

Diabetic Eye Disease

Julie Rodman OD, MS, FAAO

Diabetic Eye Disease

Diabetic eye disease refers to a group of eye problems that people with diabetes may face as a complication of diabetes. People with diabetes are at risk for diabetic retinopathy, cataract and glaucoma.

Diabetes Mellitus

- High blood glucose levels due to the body's inability to produce and/or use insulin
 - Type 1: Usually diagnosed in children and young adults. The body does not produce insulin.
 - Type 2: Either the body does not produce enough insulin or the cells ignore the insulin. Most common form.



DIABETIC EYE DISEASE AFFECTS
BOTH!!!

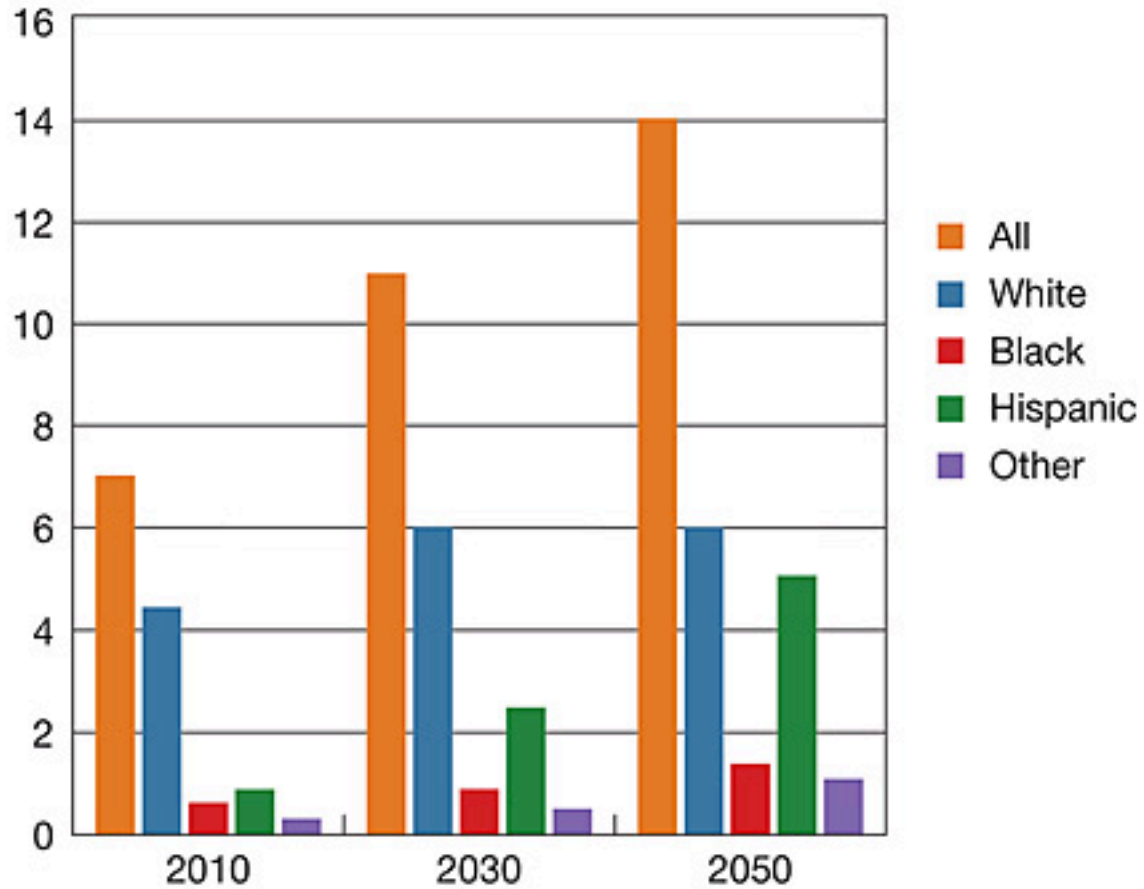
Epidemiology: Diabetes

- 29.1 million people (9.3%) of population have diabetes
- 21.0 million diagnosed
- 8.1 million undiagnosed

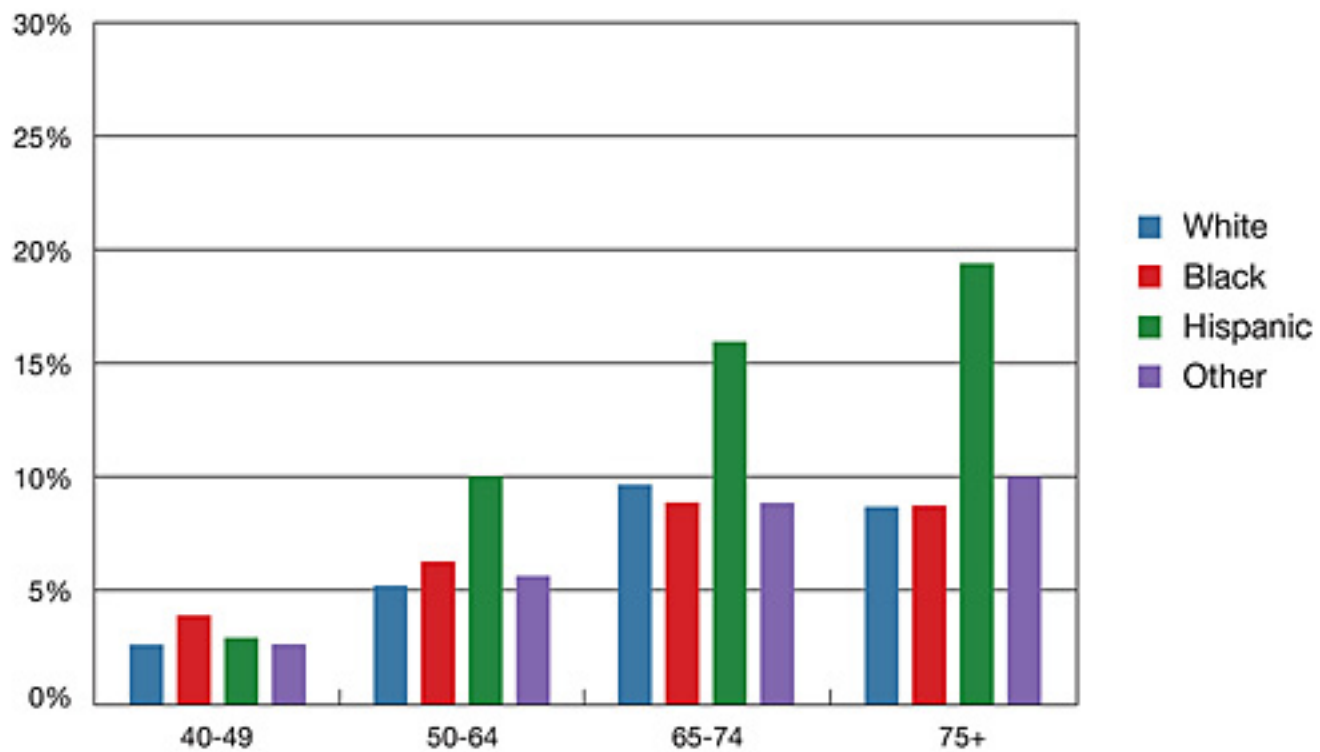
Diabetic Eye Disease: SCARY!

- Leading cause of blindness in Americans aged 20-74
- Accounts for 12% of new blindness
- Diabetic patients 25x more likely to go blind
- Approximately 28.5% of diabetic patients will develop some form of diabetic eye disease

Projections for Diabetic Retinopathy in 2030 and 2050 (in millions)

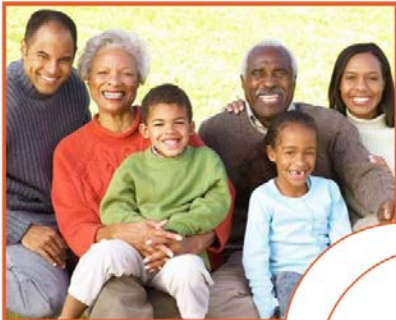


2010 U.S. Prevalence Rates for Diabetic Retinopathy by Age and Race



Risk Factors

Risk Factors for Developing Diabetes



Family background



High blood pressure

DIABETES



Gestational diabetes



Obesity, high cholesterol, and high triglycerides

If you have risk factors for diabetes, you should have your glucose levels checked.

https://nei.nih.gov/.../Ojo_DiabetesandHealthyEyes
tPPT.

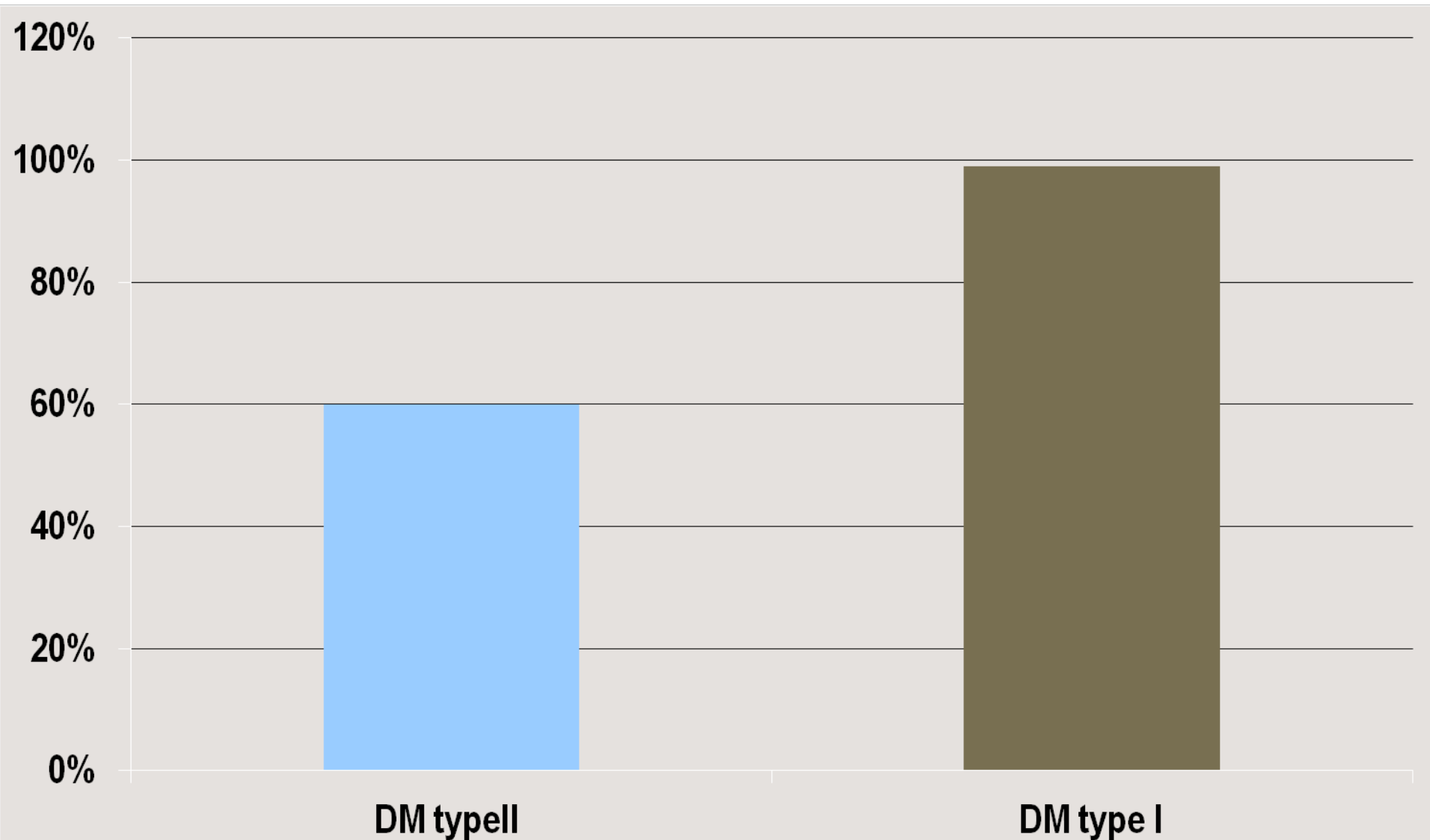
Risk factors Diabetic Retinopathy



Duration of diabetes is a major risk factor associated with the development of diabetic retinopathy

The severity of hyperglycemia is the key alterable risk factor associated with the development of diabetic retinopathy

Prevalence of diabetic retinopathy after 20 years of diagnosis



- Prevention of eye disease is possible with increased risk factor control

CLINICAL SCIENCES

The Effect of Intensive Diabetes Treatment
On the Progression of Diabetic Retinopathy
In Insulin-Dependent Diabetes Mellitus

The Diabetes Control and Complications Trial

*The Diabetes Control and Complications Trial Research
Group*

Arch Ophthalmol. 1995; 113:36-51

How does Diabetes affect the eye?

BEWARE!

