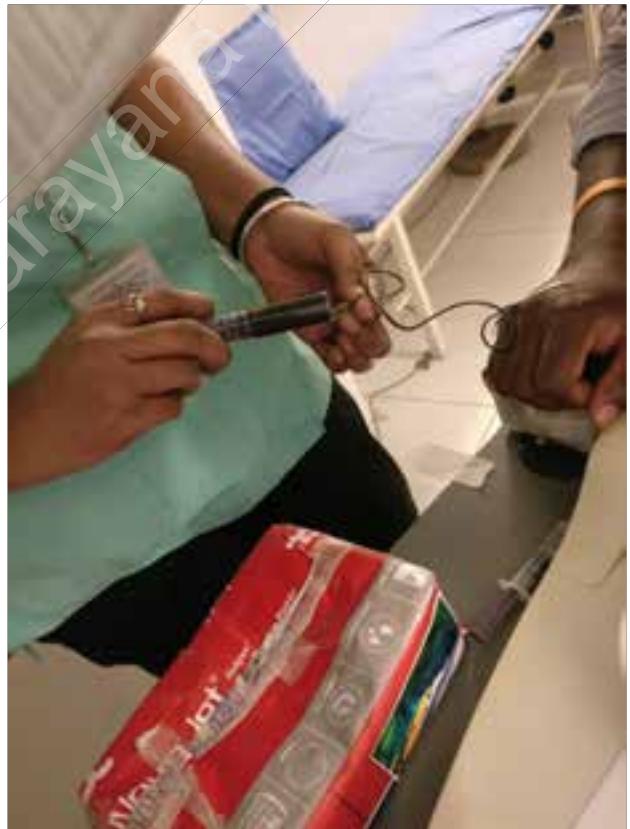


# Fundus Fluorescein Angiography and Indocyanin Green Angiography

# WHAT IS FFA?

**Used to study the retinal vasculature and perfusion**



.Vethralaya

Narayana Nethralaya

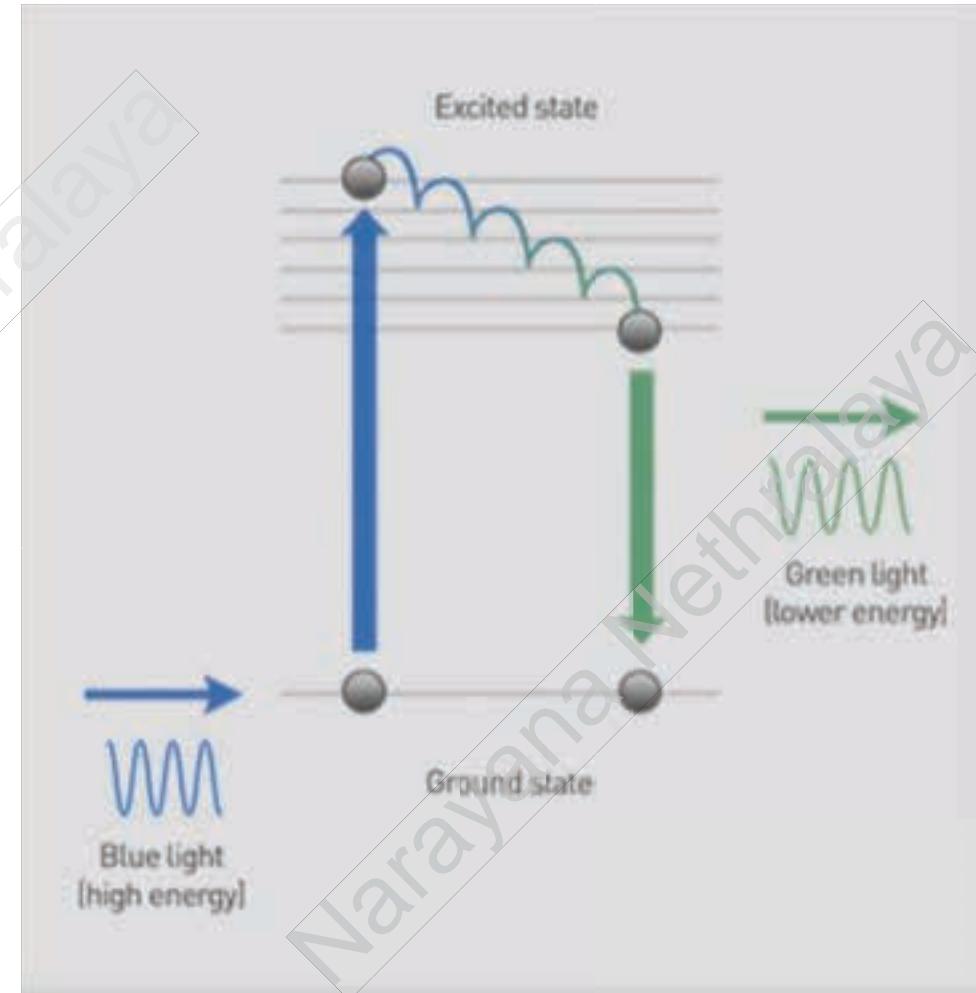
Narayana Nethralaya



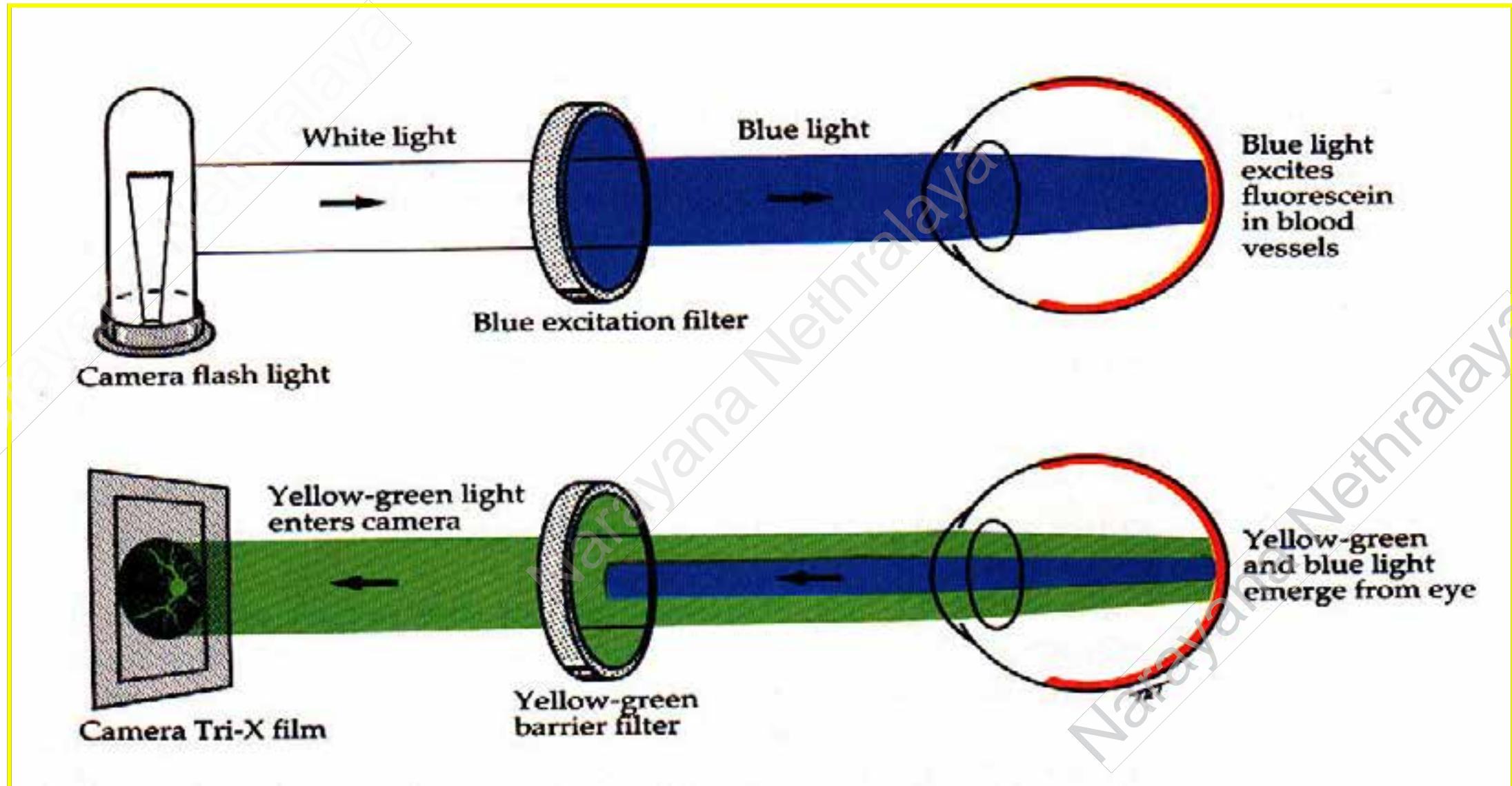
# PRINCIPLE

- **FLUORESCENCE-**

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



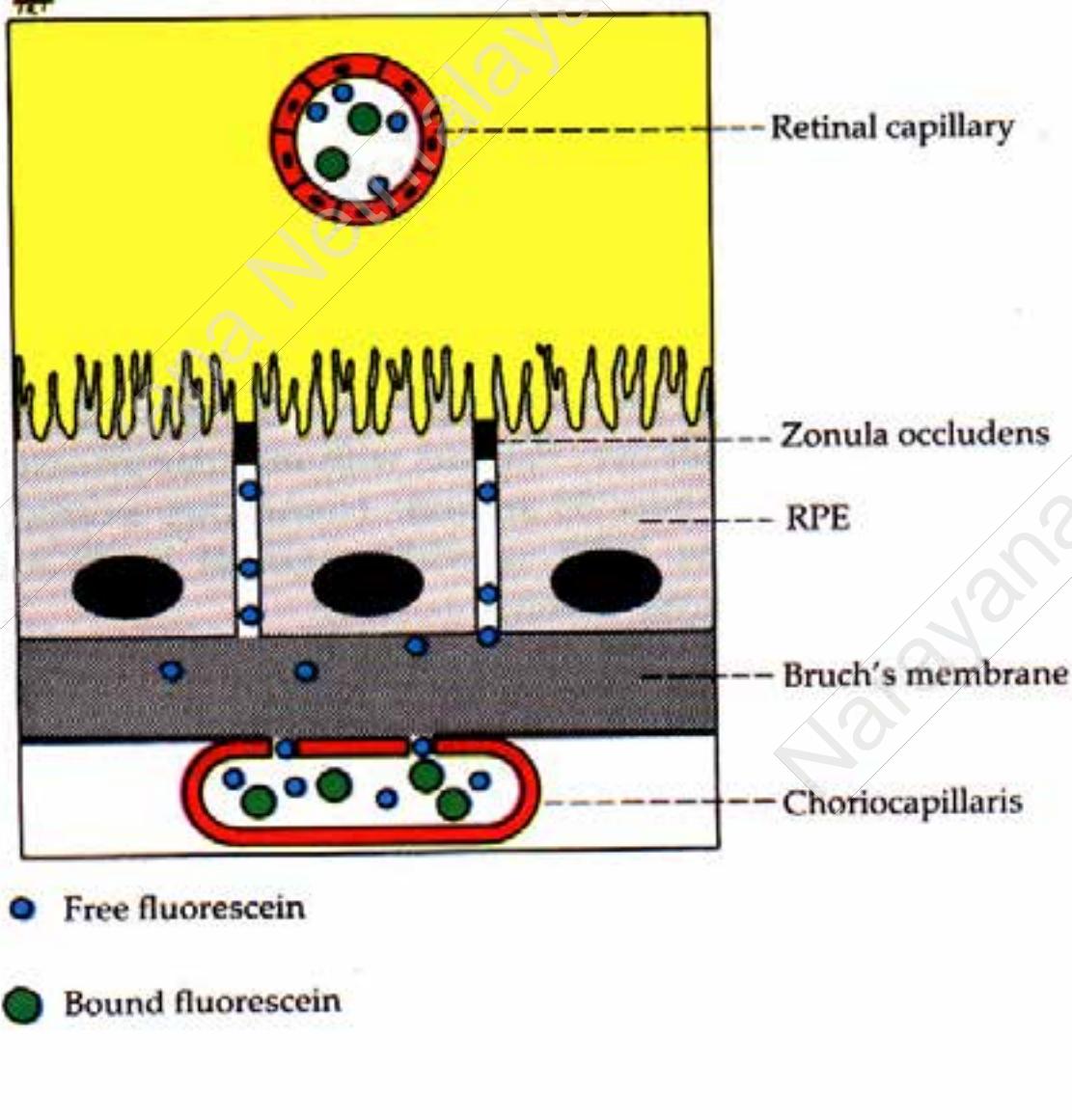
# Filters



# Sodium Fluorescein

- Orange crystalline dye
- Mol wt. of 376 daltons
- 85% bound to proteins, 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.





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

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

**Choriocapillaris-**  
Permeable to only “free” fluorescein.

# SIDE EFFECTS

MILD(0.73-14%)	MODERATE(<1%)	SEVERE(<1%)
Nausea	Urticaria	Larngeal edema
Vomiting	Rash	Bronchospasm
Pruritus	Syncope	Angioneurotic edema
sneezing	Pyrexia	Cardiac arrest
