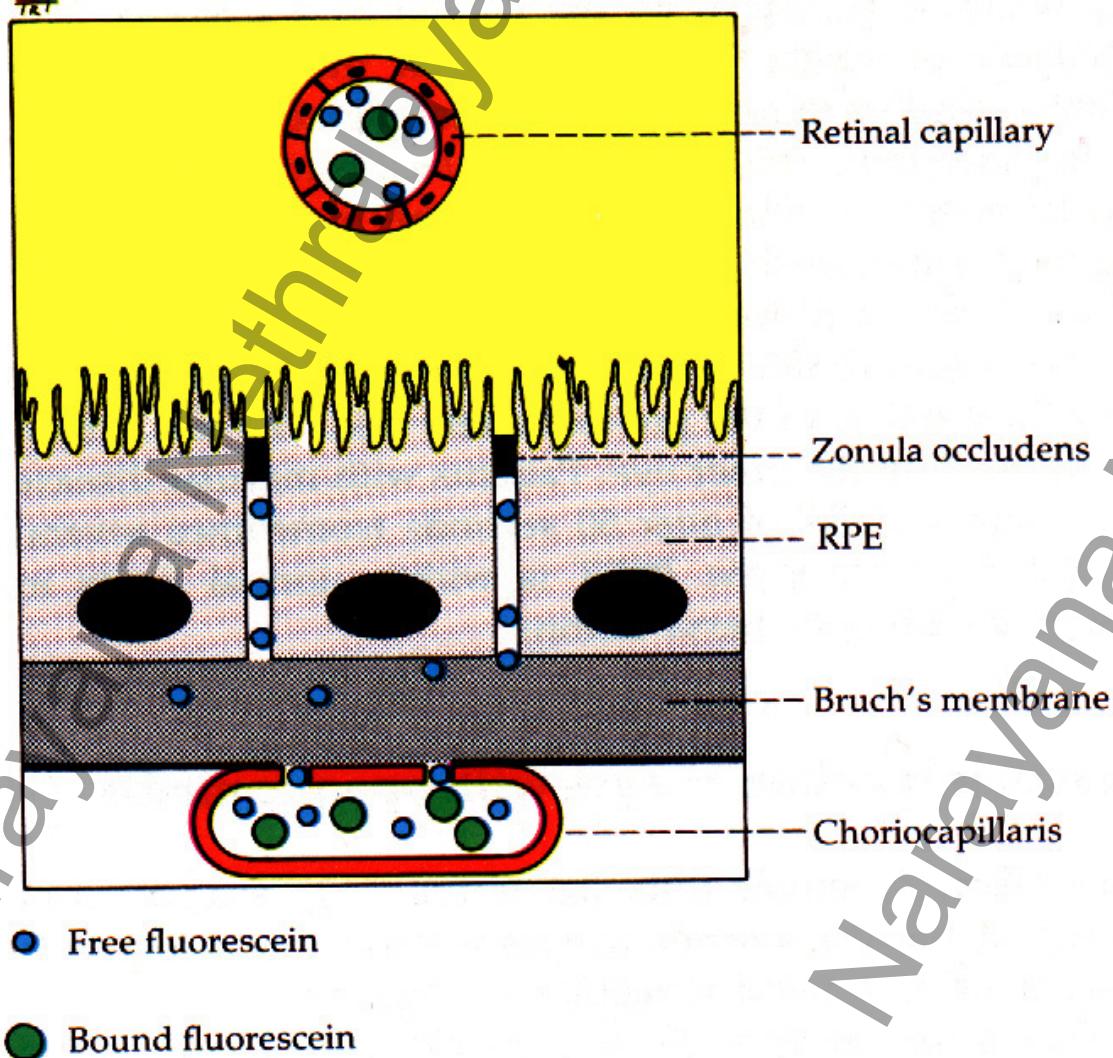
- **FLUORESCENCE-**

Property of certain molecules to emit light energy of longer wavelength when stimulated by a shorter wavelength.



Filters





Inner blood-retinal barrier (retinal capillaries)-
Impermeable to fluorescein

Outer blood-retinal barrier (zonula occludens)-
Impermeable to fluorescein

Choriocapillaris-
Permeable to only “free”
fluorescein.

Indications of FFA

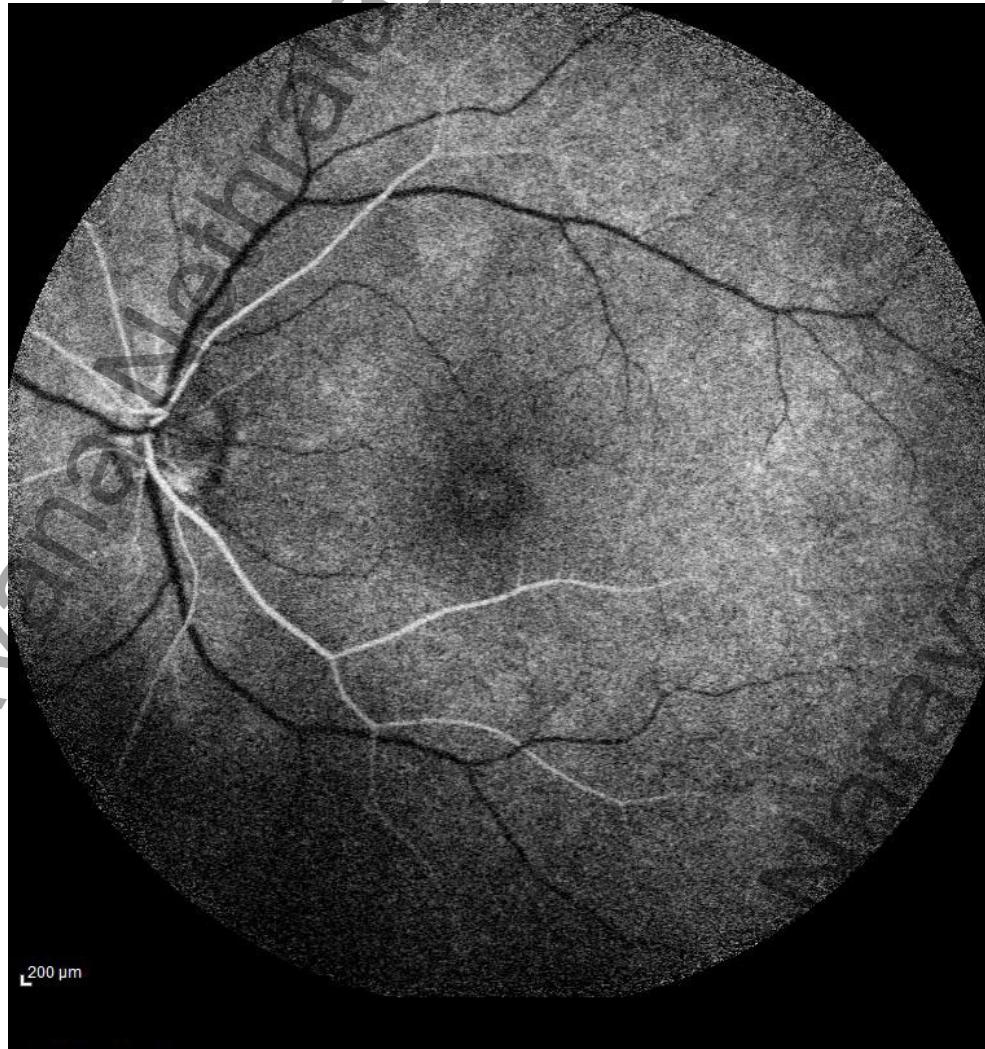
- Diagnostic : Diabetic Retinopathy and other Retinal vascular Diseases
- CNVM and CSCR
- Posterior uveitis
- To find out the activity of the disease and decide the treatment plan

Phases of FFA

Arm to Retina Time:



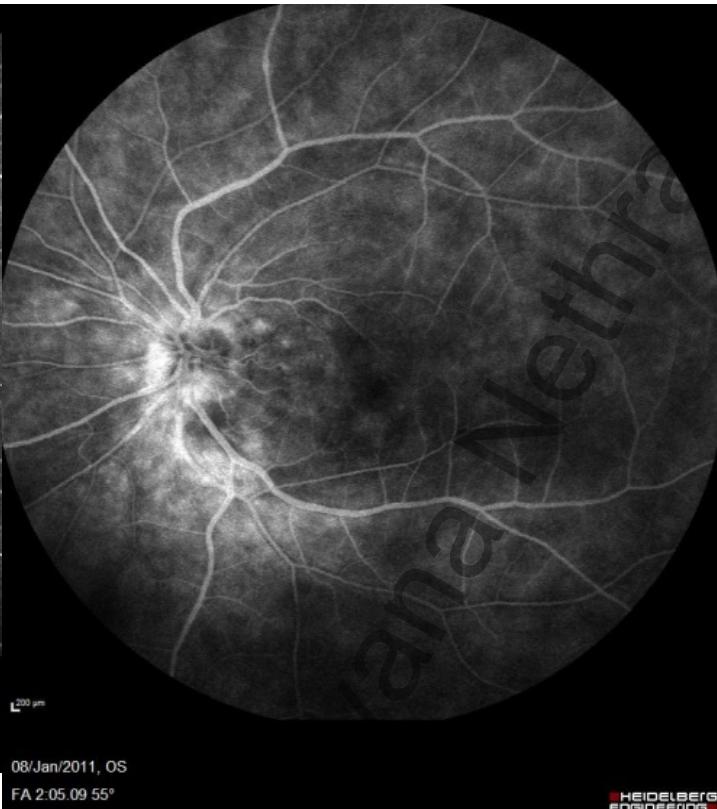
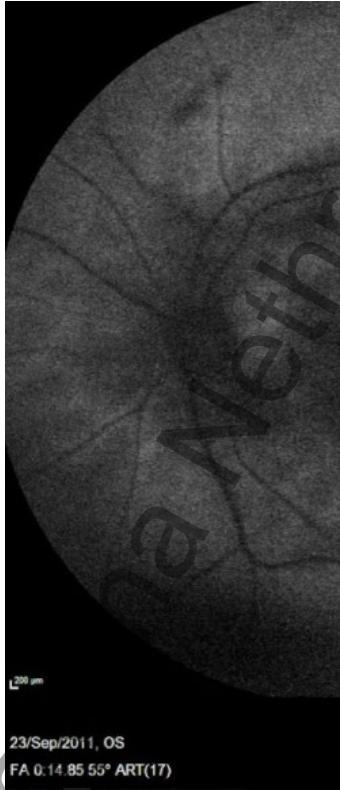
- 10 – 12 seconds - young age
- 12- 15 seconds – old age
- abnormal >20 sec
- Delayed -
 - cardiac disease
 - Blood viscosity
 - Giant cell arteritis
 - carotid artery stenosis

