

# Diabetic Retinopathy

Daniel Freed, MD



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## Daniel Freed, OD, MD

- Family physician and optometrist, Lynchburg, Virginia; Clinical faculty, Lynchburg Family Medicine Residency, Virginia
- Dr. Freed earned an optometry degree in 1991 and a medical degree in 1999. He currently practices in various inpatient, emergency, and clinical settings near Lynchburg, Virginia, including Bedford Memorial Hospital, Lynchburg General Hospital, and Bath Community Hospital (Hot Springs). He especially enjoys performing dermatology procedures and eye consults. In addition to treating a wide range of patients, Dr. Freed occasionally supervises residents and medical students. His clinical areas of interest include diabetes, neurology, infectious disease, and pediatrics.



## Learning Objectives

1. Screen diabetic patients for ocular complications according to evidence-based clinical guidelines.
2. Identify symptoms associated with common retinal disorders.
3. Reduce the risk or slow the progression of diabetic retinopathy through optimized glycemic and blood pressure control.
4. Manage referral of diabetic patients with suspected retinopathy to an ophthalmologist who is knowledgeable and experienced in the management and treatment of diabetic retinopathy.



## Audience Engagement System

The image displays three sequential screenshots of a mobile application interface for an audience engagement system. Step 1 shows a dashboard with various icons for navigation. Step 2 shows a list of CME events, with one event highlighted. Step 3 shows the details of the selected event, including its title, location, date, and a list of related topics.



## Perspective on Diabetic Retinopathy

- Symptoms and signs of diabetic eye disease
- Clinical guidelines for retinopathy screening
- Prevent and reduce vision loss in patients
- Treatments and referral management
- Case presentations and questions

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## Diabetic retinopathy screening guidelines

1. Which patients with diabetes need eye exams?
2. When should they get their first eye exam?
3. What is the interval between eye exams?
4. Who should do the eye exam?
5. What should the eye exam include?
6. Role of retinal photographs instead of eye exam?

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## Case 1. Lynchburg, Virginia 2016

- History: 56 year old female
- cc: "Vision slightly blurry" No eye pain
  - Last eye exam 2014 "Vision 20/25, No DR"
- PMH: DM-2 since 2008; Recent A1c = 11.5
- Meds: Various including Lantus 64 units daily

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## Case 1. Exam

Vision 20/30 right, 20/30 left eye with specs.  
IOP:15/15; Eye motility and pupils normal.  
Slit lamp: clear corneas, no iris rubeosis.

Dilated retinal exam reveals . . .

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## Right Eye Case 1 Left Eye



Retinal images (Case 1) reproduced with permission from Piedmont Eye Center, Lynchburg, Virginia

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## AES POLLING QUESTION

Case 1. Likely diagnosis?

- A. Acute angle-closure glaucoma
- B. Neovascular glaucoma
- C. Diabetic retinopathy (DR)
- D. DR with diabetic macular edema
- E. DR with vitreous hemorrhage

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### AES POLLING QUESTION

Based on 2017 ADA guidelines for patients with diabetes, a dilated eye exam should be done . . .

- A. Within 5 years after onset of DM-1.
- B. Within 2 years after DM-2 diagnosis.
- C. Every year and only by a retinal specialist.
- D. Every 2 years for patients with prediabetes.

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### Screening:

• **Initial dilated and comprehensive eye examination by an ophthalmologist or optometrist:**

- Adults with **type 1 diabetes**, within 5 years of diabetes onset. **B**
- Patients with **type 2 diabetes** at the time of diabetes diagnosis. **B**

2017 ADA Guidelines on Diabetic Retinopathy

American Diabetes Association Standards of Medical Care in Diabetes. Microvascular complications and foot care. Diabetes Care 2017; 40 (Suppl. 1): S88-S90

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### Screening (2):

- If no evidence of retinopathy for one or more eye exam, exams every 2 years may be considered. **B**
- If diabetic retinopathy is present subsequent examinations for type 1 and type 2 diabetic patients should be repeated annually by an ophthalmologist or optometrist. **B**
- If retinopathy is progressing or sight-threatening, more frequent exams required. **B**

2017 ADA Guidelines on Diabetic Retinopathy

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### Screening (3):