Vasovagal phenomena	Thrombophlebitis	Basilar artery ischaemia
Inadvertent arterial injection	Nerve palsy	Seizures

# Indications of FFA

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

## **ABSOLUTE CONTRAINDICATIONS**

H/o severe adverse reaction during  
Fluorescein

## **RELATIVE CONTRAINDICATIONS**

Asthma

Hay fever

Renal failure

Hepatic failure

MI

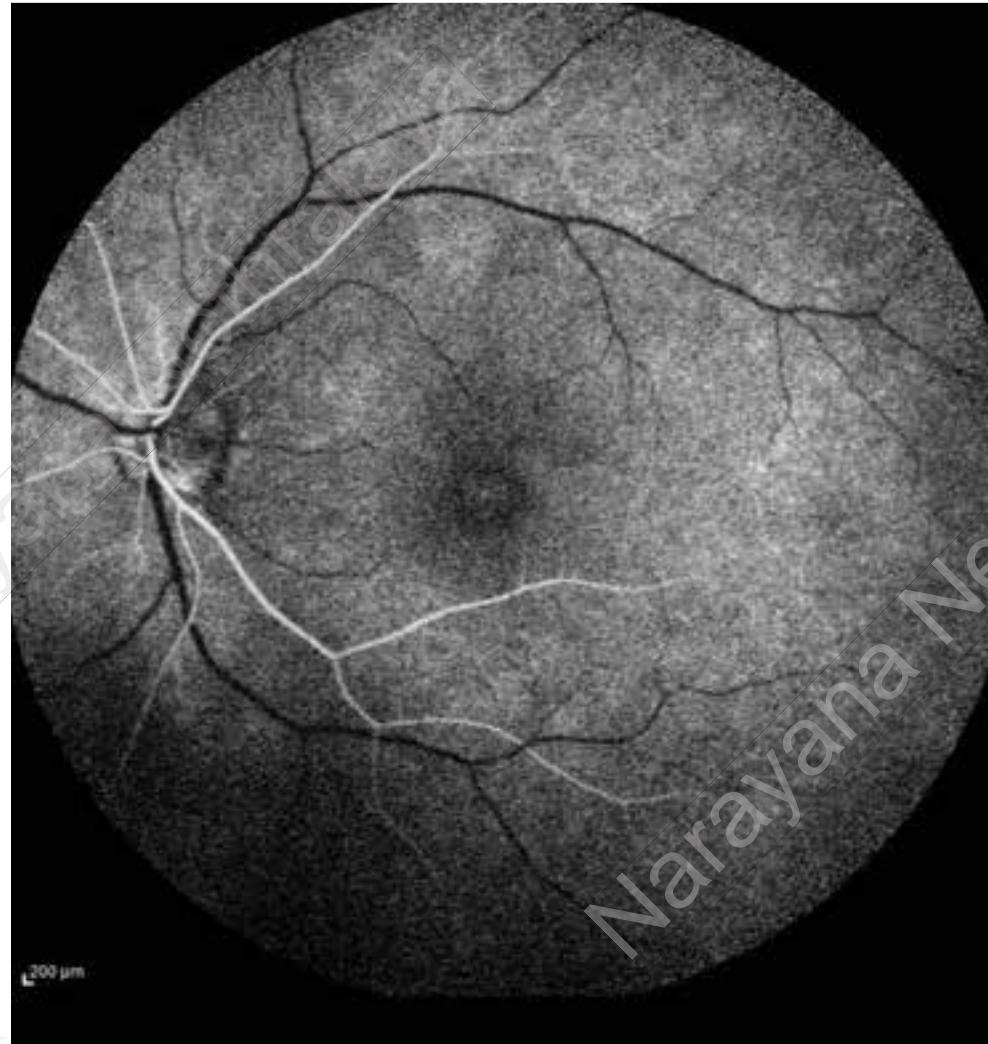
Pregnancy -1 st trimester

# Phases of FFA

Arm to Retina Time:

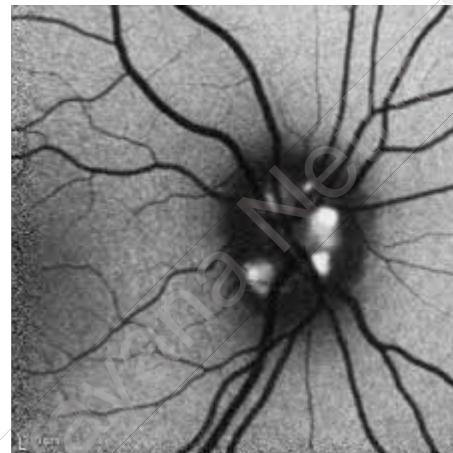


- 10 – 12 seconds - young age
  - 12- 15 seconds – old age
  - abnormal >20 sec
- 
- Delayed -
    - cardiac disease
    - Blood viscosity
    - Giant cell arteritis
    - carotid artery stenosis



## 2. Infrared free image (prior to dye injection)

- **Autofluorescence**
  - optic nerve head drusen
  - drusen
- **Pseudofluorescence**
  - wearing of filters



Nethralaya

Narayana Nethralaya

Narayana Nethralaya



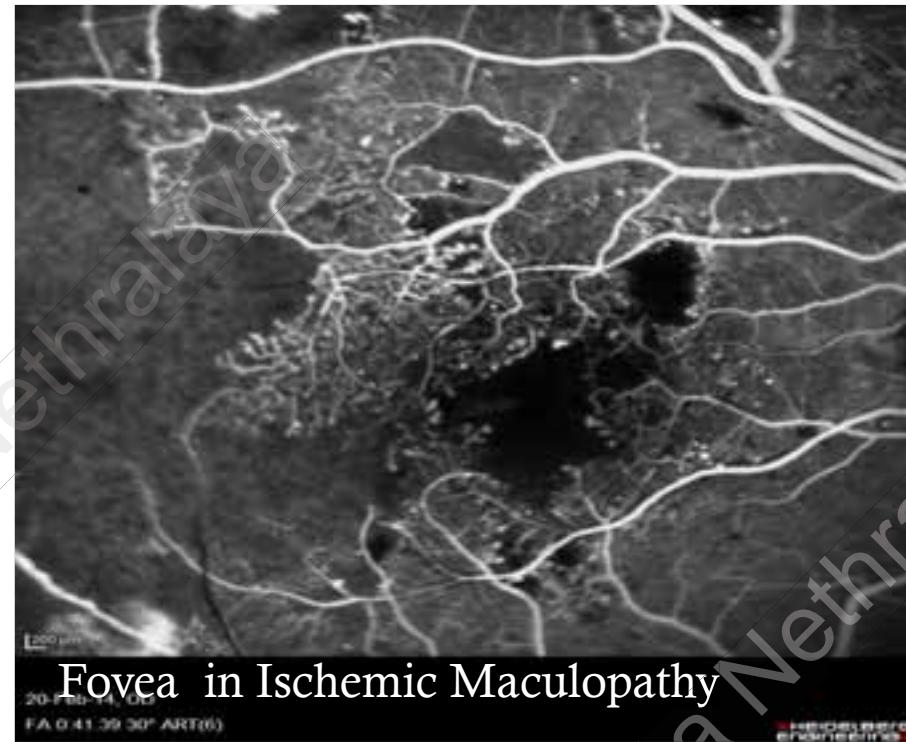


# Fovea in FFA



Why does the fovea appear dark?