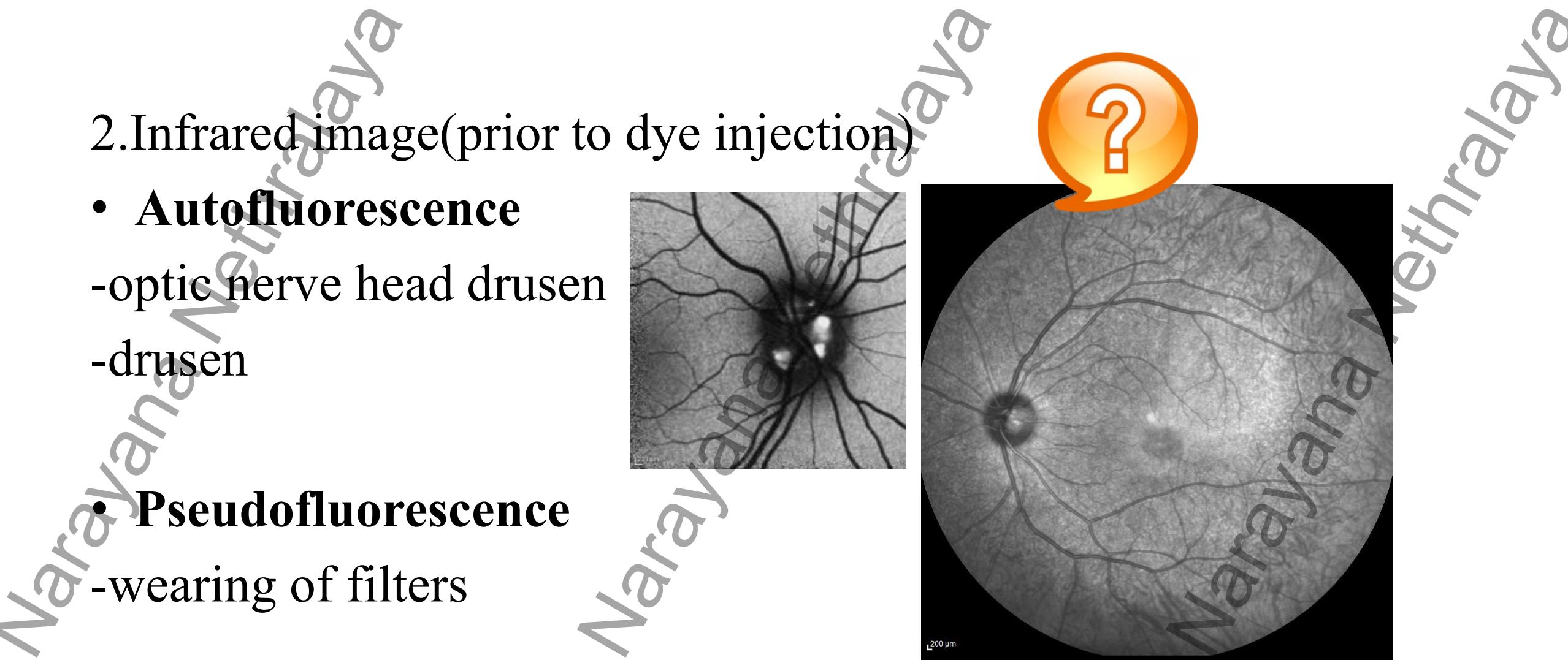


PHASES OF ANGIOGRAPHY

- 1. CHOROIDAL FLUSH/ PREARTERIAL PHASE- Arm to retina time**
- 2. ARTERIAL PHASE – 10-15 sec after injection**
- 3. ARTERIOVENOUS PHASE/ CAPILLARY PHASE-**
- 4. VENOUS PHASE**
- 5. MID PHASE**
- 6. LATE PHASE**

<i>Phase of angiogram</i>	<i>Timing from the start of injection (approximate)</i>
Injection of dye	0 sec
Posterior ciliary arteries	9.5 sec
Choroidal flush (or prearterial phase)	10 sec
Retinal arterial phase	10–12 sec
Arteriovenous phase (laminar stage or early venous stage)	14–15 sec
Venous phase	16–17 sec
Late phase	5 min





2. Infrared image(prior to dye injection)

- **Autofluorescence**

- optic nerve head drusen
- drusen

- **Pseudofluorescence**

- wearing of filters



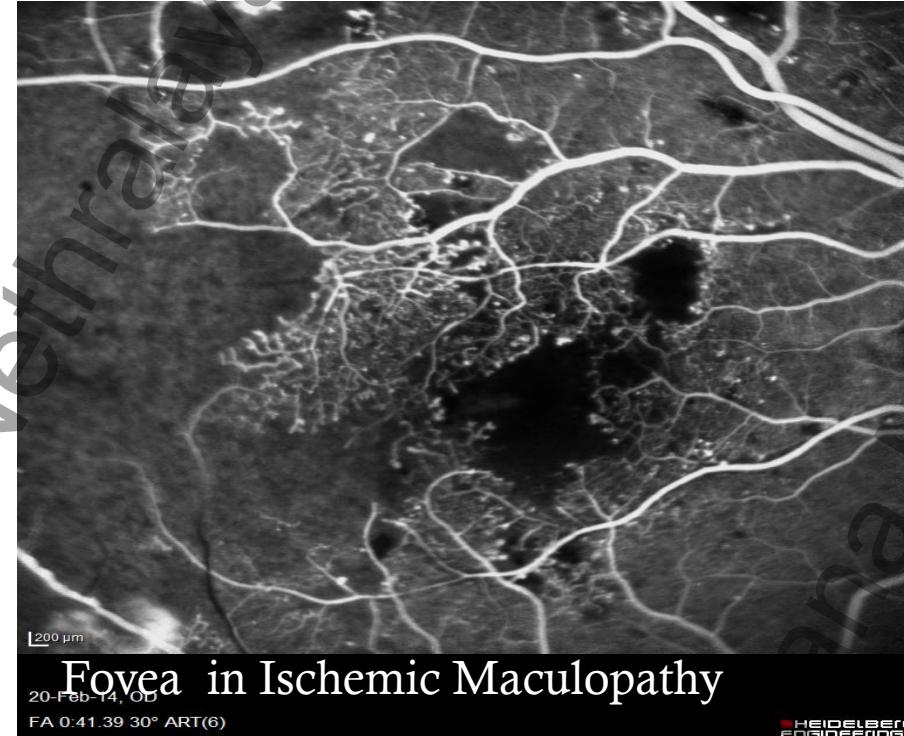


Fovea in FFA



Why does the fovea appear dark?

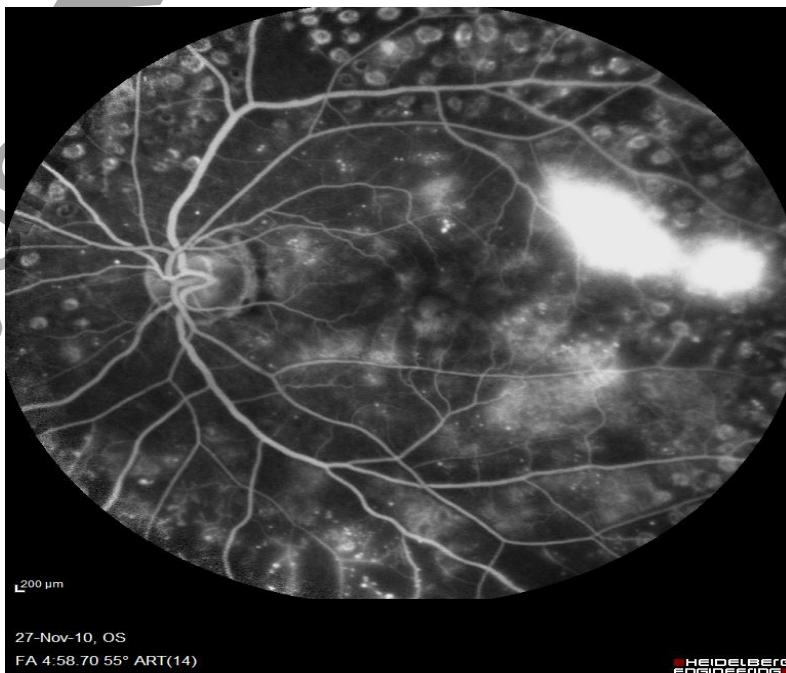
- Avascular
- Large RPE – Melanin
- Increased Xanthophyll density