Diabetic Retinopathy

Glaucoma

Cataracts

Diabetic Retinopathy Symptoms

- Blurred vision
- Floaters
- Fluctuating Vision
- Distorted vision
- Dark areas in vision
- Poor night vision
- Impaired color vision
- Partial or total loss of vision



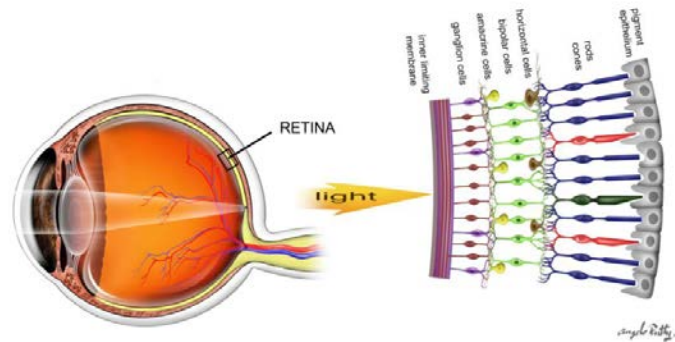
Figure 3: Normal Vision



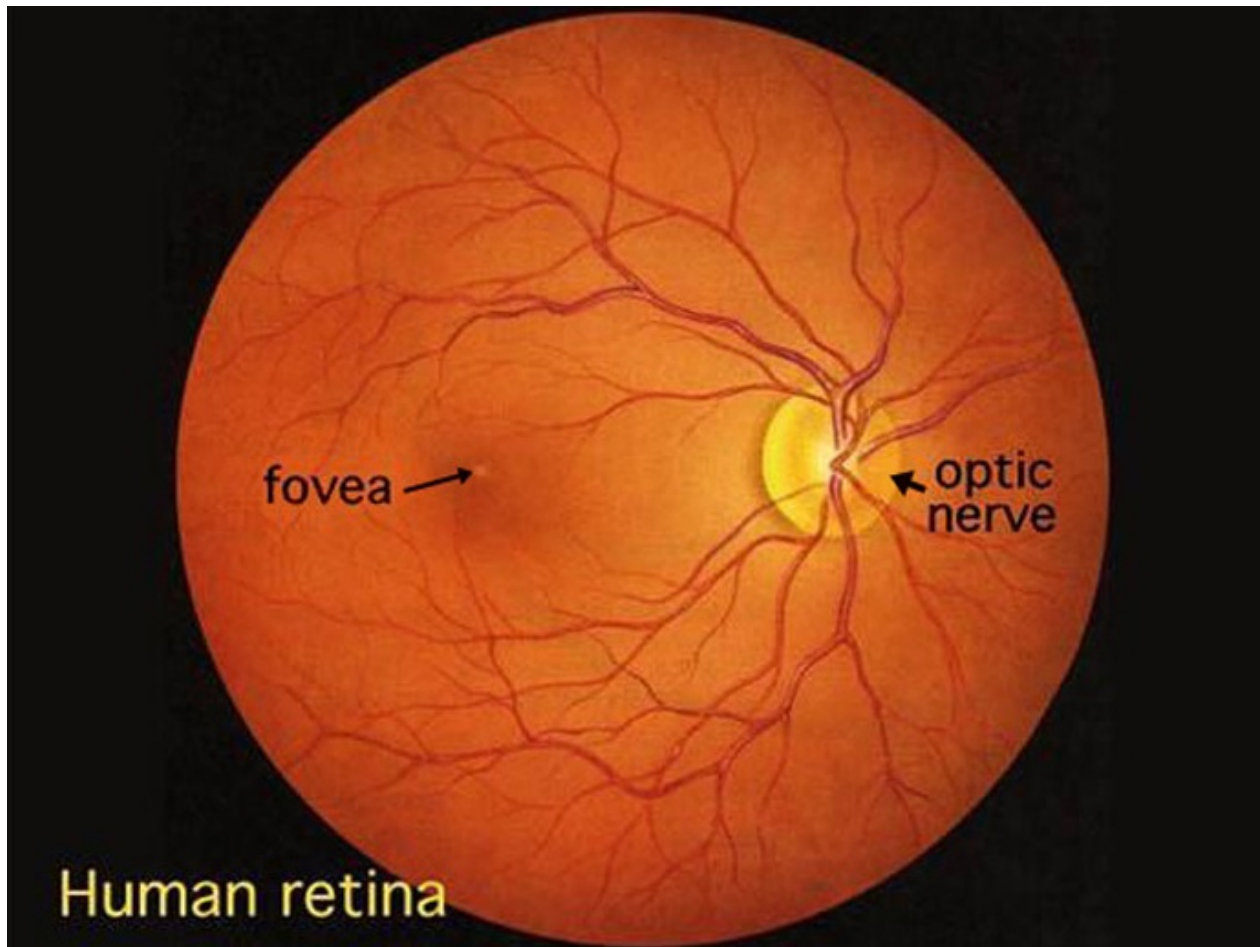
Figure 4: How vision may be affected by diabetic retinopathy

What is the Retina?

- A multilayered, light-sensitive tissue lining the inner eye.
- Light focuses on retina and is then transmitted to brain via optic nerve
- Macula: part of retina responsible for central vision

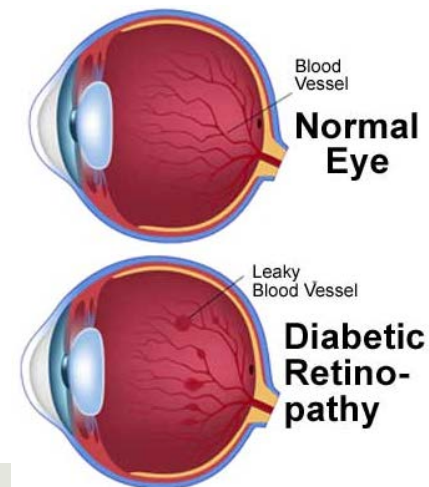


Retinal Anatomy



Diabetic Retinopathy

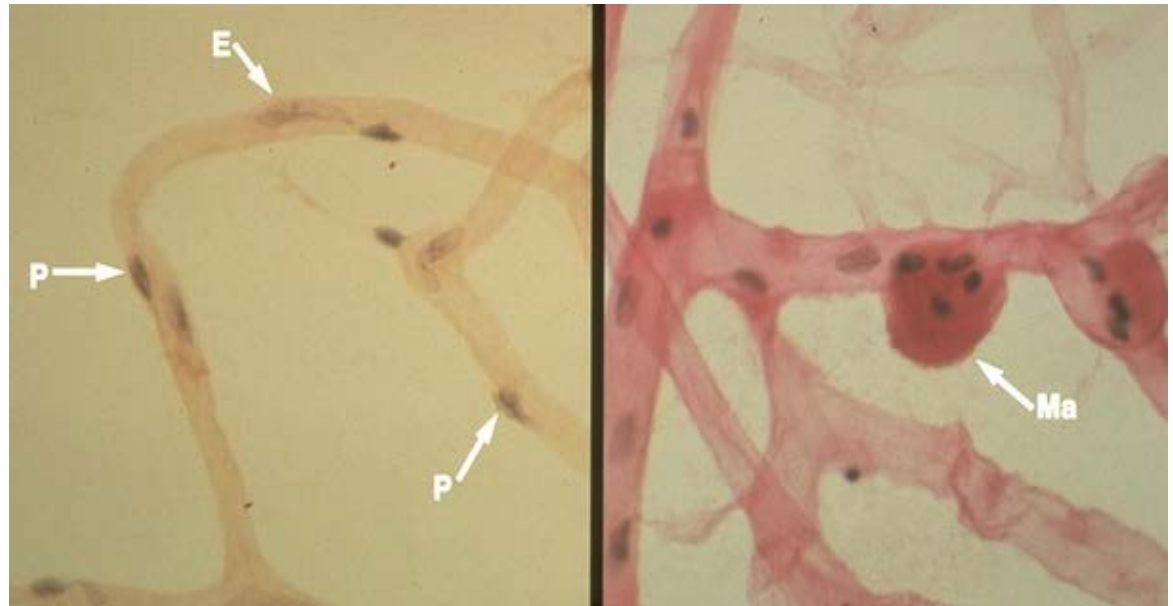
- Dysfunction of the retinal blood vessels as a result of chronic hyperglycemia (high blood sugar)
- Can be a complication of Type 1 or Type 2 Diabetes
- Starts off asymptomatic, and if left untreated, can lead to low vision or blindness.



Pathophysiology

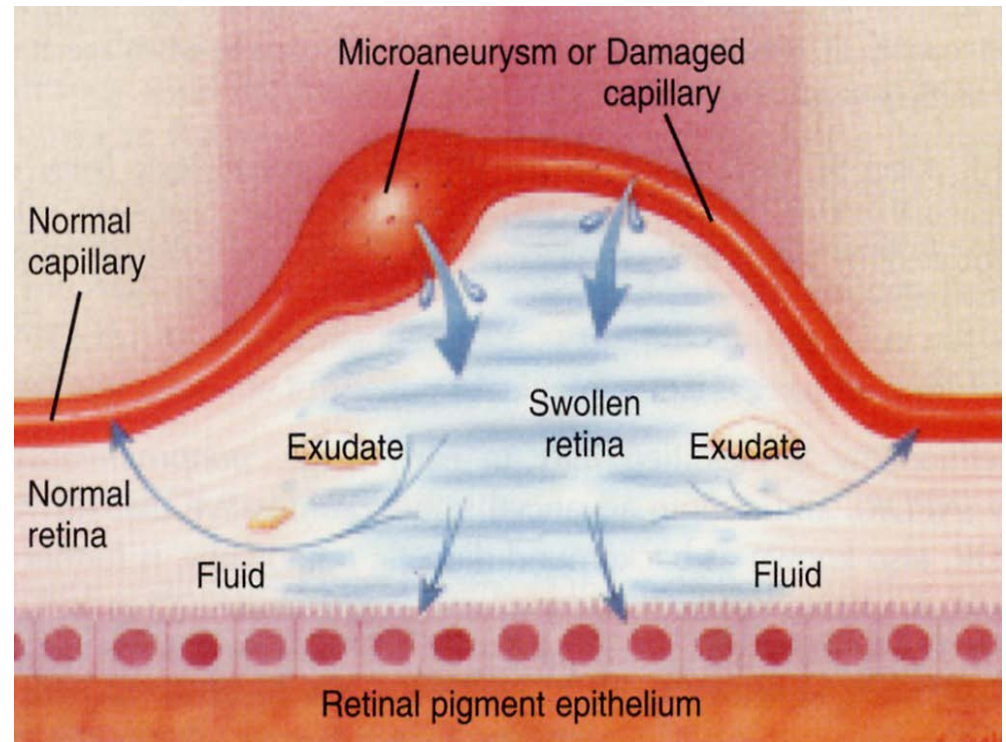
High blood sugar levels affect retinal capillaries

- Pericyte Loss
- Endothelial Cell loss
- Blood-retina barrier breakdown



Pathophysiology - Capillary Leakage

- Damaged capillaries leak
- Leakage into the macula results in vision loss



Healthy Retina



Diabetic Retinopathy



Classification of Diabetic Retinopathy

□ Non-Proliferative (NPDR)

- Mild
- Moderate
- Severe
- Very Severe

□ Proliferative (PDR)

□ Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR

Classification of Diabetic Retinopathy

- Non-Proliferative (NPDR)

- Mild
- Moderate
- Severe
- Very Severe

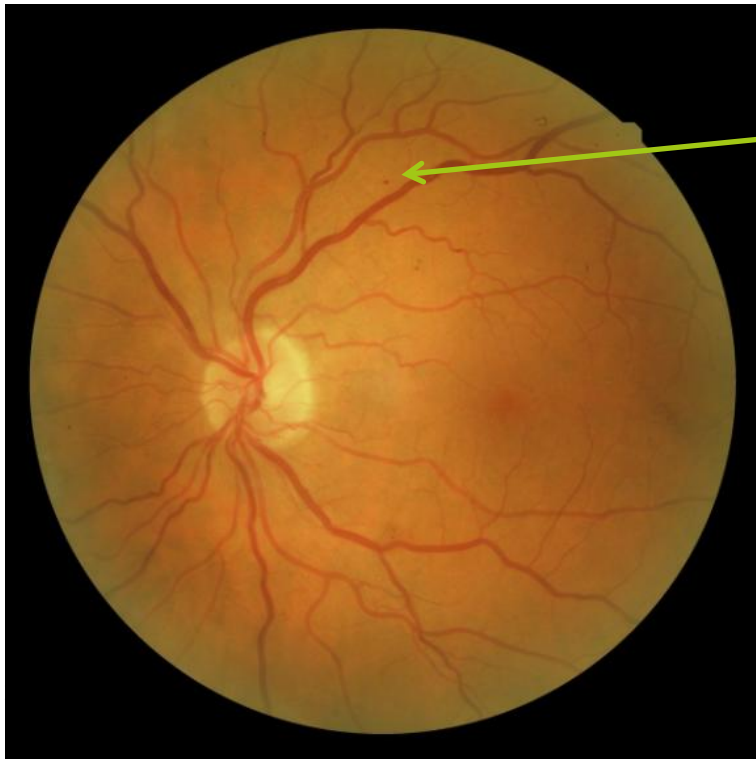
- Proliferative (PDR)

- Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR

Mild Non-Proliferative DR

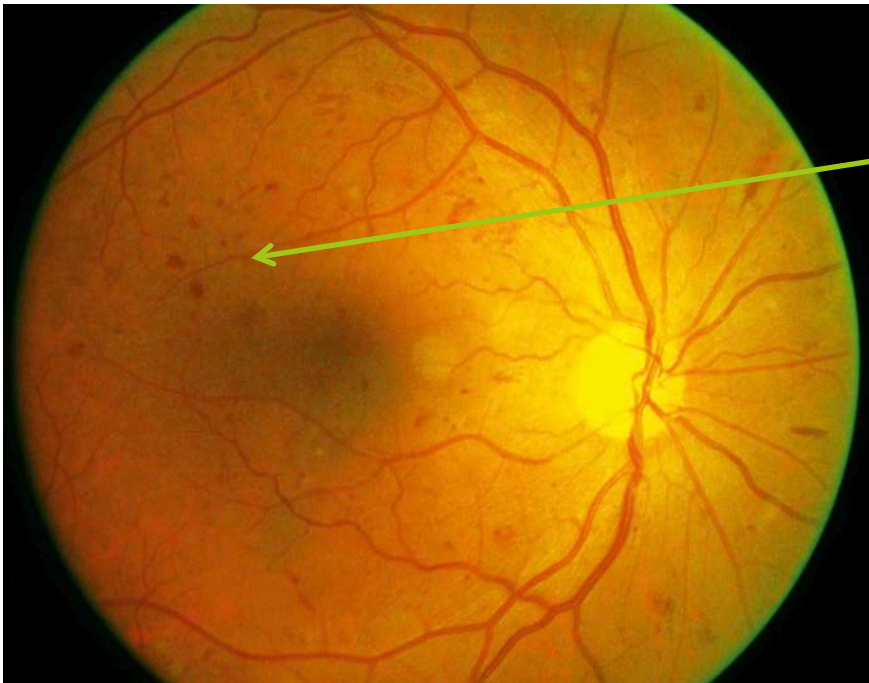
Presence of at least one retinal **microaneurysm** or hemorrhage



Microaneurysms are outpouchings of capillary walls caused by loss of pericytes leading to weakening