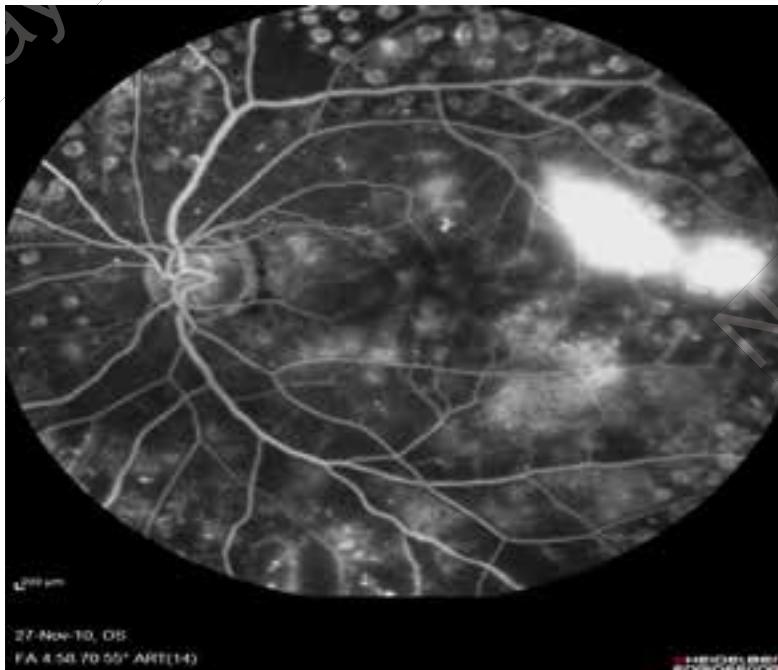
- Avascular
- Large RPE – Melanin
- Increased Xanthophyll density



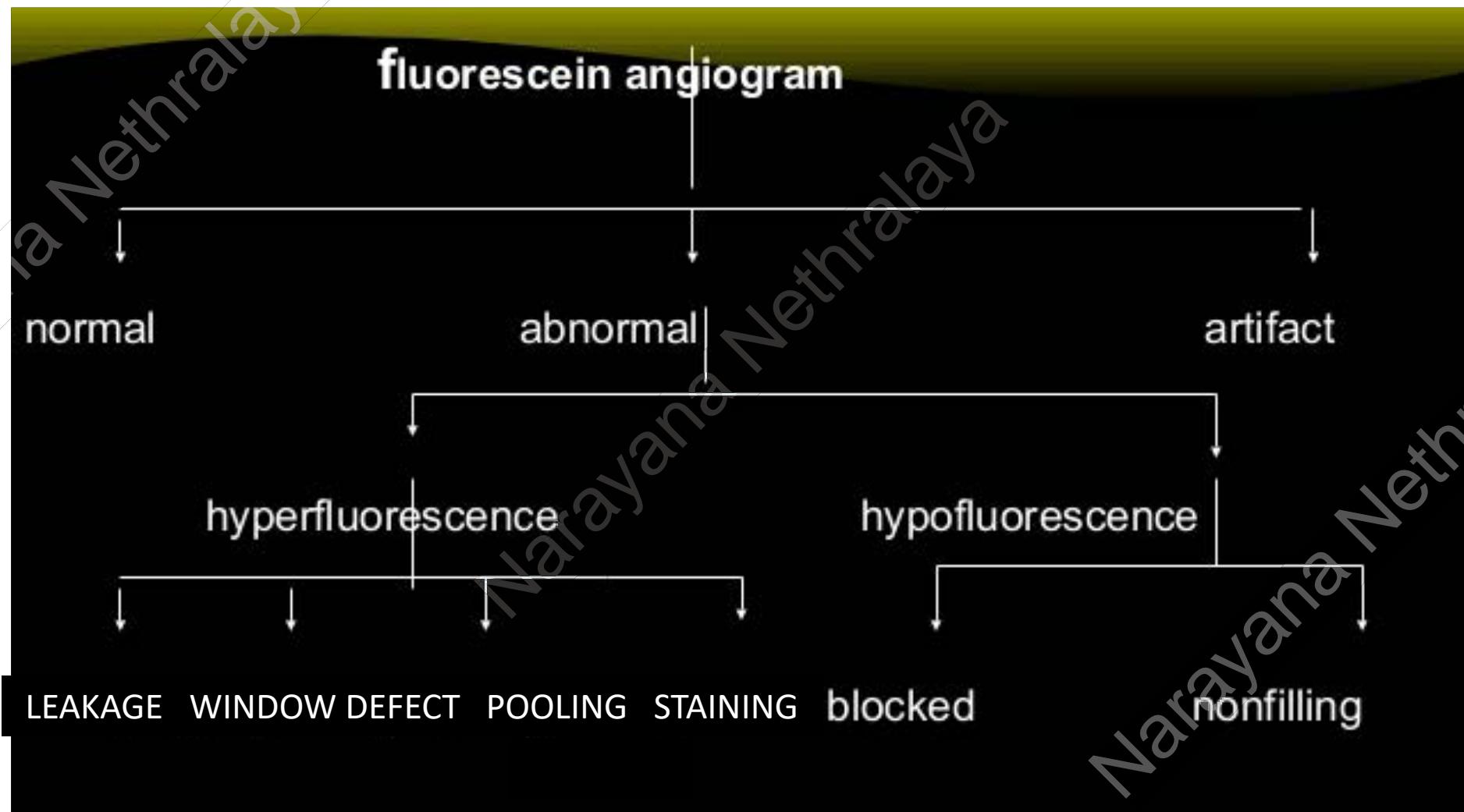
- Enlarged FAZ
- Irregular margin of FAZ
- Capillary budding

# FFA Interpretation

- Fluorescence-normal/hypo/hyper –mixed
- Phase, duration of FFA
- Level of pathology
- Intensity and Size of lesion with time