- High-quality fundus photographs can detect most clinically significant diabetic retinopathy. **E**
- Image interpretation should be performed by a trained eye care provider. **E**
- Retinal photography may serve as a screening tool for retinopathy, but is not a substitute for a comprehensive eye exam. **E**
- Perform comprehensive eye exam at least initially and at recommended intervals. **E**

2017 ADA Guidelines on Diabetic Retinopathy

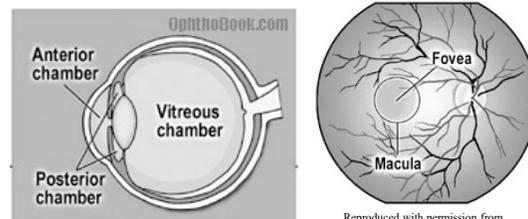
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### Case 1. Likely diagnosis?

- A. Acute glaucoma [pain, cloudy cornea, fixed mid-dilated pupil]
- B. Neovascular glaucoma [iris without rubeosis, IOP 15]
- C. **Diabetic retinopathy (DR) both eyes**
- D. DR with diabetic macular edema
- E. DR with vitreous hemorrhage [bad vision, cloudy (or no view) of fundus depending on severity]

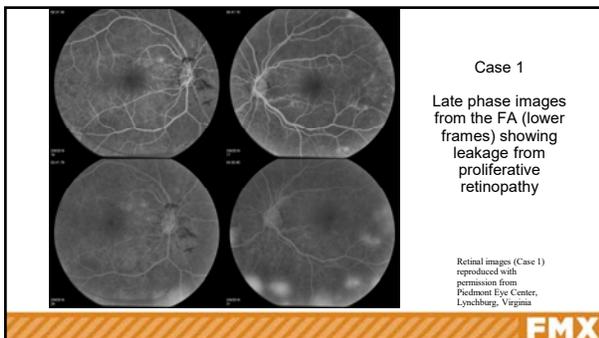
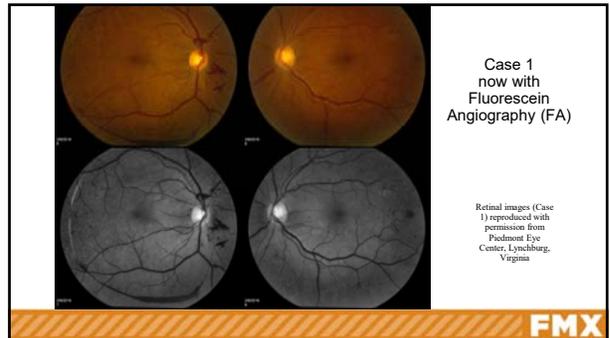
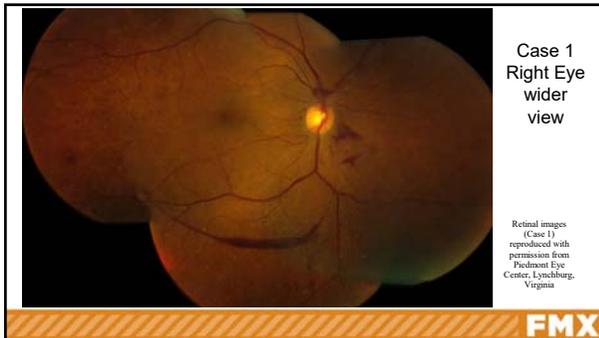
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### Eye anatomy review



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### Case 1. Laser treatment

Are we finished with the patient? **NO!** (Level A evidence)

**2017 ADA Guidelines on Diabetic Retinopathy:**

- To reduce the risk or slow the progression of retinopathy
  - Optimize glycemic control **A**
  - Optimize blood pressure control **A**

2017 ADA Guidelines on Diabetic Retinopathy

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### AES POLLING QUESTION

Based on ADA 2017 guidelines: women with pregnancy and preexisting diabetes, a dilated eye exam should be done . . .

- A. After the delivery to avoid eye drop toxicity.
- B. After delivery and after infant is weaned.
- C. Before pregnancy or in 1st trimester.
- D. Only in the 3rd trimester.