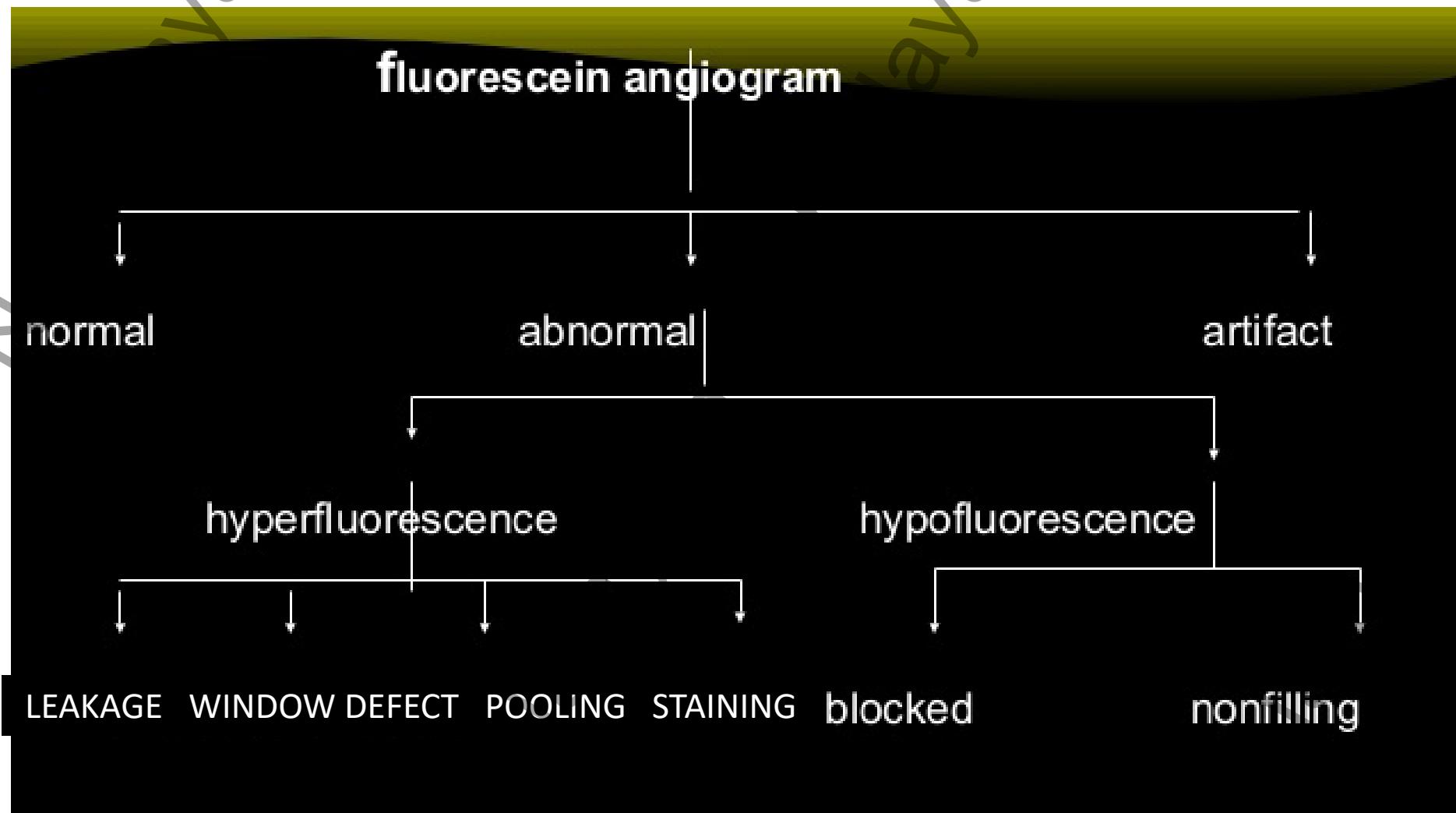
- Enlarged FAZ
- Irregular margin of FAZ
- Capillary budding

FFA Interpretation

- Eye, Phase,
- Flourescence-normal/hypo/hyper
- Level of pathology
- Intensity and Size of lesion with time