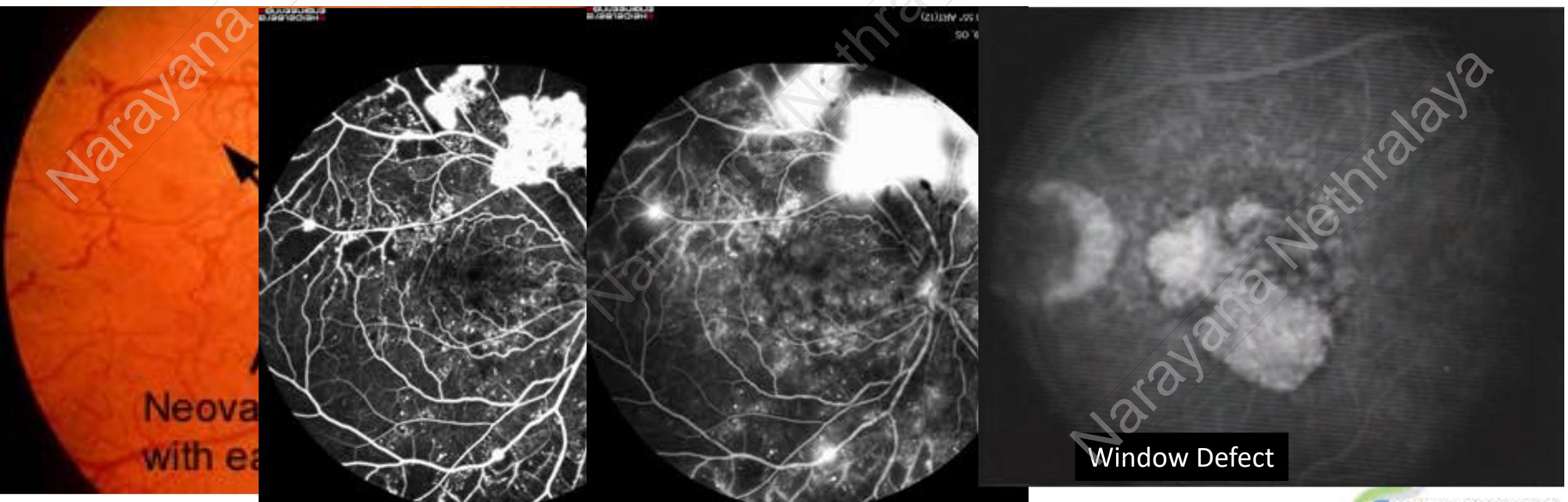
# INTERPRETATION FLOW CHART



Hyper  
fluorescence

Early  
phase

-leakage, window defect

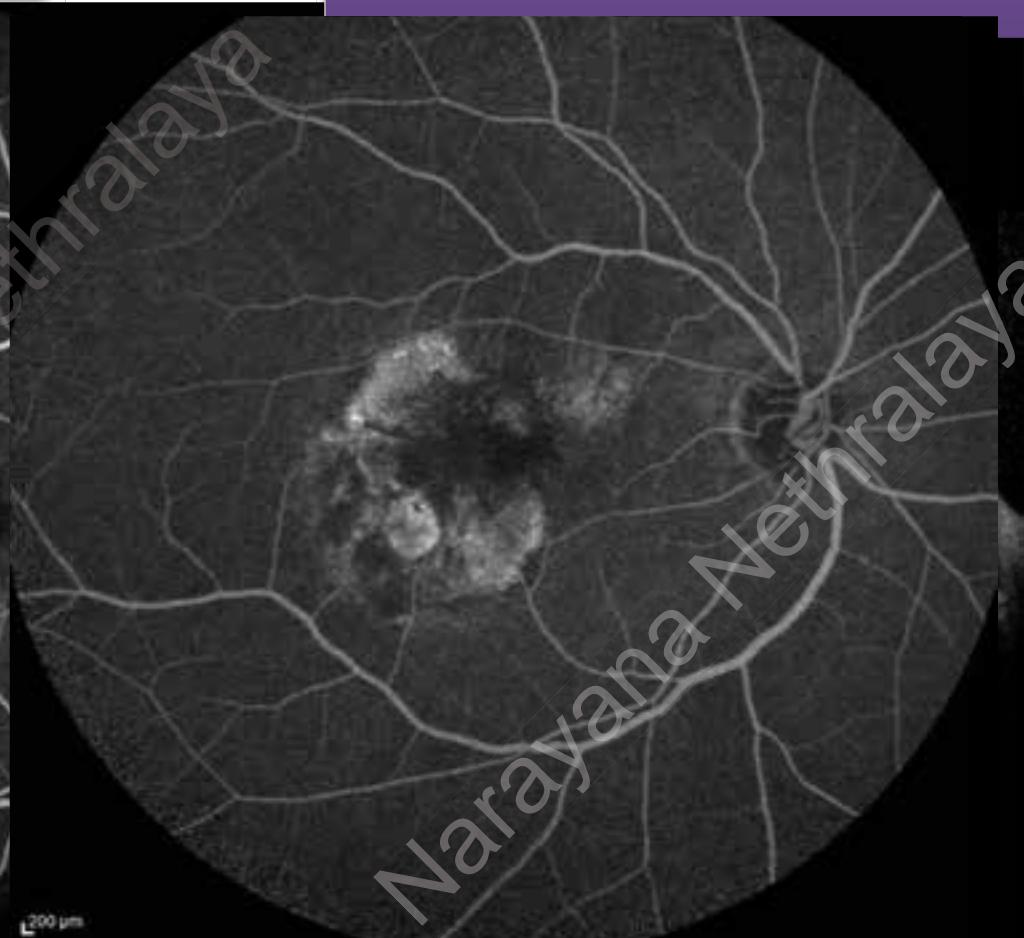


Hyper  
fluorescence

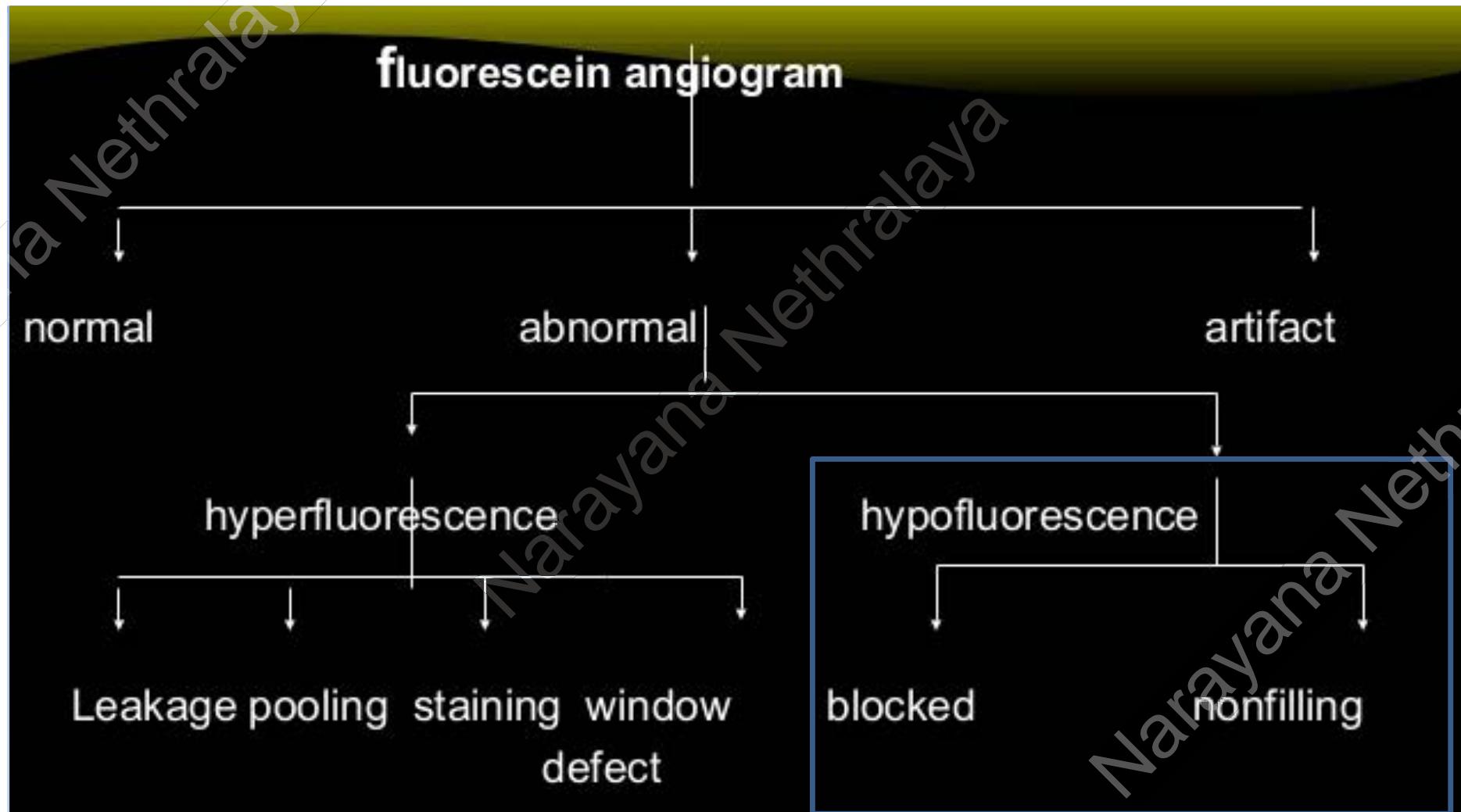
Late phase

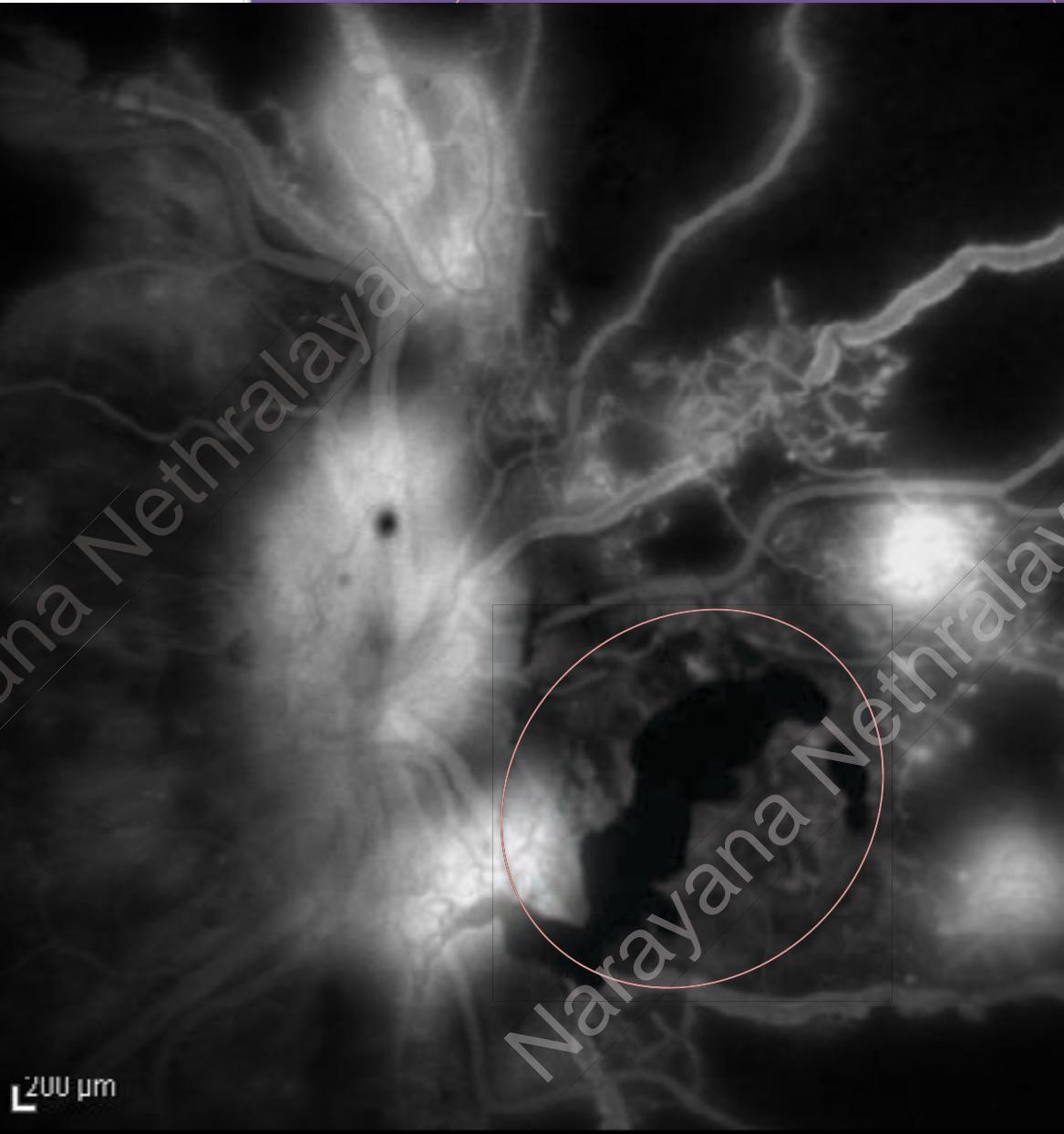
- pooling, staining

STAINING OF SCARS



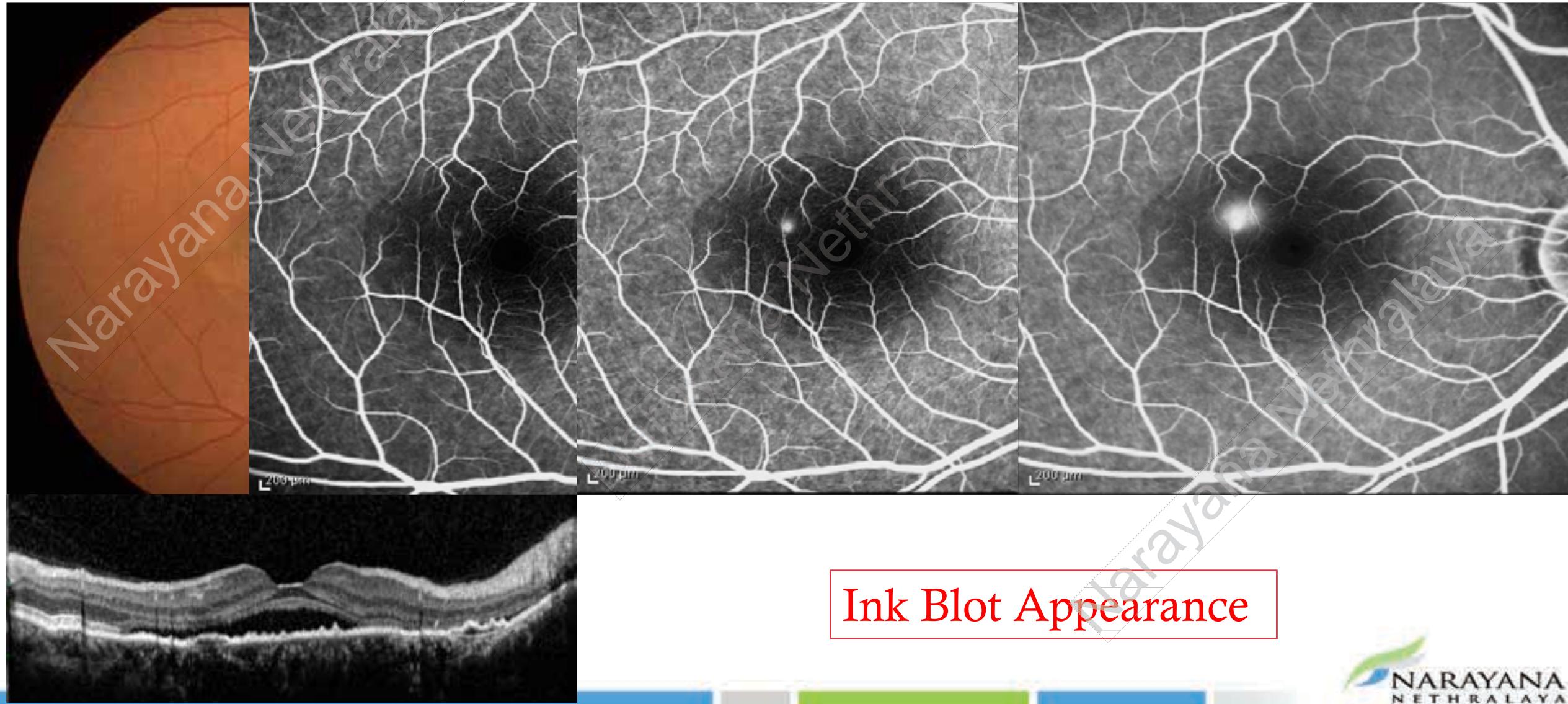