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### Screening (4):

- Women with preexisting diabetes who are planning pregnancy or who have become pregnant: **B**
  - Counsel on risk of development and/or progression of diabetic retinopathy
  - Eye examination should occur before pregnancy or in 1<sup>st</sup> trimester and quarterly for 1 year postpartum or as indicated by degree of retinopathy

2017 ADA Guidelines on Diabetic Retinopathy

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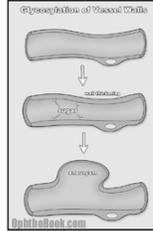
## Spectrum of Diabetic Eye Disease

1. From asymptomatic lesions to legal blindness.
2. Cataracts, glaucoma and retinal occlusive disease more common in patients with DM.
3. Microvascular retinal changes from diabetes result in most of the vision loss.

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## Microvascular diabetic lesions can lead to:

1. Macular edema with loss of central vision
2. Proliferative retinopathy, sometimes with total vision loss



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### Macular Edema

-Can be subtle fluid and/or discrete yellow flecks called hard exudates.

-Hard exudates are the lipid residues of serous leakage from damaged capillaries.

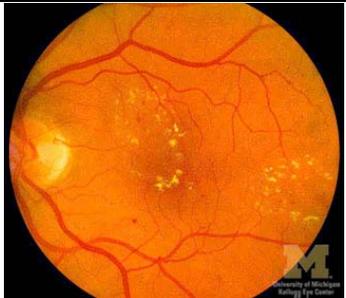


Figure 1. Reproduced with permission from University of Michigan, Kellogg Eye Center.

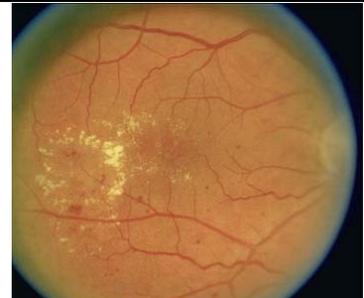
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### Macular Edema

Common cause of vision loss in patients with diabetes.

Can be mild, moderate, or severe.

Treatment with laser photocoagulation and/or anti-VEGF intravitreal injections.

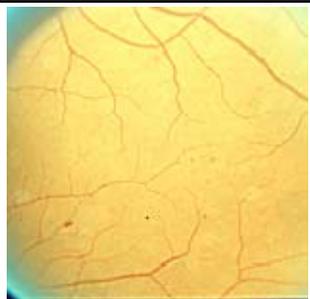


ETDRS Standard Photograph 4 Reproduced with permission from: Early Treatment Diabetic Retinopathy Study Research Group.

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### Nonproliferative diabetic retinopathy (NPDR)

**Microaneurysms:**  
first lesions appearing in diabetic retinopathy

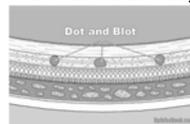


ETDRS Standard Photograph 1 Reproduced with permission from: Early Treatment Diabetic Retinopathy Study Research Group.

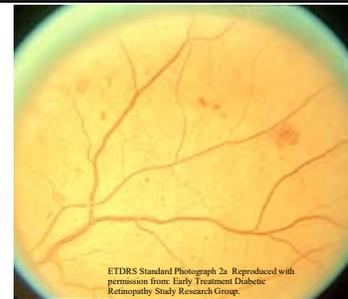
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### Nonproliferative diabetic retinopathy (NPDR)

**Microaneurysms, now with retinal hemorrhages**



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ETDRS Standard Photograph 2a. Reproduced with permission from: Early Treatment Diabetic Retinopathy Study Research Group.

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**More severe NPDR**

Can include Soft Exudates aka "Cotton Wool Spots"  
 - represent closures of capillaries (micro-infarcts) in the nerve fiber layer  
 - often occur in with IRMA

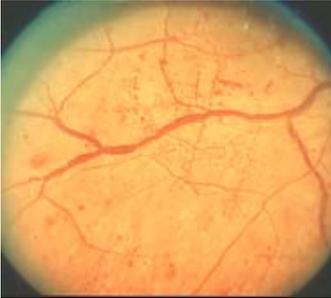


ETDRS standard photograph 5. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.

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**Severe nonproliferative DR**

Intraretinal Microvascular Anomalies (IRMA)  
 Venous beading (VB) (large vessel at 9 o'clock)



ETDRS standard photograph 6B. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.

