



Ocular Manifestations of Systemic Diseases and the Aging Eye

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Objectives

Review the anatomy of the eye and parts of the eye exam.

Describe the ocular signs and symptoms associated with selected systemic diseases and their serious ocular sequelae.

To be familiar with the important ocular features of diabetes, hypertension, thyroid disease, malignancy, sarcoidosis and inflammatory conditions.

Review common eye diseases primary seen in the aging population and their impact on quality of life.

Categories of Systemic Diseases

Congenital

Vascular

Traumatic

Neoplastic

Autoimmune

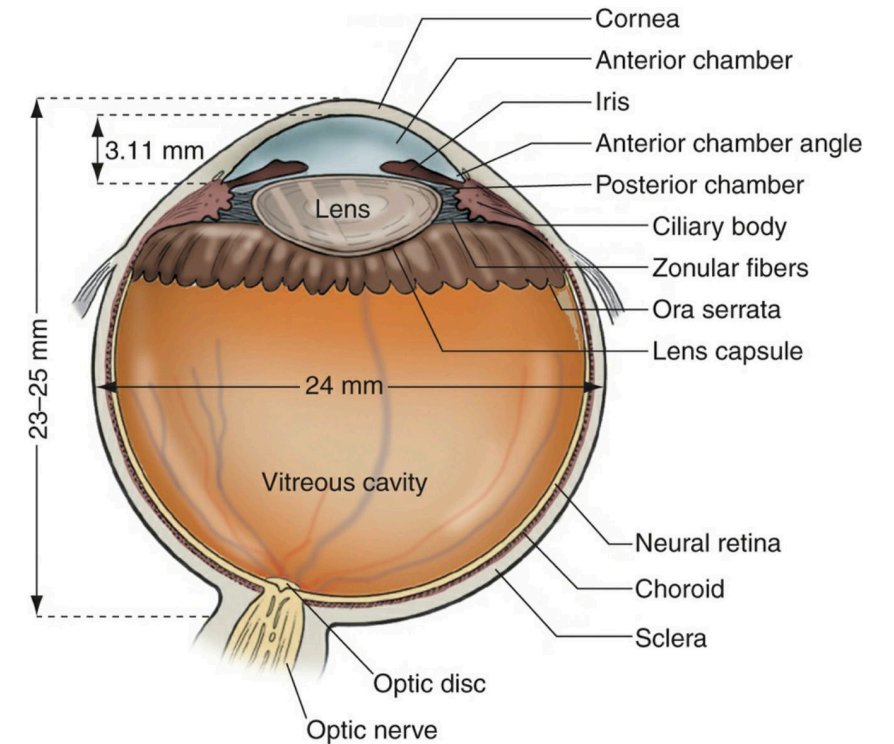
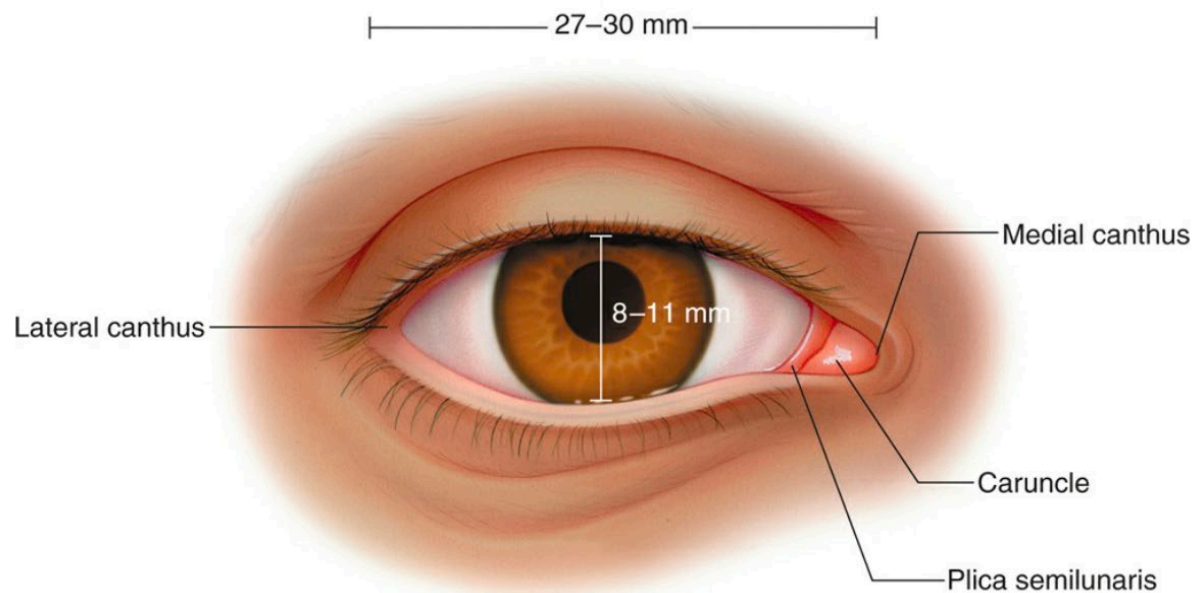
Idiopathic

Infectious

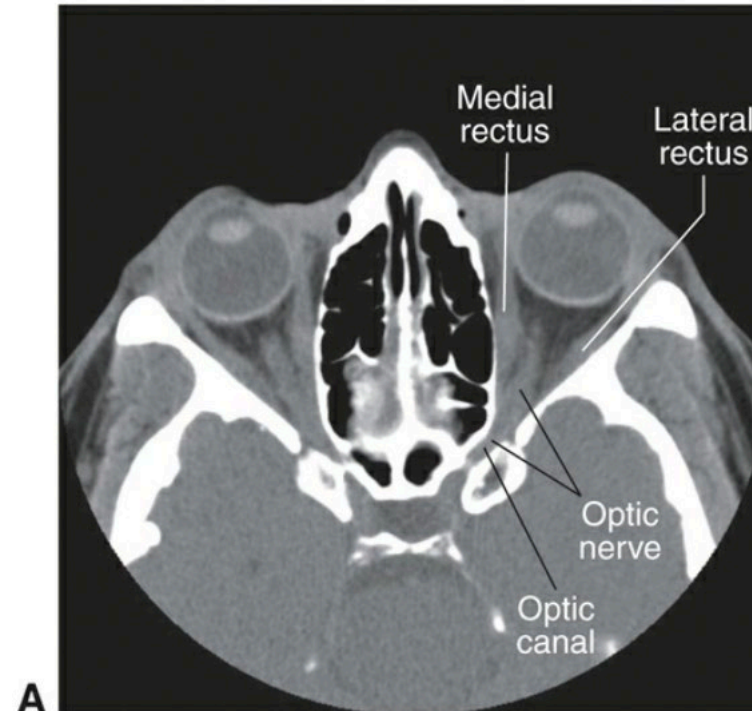
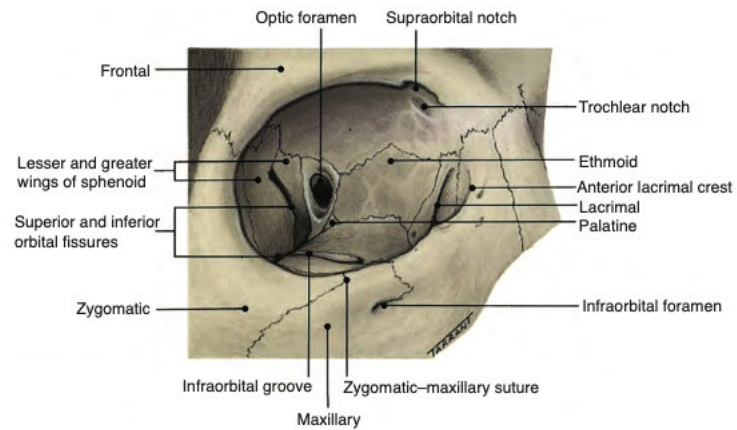
Metabolic/Endocrine