Mild Non-Proliferative DR

Presence of at least one retinal microaneurysm or **hemorrhage**

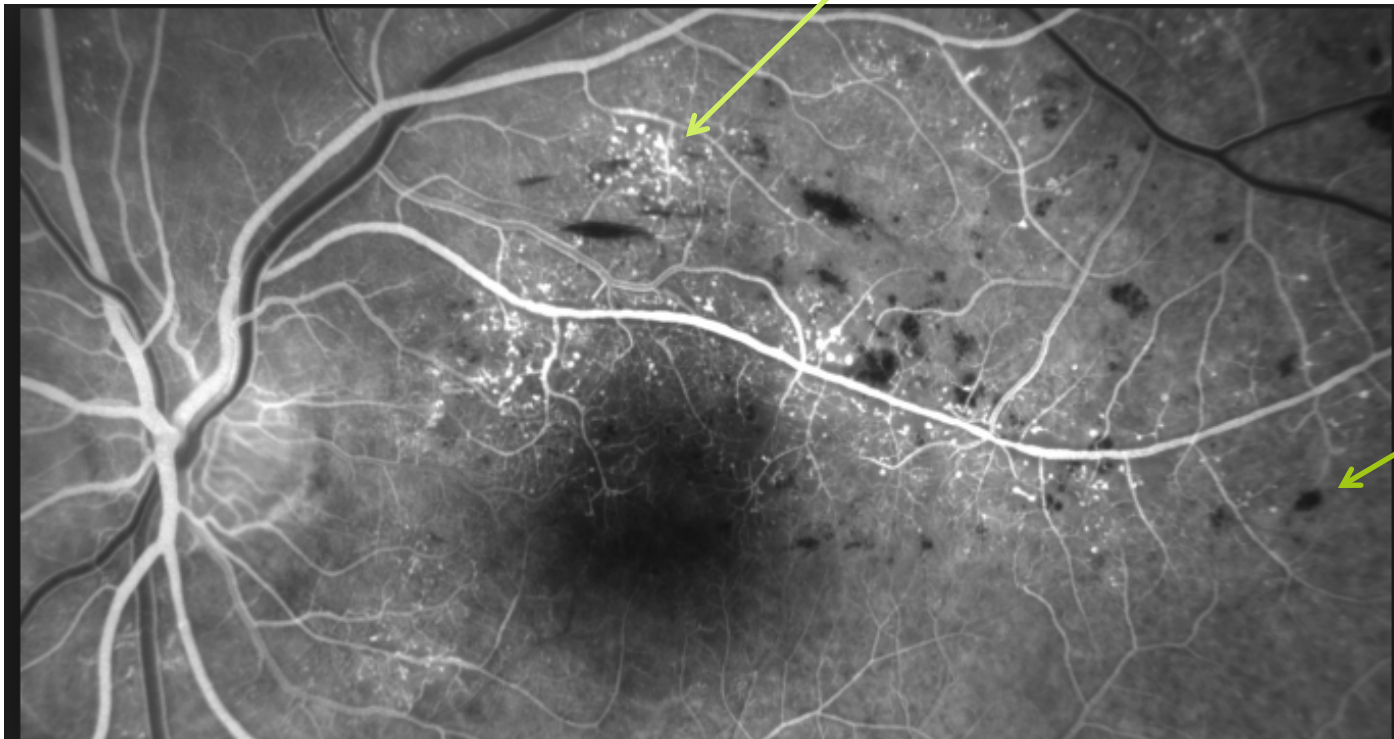


Hemorrhages result from leaking or ruptured MAs deep within the retina

How do we differentiate
between the two??

FLUORESCEIN ANGIOGRAPHY

Microaneurysms: **Hyperfluoresce**



Hemorrhages:
Hypofluoresce

When to re-examine mild NPDR?

- Re-examination within a year
- 5-10% will increase to further stages of retinopathy over the course of the year
- Obtain fundus photo

Classification of Diabetic Retinopathy

□ Non-Proliferative (NPDR)

- Mild
- **Moderate**
- Severe
- Very Severe

□ Proliferative (PDR)

□ Clinically Significant Macular Edema (CSME)

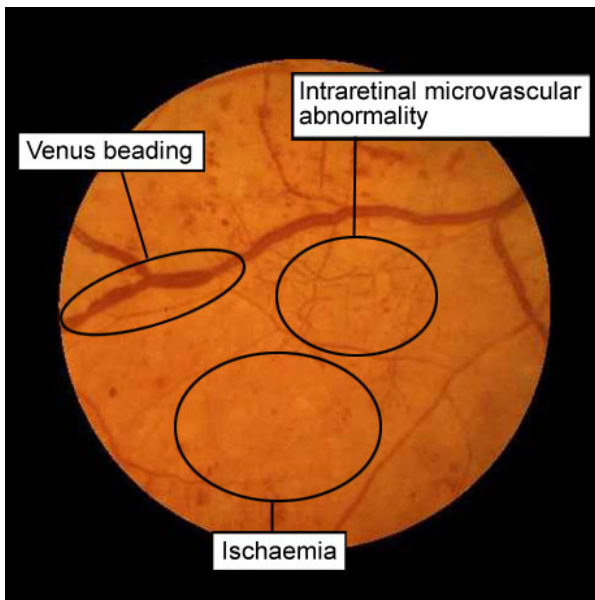
- Alone or with NPDR/PDR

Moderate Non-Proliferative DR

Increasing microaneurysms and/or hemorrhages

Cotton wool spots-areas of ischemia

Venous beading or mild **IRMA** (intraretinal microvascular abnormalities)



IRMA: new vessel growth **deep** within the retina OR pre-existing vessels that shunt blood through areas of nonperfusion

When to re-examine moderate NPDR?

- Re-examination within 6 months
- Approximately 16% of patients progress to proliferative disease within four years
- Obtain fundus photo

Classification of Diabetic Retinopathy

- Non-Proliferative (NPDR)

- Mild
- Moderate
- **Severe**
- Very Severe

- Proliferative (PDR)

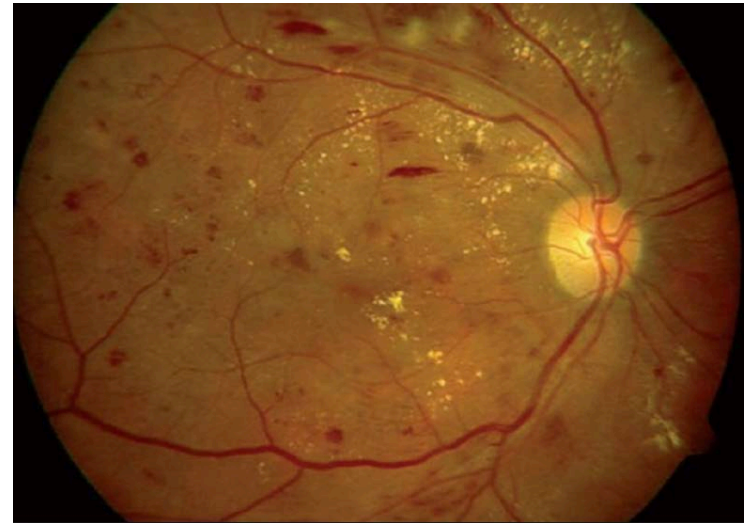
- Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR

Severe Non-Proliferative DR

- ❖ Any **one** of the following 3 features is present:
 - ❖ Microaneurysms and/or hemorrhages in all 4 quadrants
 - ❖ Venous beading in 2 or more quadrants
 - ❖ Moderate IRMA in at least 1 quadrant

- ❖ Known as the **4-2-1** rule



When to re-examine severe NPDR?

- Two to four months
- Strongly consider retina referral
 - Fluorescein angiography to assess capillary perfusion
- Obtain fundus photo

Classification of Diabetic Retinopathy

□ Non-Proliferative (NPDR)

- Mild
- Moderate
- Severe
- **Very Severe**

□ Proliferative (PDR)

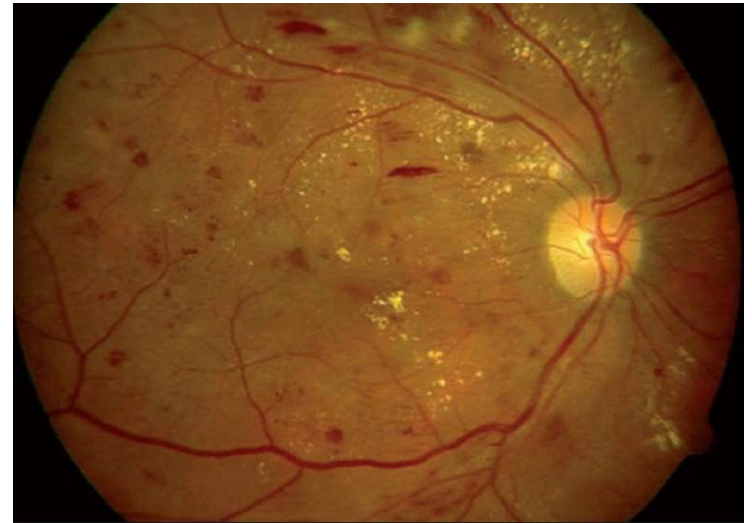
□ Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR

Very Severe Non-Proliferative DR

- ❖ Any **two** of the following 3 features is present:
 - ❖ Microaneurysms and/or hemorrhages in all 4 quadrants
 - ❖ Venous beading in 2 or more quadrants
 - ❖ Moderate IRMA in at least 1 quadrant

- ❖ Known as the **4-2-1** rule



Classification of Diabetic Retinopathy

□ Non-Proliferative (NPDR)

- Mild
- Moderate
- Severe
- Very Severe

□ Proliferative (PDR)

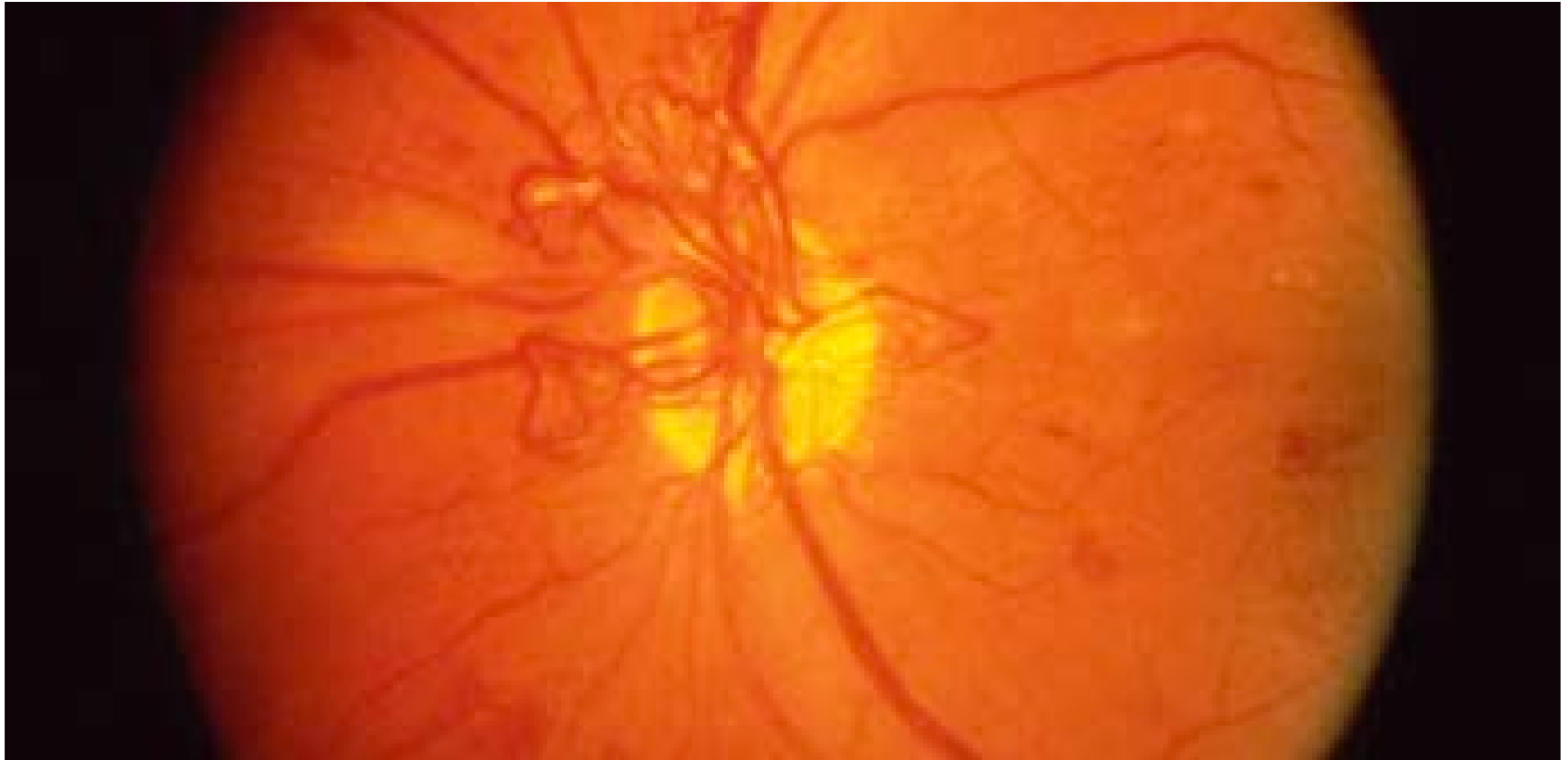
□ Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR



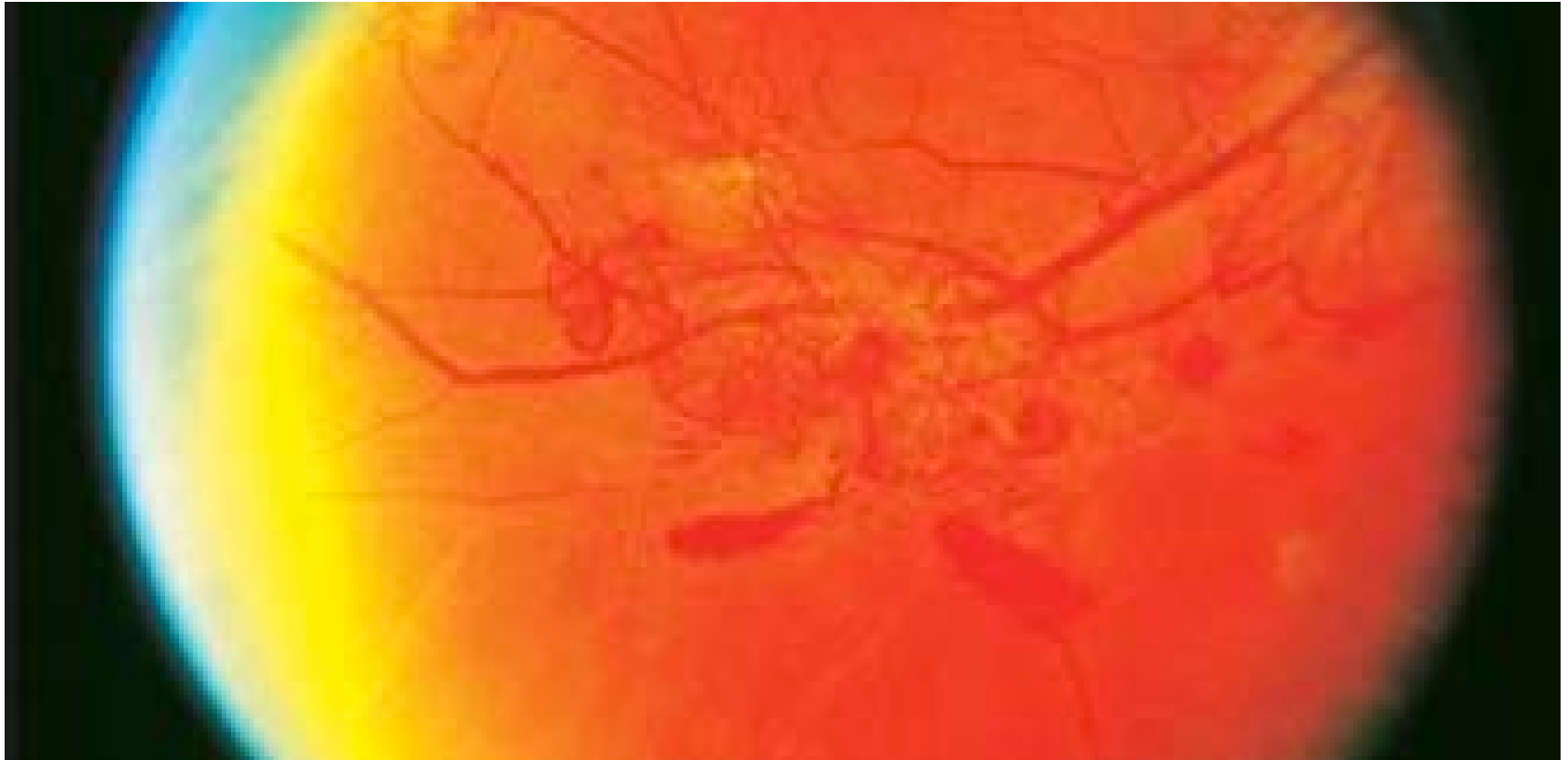
Proliferative Diabetic Retinopathy (PDR)