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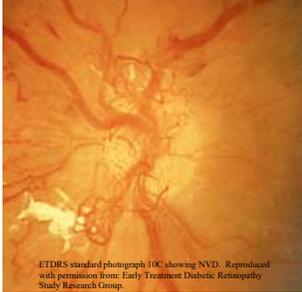
**Proliferative diabetic retinopathy (PDR) displaying neovascularization elsewhere (NVE)**



Figure 2. Reproduced with permission from University of Michigan, Kellogg Eye Center.

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**Proliferative diabetic retinopathy (PDR) displaying neovascularization at the disc (NVD)**



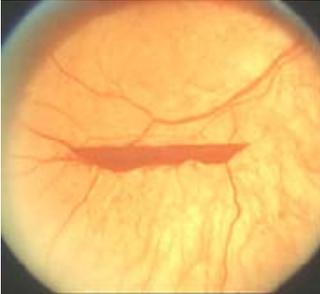
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ETDRS standard photograph 10C showing NVD. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.

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**Preretinal hemorrhage, located in front of the retina, just behind the vitreous.**

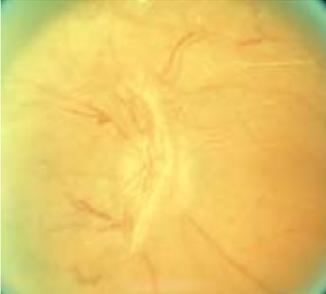
**Not a good sign; often means that PDR is nearby.**



ETDRS standard photograph 13. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.

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**Severe proliferative diabetic retinopathy with fibrous proliferation on the disc**

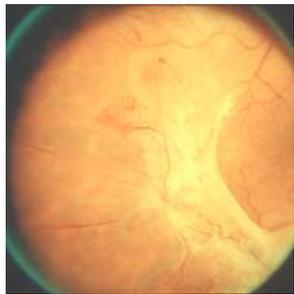


ETDRS standard photograph 15 showing FPD with associated NVD. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.

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**Severe proliferative diabetic retinopathy with fibrous proliferation elsewhere**

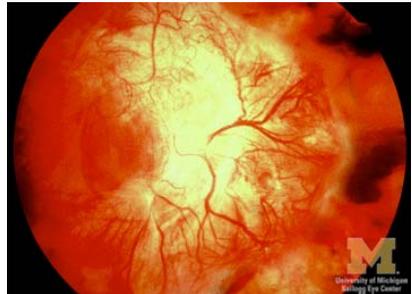
ETDRS standard photograph 11. Reproduced with permission from Early Treatment Diabetic Retinopathy Study Research Group.



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**Severe proliferative diabetic retinopathy with vitreous hemorrhage**

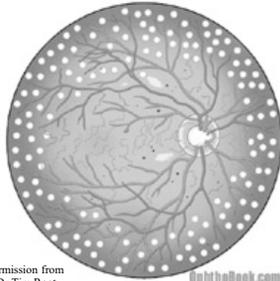
Figure 3. Reproduced with permission from University of Michigan, Kellogg Eye Center.



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**Treatment of PDR: scatter laser photocoagulation (pan-retinal laser photocoagulation)**

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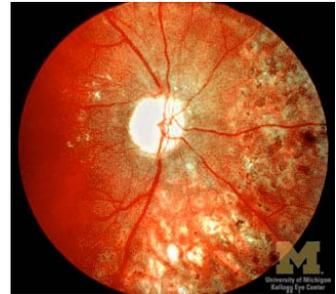


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**Chorioretinal atrophy from laser photocoagulation.**

The PDR has regressed so it is not seen.

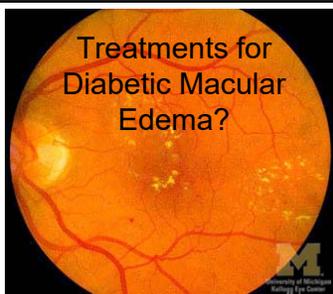
Figure 4. Reproduced with permission from University of Michigan, Kellogg Eye Center.



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1. Control glucose and BP
2. Anti-VEGF injections
3. Corticosteroid injection
4. Focal laser, but not in fovea
5. Consider vitrectomy, if tractional component present

Figure 1. Reproduced with permission from University of Michigan, Kellogg Eye Center.



