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

- **White**
- **Black**
- **Hispanic**
- **Other**

Age Groups:
- 40-49
- 50-64
- 65-74
- 75+

Prevalence Rates:
- 0%
- 5%
- 10%
- 15%
- 20%
- 25%
- 30%
Risk Factors
Risk Factors for Developing Diabetes

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

https://nei.nih.gov/.../Ojo_DiabetesandHealthyEyesPPT.
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.

http://one.aaao.org/CE/PracticeGuidelines/PPP_Content.aspx?cid=d0c853d3-219f-487b-a524-326ab3cecd9a
Prevalence of diabetic retinopathy after 20 years of diagnosis

- DM type II: 60%
- DM type I: 100%
Prevention of eye disease is possible with increased risk factor control

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

https://nei.nih.gov/.../Ojo_DiabetesandHealthyEyesFlipchart

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

Human retina
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

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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??

FLUORESCIN ANGIOGRAPHY

Microaneurysms: \textbf{Hyper}fluoresce

Hemorrhages: \textbf{Hypo}fluoresce
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
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Moderate Non-Proliferative DR

Increasing microaneurysms and/or hemorrhages

Cotton wool spots - areas of ischemia

Venous beading or mild IRMA (intra-retinal 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

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  - 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 **three** 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

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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)
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)
- Panretinal photocoagulation (PRP)
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

Ophthalmology 1991; 88; 583-600
Intraocular (anti-VEGF) injections:

- Lucentis, Avastin, Eylea

- Reduces swelling in the retina and causes abnormal vessels to regress
- Alone or in conjunction with PRP
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](image-url)
Diabetic Eye Disease
Treatment – Vitreous Heme

Vitrectomy

Before

After
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

Arch Ophthalmol. 1985; 103 1644-1652
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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 associated 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
Other Ocular Complications of Diabetes

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

The main parts of the eye—

- Vitreous gel
- Optic nerve
- Macula
- Retina
- Iris
- Cornea
- Pupil
- Lens
- Iris
Diabetes and Cataract

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

Normal vision.

Same scene viewed by a person with cataract.

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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.
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
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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

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
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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?

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THANK YOU!!

rjulie@nova.edu