- ❖ Neovascularization:
 - ❖ On or within one disc diameter of the Optic Disc (NVD) or elsewhere on the retina (NVE)
- ❖ Preretinal hemorrhage
- ❖ Vitreous hemorrhage



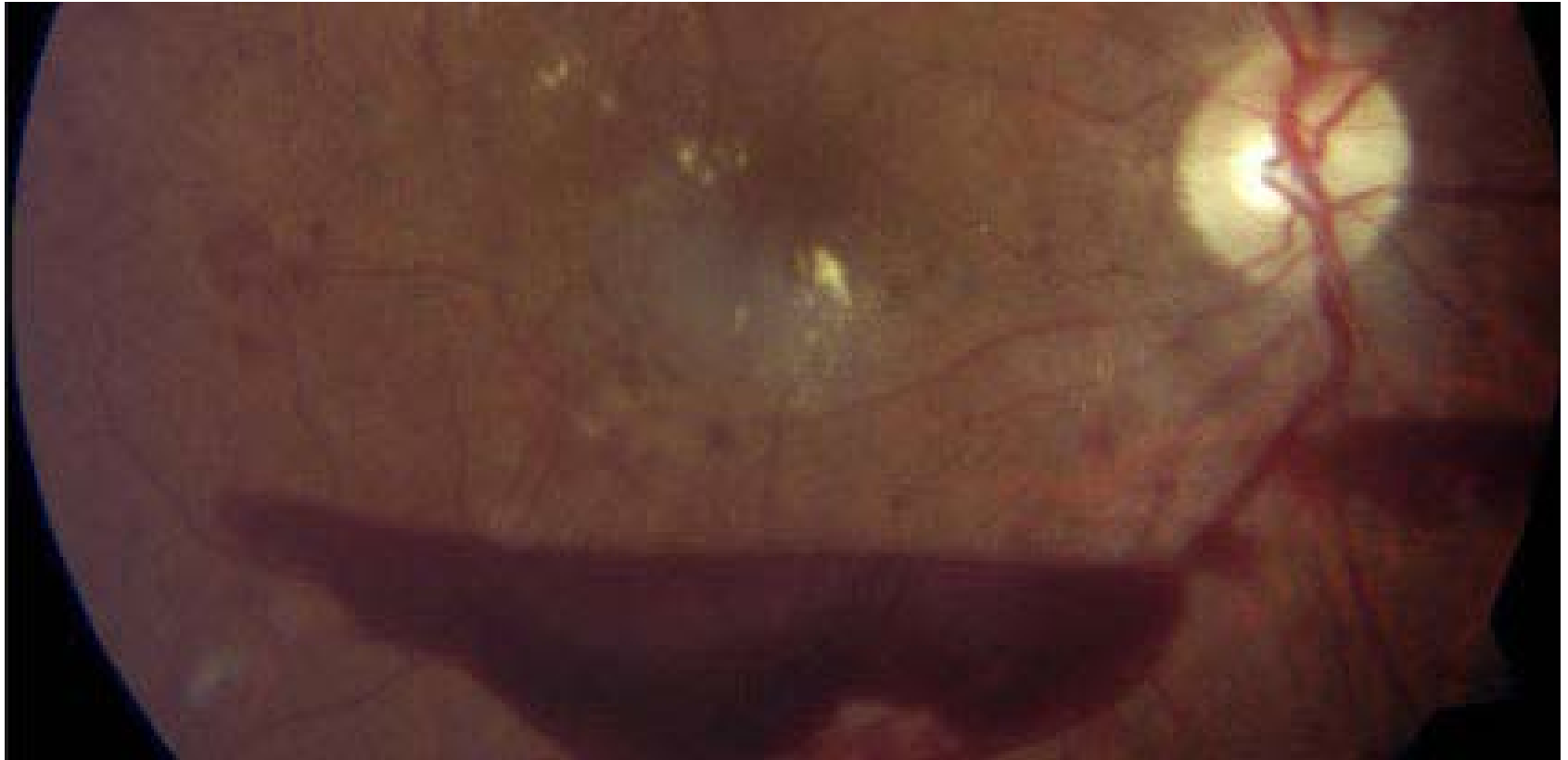
Neovascularization of the disc

PDR



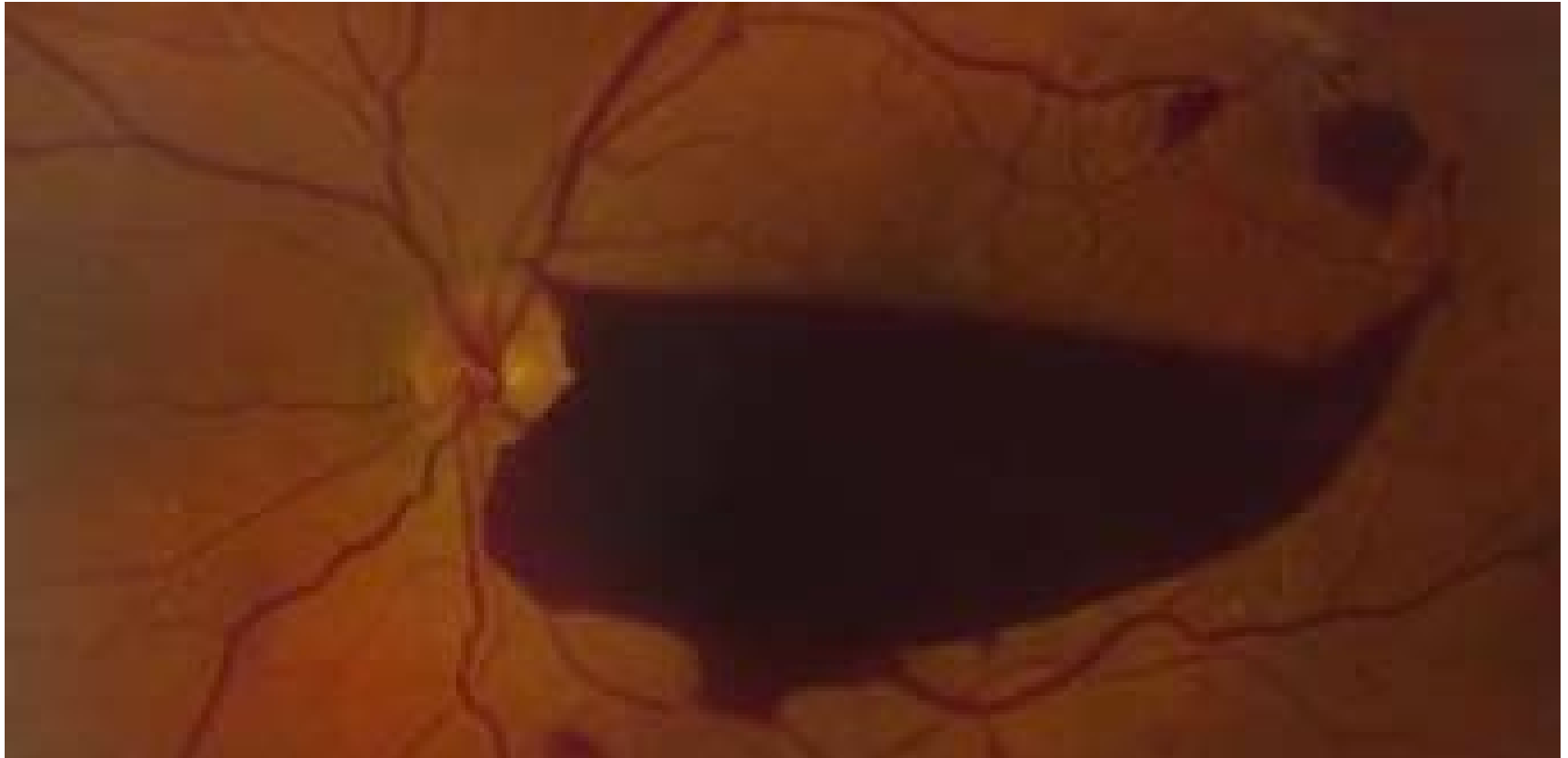
Neovascularization elsewhere (NVE)

PDR



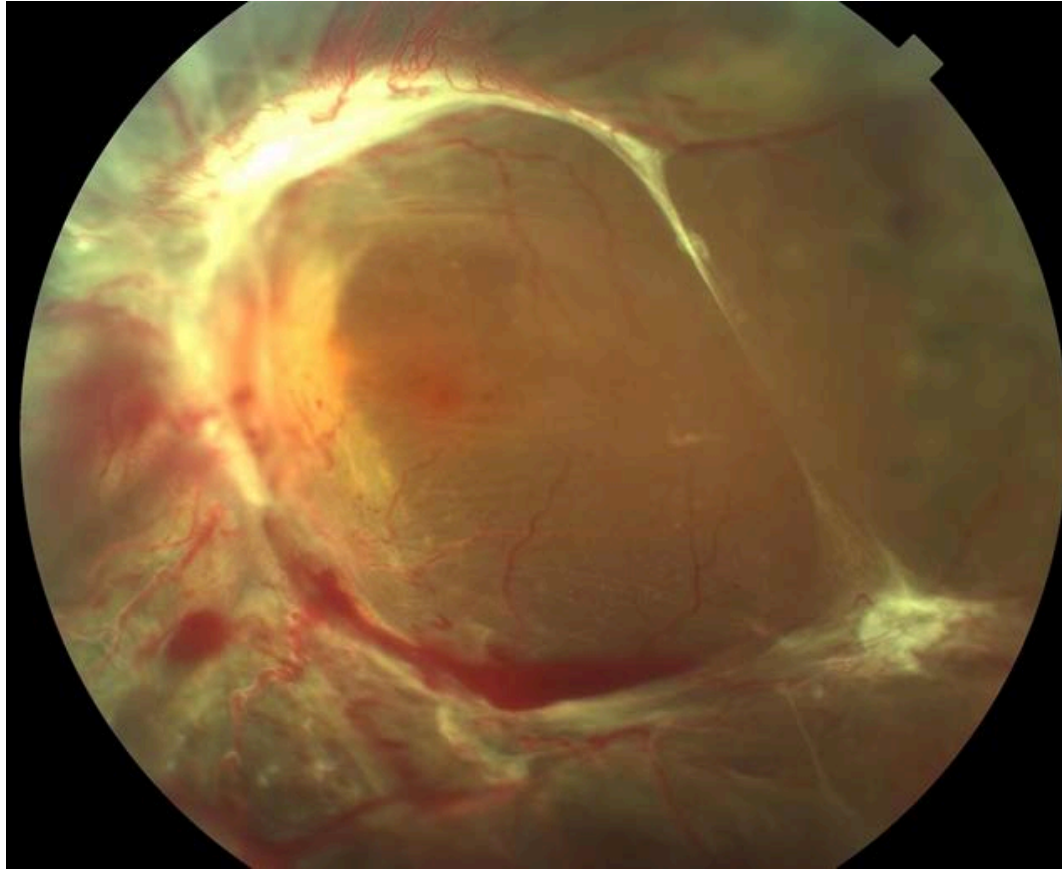
Preretinal hemorrhage

PDR



Vitreous hemorrhage

PDR



Tractional Retinal Detachment

PDR

When to re-examine PDR?

