Age Related Changes of the Eye
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Outline

- Review anatomy of healthy eye
- Details of age related changes
  - Vision Changes, Dry Eye, and Eyelids
  - Lens-Cataracts
  - Optic Nerve-Glaucoma
  - Macula-Age Related Macular Degeneration
  - Retina-Diabetes, Hypertension, Retinal Detachments
Anatomy

- Cornea
- Anterior Chamber
- Iris
- Lens
- Vitreous
- Retina
- Macula/ONH

The eye as an optic instrument

Focus light

Detect light
What happens when we age?

- Presbyopia
  - The lens inside of the eye becomes harder to flex due to years of sunlight exposure and we lose the ability to accommodate or focus on near objects.
  - Can occur in the ages of 38-60
- 60 y.o. can focus at 1-1.5 meters

Presbyopia

- Treatment:
  - Reading glasses, bifocals, or progressives
  - Mono-vision contact lenses, bifocal contact lenses
  - Nothing (often referred to as denial): hold reading materials out further, squint, guess at what you are reading, or have your neighbor/child read it for you.
Presbyopia

- Left untreated, near vision will become worse as the years go by
  - This is also true if you treat presbyopia with glasses or contact lenses.
  
Bottom line: if you get to live long enough, you will be presbyopic.

MYTH: Our vision gets worse by wearing reading glasses.

Dry Eyes

- Symptoms
  - Epiphoria or tearing
  - Burning sensation when closing eyes
  - “eyes feeling tired”
  - Fluctuating vision
  - Photophobia or light sensitivity
Risks of Dry Eye Disease

- Excessive computer use
  - Decreased blink rate
- Women > Men
- Increasing Age
- Auto-immune disease such as Sjogrens or Rosacea
- Living and working in low humidity conditions
Treatment of Dry Eye

- Artificial tears
  - Daytime drops and night time ointment
- Anti-inflammatory medication eye drops
  - Cyclosporin eye drops
- Dietary Changes
  - Flax/Fish oils
- Punctal Plugs

Treatment of Dry Eye

- Environmental changes
  - Invest in a humidifier
  - Take frequent breaks while working on the computer 20:20:20
  - Move to Hawaii
Miebomian Gland Dysfunction

- **Miebomian Glands**
  - Tiny glands at the base of the eye lash that expel droplets of oil onto eye with each blink

- **Causes:**
  - The oils tend to thicken when blink rate decreases
  - Women > Men
  - Increasing age
  - Systemic diseases such as Rosacea

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Treatment of MGD

- **Heat**
- **Lid massage or expression**
- **Antibiotic ointment**
- **Eating more Omega 6 oils**
- **Blepharitis – add oral doxycycline for 2-3 months**
**Eyelid Dermatochalasis/Ptosis**

Abnormal finding frequently noted in elderly
- Chronic Lid droop
- Decreased visual field
- Brow raising
- Head tilt

**Treatment**
- Intervention-treat underlying cause/surgery

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**Eyelid Entropion vs. Ectropion**

- **Entropion**
  - Eyelid turns in
  - Eyelashes rub cornea
  - Pain, tearing
  - Cornea damage

- **Ectropion**
  - Eyelid turns out
  - Lid does not approximate globe
  - Dryness and excessive tearing
Common causes of chronic visual loss

- Cataract (human crystalline lens)
- Glaucoma (intraocular pressure)
- Age-related macular degeneration (retina)

Cataract: Definition

G. katarrhakies means a waterfall
Loss of transparency of the lens or its capsule
Cataract: presentation

- Gradual visual loss
- Not correctable by glasses
- Difficulty at night
- Glare
- Monocular diplopia

Subluxation of a Clear Len
Many presentations of cataract

Cataract trans-illumination
Mature cataract

Symptoms of cataract: examples
Cataract: management

- Medical
  - Glasses
  - Low vision aid
- Surgical
  - Cataract extraction
  - Intraocular lens implantation

Who Is the Artist?