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**Treatment:**

- Promptly refer patients with macular edema, severe NPDR, or any PDR to an ophthalmologist knowledgeable & experienced in management, treatment of diabetic retinopathy. **A**
- Laser photocoagulation therapy is indicated to reduce the risk of vision loss in patients with high-risk PDR and, in some cases, severe NPDR. **A**

PDR: treatment → PRP (laser) or intravitreal injection of anti-VEGF therapy (2017 updated Reference 7)

2017 ADA Guidelines on Diabetic Retinopathy

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### Treatment (2):

- **Intravitreal injections of VEGF are indicated for center-involved diabetic macular edema, which occurs beneath the foveal center and which may threaten reading vision. A**
- **Retinopathy is not a contraindication to aspirin therapy for cardioprotection, as it does not increase the risk of retinal hemorrhage. A**

2017 ADA Guidelines on Diabetic Retinopathy

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## AES POLLING QUESTION

Which is false?

- A. PDR and some severe NPDR can benefit from laser treatment.
- B. Center-involved diabetic macular edema should be treated with an anti-VEGF injection.
- C. PDR with vitreous hemorrhage may need both laser and a vitrectomy.
- D. Most diabetic retinopathy remains nonproliferative and does not need eye treatment; eyes should be monitored, and glucose and BP controlled.
- E. Aspirin should be stopped in patients with proliferative DR.

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## Treatment benefits for PDR and DME <sup>7</sup>

Diabetic Retinopathy Study - pan-retinal laser for proliferative diabetic retinopathy (PDR)  
Severe vision loss in treated eyes 6%  
Severe vision loss in untreated eyes 16%

Early Treatment Diabetic Retinopathy Study - focal laser for diabetic macular edema (DME) \*\*  
Severe vision loss in treated eyes 8%  
Severe vision loss in untreated eyes 20%

\*\* Intravitreal anti-vascular endothelial growth factor (anti-VEGF) agents is even more effective than laser for center-involved diabetic macular edema.

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## Case 2. Refractory DME

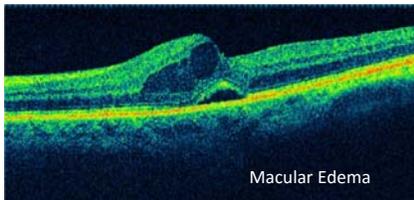
71 yr old female with proliferative diabetic retinopathy and diabetic macular edema.

Not responding to multiple anti-VEGF intravitreal injections.

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## Case 2. Exam data

Optical coherence tomography (OCT) is a non-invasive imaging test that uses light waves to take cross-section pictures of the retina



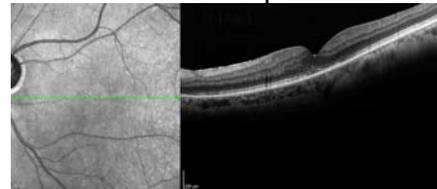
VA: 20/60

Macular Edema

Retinal images (Case 2) reproduced with permission from Piedmont Eye Center, Lynchburg, Virginia

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## Case 2. Actos was stopped and vision improved to 20/30!



OCT improved as well

Retinal images (Case 2) reproduced with permission from Piedmont Eye Center, Lynchburg, Virginia

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### Risks and benefits of pioglitazone (Actos)

- Positives: Lipid, CVA, MI, Liver
- Negatives: Weight gain, generalized edema, possible links to bone fractures, bladder cancer and diabetic macular edema, cost

Schemthamer, et al. Do We Still Need Pioglitazone for the Treatment of Type 2 Diabetes? A risk-benefit critique in 2013. Diabetes Care 2013 Aug; 36(Supplement 2): S155-S161. <http://dx.doi.org/10.2337/dcS13-2031> (reference 6)

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### Case 3. Bedford, Virginia

History: 77 year old female

cc: Central vision loss right eye for at least 36 hours

No eye pain

PMH: DM-2 with DPN, HTN, Lipids, hypothyroid

Meds: Aspirin 81 mg, Lisinipril 20 mg, Lipitor 40mg, Levemir 35 units, gabapentin 300 mg (noncompliance with most meds)

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### Case 3. Exam

BP:161/79, P:78, sats 97% RA

Vision: Right eye: counting fingers in periphery.