- Refer promptly to retina specialist for treatment
 - Within one day to one week depending on severity
- Without treatment, approximately 50% of eyes with PDR are blind within 5 years

Treatments: PDR

Laser surgery: PRP

- Microscopic thermal laser burns are made in the retina
- Shrinks and prevents abnormal new blood vessel growth, and stops leaking of blood vessels
- Can reduce risk of further vision loss by 50%

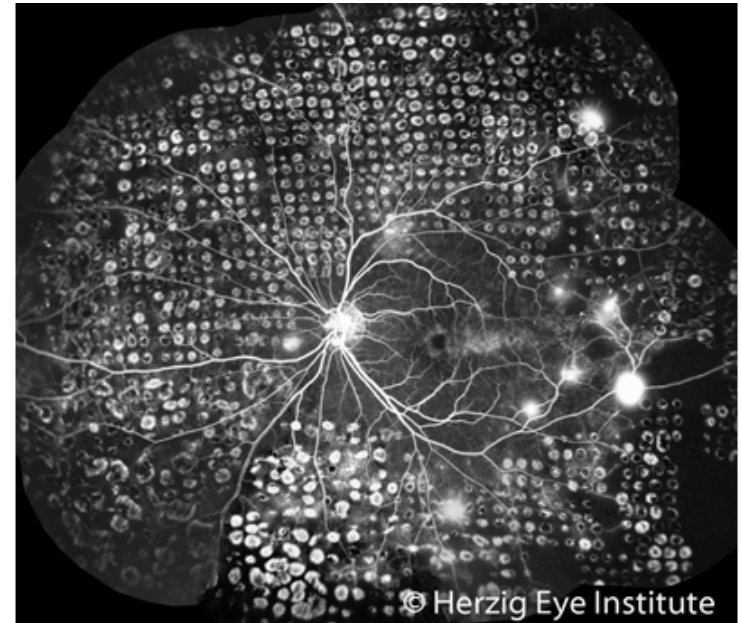
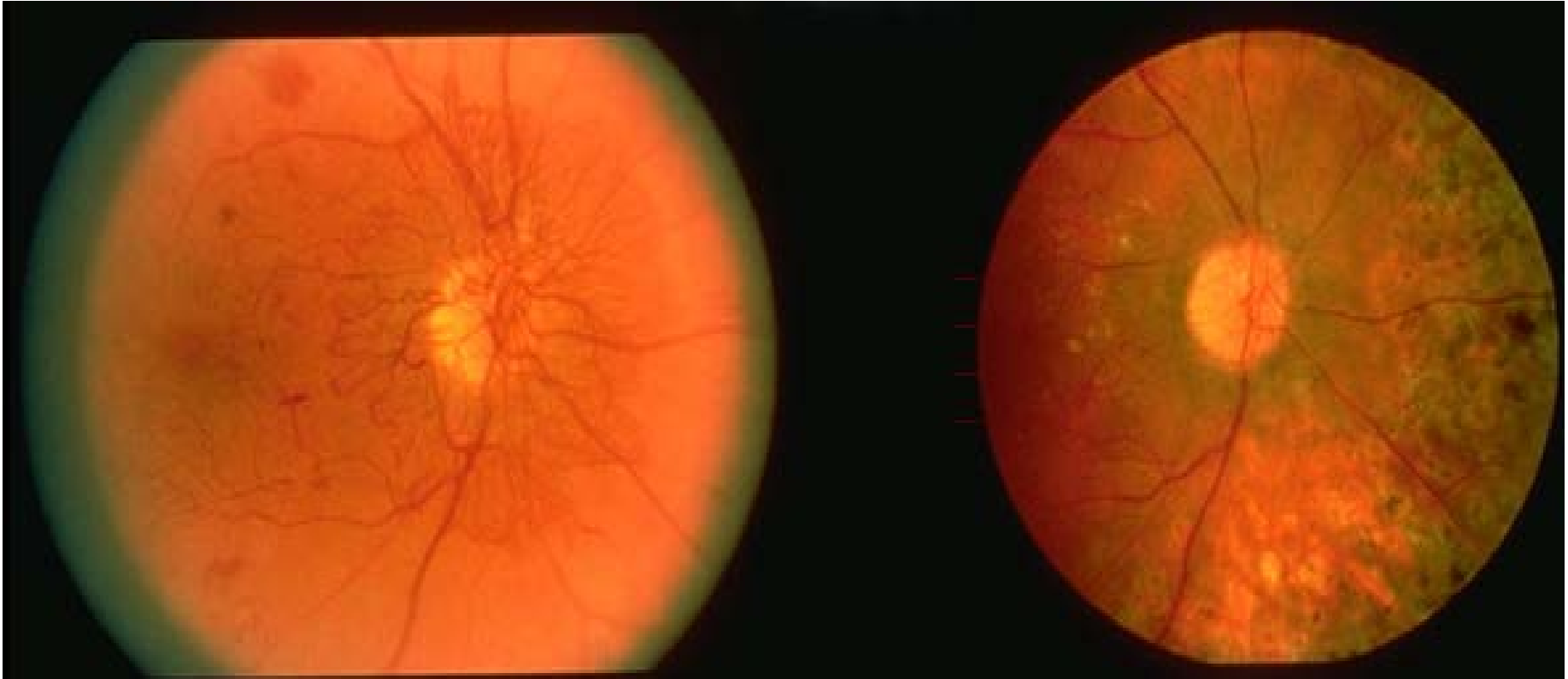


Figure 10: Laser photocoagulation

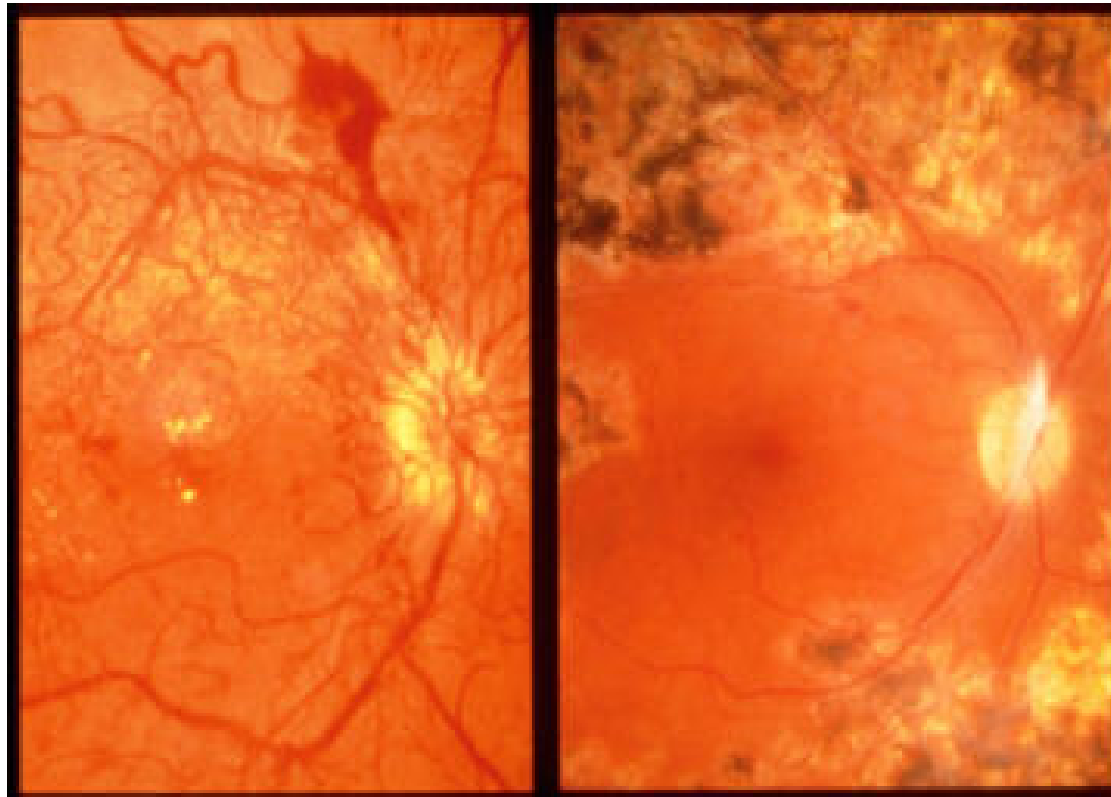
▣ Panretinal photocoagulation (PRP)



Before

After

■ Panretinal photocoagulation (PRP)



Before

After

PRP reduces the risk of severe vision loss by more than 50%

Photocoagulation Treatment of Proliferative Diabetic Retinopathy

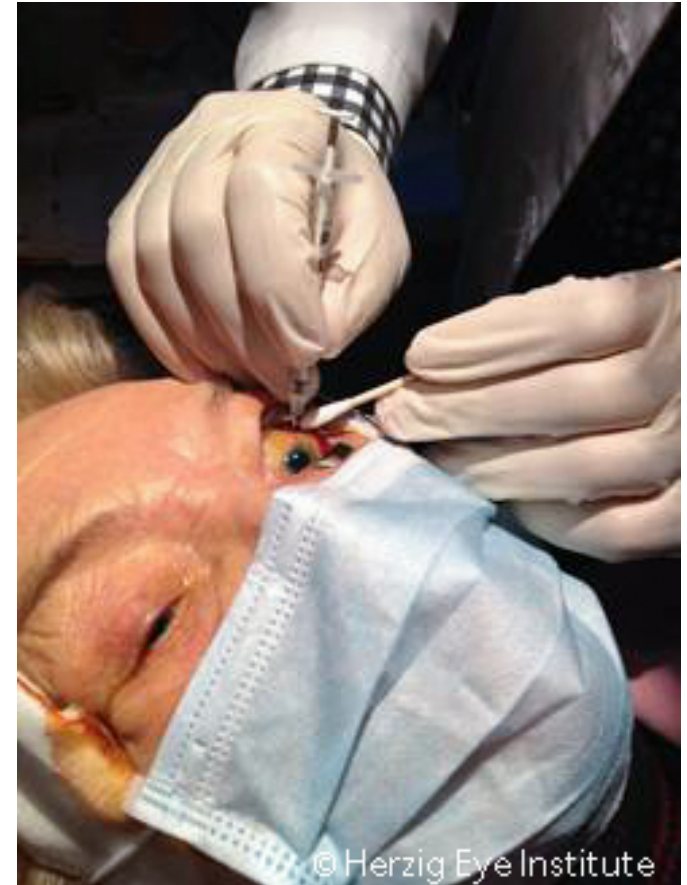
Clinical Application of Diabetic Retinopathy Study
(DRS) Findings, DRS Report Number 8

THE DIABETIC RETINOPATHY STUDY RESEARCH GROUP

Treatments: PDR

Intraocular (anti-VEGF) injections:

- Lucentis, Avastin, Eylea
- Reduces swelling in the retina and causes abnormal vessels to regress
- Alone or in conjunction with PRP



Intraocular injection

Treatments

Patients who fail to have vessel regression with PRP or anti-VEGF:

Vitrectomy

- Cloudy vitreous is removed and replaced with a clear solution that mimics the normal eye fluids
- Allows light rays to focus on the retina again

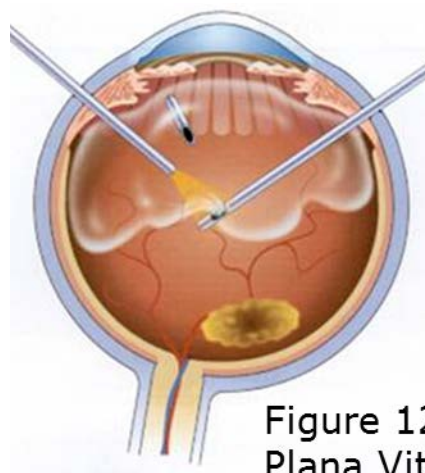
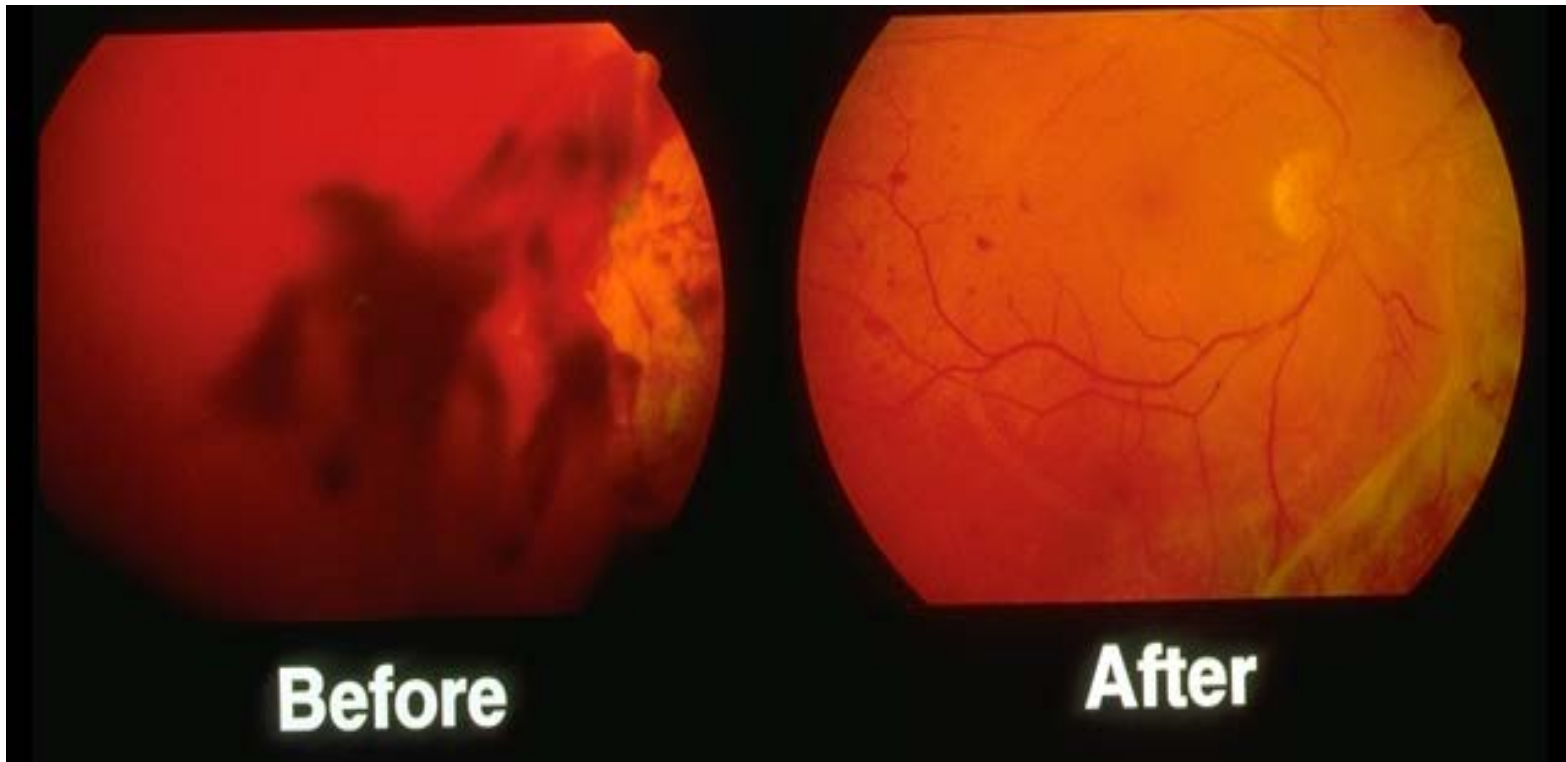


Figure 12: Pars plana vitrectomy

Diabetic Eye Disease Treatment – Vitreous Heme

Vitreotomy



Vitrectomy results in improved vision
in patients with persistent vitreous
hemorrhage

Early Vitrectomy for Severe Vitreous Hemorrhage in Diabetic Retinopathy

Two-Year Results of a Randomized Trial
Diabetic Retinopathy Vitrectomy Report 2

THE DIABETIC RETINOPATHY VITRECTOMY STUDY RESEARCH GROUP

Classification of Diabetic Retinopathy

- Non-Proliferative (NPDR)

- Mild
- Moderate
- Severe
- Very Severe

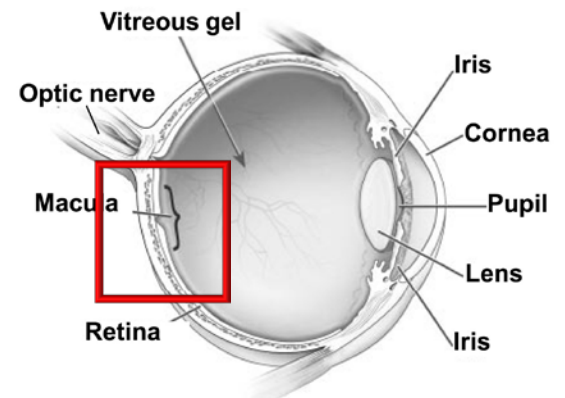
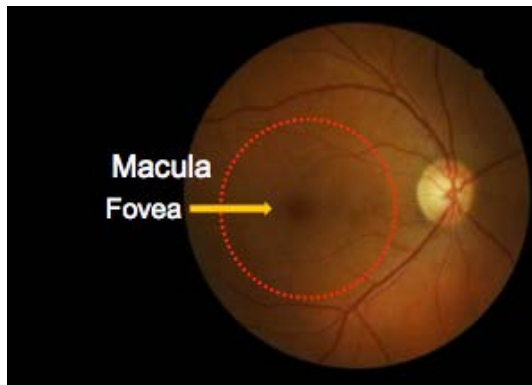
- Proliferative (PDR)

- Clinically Significant Macular Edema (CSME)

- Alone or with NPDR/PDR

Diabetic Macular Edema: The other problem!!!