Drugs/Toxins

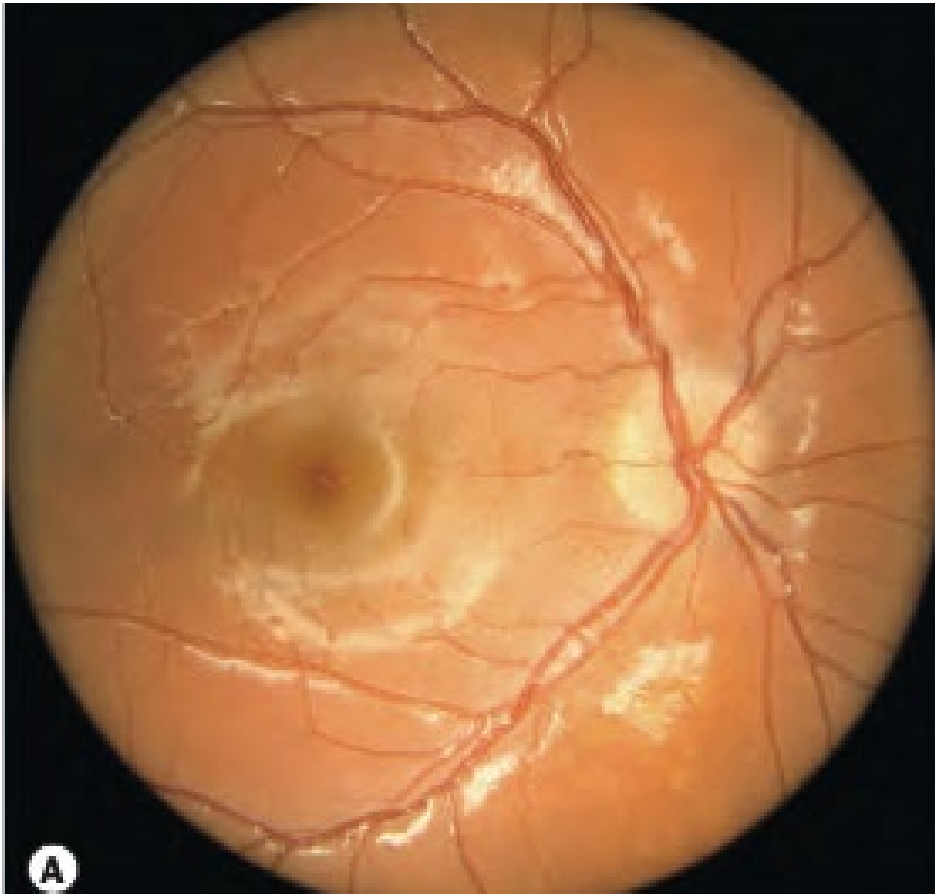
Ocular Anatomy



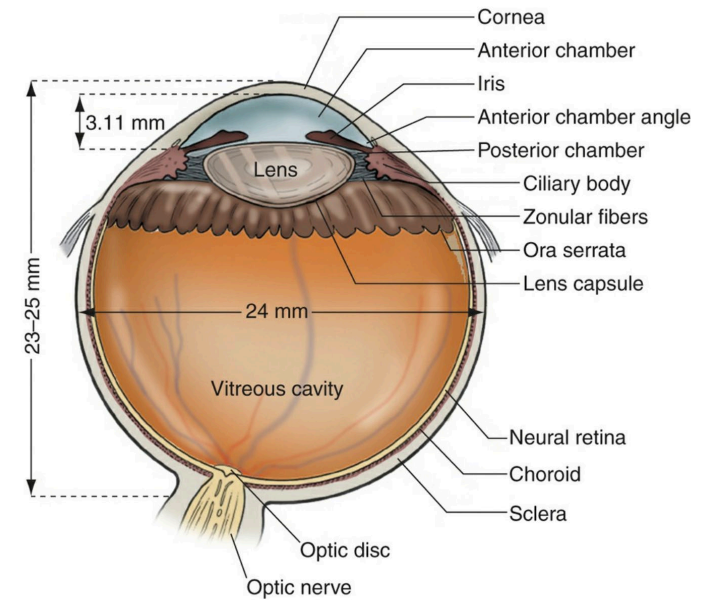
Orbital Anatomy



Retinal Anatomy



Kanski's Clinical Ophthalmology: A Systemic Approach (556):2020, Elsevier



BSCS 2: Fundamentals and Principles of Ophthalmology (75): 2019, AAO.

Basic Eye Exam

Vision

External

Pupil (RAPD)

Motility

Anterior Segment
Exam/ Slit Lamp

Dilated
Ophthalmoscopy



Hypertension

Arteriolar narrowing and AV nicking

Cotton Wool Spots

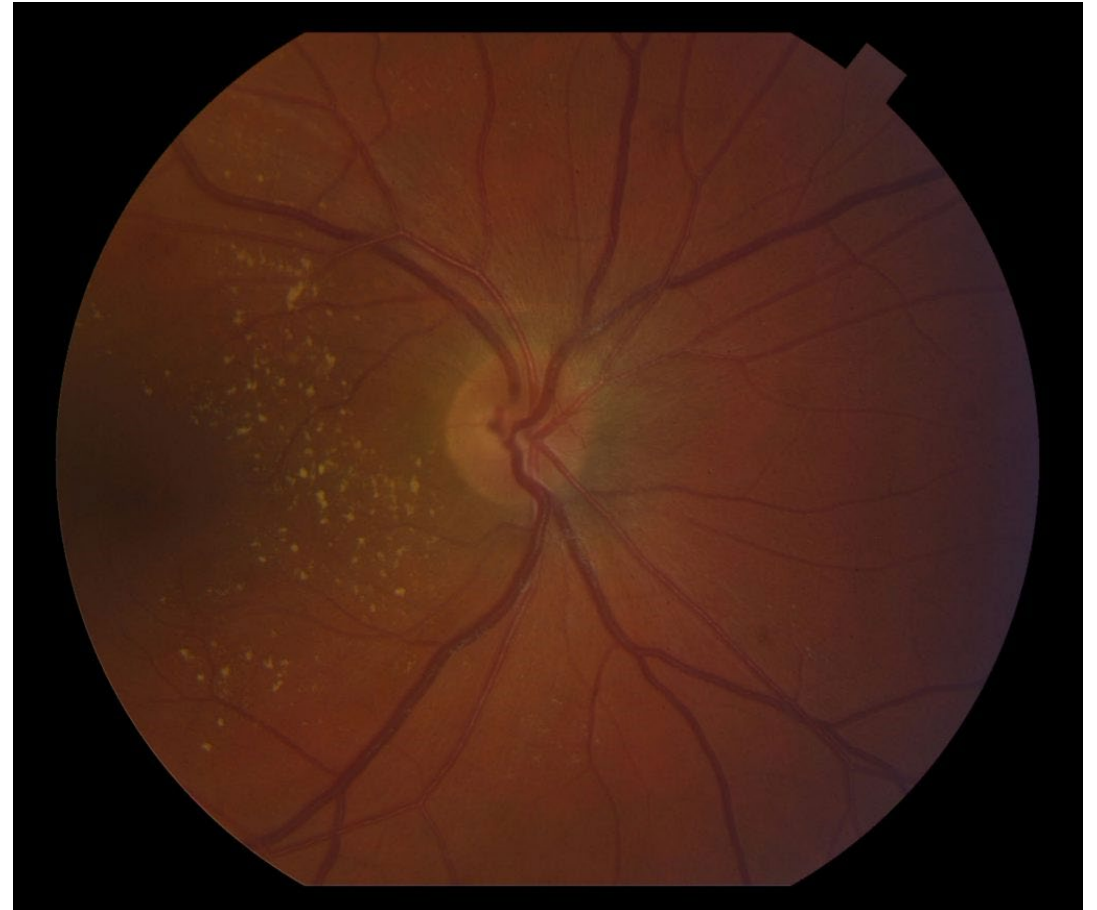
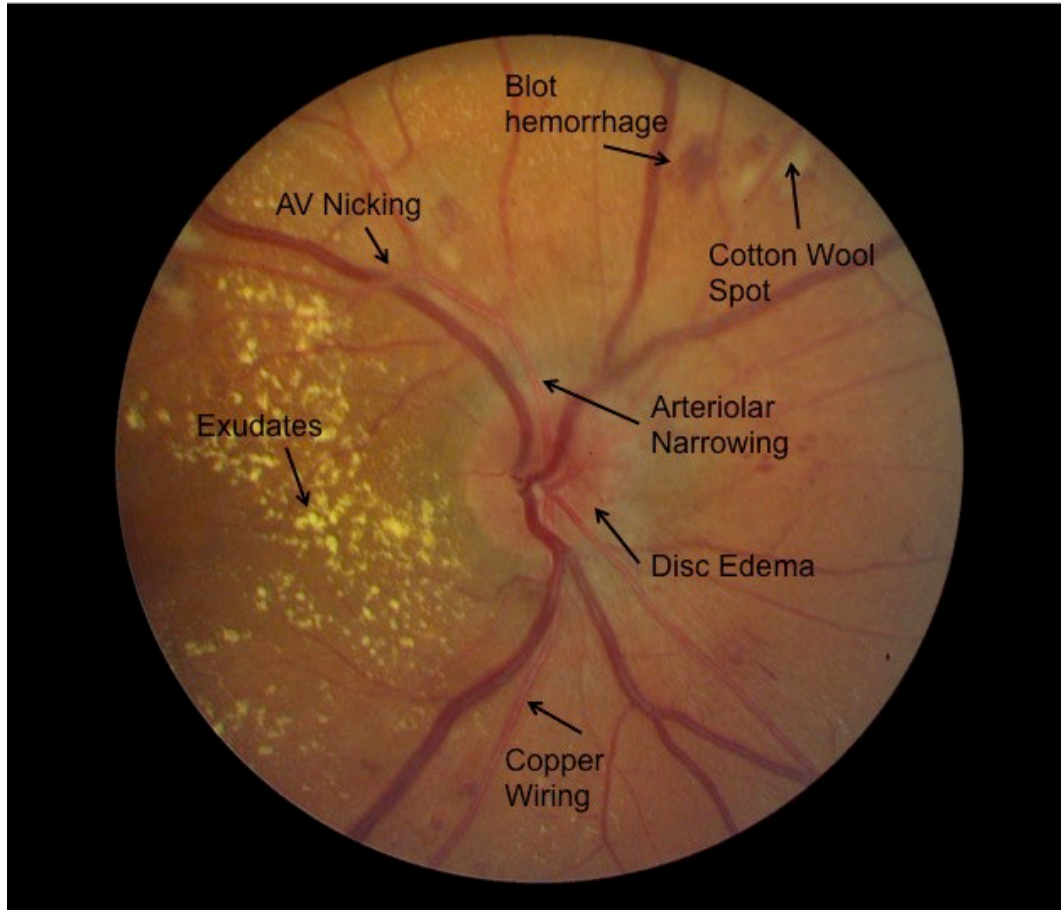
Retinal Hemorrhages

Optic Nerve Swelling (Disc Edema)

Retinal ischemia & Neovascularization



Hypertensive Retinopathy Before and After



Diabetic Retinopathy: Prevalence

Over 34 million people in the US are impacted by diabetes

Diabetic retinopathy (DR) affects approximately 1 in 3 adults with diabetes

DME is a vision-threatening complication of DR, characterized by retinal thickening in the macula area

Up to 25% of people with diabetes will develop DME and it is the primary cause of vision loss in people with DR

Diabetic Retinopathy

Classification:

- Non-Proliferative Diabetic Retinopathy (NPDR)
- Proliferative Diabetic Retinopathy (PDR)