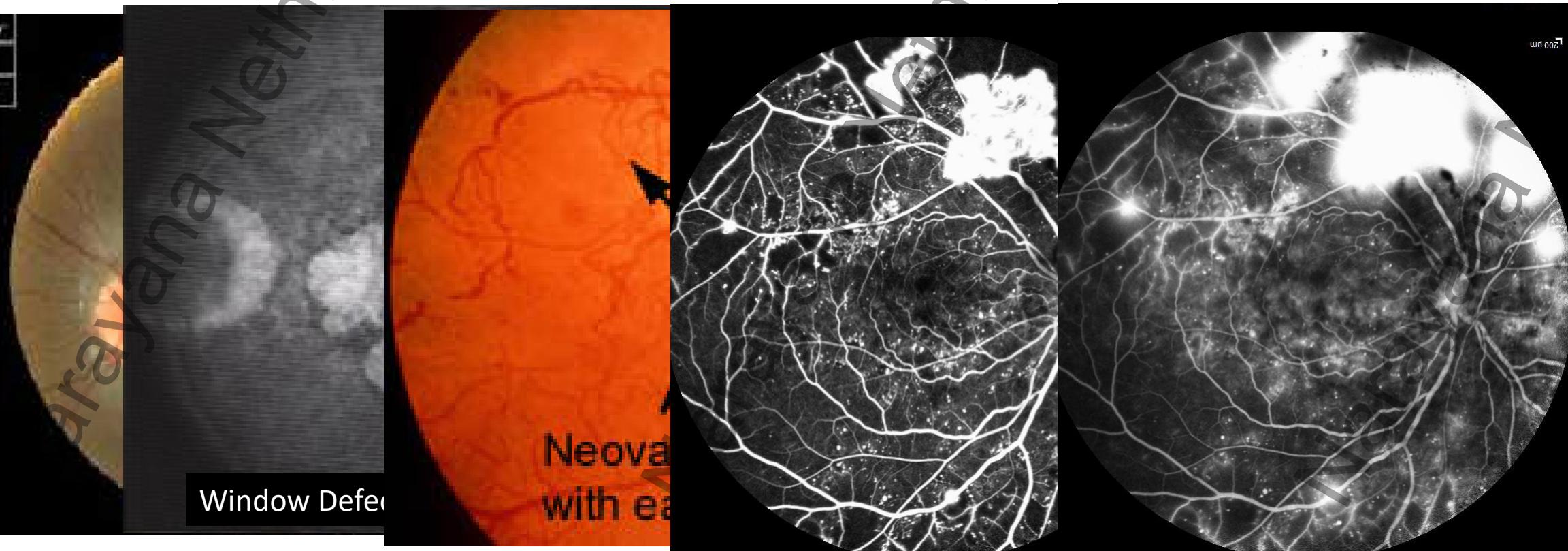
INTERPRETATION FLOW CHART



Hyper
fluorescence

Early
phase

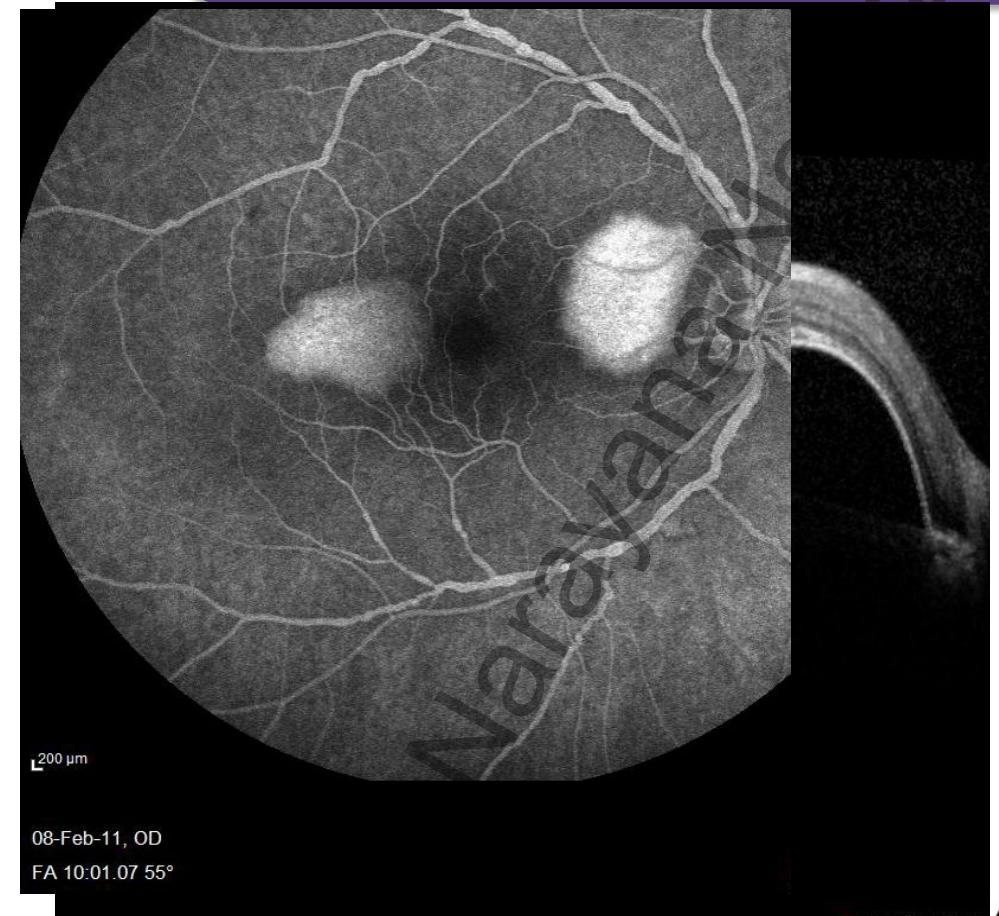
- Window defect, leakage

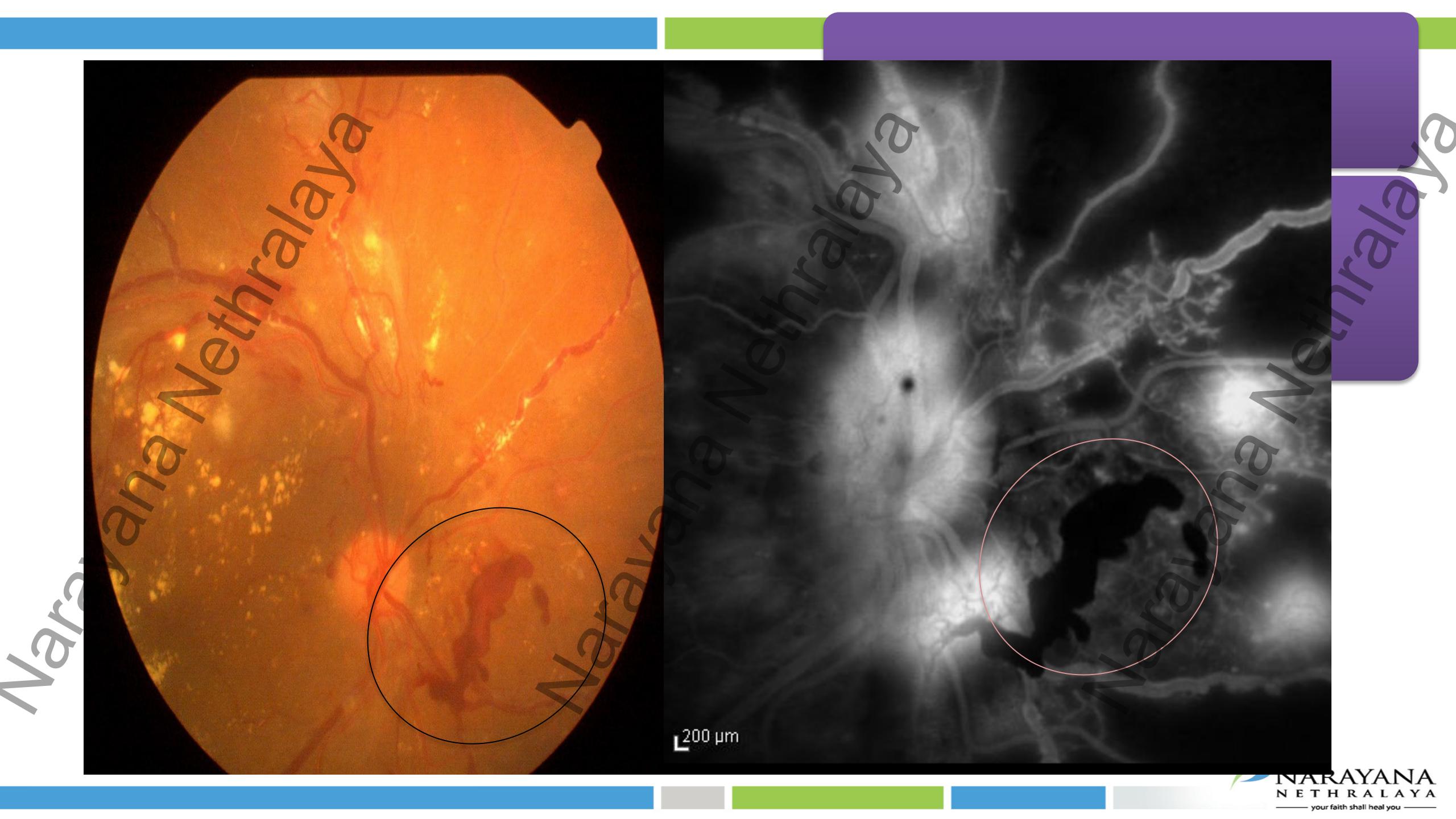


Hyper
fluorescence

Late phase

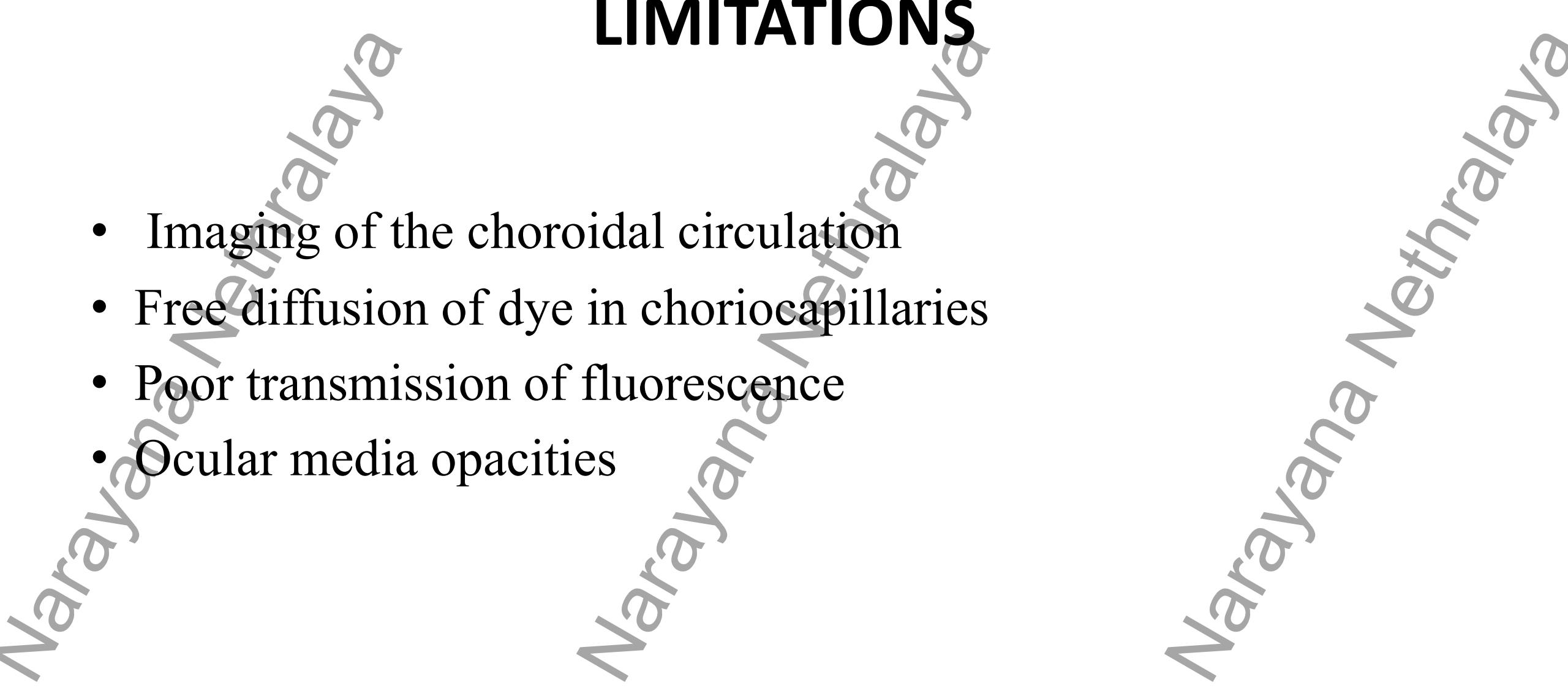
- Pooling, staining







LIMITATIONS

- Imaging of the choroidal circulation
 - Free diffusion of dye in choriocapillaries
 - Poor transmission of fluorescence
 - Ocular media opacities
- 