- Macula is responsible for central vision
- Fluid at macula leads to blurry vision
- Leading cause of legal blindness in diabetics
- Can be present at any stage of the disease

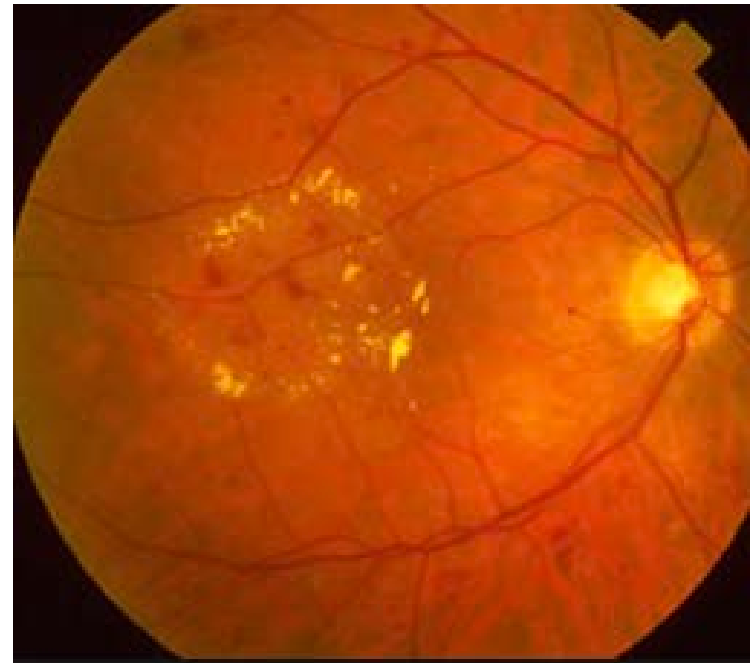


Clinically significant macular edema

Normal



Macular edema



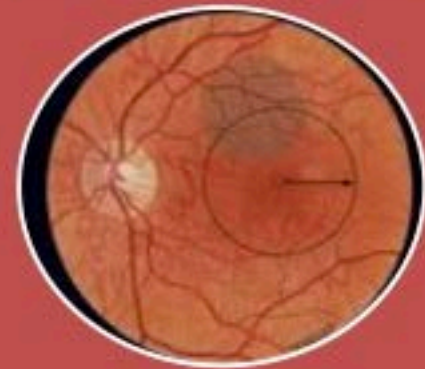
Clinically Significant Macular Edema (ETDRS)



**Retinal thickening
within 500 μm of
the center of the
macula**



**Hard exudates at or
within 500 μm of
the center of the
macula (if associate
with retinal
thickening of the
adjacent retina**



**Retinal thickening
one disc area (1500
 μm) or larger, any
part which is within
one disc diameter of
the center of the
macula.**

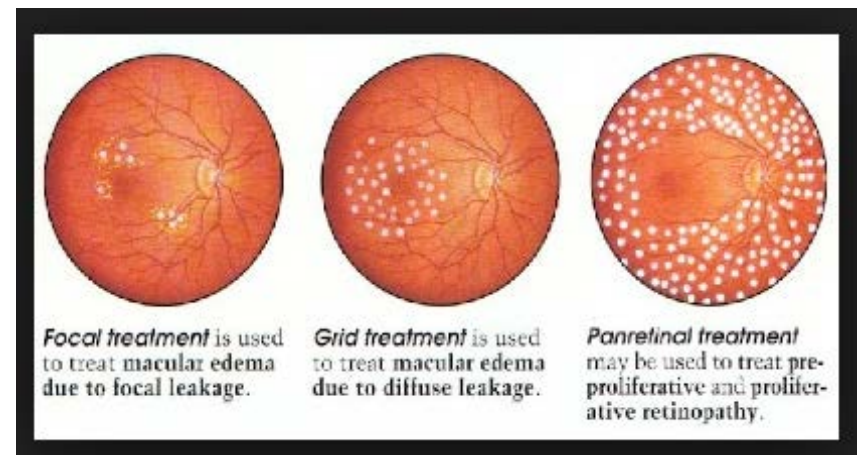
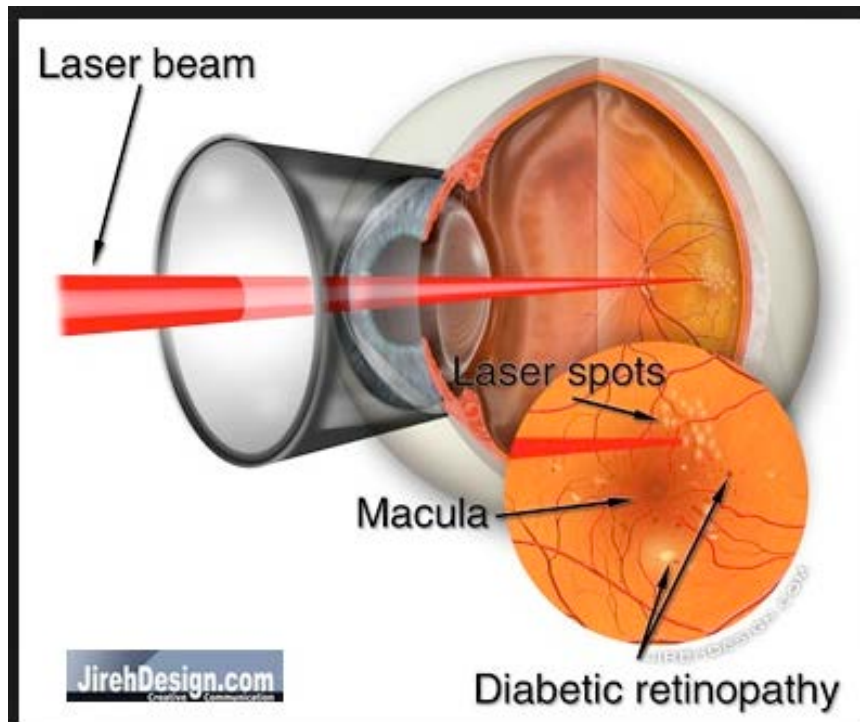


When to re-examine Diabetic Macular Edema?

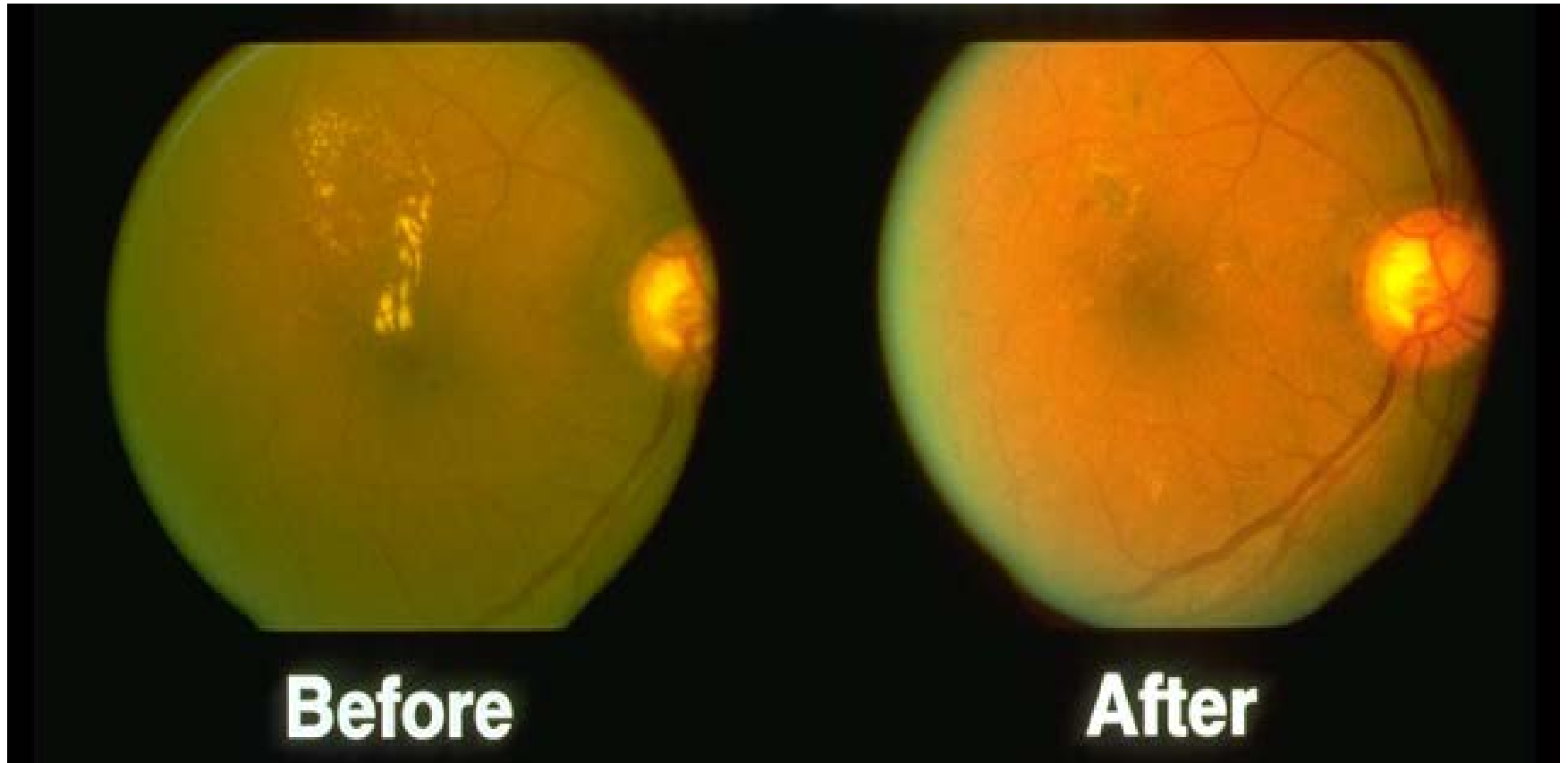
- Non-center involving DME
 - Every two to four months
 - Prompt referral when center becomes involved
 - Referral to PCP to optimize glycemic control
- Center involving DME
 - Referral to retina specialist within one to two weeks