Complication Resulting in Visual Loss

- Macular Edema (capillary leakage)
 - Macular Ischemia (capillary occlusion)
 - Sequelae from Ischemia-induced Neovascularization
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- ```
graph LR; NPDR_PDR[NPDR & PDR] --> ME[Macular Edema (capillary leakage)]; NPDR_PDR --> MI[Macular Ischemia (capillary occlusion)]; PDR[PDR] --> IN[Sequelae from Ischemia-induced Neovascularization];
```

# Clinical Stages of Diabetic Retinopathy

S  
T  
A  
G  
E  
S

**No Diabetic  
Retinopathy**

Biochemical changes,  
leukocyte adhesion,  
basement membrane  
thickening, pericyte  
loss, altered retinal  
blood flow, neuronal  
and erg change

**NPDR  
Nonproliferative Diabetic  
Retinopathy**

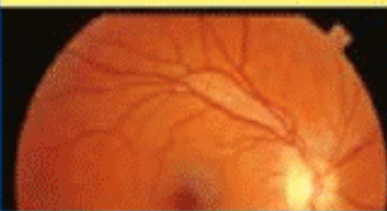
**BDR**  
(Background)

**PPDR**  
(Preproliferative)

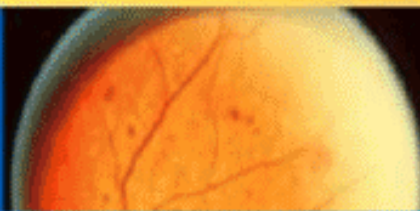
**PDR  
Proliferative  
Diabetic  
Retinopathy**

S  
E  
V  
E  
R  
I  
T  
Y

**Macular Edema**



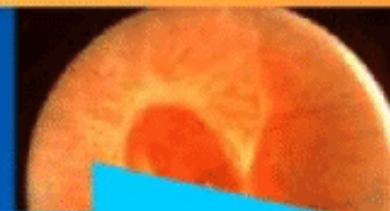
None



Mild to Moderate



Moderate to Severe



Neovascularization

**TABLE 2 RECOMMENDED EYE EXAMINATIONS FOR PATIENTS WITH DIABETES MELLITUS AND NO DIABETIC RETINOPATHY**

| Diabetes Type                                | Recommended Initial Evaluation                                            | Recommended Follow-up*                                                                                                                                                                            |
|----------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type 1 <sup>†</sup>                          | 5 years after diagnosis <sup>34</sup>                                     | Yearly <sup>34</sup>                                                                                                                                                                              |
| Type 2 <sup>†</sup>                          | At time of diagnosis <sup>40,122</sup>                                    | Yearly <sup>40,122</sup>                                                                                                                                                                          |