Narayana Nethralaya

ICG-Indocyanin green angiography

Narayana Nethralaya

Narayana Nethralaya

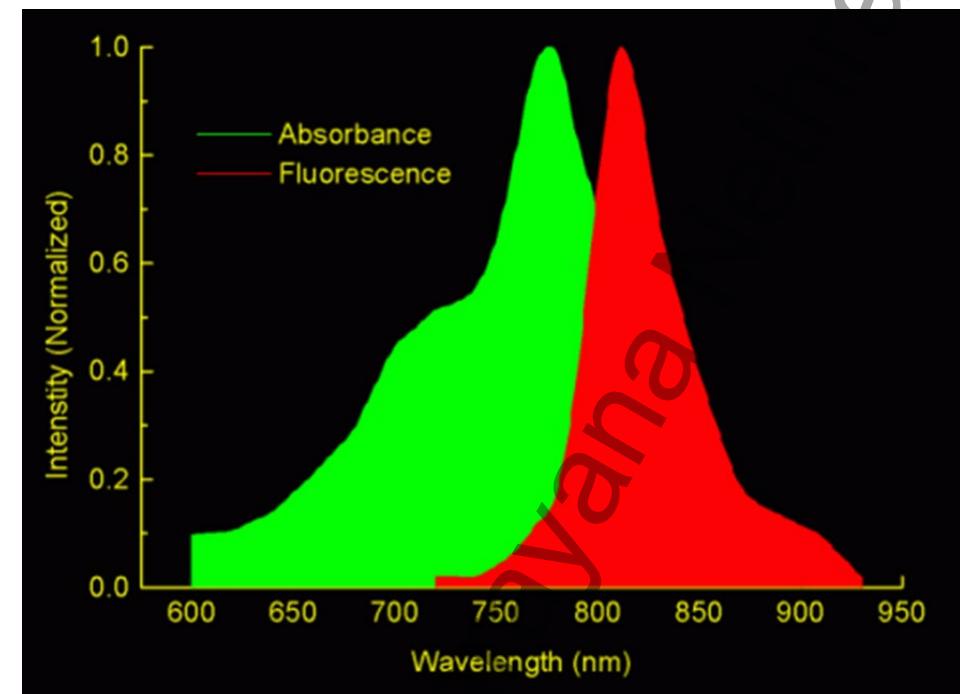
ICG angiography

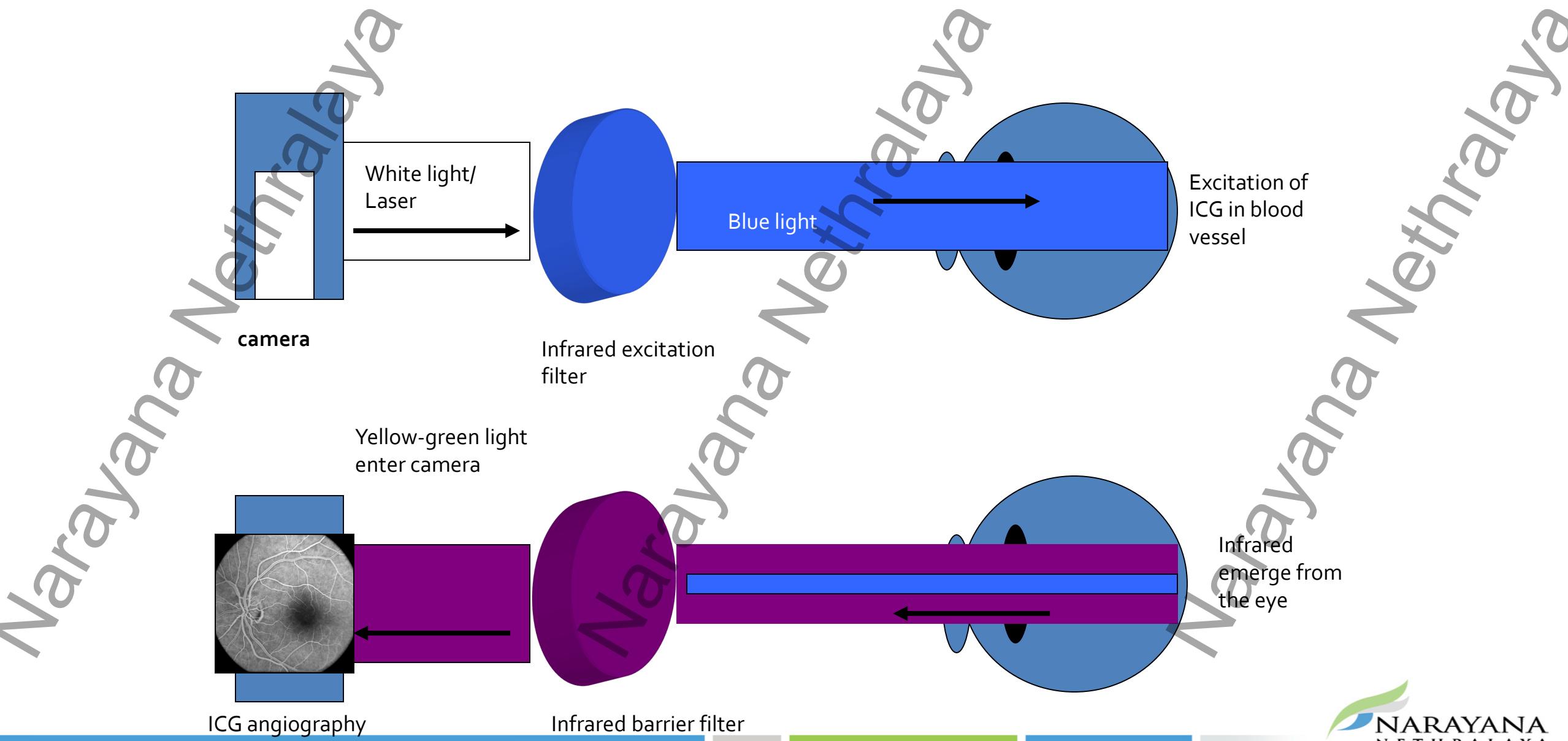
Over comes the limitations of FFA

- **Infrared light**

- Absorption: 790-805 nm
 - Emission: 825-835 nm

- Masking by pigments and blood is minimized



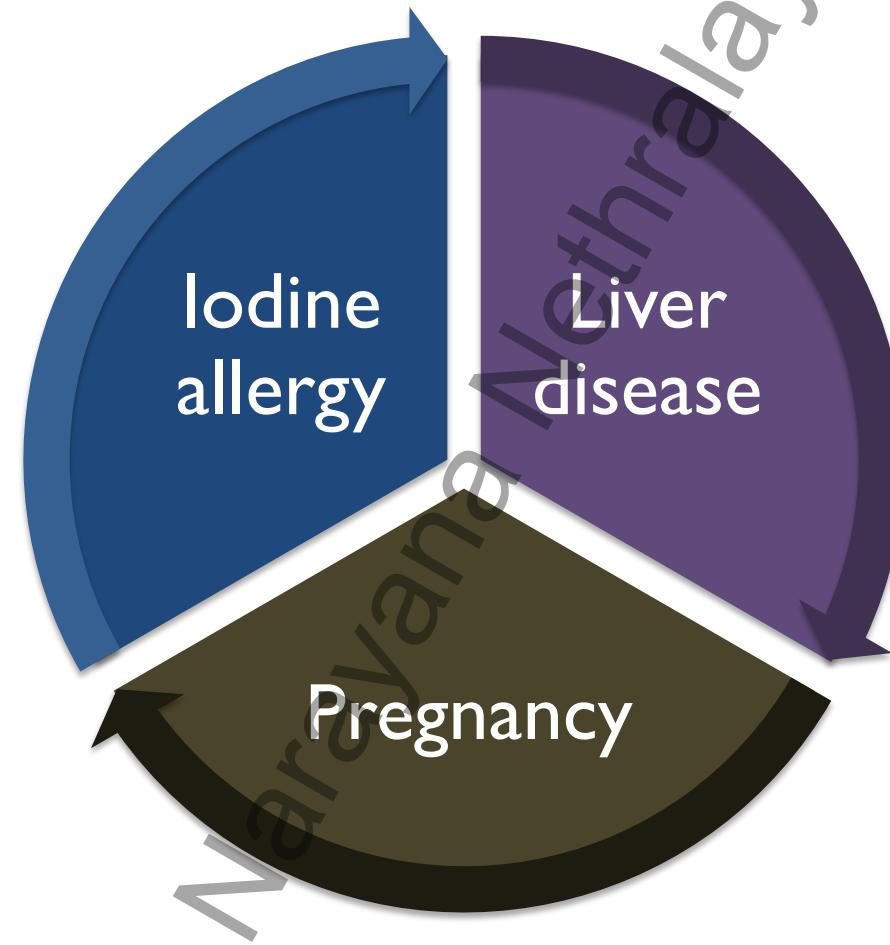




ICGA

- Indications:
 - IPCV (Idiopathic polypoidal choroidal vasculopathy)
 - Occult CNVM
 - CSCR
 - Choroidal tumours-Melanoma and Hemangioma

CONTRAINDICATIONS





FFA & ICGA DEMONSTRATION



Sodium Fluorescein

- Orange crystalline dye
- Mol wt. of 376 daltons
- 85% bound to albumin, 15% unbound
- 5ml of 10 % (500 mg)
- Metabolized by the liver and excreted by the kidneys.
- Most of the dye is cleared with 24-36 hours.



SIDE EFFECTS



SEVERE(<1%)

Larngeal edema

Bronchospasm

Angioneurotic edema

Cardiac arrest

Seizures

ABSOLUTE CONTRAINDICATIONS

H/o severe adverse reaction during
Fluorescein

RELATIVE CONTRAINDICATIONS

Asthma

Hay fever

Renal failure

Hepatic failure

MI

Pregnancy -1 st trimester

Angiography Procedure

500mg in
5ml vial

rapid IV
injection

5 ml NS
flush

Rapid
photographs

3 min

10 min

Narayana A.



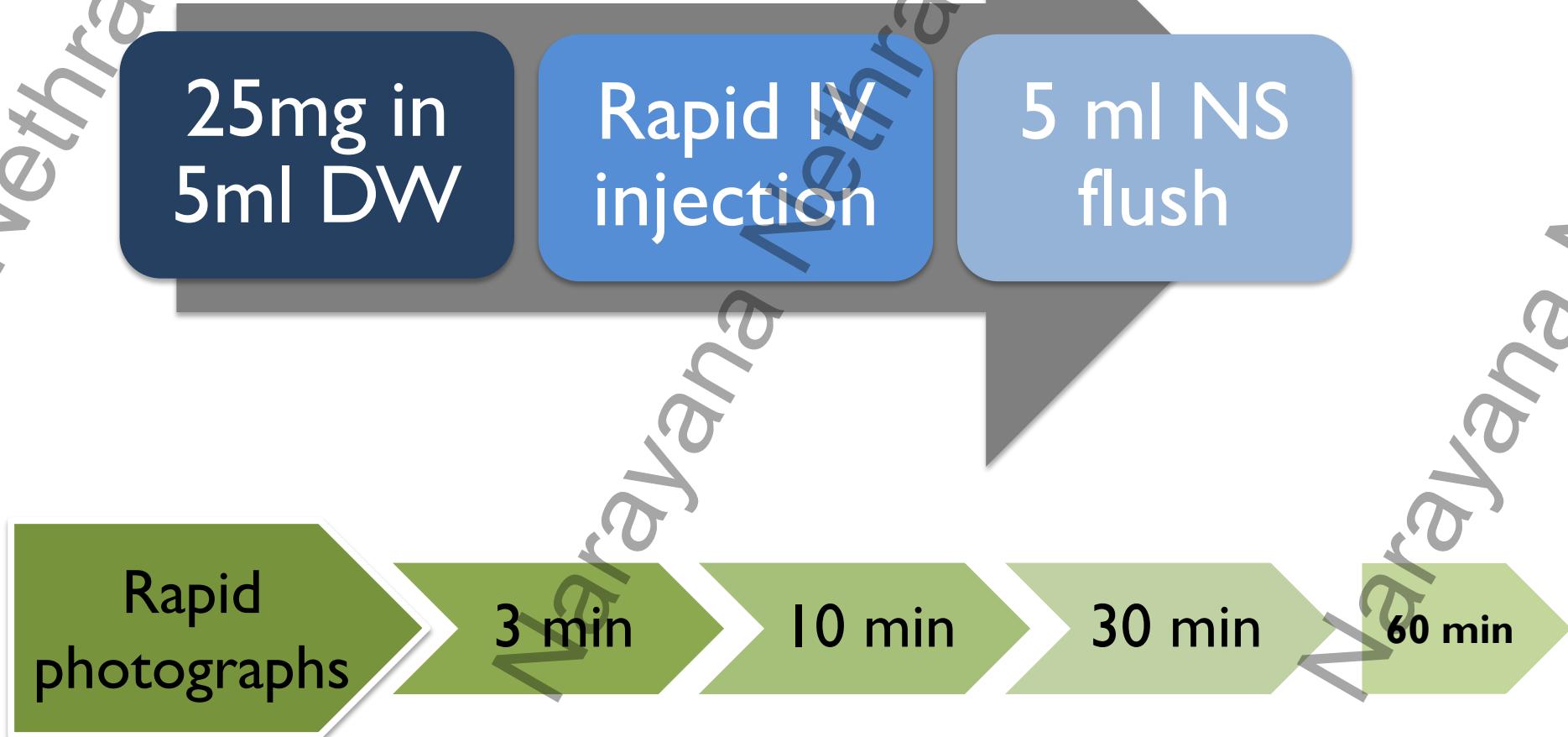
Narayana Nethralaya

Pharmacokinetics

- ICG is a tricarbocyanine, anionic dye.
- ICG-high molecular weight
- In vivo, ICG is **98% protein bound**.
- it has both lipophilic and hydrophilic properties.
- Therefore, less dye escapes from the choroidal vessels fenestrations.
- ICG is excreted through liver.