# INTERPRETATION FLOW CHART





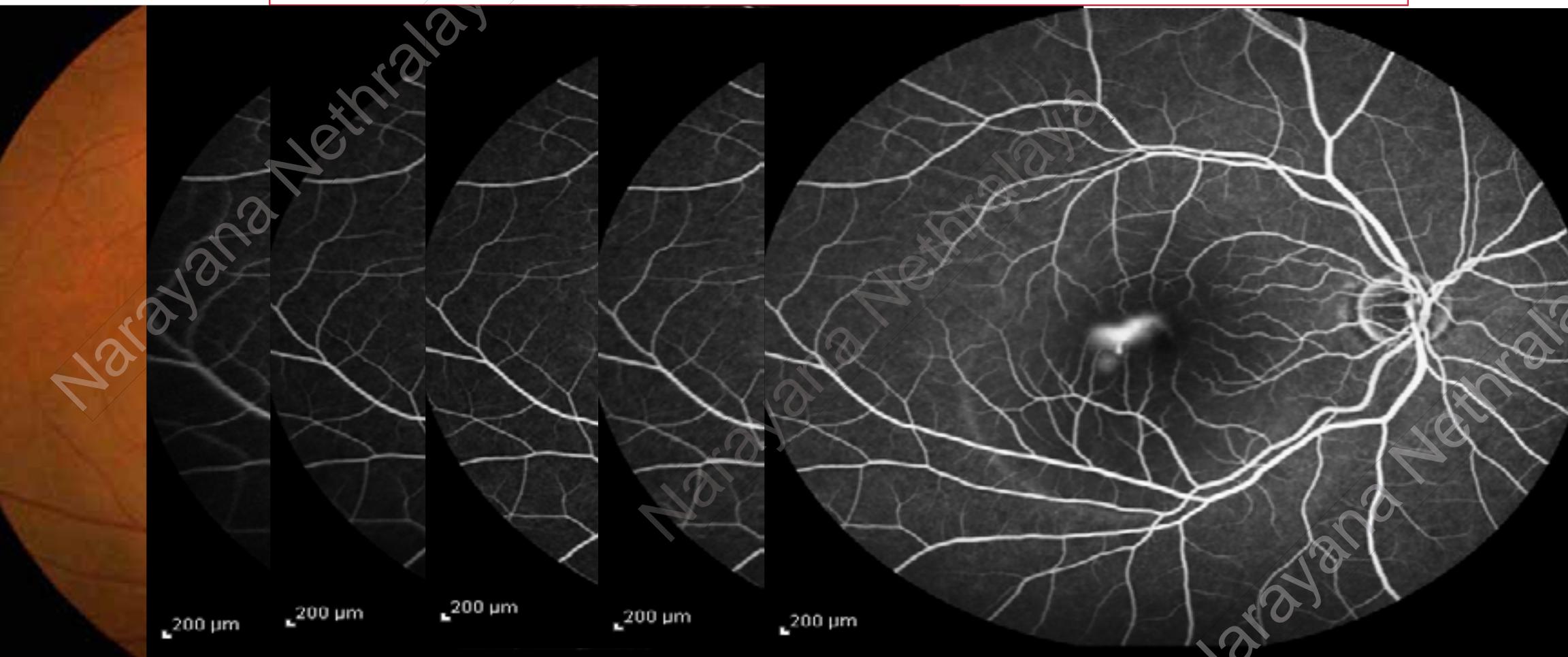
# *Case Examples*

# Central Serous Chorioretinopathy

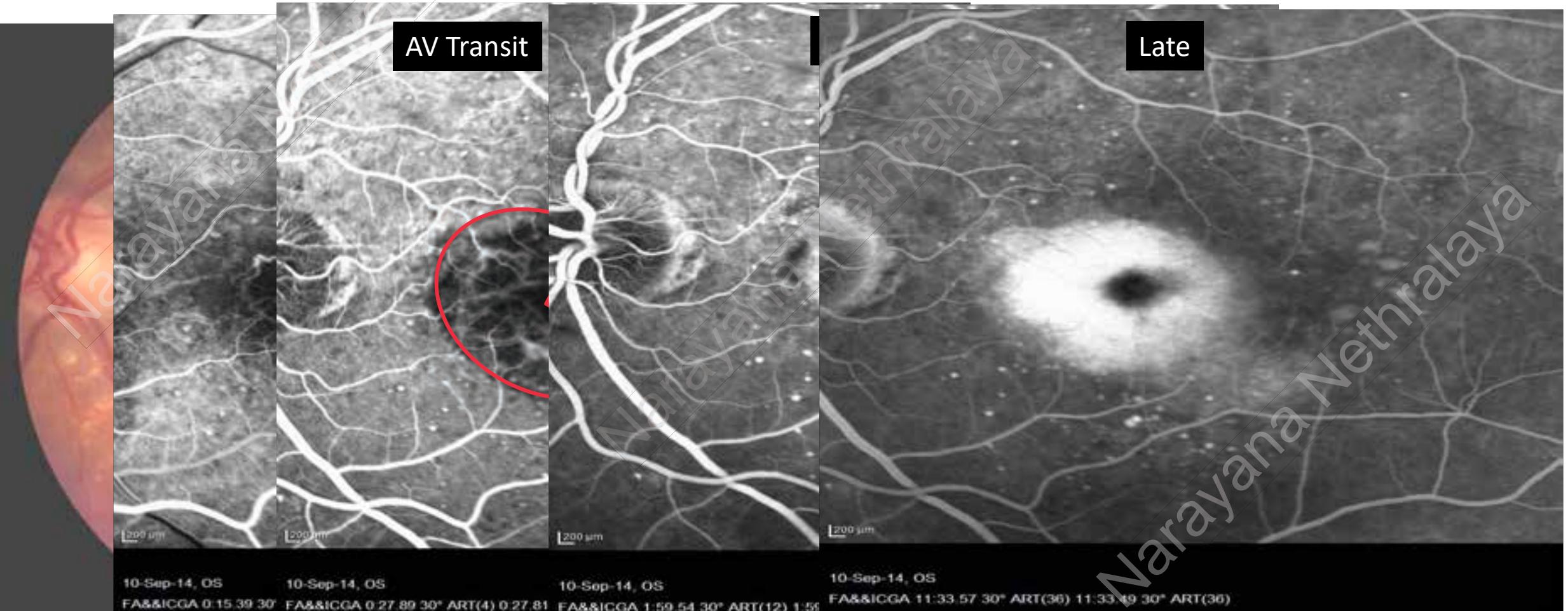


Ink Blot Appearance

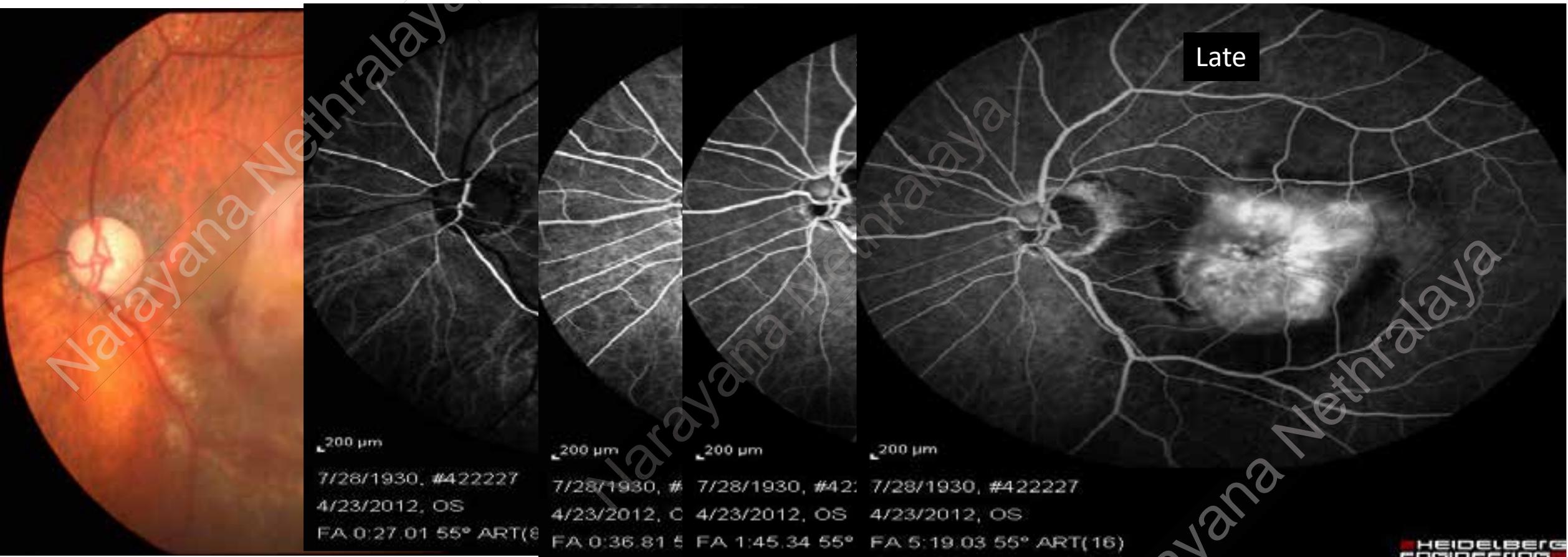
# Smoke Stack Appearance



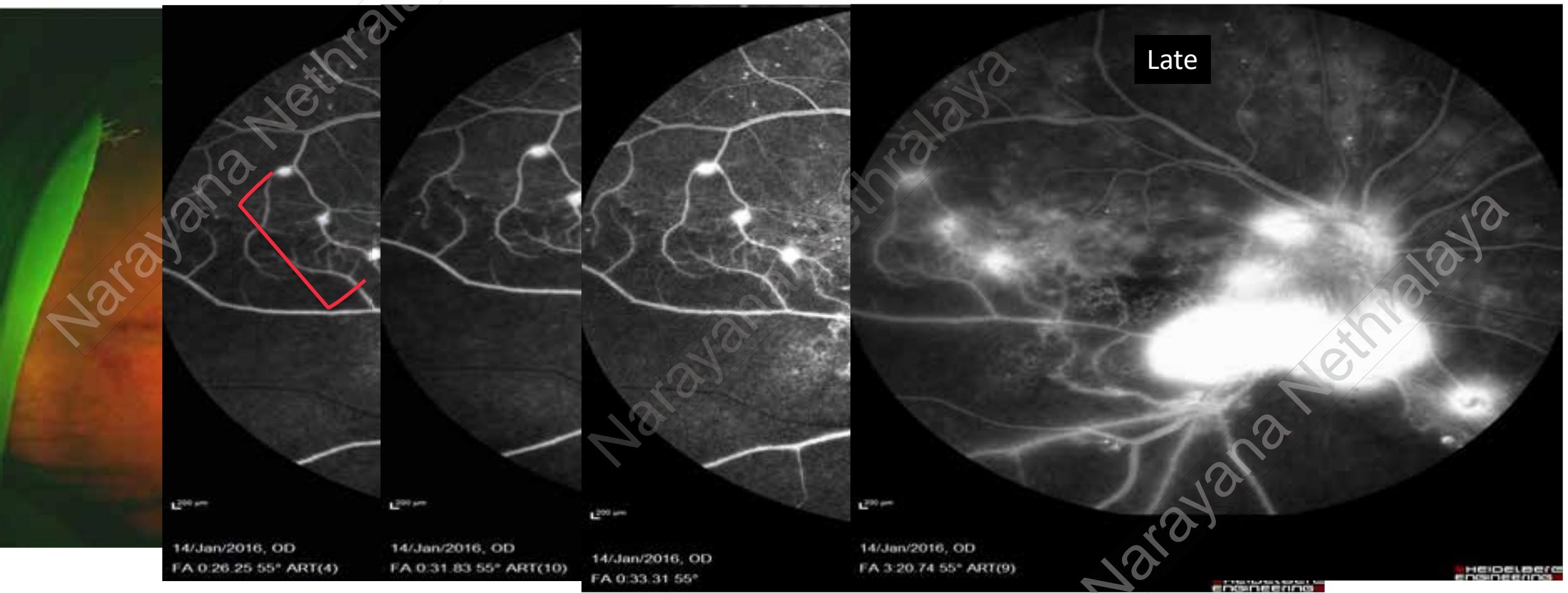
# Choroidal Neovascular Membrane ( classic)