| Pregnancy <sup>‡</sup><br>(type 1 or type 2) | Soon after conception and early in the first trimester <sup>123-125</sup> | <ul style="list-style-type: none"><li>• No retinopathy to mild or moderate NPDR: every 3-12 months<sup>123-125</sup></li><li>• Severe NPDR or worse: every 1-3 months<sup>123-125</sup></li></ul> |

NPDR = nonproliferative diabetic retinopathy

\* Abnormal findings may dictate frequent follow-up examinations.

<sup>†</sup> Pubertal patients require increased vigilance due to increased risk of progression

<sup>‡</sup> Women who develop gestational diabetes do not require an eye examination during pregnancy and do not appear to be at increased risk for diabetic retinopathy during pregnancy.

\*\*

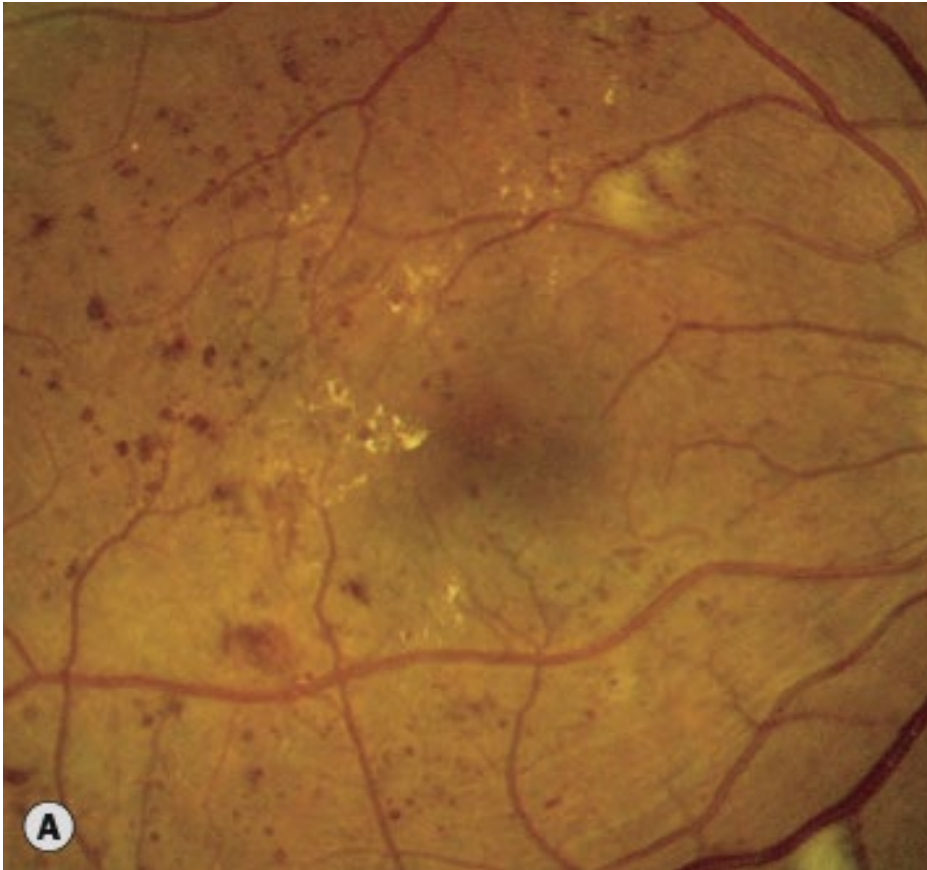
# Vision Loss with Diabetic Retinopathy

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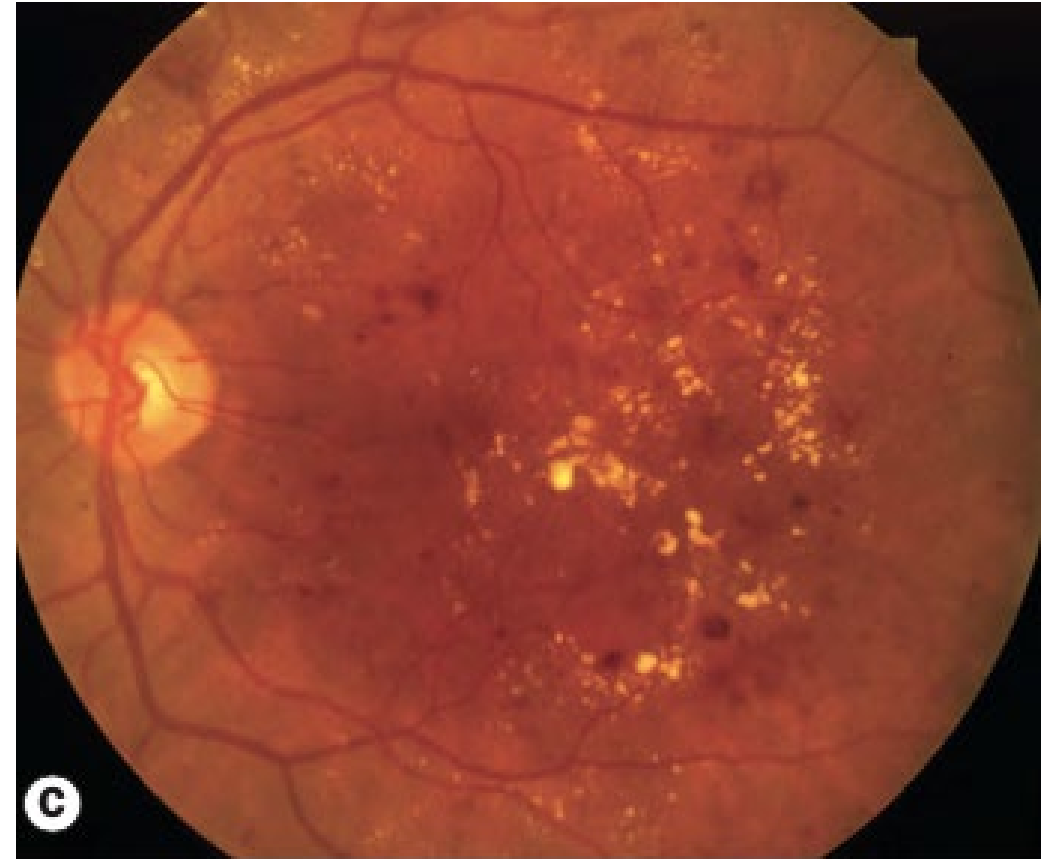


# NonProliferative Diabetic Retinopathy (NPDR)

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Kanski's Clinical Ophthalmology: A Systemic Approach (500):2020, Elsevier

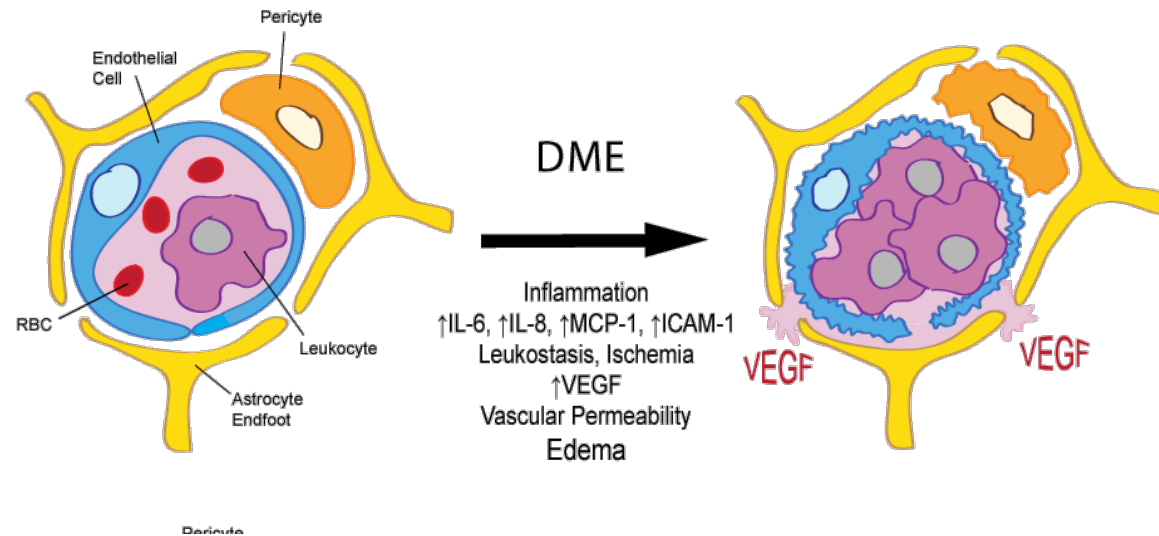


Kanski's Clinical Ophthalmology: A Systemic Approach (501):2020, Elsevier

# Diabetic Macular Edema (DME)

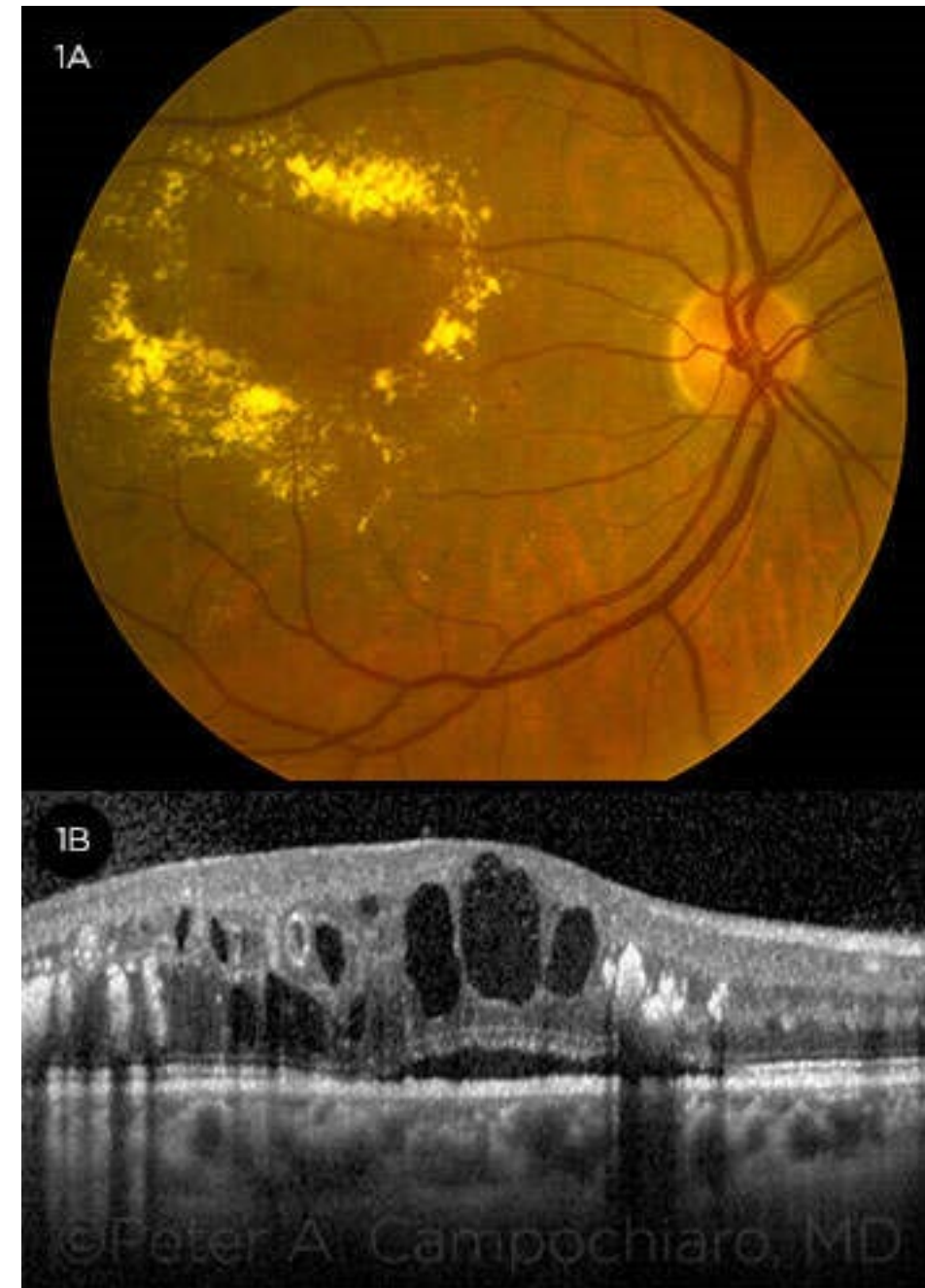


## Inflammation and Vascular Dysfunction in Diabetic Retinopathy



Abcouwer, Steven. (2013). Angiogenic Factors and Cytokines in Diabetic Retinopathy. Journal of clinical & cellular immunology. Suppl 1. 10.4172/2155-9899.

Small choroidal breast mets. Finger, NYECC.

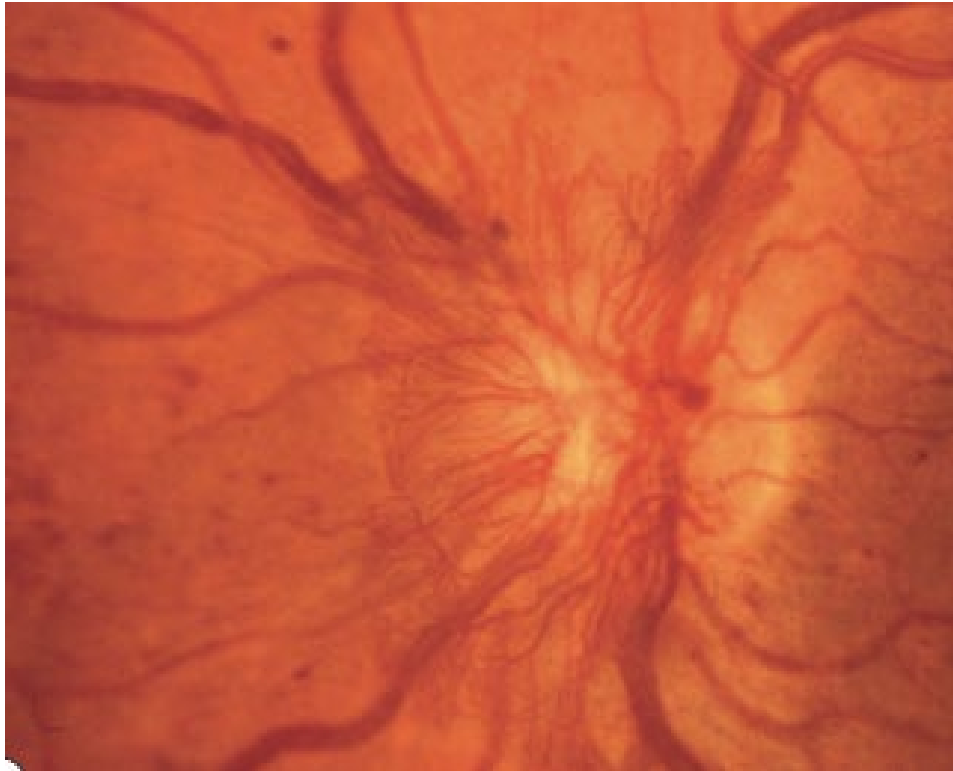


Stuart, A. EyeNet (47).May 2016.



# Proliferative Diabetic Retinopathy (PDR)

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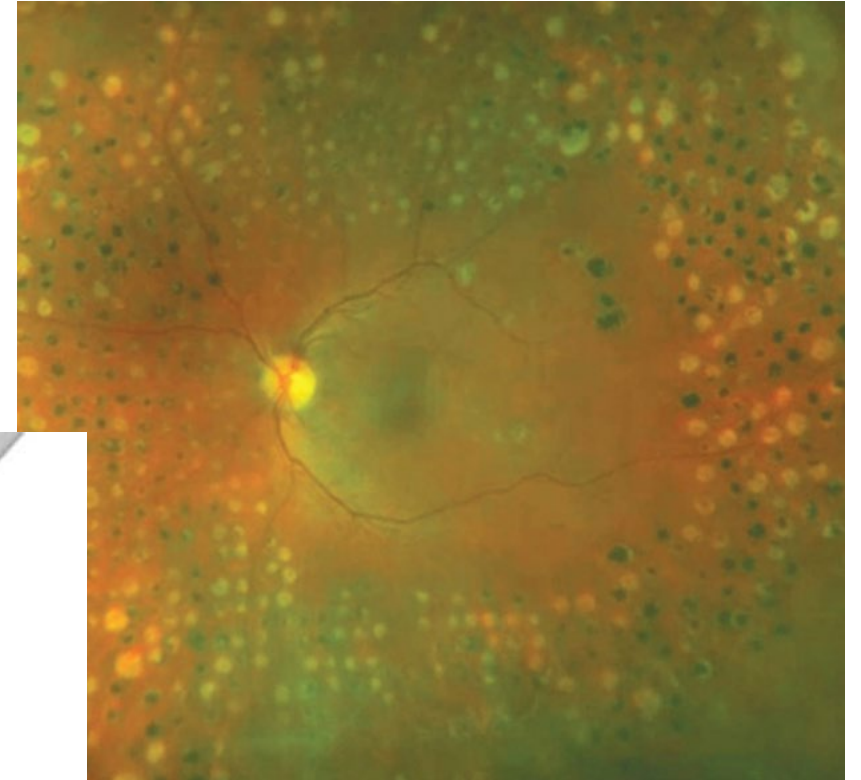
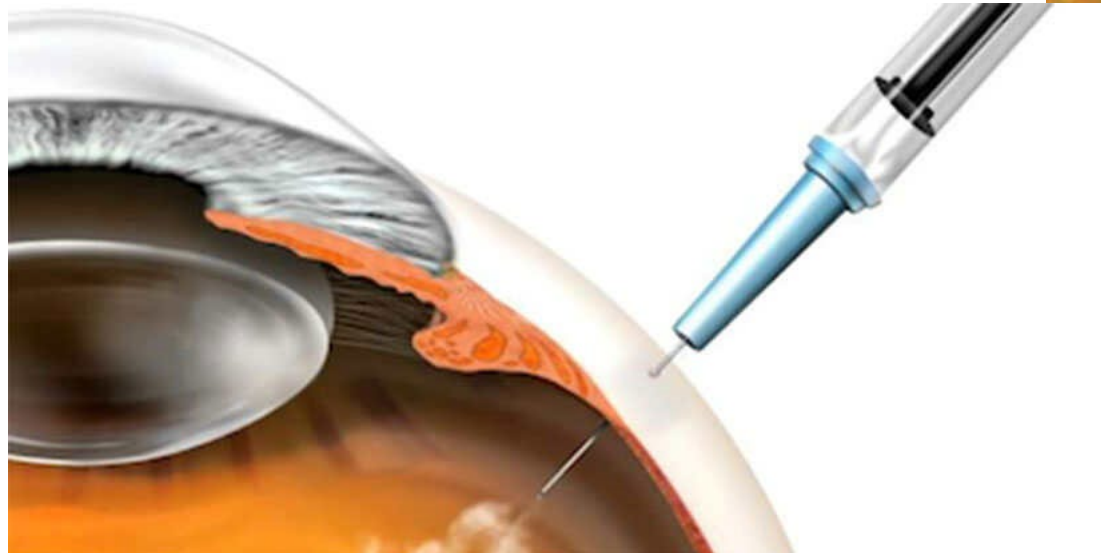
Kanski's Clinical Ophthalmology: A Systemic Approach (506):2020, Elsevier



Kanski's Clinical Ophthalmology: A Systemic Approach (506):2020, Elsevier

# Diabetic Retinopathy: Treatments

- Blood sugar control
- Laser
- Anti- VEGF injections
- Surgery



BSCS 12: Retina and Vitreous(138): 2019, AAO.

# Autoimmune Disorders

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- Connective Tissue Disease
- Thyroid Eye Disease
- Myasthenia Gravis

## **Dry Eyes: Treatment**

- Artificial Tears
- Lubricating ointment at night
- Punctual Occlusion
- Environmental modification
- Topical anti-inflammatory agents