Angiography Procedure



Narayana



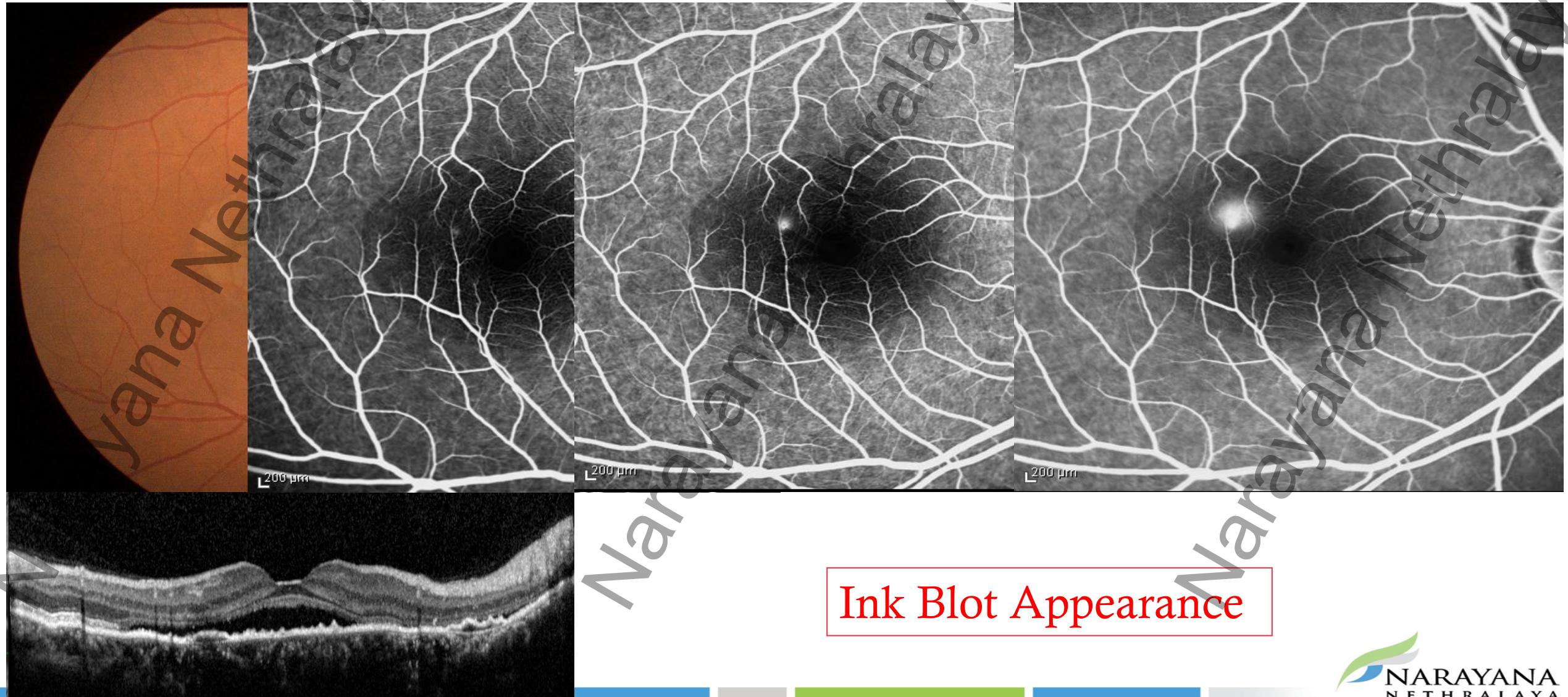
Narayana Nethralaya

Narayana Nethralaya

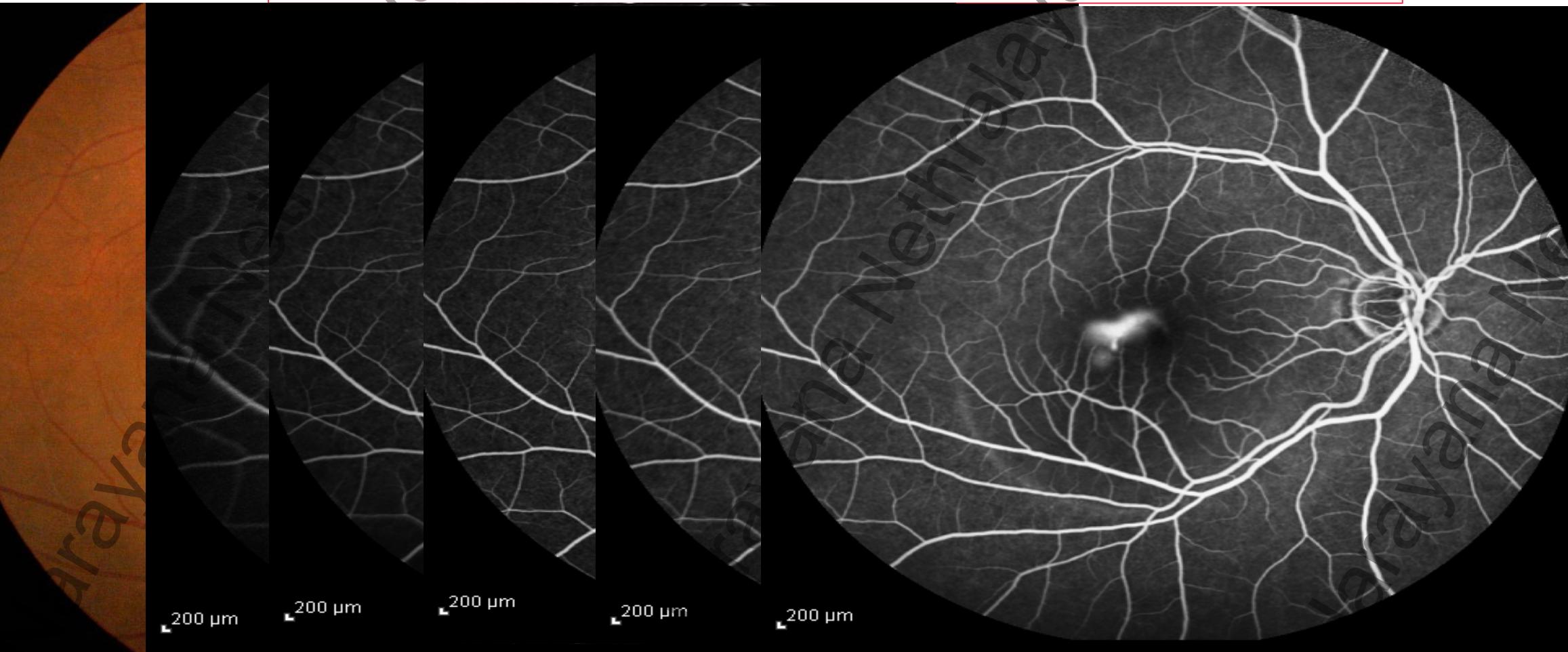
Case Examples

Narayana Nethralaya

Central Serous Chorioretinopathy



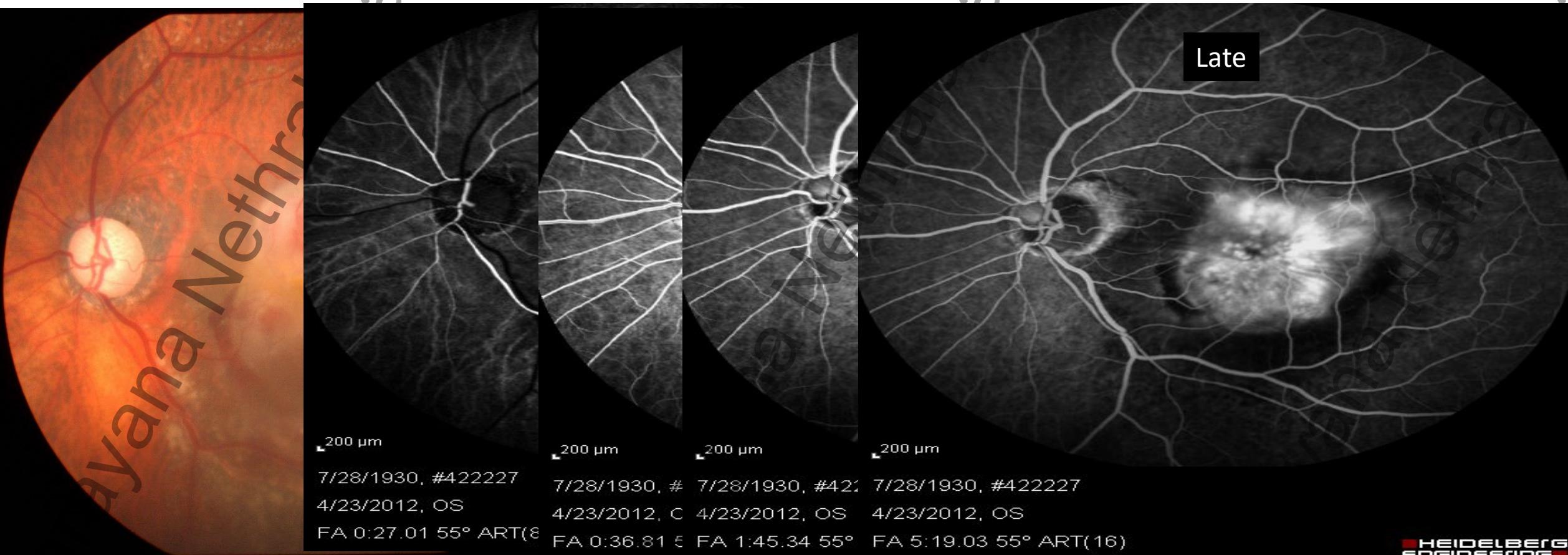
Smoke Stack Appearance



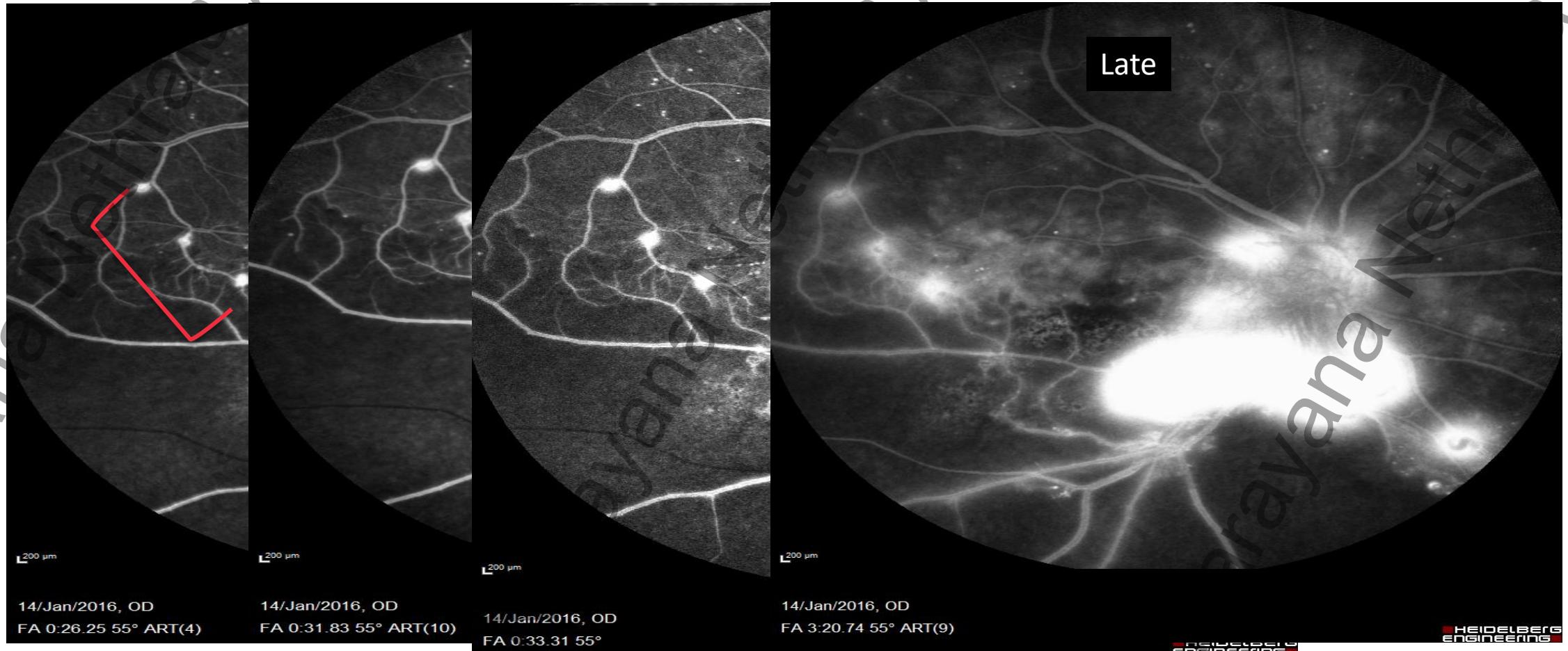