Treatments

- Laser surgery: Focal
- Anti-VEGF agents



Focal Laser



Focal Laser reduces risk of
visual loss by 50%

Early Photocoagulation for Diabetic Retinopathy

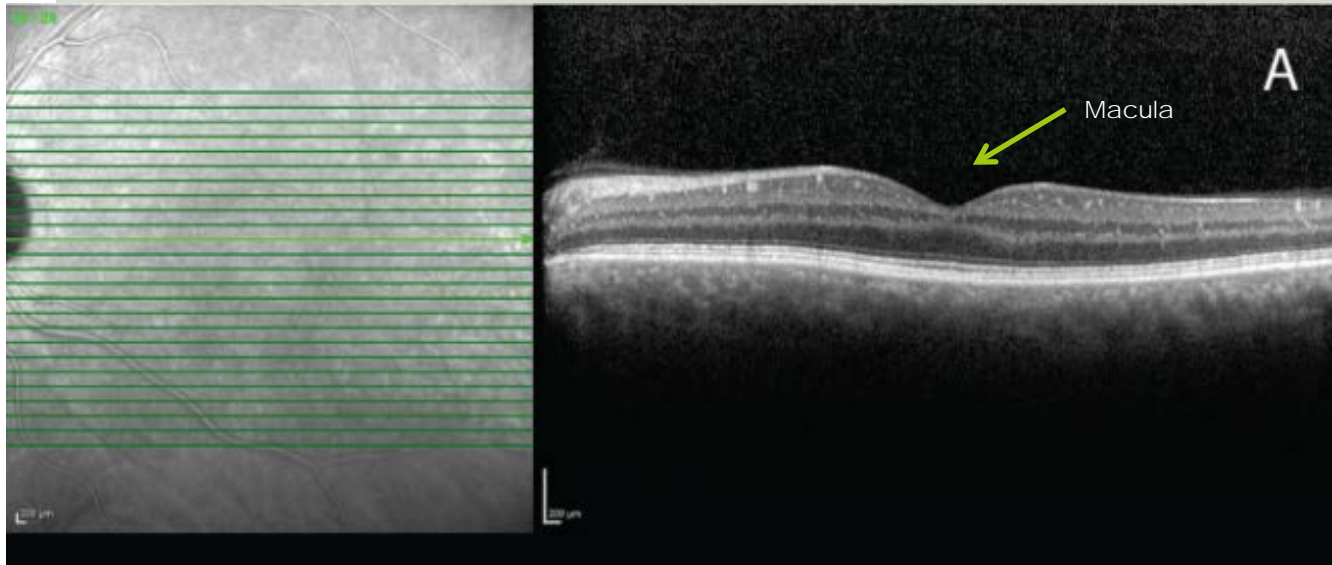
ETDRS Report Number 9

EARLY TREATMENT DIABETIC RETINOPATHY STUDY RESEARCH GROUP

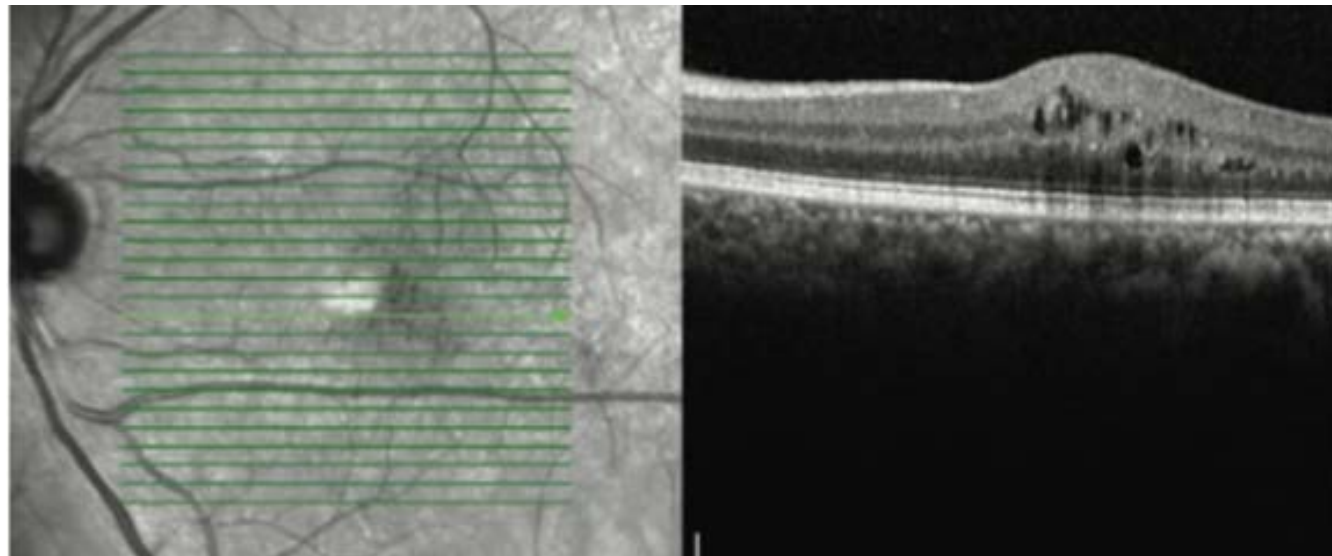
Ophthalmology 1991; 98; 766-785

What about Optical Coherence Tomography?

- Non-invasive technology that uses light waves to image the retina and other ocular tissues
- New method of assessing for diabetic retinopathy
- Classify macular edema:
 - CENTER INVOLVING
 - NON CENTER INVOLVING
 - Greater risk of vision loss



Normal



Abnormal

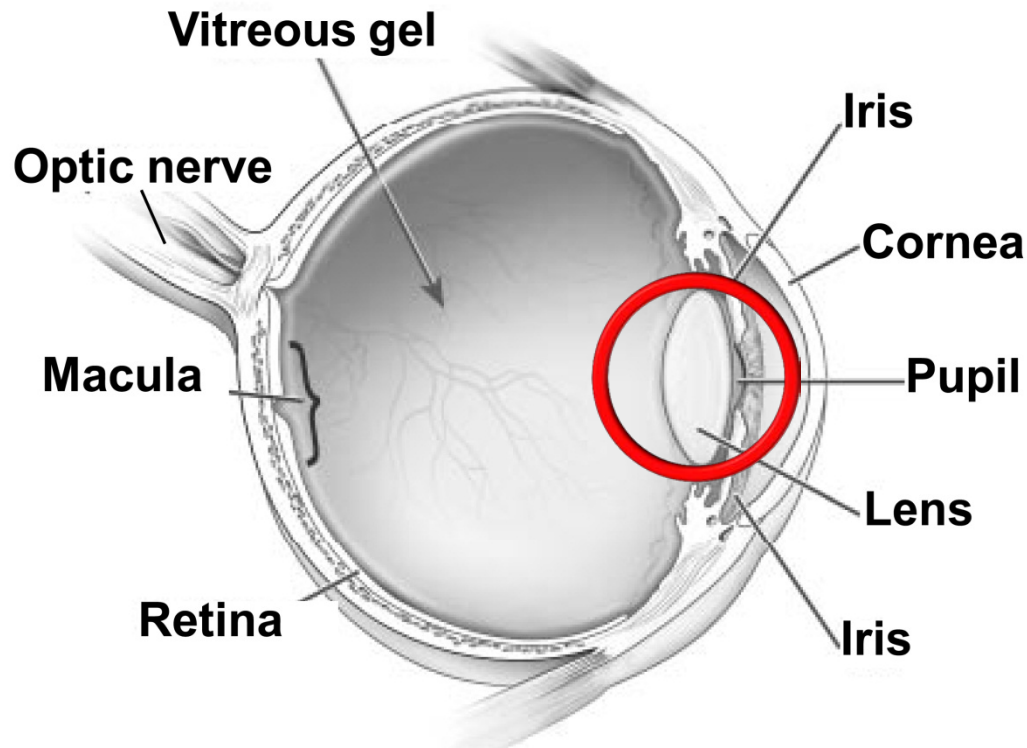
Other Ocular Complications of Diabetes

BEWARE!!

Anatomy of the Eye and Its Function

Vision is wonderful, but you could lose it if you have diabetes.

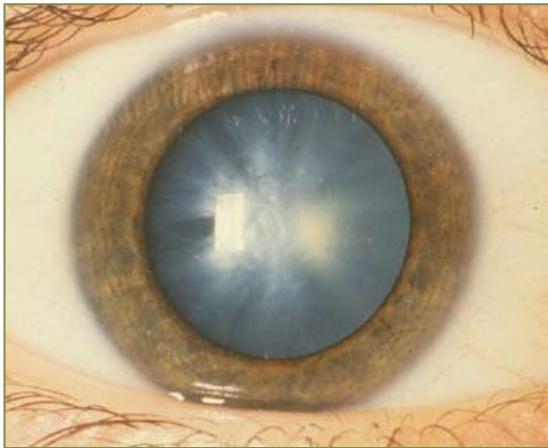
The main parts of the eye—



Diabetes and Cataract



Normal vision.



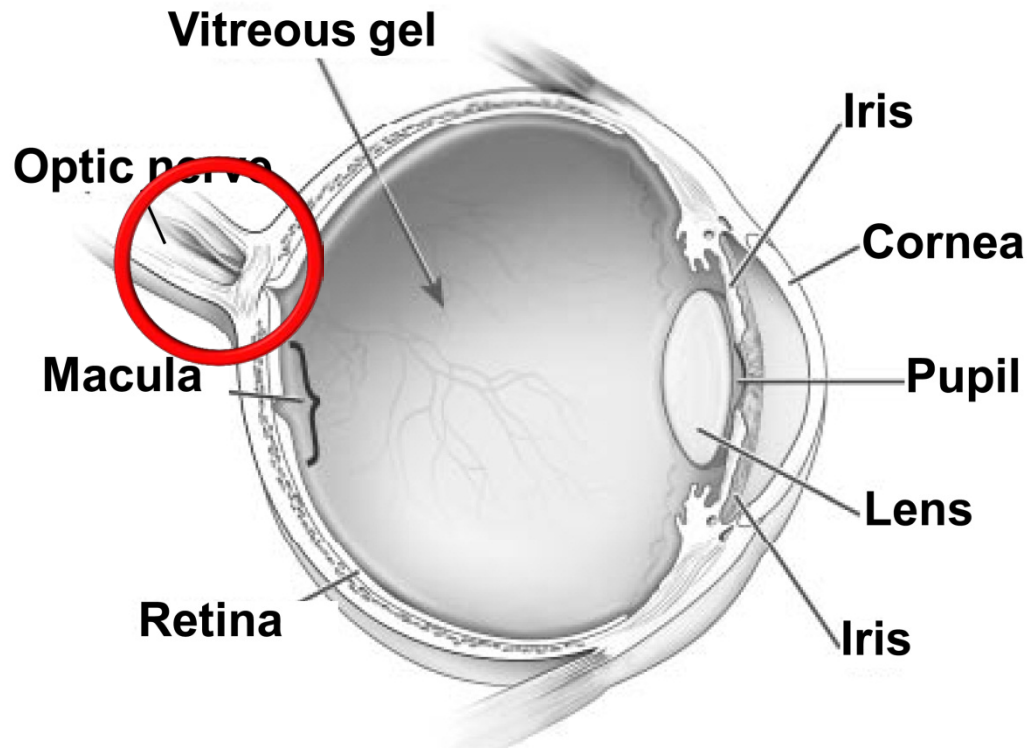
Same scene viewed by a person with cataract.

A cataract is a clouding of the lens.
People with cataract see through a haze.

Anatomy of the Eye and Its Function

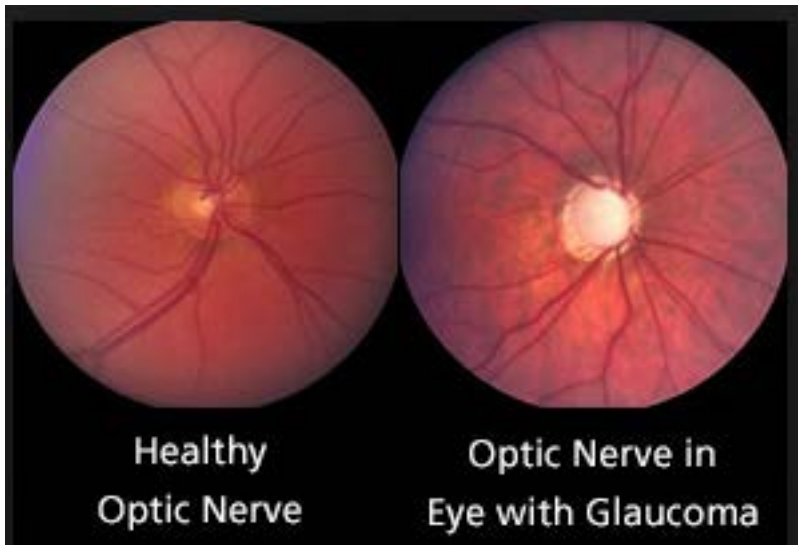
Vision is wonderful, but you could lose it if you have diabetes.

The main parts of the eye—



Diabetes and Glaucoma

Glaucoma is a group of diseases that can damage the optic nerve and result in vision loss and blindness.



Normal vision.



Same scene viewed by a person with glaucoma.

Neovascular Glaucoma



- Symptoms
 - Loss of Vision
 - Pain
- “Red Eye”
- Iris Neovascularization
- High Intraocular Pressure
- Abnormal pupil response

The Eye Health Team

People with diabetes can protect their vision.

Health professionals who are part of an eye health team include—

- Certified diabetes educator
- Health promoter
- Nurse
- Ophthalmologist
- Optometrist
- Pharmacist
- Primary care provider
- Social worker

Remember—

- Visit an eye care professional and take care of your eyes.
- Ask for a dilated eye exam.
- Have a dilated eye exam at least once a year.



CONCLUSIONS



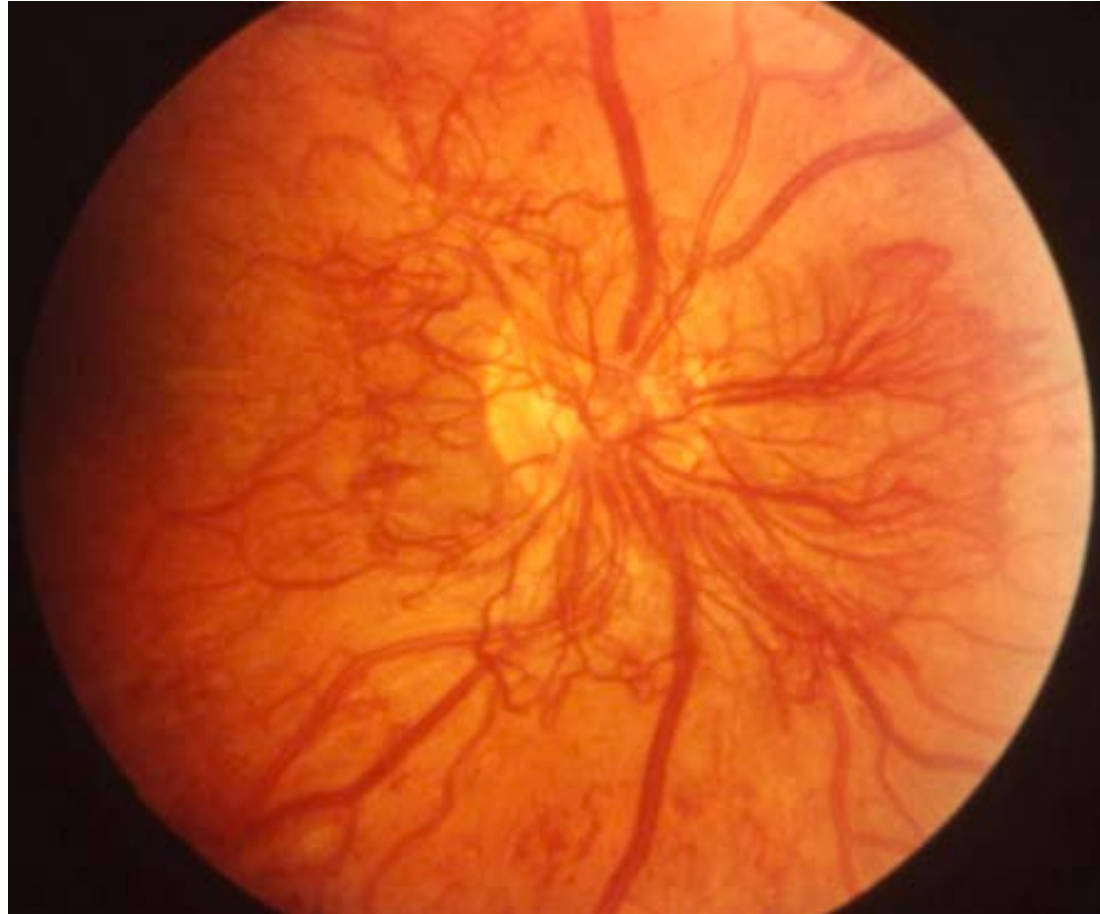
Diabetic Eye Disease is preventable through strict glycemic control and annual dilated eye exams by an eye doctor.