# Thyroid Eye Disease (TED)

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Eyelid Retraction

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Proptosis (exophthalmos)

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Extraocular muscle dysfunction

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Corneal Exposure

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Conjunctival erythema

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Optic nerve dysfunction



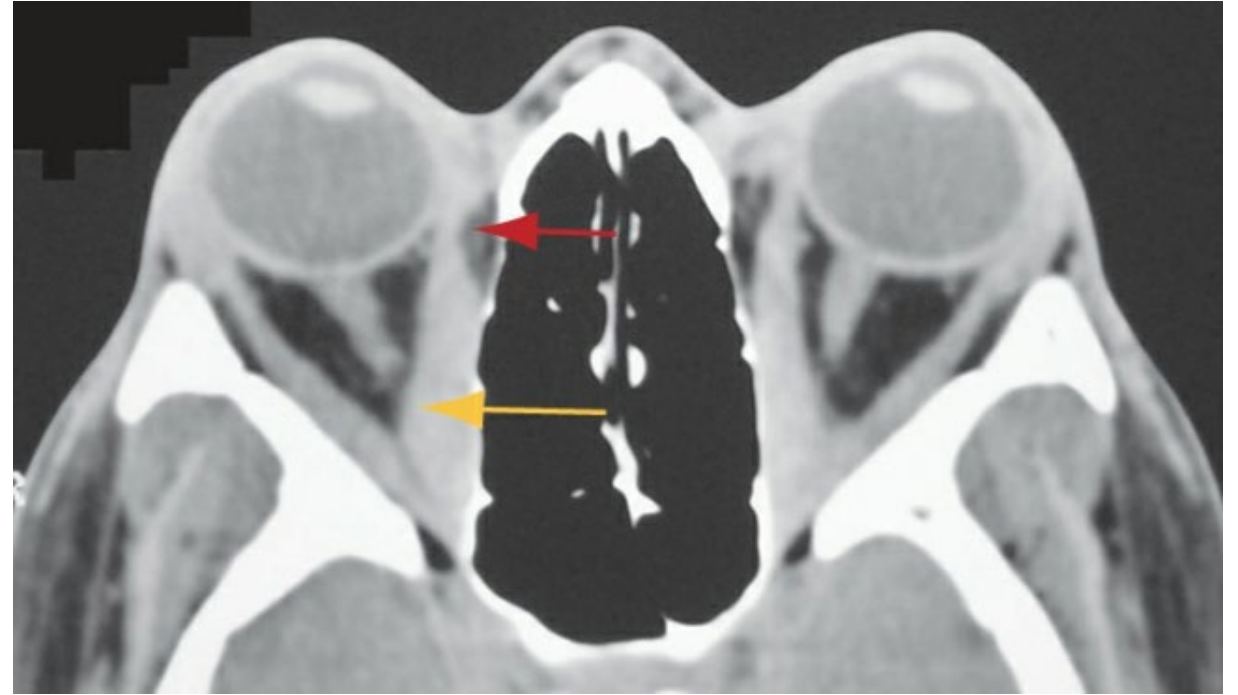
BSCS 7: Oculofacial Plastic and Orbital Surgery (77): 2019, AAO.

# TED

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Active thyroid eye disease (TED) in a patient demonstrating bilateral chemosis, conjunctival injection, and caruncular edema. BSCS 7: Oculofacial Plastic and Orbital Surgery (76): 2019, AAO.



Axial orbital CT scan shows characteristic fusiform extraocular muscle enlargement (yellow arrow) that spares the tendons (red arrow). (Courtesy of Julian D. Perry, MD.) BSCS 7: Oculofacial Plastic and Orbital Surgery (79): 2019, AAO.

# TED Key Points

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15,000-20,000 patient with TED in US per year

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Eyelid retraction is the most common clinical feature of TED (and TED is the most common cause of eyelid retraction).

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TED is the most common cause of unilateral or bilateral proptosis.

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TED may be markedly asymmetric.

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TED is associated with hyperthyroidism in 90% of patients, but 6% of patients may be euthyroid.

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TED is up to 6 times as common in women as in men.

# TED Key Points Cont'd

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Smoking is associated with increased risk and severity of TED.

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Urgent care may be required for optic neuropathy or severe proptosis with corneal decompensation.

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If surgery is needed, the usual order is orbital decompression, followed by strabismus surgery, followed by eyelid retraction repair

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FDA approved Jan 2020 teprotumumb (Tepezza) for active TED