Choroidal Neovascular Membrane (classic)



Choroidal Neovascular Membrane (Occult)

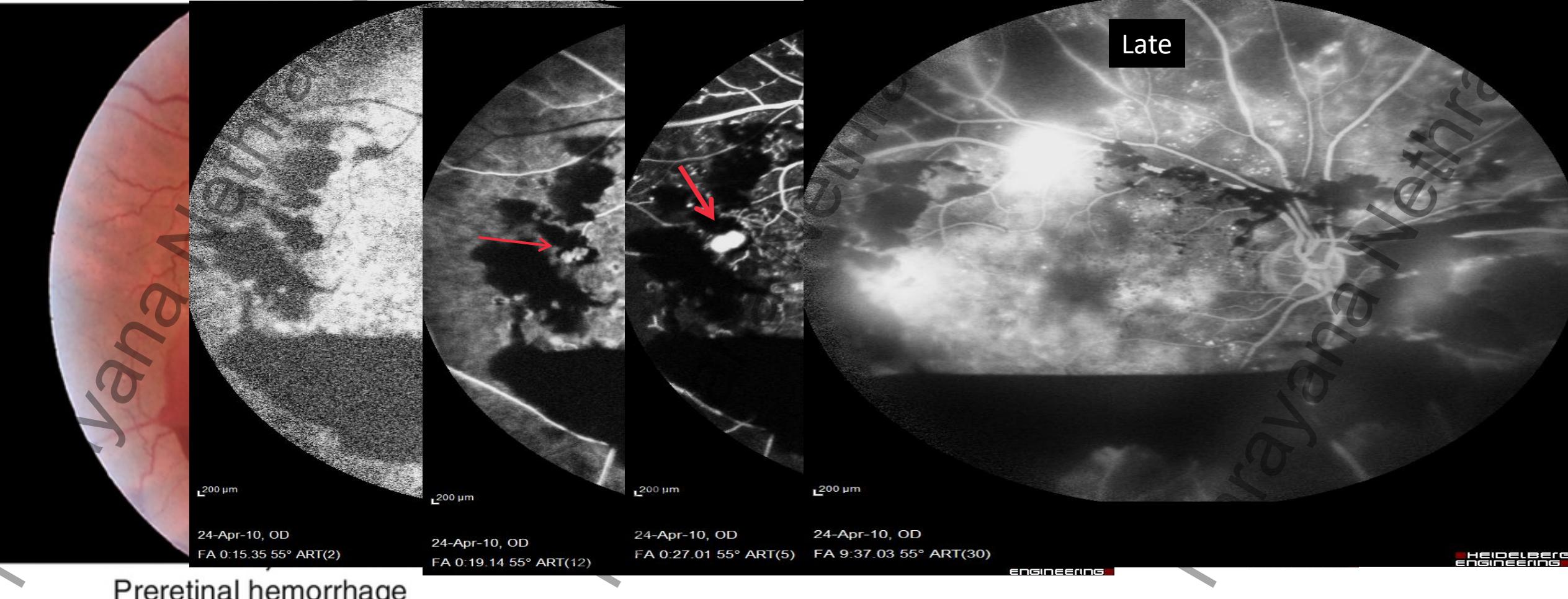


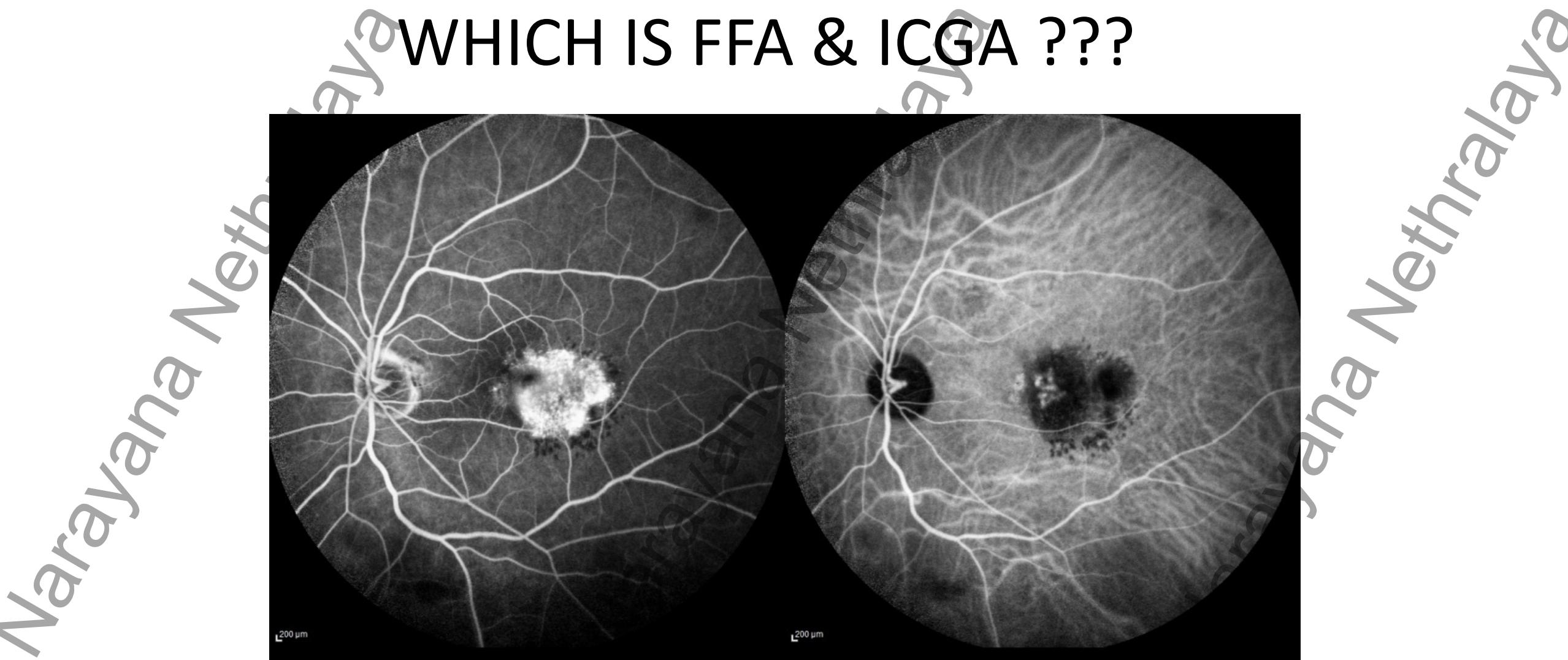
Branch Retinal Vein Occlusion



Advanced Proliferative Diabetic Retinopathy

Intraretinal hemorrhage: flame and dot/blot





15-Feb-16, OS

FA&ICGA 10:06.84 55° ART(18) 10:06.78 55° ART(18)