# Choroidal Neovascular Membrane ( Occult)

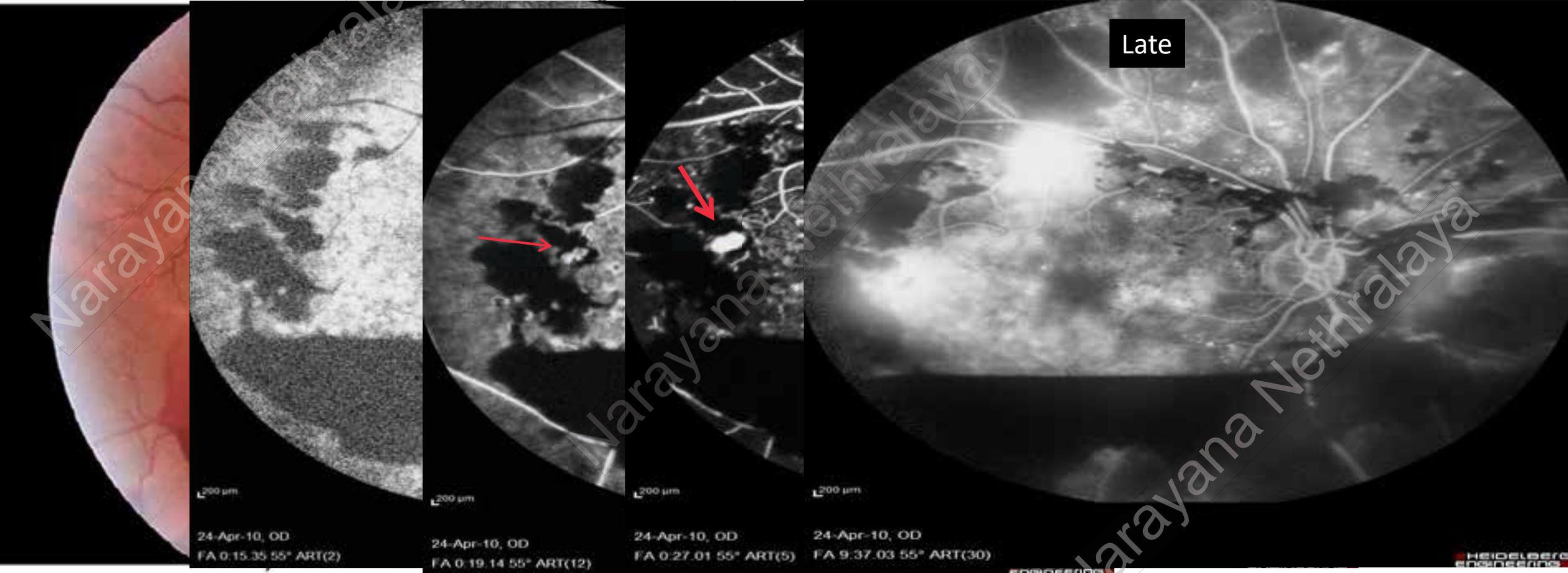


# Branch Retinal Vein Occlusion



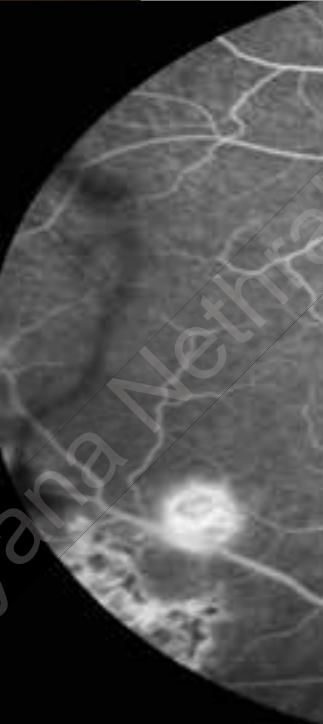
# Advanced Proliferative Diabetic Retinopathy

Intraretinal hemorrhage: flame and dot/blot



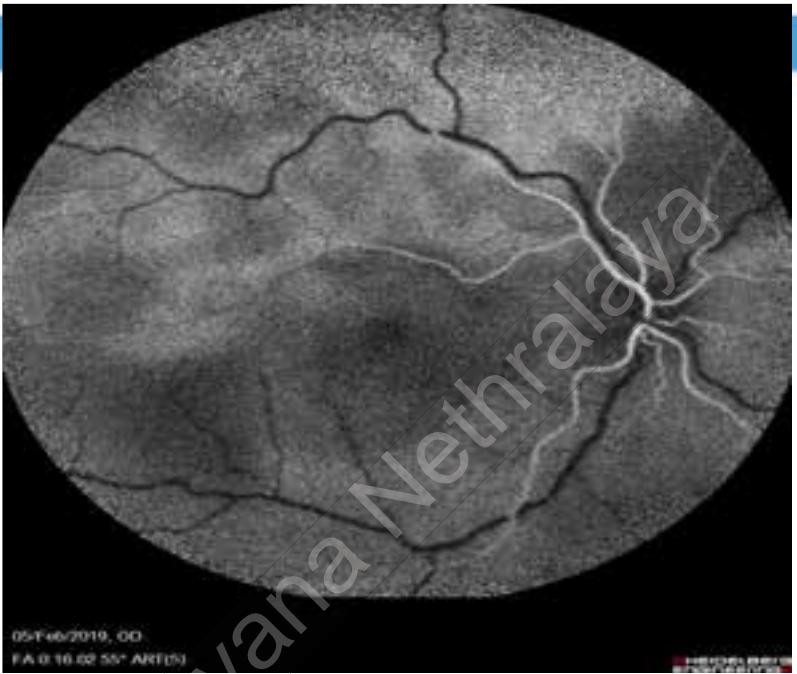


## VASCULITIS

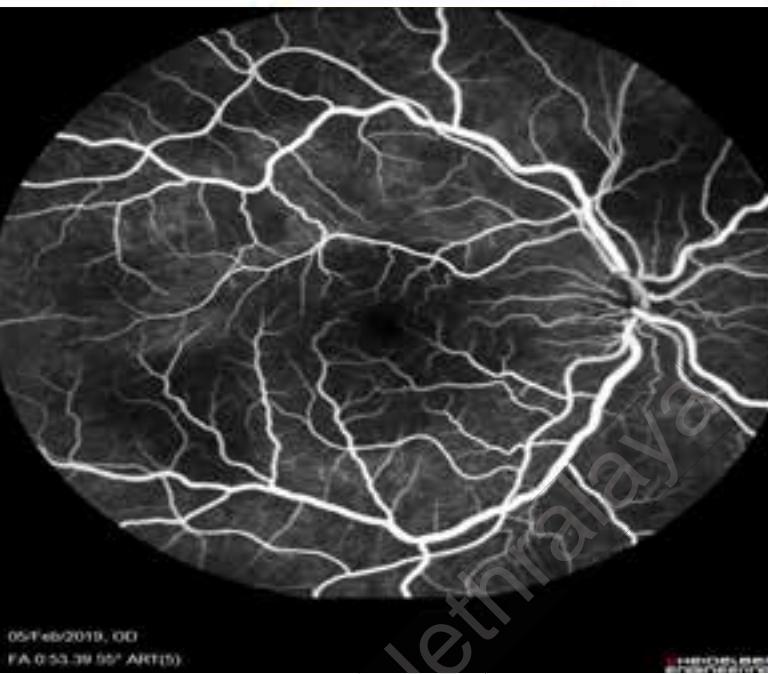


## CHOROIDITIS

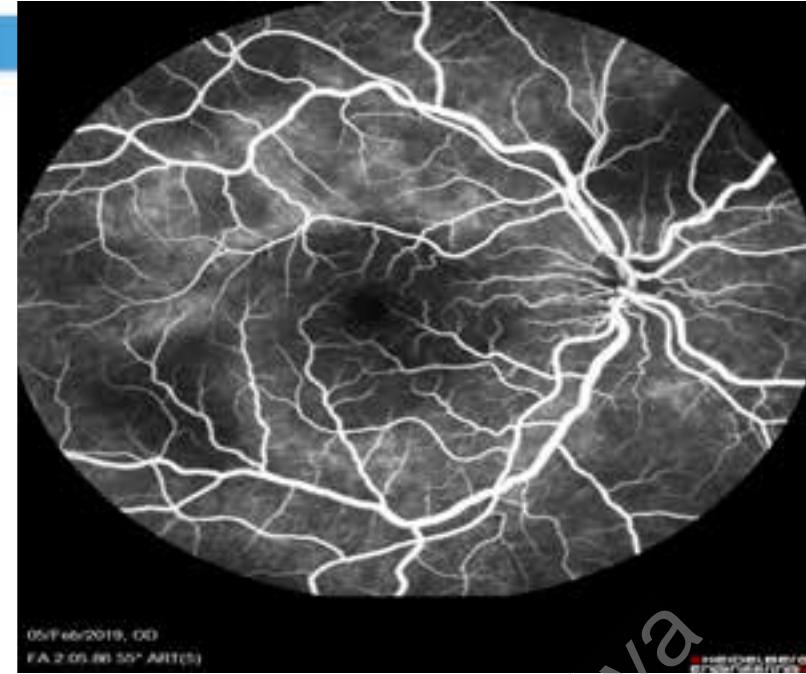




05-Feb-2019, 00  
FA 0.16 02° 55° ART(5)



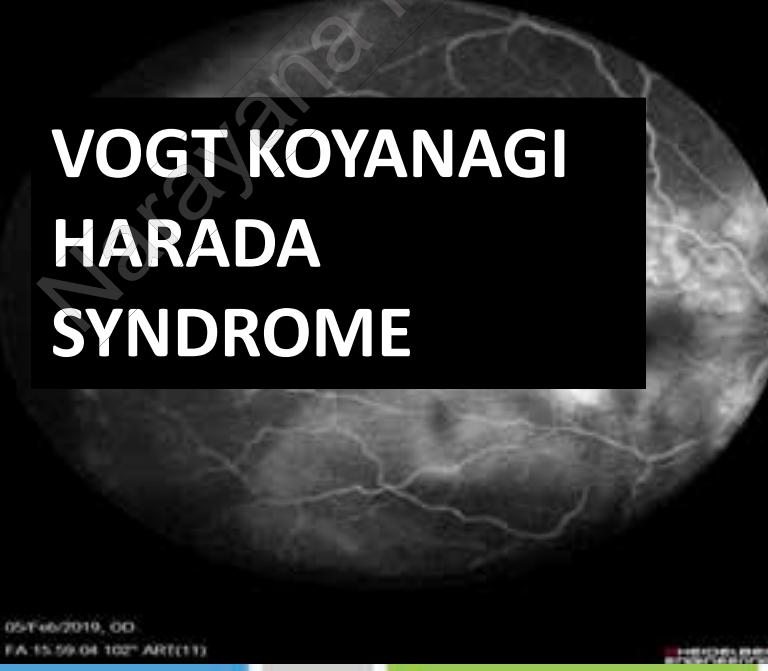
05-Feb-2019, 00  
FA 0.53 39 95° ART(5)