Images courtesy of Raymond Douglas, MD



# Inflammatory

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HLA B-27

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Sarcoidosis

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Juvenile Idiopathic arthritis

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Multiple Sclerosis

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Lyme Disease

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Lupus

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Sjogren's Syndrome

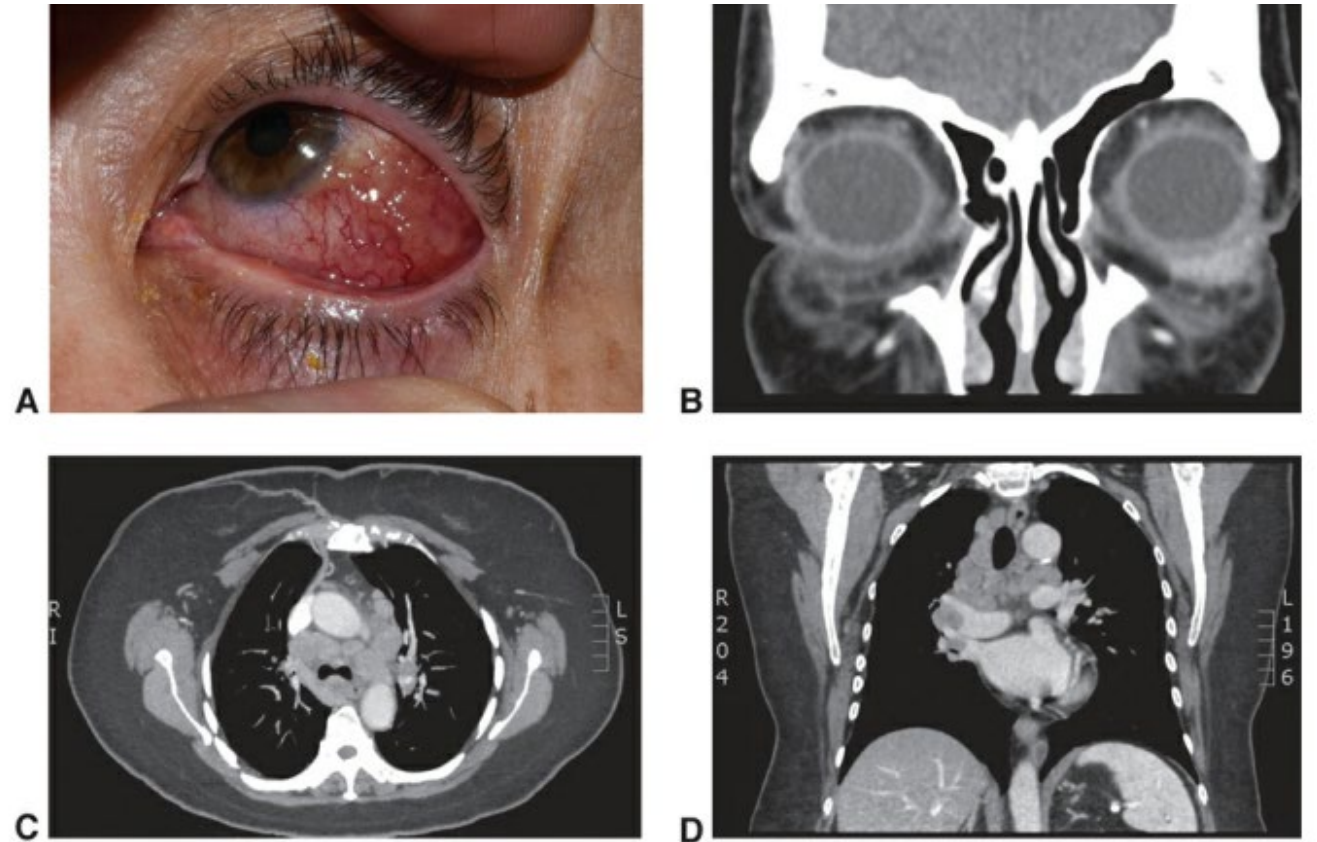
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Behcet's Syndrome

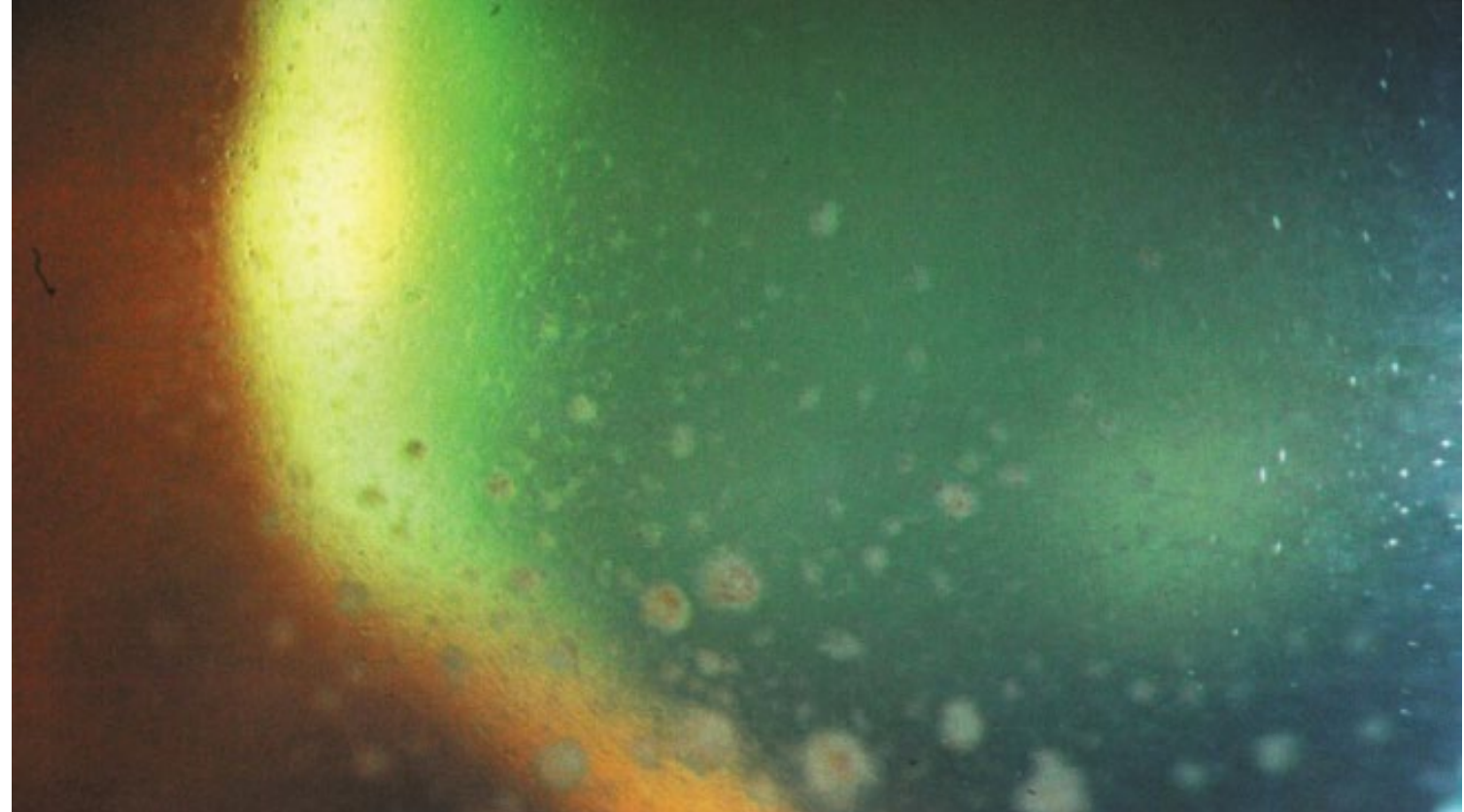


# Sarcoidosis

- Noncaseating granuloma
- 3-4x more common in African descent
- Lacrimal gland most common



**Figure 4-15** Sarcoidosis. **A**, Sarcoidosis presenting in a patient as left subconjunctival nodules. **B**, Orbital coronal CT scan shows the lesion in the anterior orbit. **C** and **D**, CT scans of the chest show bilateral hilar adenopathy. (Courtesy of Bobby S. Kom, MD, PhD.)



BSCS 9: Uveitis and Ocular Inflammation(87): 2019, AAO.

# Sarcoidosis

Busacca Nodule  
Mutton-Fat Keratic Precipitates

# Malignancy/ Metastatic Disease

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Metastatic Disease is the most common intraocular malignancy in adults

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May be asymptomatic

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Decreased/distorted vision

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Most common primary: Lung, Breast

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10% have unknown primary

# Metastatic Breast Cancer



Small choroidal breast mets. Finger, NYECC.



Ahn, J., Gorin, M.B. The Associations of Obstructive Sleep Apnea and Eye Disorders: Potential Insights into Pathogenesis and Treatment. *Curr Sleep Medicine Rep* 7, 65–79 (2021). <https://doi.org/10.1007/s40675-021-00215-0>

## Sleep Apnea: Floppy Eyelid Syndrome (FES)

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**Obese, middle-aged men sleep with eyelids  
against the pillow –lid pulls away from the globe**

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**Chronic keratoconjunctivitis**