Monet in 1860
Monet in 1880s

Glaucoma

An eye disease in which the intraocular pressure is high enough to cause damage to the optic nerve, resulting in visual loss; caused by impaired drainage of the aqueous fluid out of the eye or increased production of fluid in the eye.
Glaucoma

- Over production of intraocular fluid
- Malformation or malfunction of drainage structures (slow drain).
- Closure of drainage structures (blocked drain)

Glaucoma

Intraocular pressure is influenced by

• Time of day
• Season
• Heartbeat
• Respiration
• Fluid intake
• Systemic medications
• Topical medications

But NOT
Body temperature

Glaucoma: Common Types

Angle Closure
- Less common (10%)
- Blockage of the drain

Chronic Open Angle
- Most common (90%)
- Slowing of the drain
Glaucoma: Closed Angle

- Eye emergency
- Usually monocular
- Severe eye pain
- Clouded or blurred vision
- Nausea and vomiting
- Dilated pupil
- Rainbow halos around lights

Glaucoma: Open Angle

- Gradual, painless loss of vision
- Deterioration begins in periphery
- No apparent symptoms in early stages
- Most unaware of vision loss until optic nerve is badly damaged.
- Vision loss is irreversible
Glaucoma: symptoms

Normal  Glaucoma

Glaucoma: management

- Medication eye drops
- Surgery
- Follow-up
  - Routine visual field
  - Eye pressure
  - NFL/ONH Assessment
Normal Retina

Photo courtesy of wikipedia

Macular Degeneration

- #1 cause of blindness in Americans over age 65
Pathophysiology

- Causes not well understood
- Theorized link to
  - UV light exposure
  - subsequent release of free radicals
  - oxidation within retinal tissues
- Another theory—areas of decreased vascular perfusion in retina, lead to cell death

Dry Form

- Slow, progressive loss of central vision
- Breakdown of underlying retinal tissues, resulting in mottling or clumping of normal pigment
- Drusen begin to accumulate
- Geographic atrophy can also occur
Symptoms

- None
- Blurred vision
- Metamorphopsia—straight lines appear wavy or distorted
- Scotomas—missing areas in vision

Testing at home

**Amsler Grid**

**Instructions:**
- Stand or sit eye level to grid
- Cover one eye and stare at center dot
- Ask yourself if you see all vertical and horizontal lines.
- Do you see all four corners?
Treatment for Dry Form

- Regular eye exams
- Careful discussion regarding family history
- Education
- UV protection
- Antioxidants
  - AREDS
- Stop smoking

Age-Related Eye Disease Study (AREDS)

- For people at high risk of developing advanced stages of AMD, use of the combination of antioxidants and zinc supplements reduced that risk by 25%
- For this same group, the risk of vision loss itself was reduced by 19%
- Study participants who had either no AMD or early AMD did not derive any apparent benefit from the supplements
AREDS

- Vitamin C - 500 milligrams
- Vitamin E 400 IU
- Beta-Carotene 15 milligrams
- Zinc (as zinc oxide) 80 milligrams
- Copper (as cupric oxide) 2 milligrams

*At the time of the study, lutein was not as widely recognized as a critical antioxidant for the eyes

AREDS II

- In 2008 the AREDS II study found that by removing beta-carotene and adding lutein/zeaxanthin there was an additional 18% overall benefit of reducing the risk of advanced AMD.
- The results were the most effective in people who had a diet low in these carotenoids prior to the study.
- Smokers who took the new formula without Beta-Carotene had lower incidence of lung cancer.

Take home message: eat your vegetables.
AREDS II Formula

- 10 mg Lutein and 2 mg zeaxanthin
- 350 mg DHA and 650 mg EPA
- No Beta-Carotene
- 25 mg Zinc

Wet Form

- Can quickly degrade central vision
- Break in underlying tissues allows new blood vessels or fluid to come through
- New blood vessels are weak so frequently break and bleed
AMD-clinical picture

Treatment for Wet Form

- Refer to retinal specialist
- Photocoagulation
- Photo-dynamic therapy (PDT)
- Submacular surgery
- Macular translocation
- Anti-angiogenic drug therapy
Posterior Vitreous Detachment

- Acute onset of photopsia (flashing lights) or a large floater
- Vitreoretinal separation
- Alterations to the vitreous hyaluronic acid and collagen matrix

PVD

- PVD can be localized, partial or total
- Incidence 65% over the age of 65
- Higher risk in myopes & women
- PVD results in collapse and decrease size of vitreous
- Floaters result from entopic phenomena caused by condensed vitreous fibers, glial tissue, or intravitreal blood.
- Flashing Lights-vitreoretinal traction
Retinal detachment