05-Feb-2019, 00  
FA 2.05 86 55° ART(5)



05-Feb-2019, 00  
FA 15.28 08 102° ART(12)



05-Feb-2019, 00  
FA 15.59 04 102° ART(11)



05-Feb-2019, 05  
FA 16.35 28 102° ART(7)

# LIMITATIONS

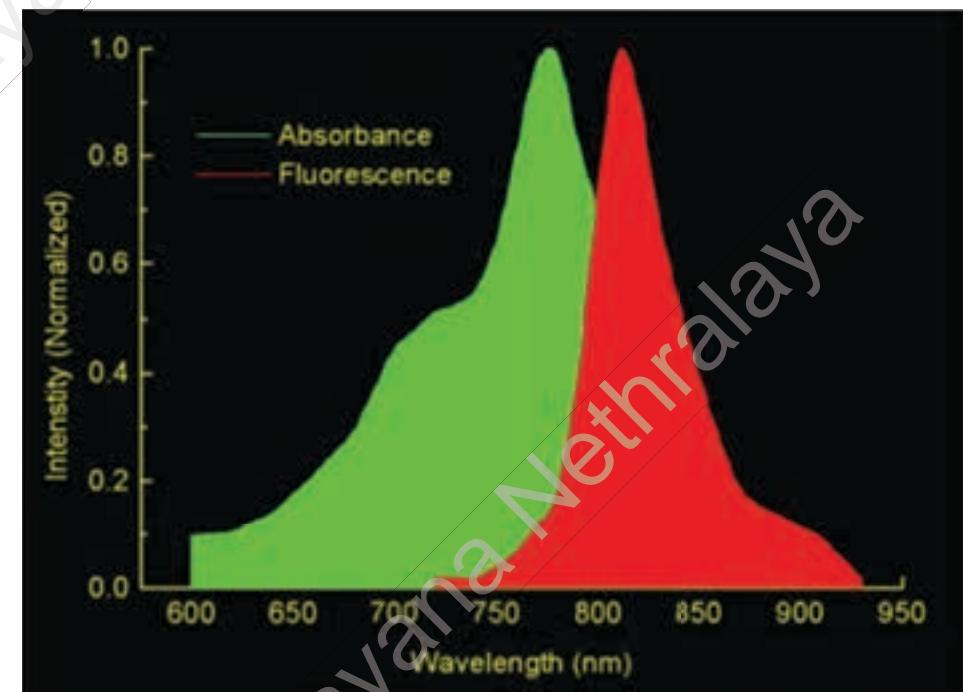
- Imaging of the choroidal circulation
- Free diffusion of dye in choriocapillaries
- Poor transmission of fluorescence
- Ocular media opacities

# **ICG-Indocyanin green angiography**

# ICG angiography

Over comes the limitations of FFA

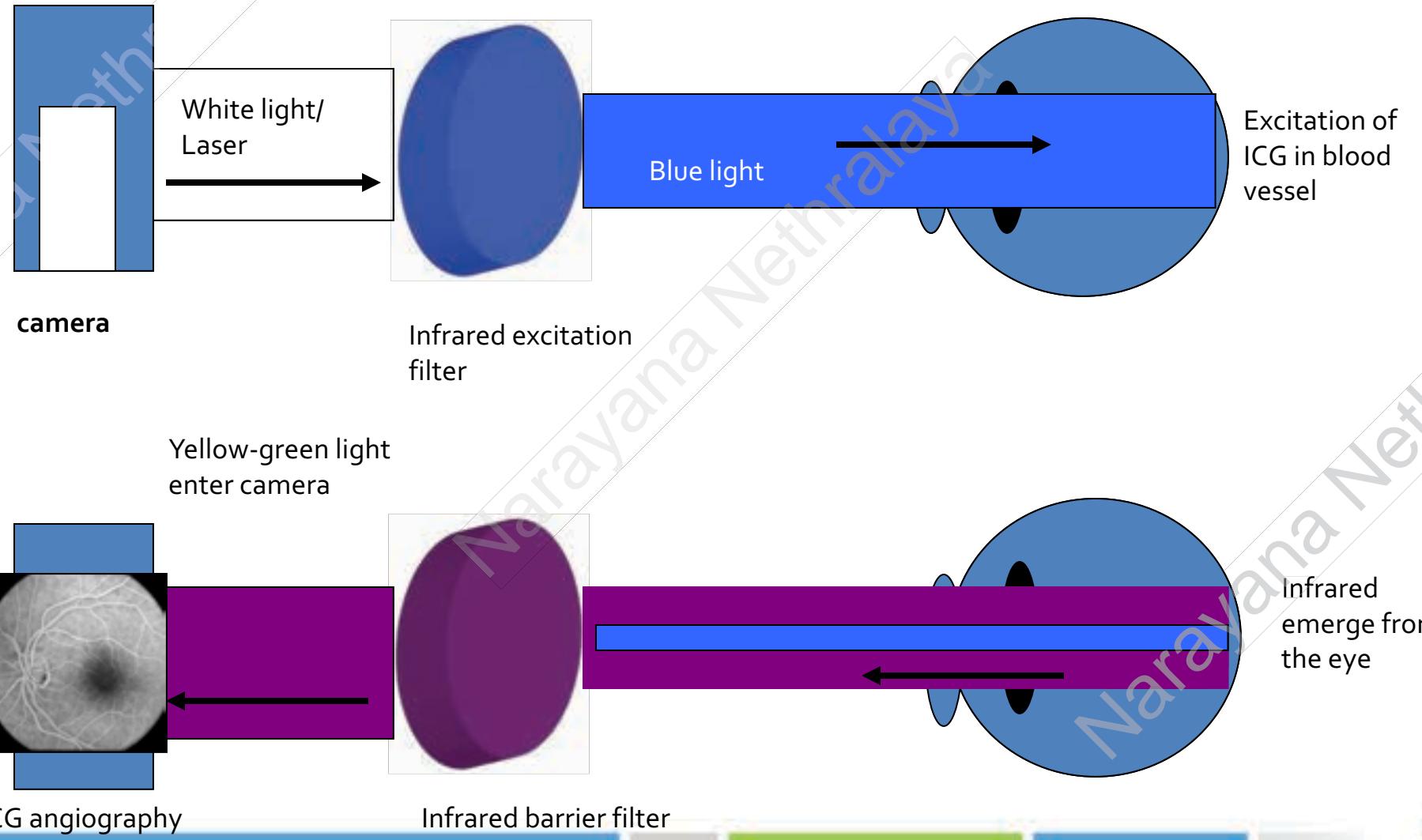
- **Infrared light**
  - Absorption: 790-805 nm
  - Emission: 825-835 nm
- Masking by pigments and blood is minimized