HEIDELBERG
ENGINEERING



RE-6/6,LE-6/12

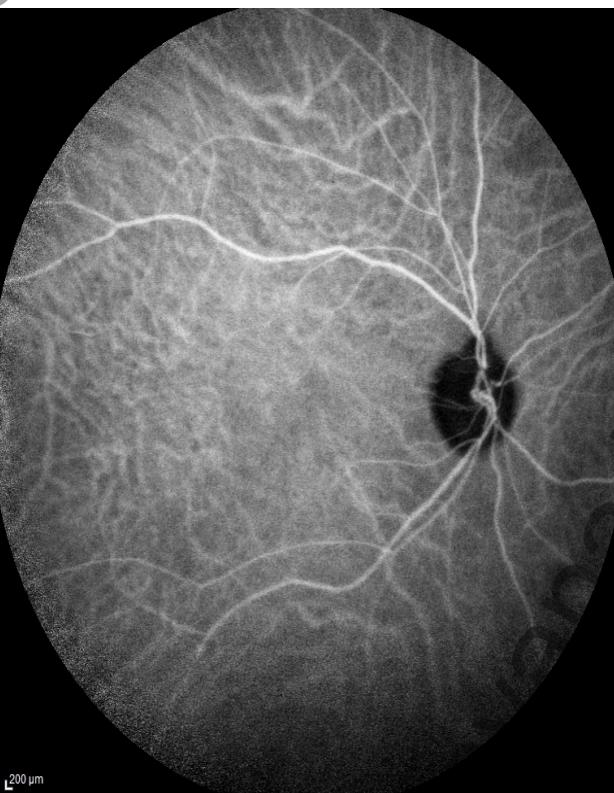
Naraya

This image is a fundus photograph of the retina, likely taken using Optical Coherence Tomography (OCT). The image is circular, centered on the macula. A large, dark, irregular lesion is visible in the central area, appearing as a cluster of dark pixels. The surrounding retinal tissue shows the characteristic branching pattern of blood vessels. The image has a grayscale color scheme, with the lesion being significantly darker than the surrounding tissue.

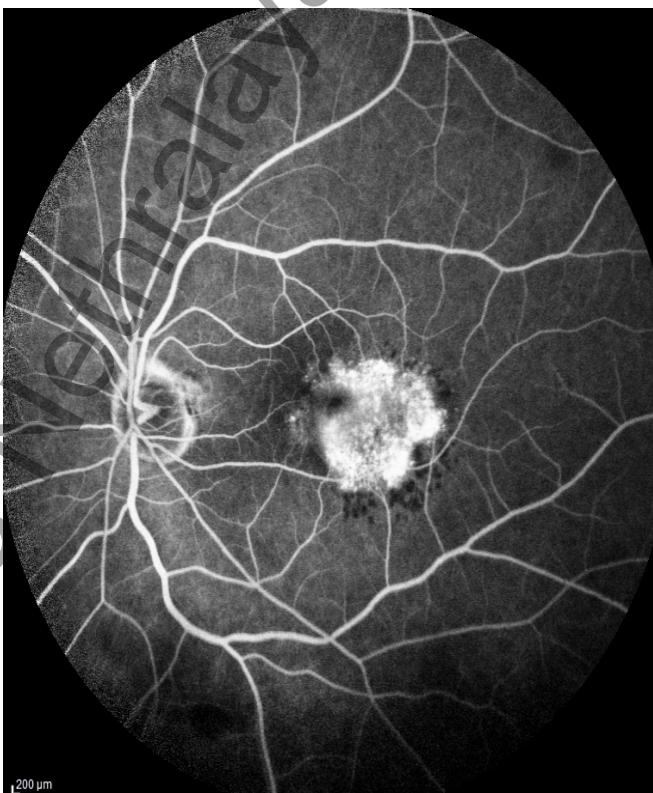
IPCV



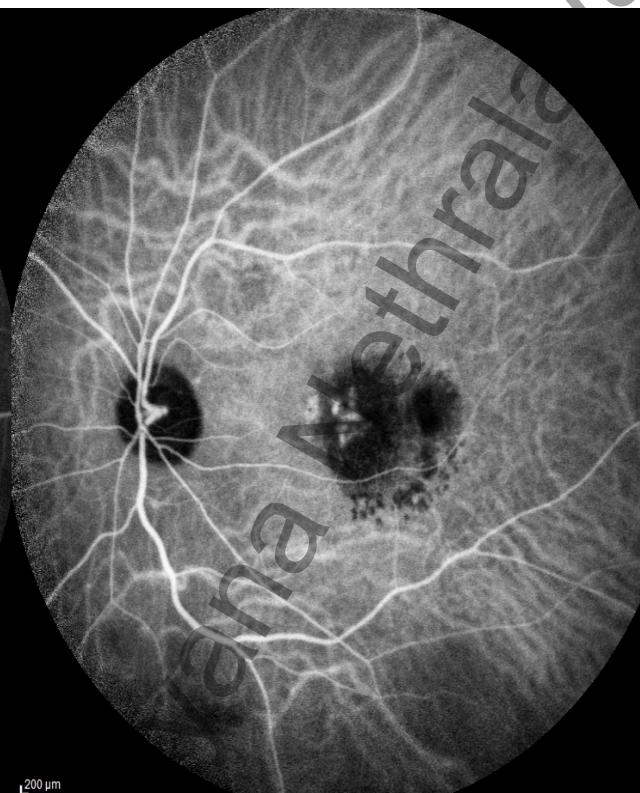
15-Feb-16, OD
FA&ICGA 10:30 16 55° ART(12) 10:30.09 55° ART(12)



HEIDELBERG
ENGINEERING



15-Feb-16, OS
FA&ICGA 10:05 57 55° ART(12) 10:05.51 55° ART(12)



Narayana

200 µm

09-May-16, OD

FA&ICGA 0:15.30 55° ART(4) 0:15.22

200 µm

09-May-16, OD

FA&ICGA 0:17.63

200 µm

09-May-16, OD

FA&ICGA 0:19.53 55°

200 µm

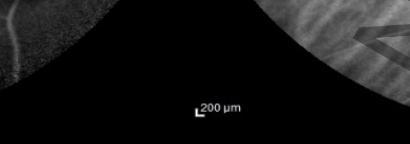
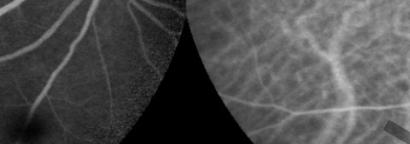
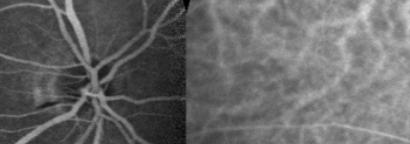
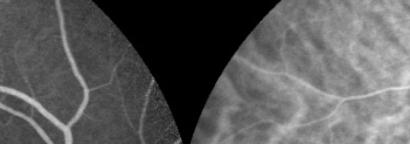
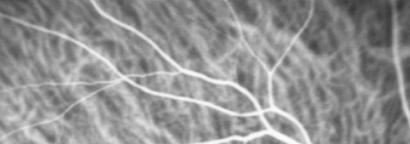
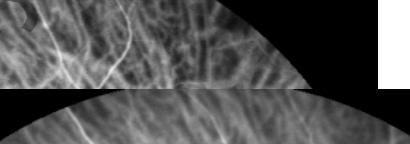
09-May-16, OD

FA&ICGA 1:37.42 55° ART(15) 1:37.34 55° ART

200 µm

09-May-16, OD

FA&ICGA 4:40.37 55° ART(11) 4:40.30 55° ART(11)



Heidelberg
Engineering

A

NETHRALAYA

your faith shall heal you

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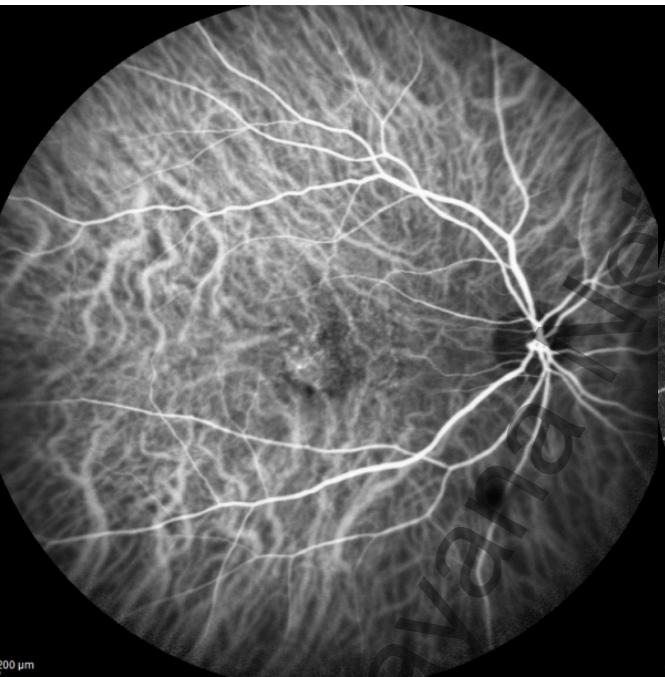
Narayana Nethralaya

OCCULT CNVM

Narayana Nethralaya

FFA vs ICG

CASE 2



CASE 1



09-May-16, OD
FA&ICGA 1:37.42 55° ART(15) 1:37.34 55° ART(15)

15-Feb-16, OS
HEIDELBERG
Engineering FA&ICGA 3:06.49 55° ART(12) 3:06.43 55° ART(12)

HEIDELBERG
Engineering