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**Lax upper lid that everts easily**

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**Sleep study, weight loss, lubrication, surgical  
horizontal lid shortening**

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# Herpes Zoster

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1/3 will develop HZO in their lifetime

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Ophthalmic division of CN5 (Trigeminal Nerve)

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Hutchinson's sign

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Dendritic corneal lesions

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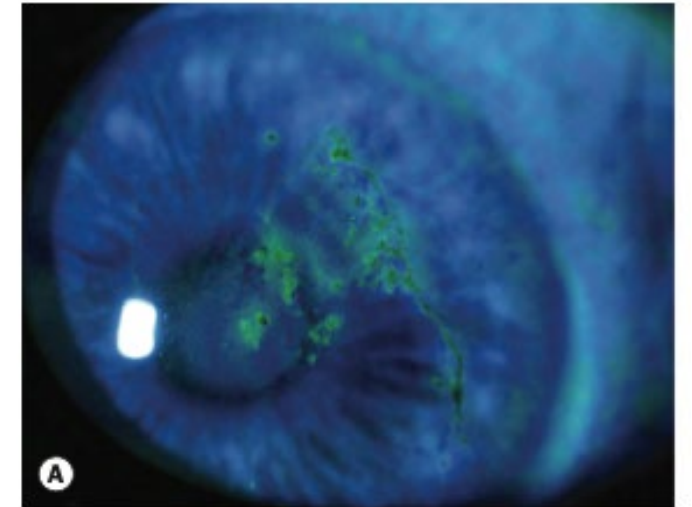
Skin lesions tx with e-mycin

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Oral antivirals reduce severity and duration of acute episode



Kanski's Clinical Ophthalmology: A Systemic Approach (225):2020, Elsevier



Kanski's Clinical Ophthalmology: A Systemic Approach (227):2020, Elsevier

# Aging Population

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2019 US population 65+ was 54.1 million (ACL 2020.gov)

# Vision Loss over 40

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Smoking

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UV light exposure

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Avoidable trauma

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Increased chronic illnesses

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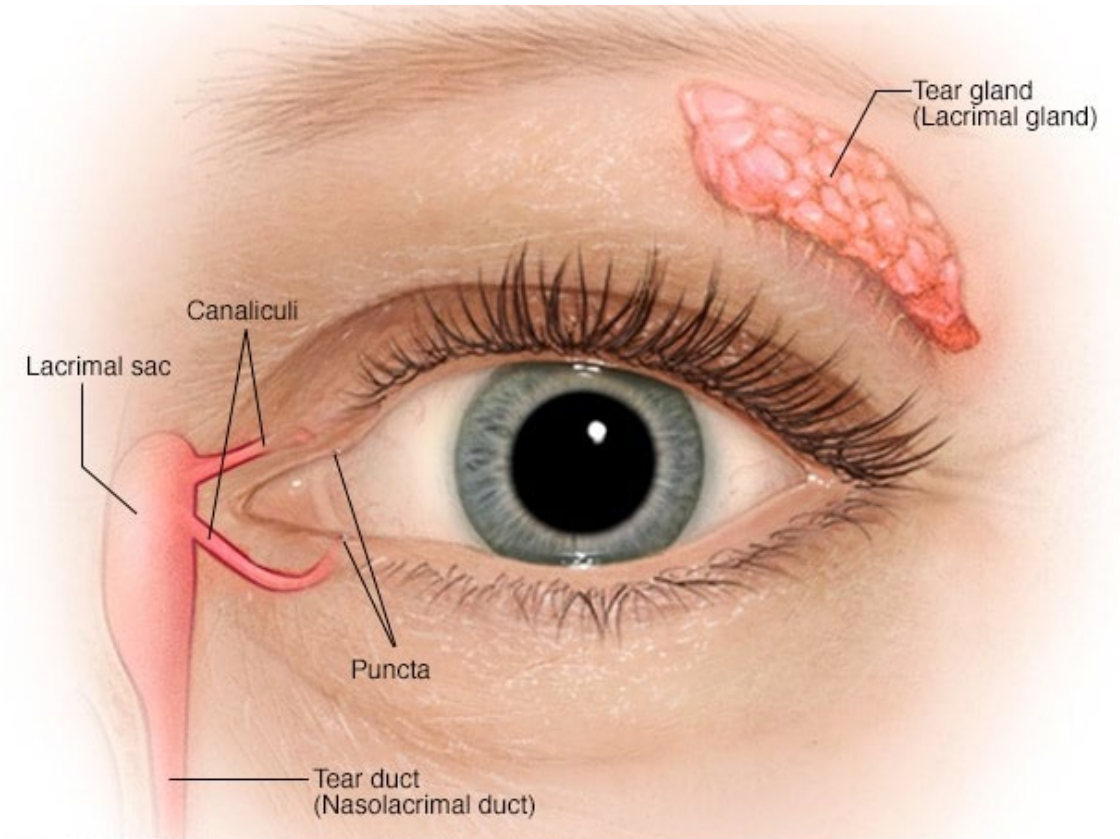
Multiple medications



# Dry Eyes: Keratoconjunctivitis Sicca

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- The eyes do not produce tears properly
- The tears evaporate quickly
- Inflammation on surface of eye occurs concomitantly



# Dry Eyes: Treatment

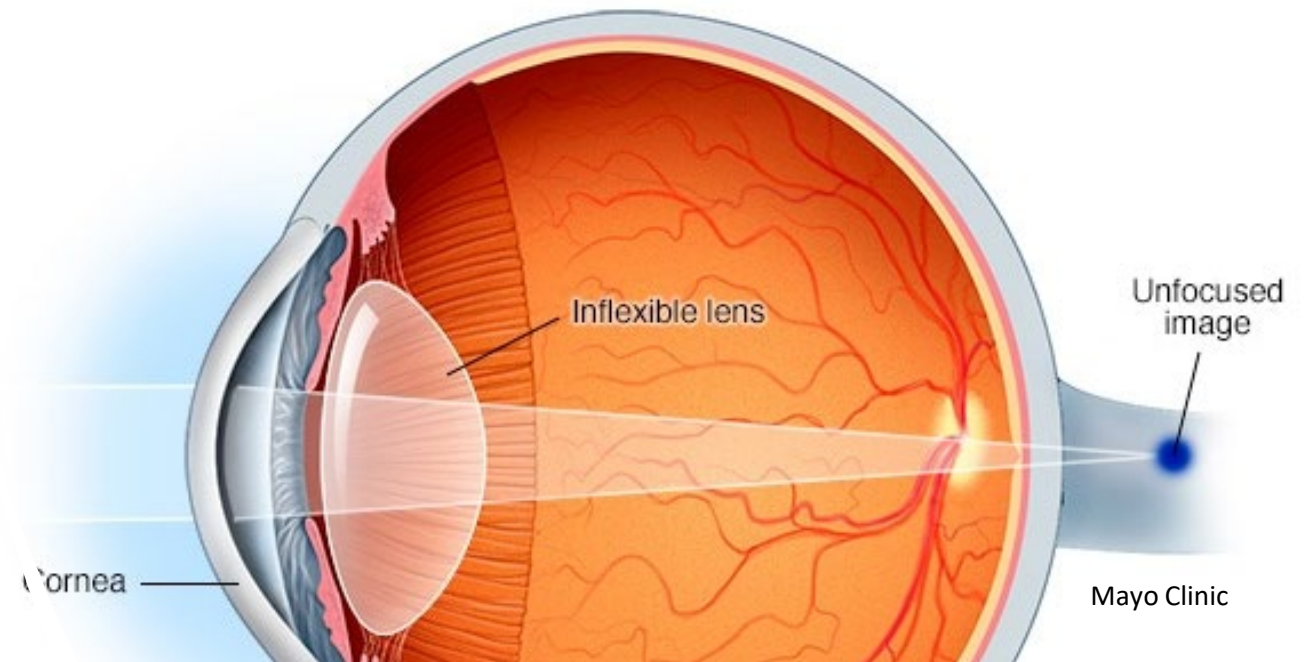
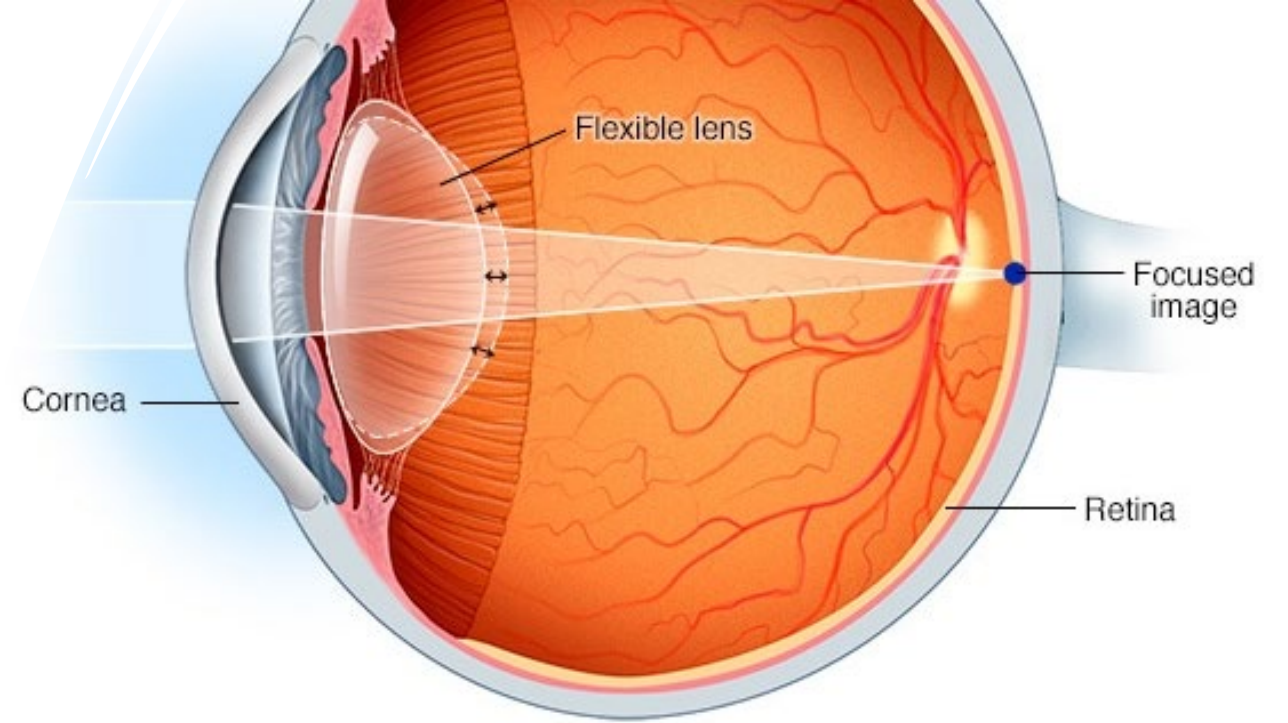
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- Environmental modifications
- Artificial Tears, prescription eye drops, gels, ointments
- Wearing sunglasses, glasses
- Punctal plugs

# Presbyopia

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- Loss of ability to focus nearby objects
- Noticeable in 40s
- Can be corrected with glasses, contacts, surgery, drops
- FDA approved Vuity Dec 2021