# 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

25mg in  
5ml DW

Rapid IV  
injection

5 ml NS  
flush

Rapid  
photographs

3 min

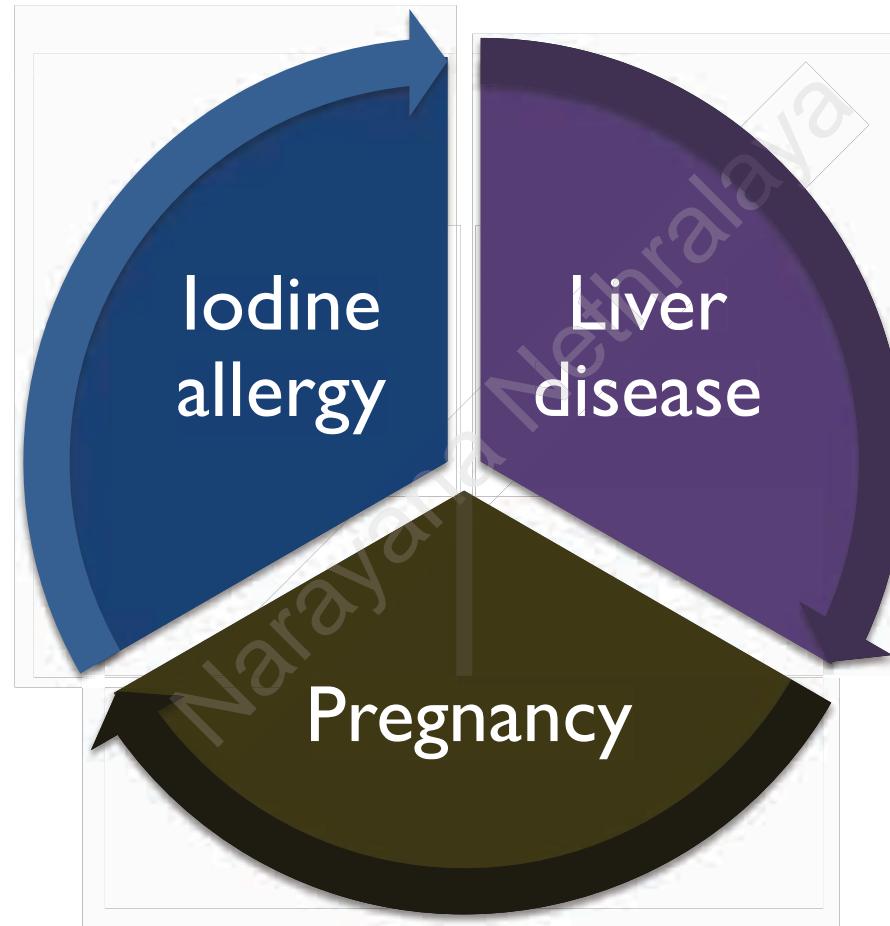
10 min

30 min

60 min



# CONTRAINDICATIONS

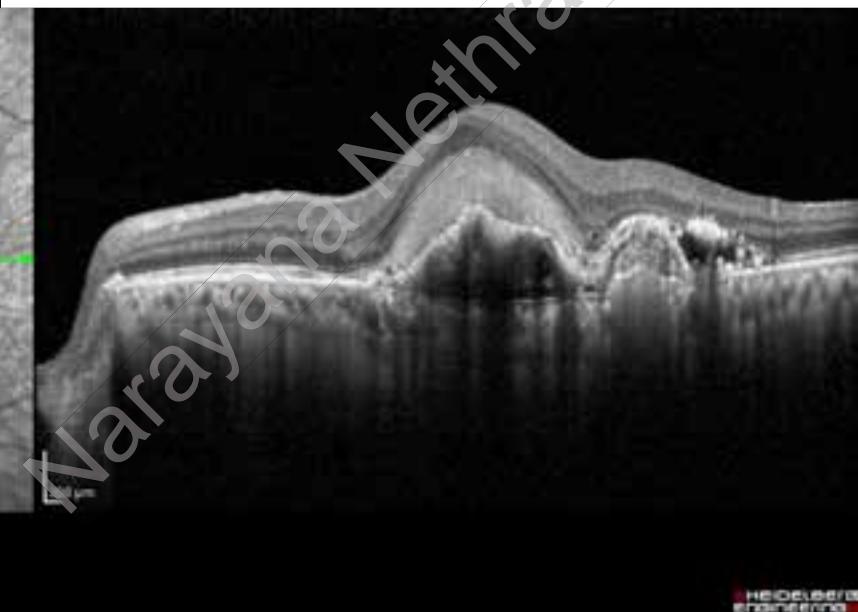
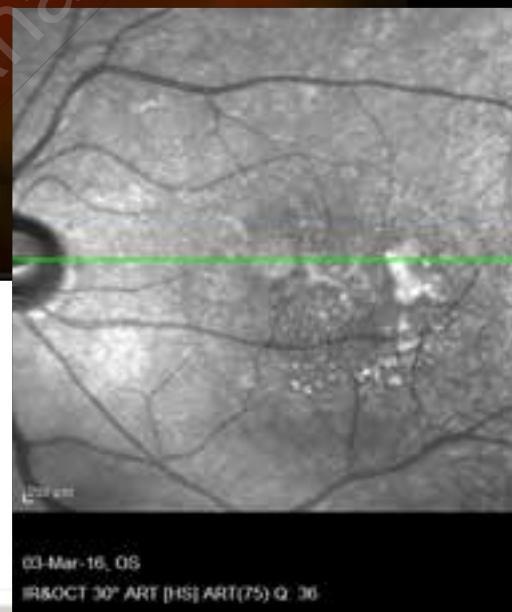


# **ICGA**

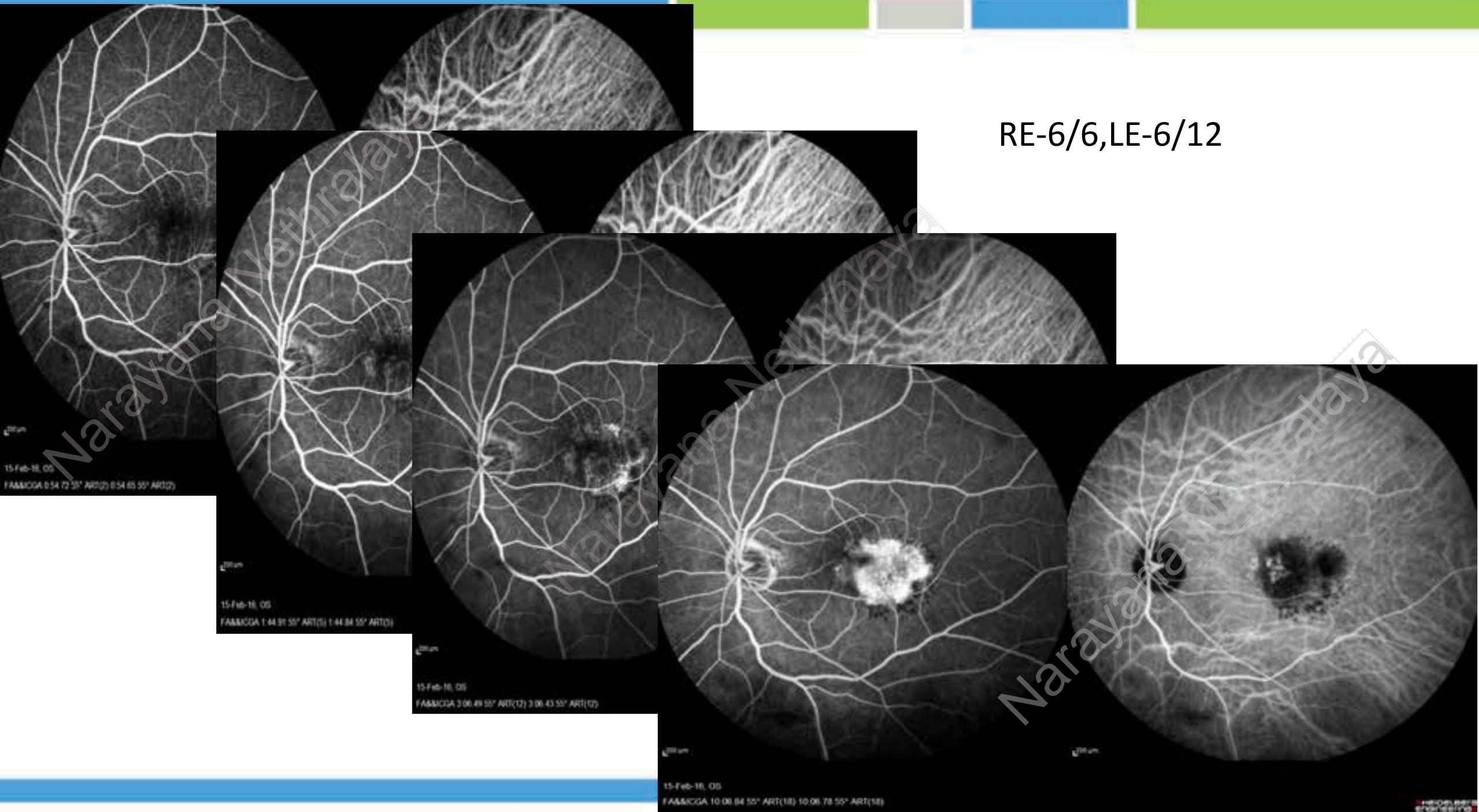
- Indications:
  - Occult CNVM
  - CSCR
  - IPCV
  - Choroidal tumours-Melanoma and Hemangioma

# CASE EXAMPLES

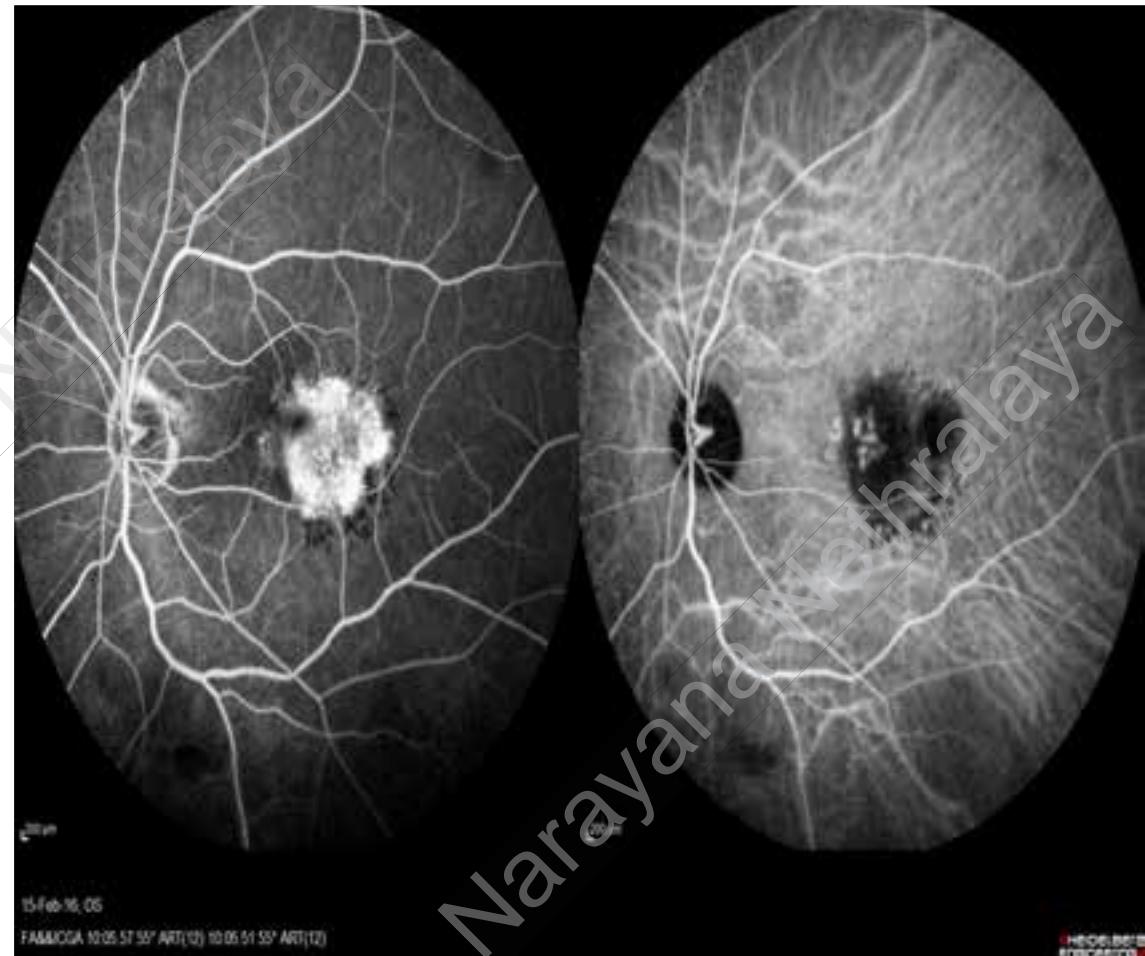
# CASE 1



RE-6/6,LE-6/12



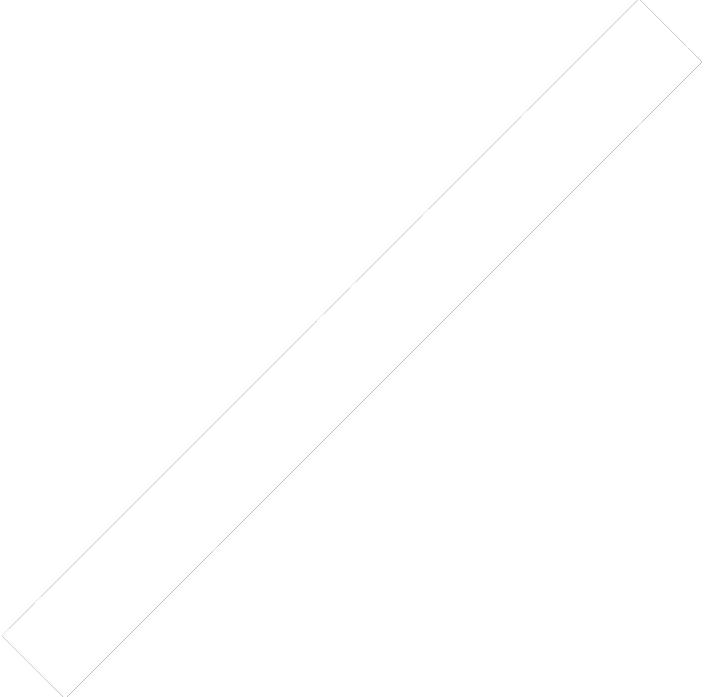
# IPCV



# CASE 2







**CNVM**

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