20/50 left eye with specs.

Central field defect OD, full field OS.

Eye motility and pupils normal.

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### Case 3. Exam

External eye exam: clear corneas, mild cataracts bilaterally.

Carotid bruit: left side

Nondilated retinal exam (DO) reveals:

Fairly normal optic nerves and vessels.

Maybe slight pallor of the right macula compared to the left. No obvious DME.

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### Case 3. Impression / Plan

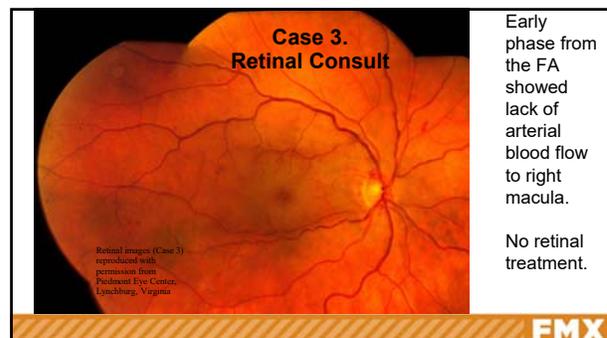
#### Impression:

1. Vision loss, possible cilioretinal artery occlusion.
2. HTN, DM, Hyperlipidemia - not controlled

#### Plan:

1. Patient declined hospital admission.
2. Restart ACE-I, statin, aspirin, and insulin.
3. Follow-up with PCP to arrange further vascular testing.
4. Consult retinal specialist in next 24-48 hours.

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### Case 3. Medical Epilogue

Carotid US revealed occlusions:

- Right side: 20% ECA and 60% ICA
- Left side: 80% ECA and 90% ICA

TX: Carotid stenting, previous meds + Plavix

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### Practice recommendations

1. Optimize glycemic, BP and lipid control.
2. Consider adding fenofibrate 160mg daily to slow progression of DR (ACCORD and FIELD Studies).  
(reference 7)
3. Ask patients about vision and last eye screenings.

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### Practice recommendations (cont.)

4. Identify local barriers and resources (retinal photos) for eyes.
5. Utilize the EHR and the clinic team to the max.
6. Facilitate communication with eye specialists.
7. Sympathize with visual losses and adjust care plan as needed.

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### Questions



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Questions?

Thank you.

Dan Freed, OD, MD  
email: [danielfreed@centrahealth.com](mailto:danielfreed@centrahealth.com)

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### References

1. American Diabetes Association (ADA) Standards of Medical Care in Diabetes-2017. *Diabetes Care* Jan 2017; Volume 40: S1-S2. [http://care.diabetesjournals.org/content/diacare/suppl/2016/12/15/40.Supplement\\_1.DC1/DC\\_40\\_S1\\_final.pdf](http://care.diabetesjournals.org/content/diacare/suppl/2016/12/15/40.Supplement_1.DC1/DC_40_S1_final.pdf)
2. ETDRS Standard Photographs. Reproduced with permission from: Early Treatment Diabetic Retinopathy Study Research Group. *Ophthalmology*, Volume 98, Issue 5, Supplement, May 1991, Pages 786-806.
3. Retinal photos (Figures 1,2,3,4) reproduced with permission from "The Eyes Have It" [University of Michigan Kellogg Eye Center](http://www.michigan.kellogg.eyes.com)
4. Thanks to [OphthoBook.com](http://OphthoBook.com), (Dr. Timothy Root, MD) for permission to use his eye illustrations.
5. Images for Cases 1, 2 and 3 courtesy of Dr. Golnaz Javey, Piedmont Eye Center, Lynchburg, Virginia.
6. Schemthamer, et al. Do We Still Need Pioglitazone for the Treatment of Type 2 Diabetes? A risk-benefit critique in 2013. *Diabetes Care* 2013 Aug; 36(Supplement 2): S155-S161. <http://dx.doi.org/10.2337/dcS13-2031>
7. Diabetic Retinopathy: A Position Statement by the American Diabetes Association. *Diabetes Care* 2017;40:412-418

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