# Presenting Symptoms of Vision Loss in Elderly Patients

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Age-related  
macular  
degeneration

Blurred vision, image  
distortion, central scotoma,  
difficulty reading

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Glaucoma

Visual field loss, blurred  
vision (late)

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Cataract

Blurred vision, glare,  
monocular diplopia

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Diabetic  
retinopathy

Blurred vision, floaters,  
visual field loss, poor night  
vision

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# Cataract

- Clouding of the lens that affects vision
- Mostly related to aging
- Blurry vision, faded colors, glare
- Treatment with Surgery

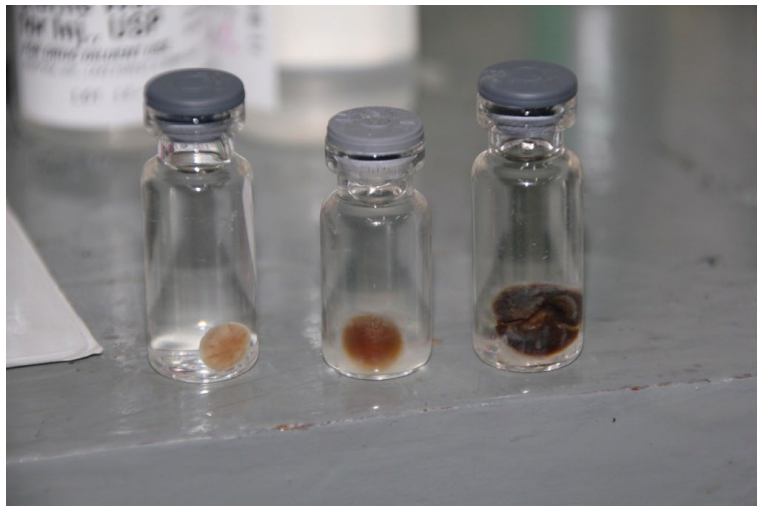


Photo by Zaiba Malik



[lowvisionsource.com/eye-conditions/](http://lowvisionsource.com/eye-conditions/)

# Age Related Macular Degeneration (AMD)

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#1 cause of vision loss in patients over 65

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Painless loss of central vision

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Risk Factors

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Smoking

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Family History

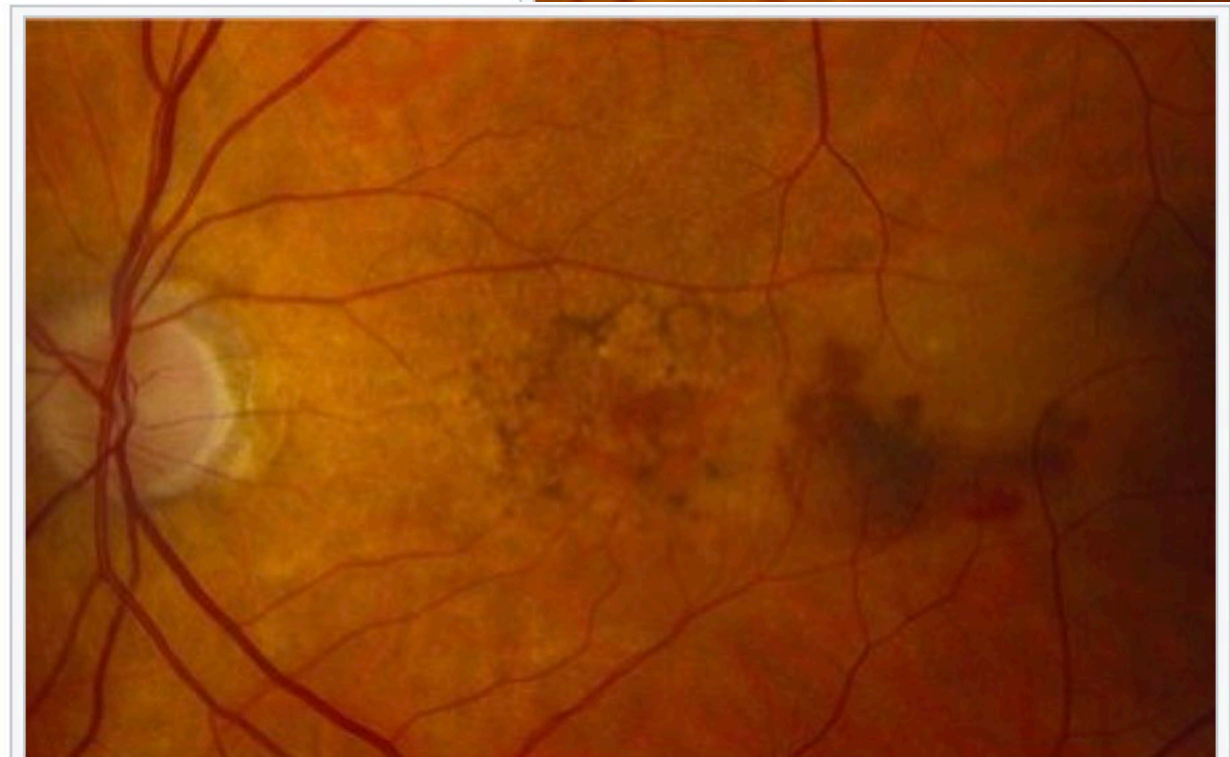
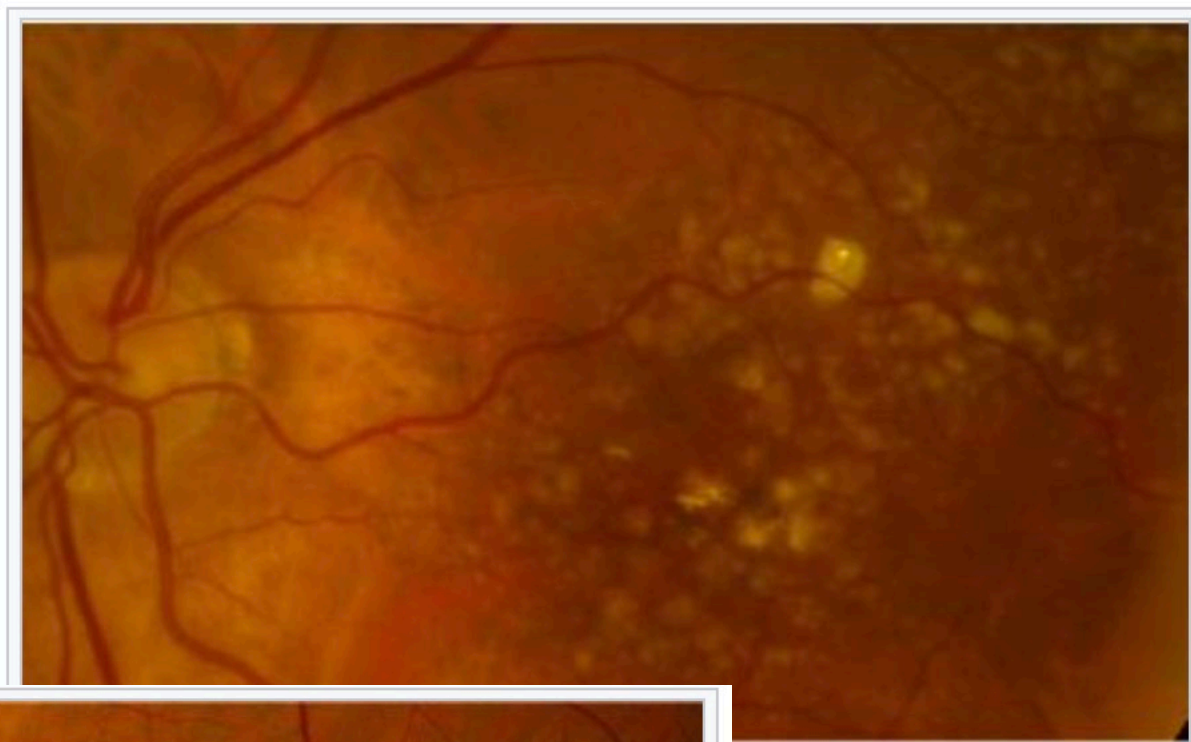
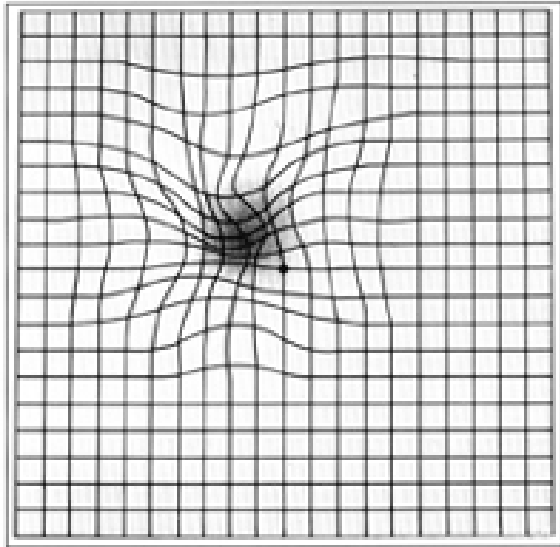
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Race: Caucasian

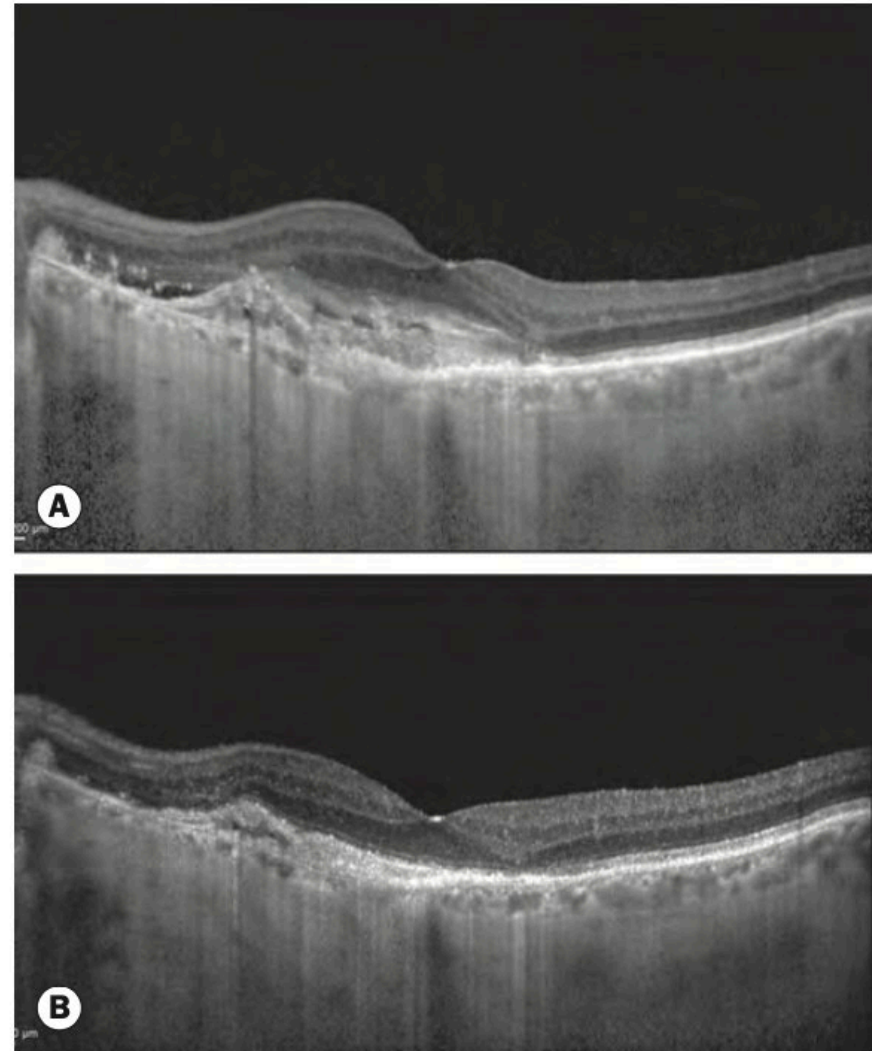
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# Dry vs Wet AMD



# Intravitreal Anti-VEGF Treatments for Neovascular AMD

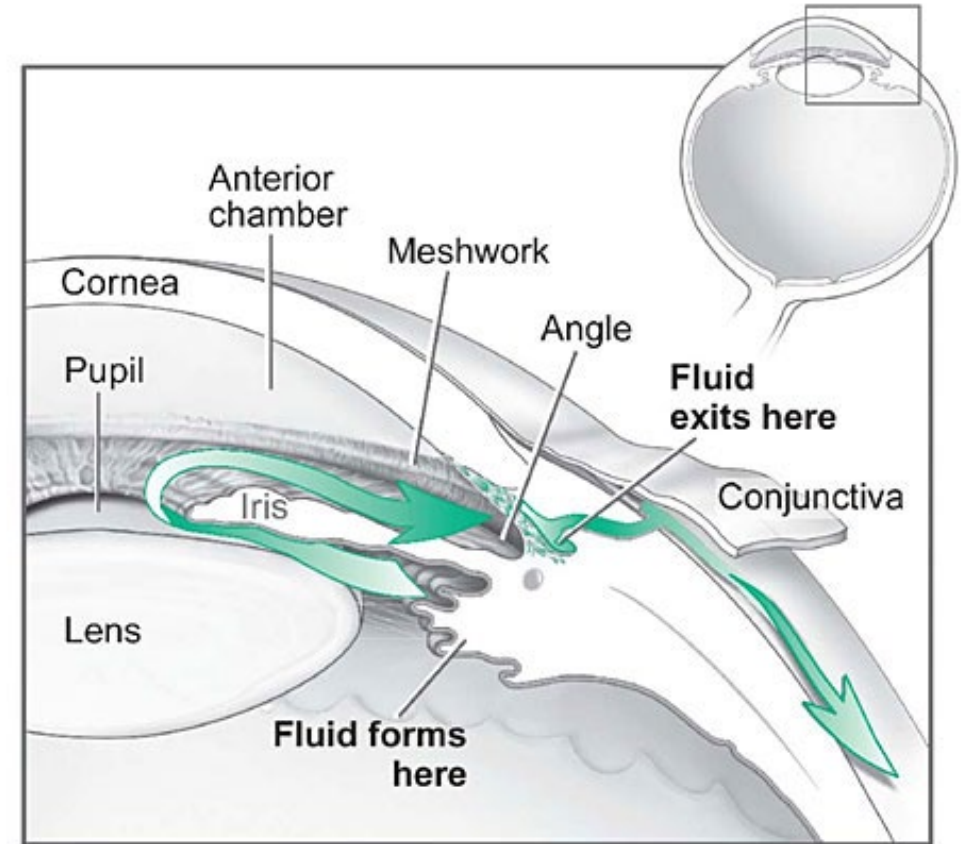


**Fig. 14.41** OCT of classic CNV. **(A)** On presentation; **(B)** after three anti-VEGF injections showing significant improvement (Courtesy of A Ambresin)



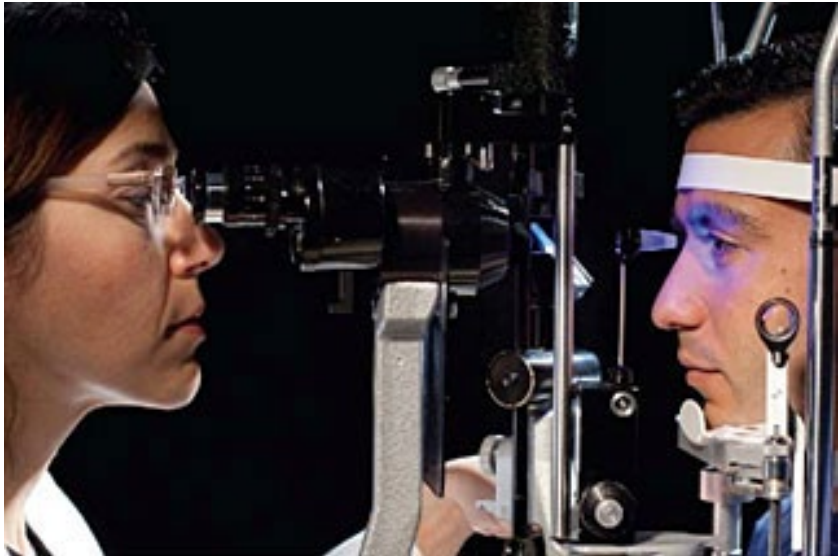
# Glaucoma

- Group of nerve disease that damage the optic nerve
- Too much fluid production or blockage of outflow
- Risk Factors:
  - African American
  - Family History
  - Increased Age
  - Increased IOP



# Glaucoma

- Painless loss of vision
- Peripheral vision affected first
- Drops, laser, surgery



Thank you  
Questions?

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