QUIZ

Diabetes and the Eye

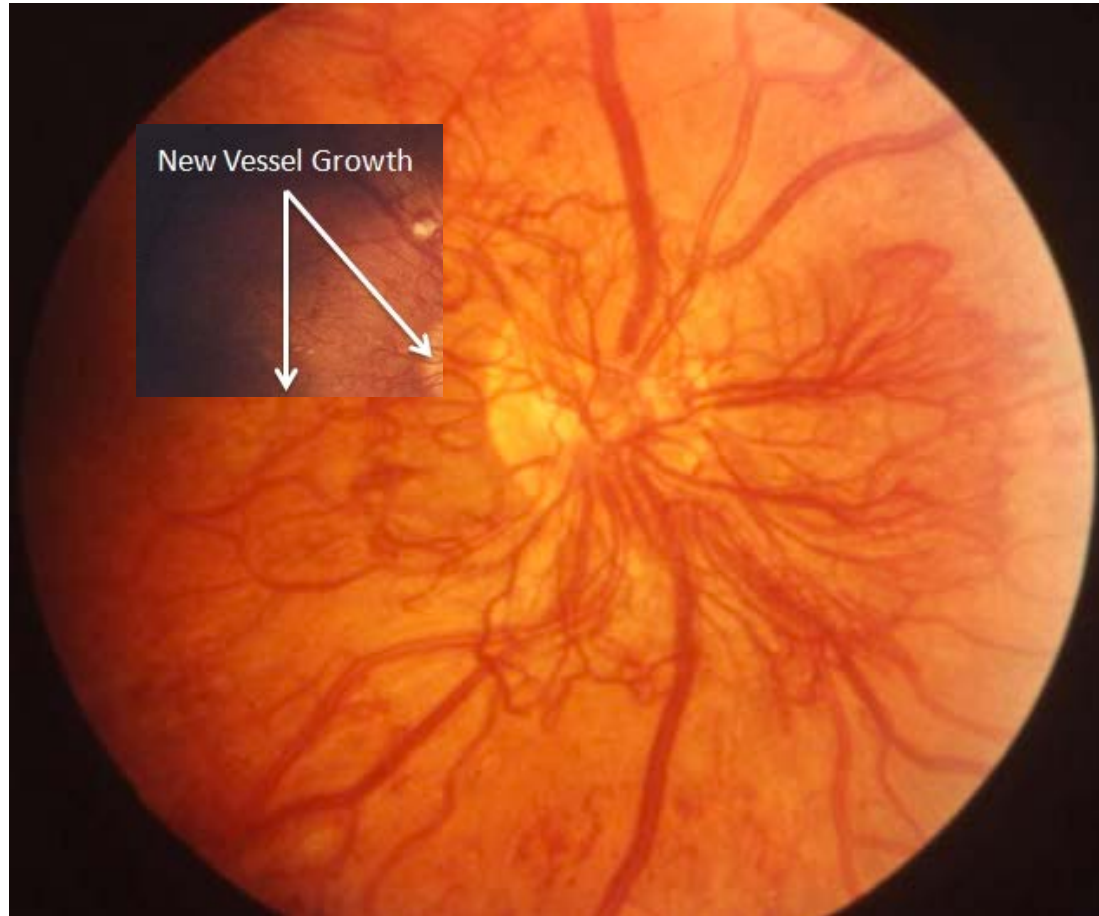
What is the category of diabetic retinopathy imaged below?

- A. Mild non-proliferative diabetic retinopathy
- B. Clinically significant macular edema
- C. Severe non-proliferative diabetic retinopathy
- A. Proliferative diabetic retinopathy



What is the category of diabetic retinopathy imaged below?

- A. Mild non-proliferative diabetic retinopathy
- B. Clinically significant macular edema
- C. Severe non-proliferative diabetic retinopathy
- A. Proliferative diabetic retinopathy**



Diabetic retinopathy can result in vision loss due to:

- A. Vitreous hemorrhage
- B. Retinal detachment
- C. Macular edema
- A. All of the above



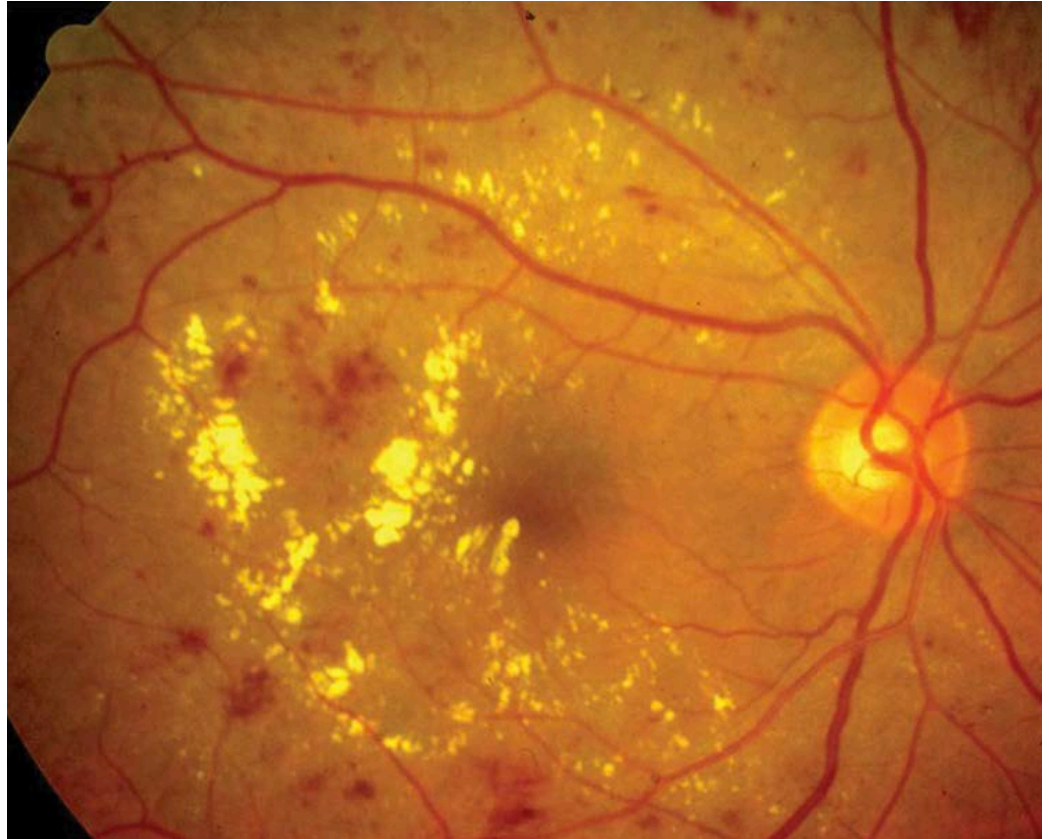
Diabetic retinopathy can result in vision loss due to:

- A. Vitreous hemorrhage
- B. Retinal detachment
- C. Macular edema
- A. All of the above**



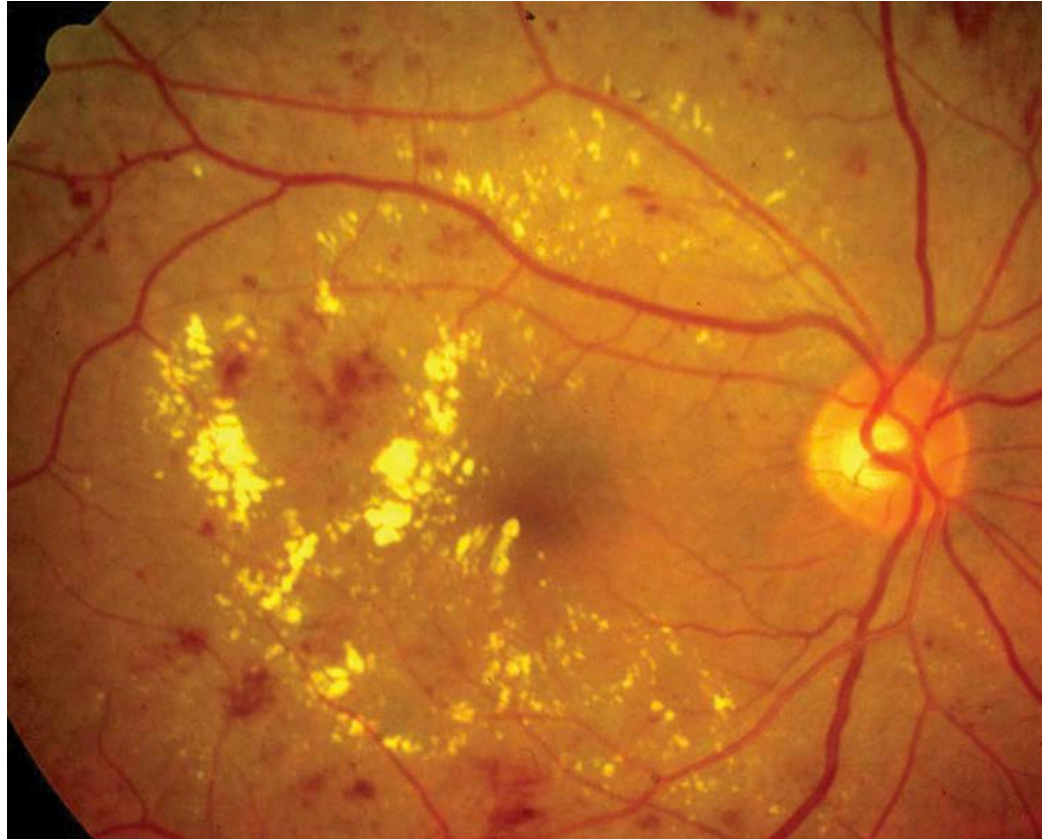
Which of the following may result in visual reduction or symptomatology?

- A. Mild non-proliferative diabetic retinopathy
- B. Macular edema
- C. Neovascularization of the disc
- A. Neovascularization elsewhere
- B. All of the above



Which of the following may result in visual reduction or symptomatology?

- A. Mild non-proliferative diabetic retinopathy
- B. Macular edema
- C. Neovascularization of the disc
- A. Neovascularization elsewhere
- B. All of the above**



NVD is apparent on the photo below. Why are the vessels out of focus?

- A. Because the vessels are growing into the vitreous cavity
- B. Because the vessels are growing into the retina
- C. Poor photo quality
- A. Because they are too small to focus on



NVD is apparent on the photo below. Why are the vessels out of focus?

- A. **Because the vessels are growing into the vitreous cavity**
- B. Because the vessels are growing into the retina
- C. Poor photo quality
- A. Because they are too small to focus on



Which is not one of the biggest risk factors for diabetic retinopathy?

- A. Duration of diabetes
- B. Ethnicity
- C. Blood glucose
- A. Hypertension



Which is not one of the biggest risk factors for diabetic retinopathy?

A. Duration of diabetes

B. Ethnicity

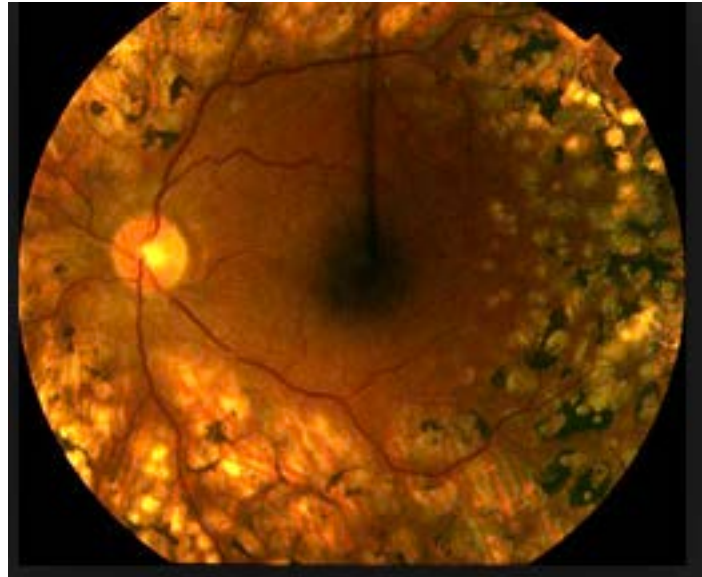
C. Blood glucose

A. Hypertension



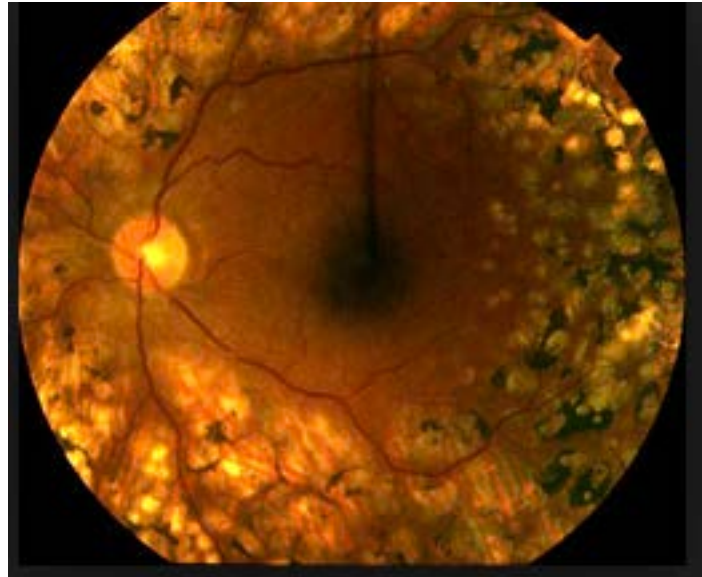
Which of the following treatments is appropriate for proliferative diabetic retinopathy?

- A. Photocoagulation
- B. Vitreoretinal surgery
- C. Anti-VEGF
- A. All of the above



Which of the following treatments is appropriate for proliferative diabetic retinopathy?

- A. Photocoagulation
- B. Vitreoretinal surgery
- C. Anti-VEGF
- A. All of the above**



Which of the following statements is incorrect regarding managing diabetic retinopathy?

- A. Blood glucose control is not only important in preventing the development of retinopathy but in affecting the progression of established retinopathy
- A. Patients with any amount of non-proliferative retinopathy should be referred for a dilated eye exam
- B. Hard exudates in the macula imply vascular leakage and are an indication for referral
- A. The retina can be adequately screened for diabetic retinopathy without dilating the pupils if the room is dark

Which of the following statements is incorrect regarding managing diabetic retinopathy?

- A. Blood glucose control is not only important in preventing the development of retinopathy but in affecting the progression of established retinopathy
- A. Patients with any amount of non-proliferative retinopathy should be referred for a dilated eye exam
- B. Hard exudates in the macula imply vascular leakage and are an indication for referral
- A. The retina can be adequately screened for diabetic retinopathy without dilating the pupils if the room is dark**

THANK YOU!!

rjulie@nova.edu