**Symptoms:**
- Flashes
- Floaters
- loss of vision, curtain coming down over vision

Retinal Detachment

- Several types
  - Rhegmatogenous—caused by break in retina
  - Exudative—caused by fluid accumulation beneath retina
  - Tractional—proliferative fibrovascular vitreal strands
Emergency

- Patients with these symptoms must see eyecare provider immediately
- Additional risk factors
  - Highly nearsighted
  - Diabetic
  - Recent trauma/injury

Treatment

- Laser photocoagulation or cryotherapy
- Pneumatic retinopexy—gas bubble to tamponade retina back into place
- Scleral buckle
- Silicone oil
Examples of Systemic Diseases that Effect the Eyes

A. Diabetes
B. Herpes Zoster
C. Rosacea
D. Rheumatoid Arthritis
E. Sjogrens Syndrome
F. Hypertension
G. Hypercholesterolemia

Diabetic Retinopathy

- Diabetes affects retinal microvasculature
- One of leading causes of blindness among ages 20-64
Diabetic retinopathy

Over time, elevated and fluctuating blood sugar damages vessel walls
Vessels leak fluid, lipids or blood into retina
New vessels grow to bring more oxygen to retina

Progression
Symptoms

- Fluctuating vision
- Blurred vision
- Distortion
- Sudden loss of vision

Treatment

- Control blood sugar
- Refer to retinal specialist when vision threatened
  - PRP (pan-retinal photocoagulation)
  - Focal laser
  - Vitrectomy
  - Retinal detachment repair
Hypertensive Retinopathy

- Is often symptomless but can include vision fluctuations and headaches.
- A dilated eye exam would reveal:
  - Narrowing of vessels
  - Fluid leaking from vessels
  - Cotton wool spots and exudates
  - Macular swelling or edema
  - Hemorrhages
Herpes Zoster

- Varicella-zoster virus
- VZV becomes latent in dorsal root ganglia until a decrease in cellular immunity triggers the reactivation of the virus
- It can occur at any age but the vast majority of patients diagnosed with it are more than 50 years old
- 75% chance of ocular involvement if tip of nose affected by rash
- 10-25% present HZO

HZO

- Eyelid-Blepharoconjunctivitis
- Episcleritis
- K-Dendritic, K- Neurotrophic
- Uveitis
- Retinitis
- Optic Neuritis

Image from http://eyelearn.med.utoronto.ca/Lectures04-05/RedEye11Keratitis.htm
HZO

- Treat within 72 hours of onset for best outcome.
- Oral antivirals
  - Acyclovir, famciclovir, valacyclovir
- Topical antiviral eye drops.
  - Zirgan – 5 times a day until the eye is healed then 3 times a day for another week

Examples of Systemic Meds and Ocular Side Effects

- Digoxin
- Amiodarone
- Tamoxifen
- Plaquinil
- Prednisolone
Digoxin

- cardiac glycoside
- Used for congestive heart failure
- Because of the inhibition of Na+, K+-ATPase the photoreceptors are affected - color vision changes - yellow, blurred vision, and peri-central scotomas can occur
- Rarely causes optic neuritis
- General Eye Exam annually

Amiodarone

- Antiarrhythmic agent (K+ channel blocker)
- 69-100% Whorl-like pattern on the cornea
- Lipophilic drug attaches to the basal stem cells at the limbus and is carried with them into the center of the cornea until the cells differentiate and then desquamate at the surface of the cornea
Amiodarone

- Does not typically have a major impact on vision, but patients may be more photophobic
- Can also rarely affect color vision
- Can resolve months after therapy is discontinued
- General eye exam every 6-12 months

Tamoxifen

- Anti-estrogen therapy for the management of breast cancer
- Crystalline retinopathy
- Vortex keratopathy
- Macular edema

Image from http://www.opt.indiana.edu/ce/syspharm/part2.htm
Tamoxifen

- Retinal and corneal findings were more common at dosages of 180 mg/day.
- The standard dosage is now 20 mg/day or less, and the ocular side-effect incidence levels are around 1 to 2%.
- General Eye Exam annually unless there are corneal or retinal findings.

Plaquenil

- Hydroxychloroquine prescription for Rheumatoid Arthritis, Lupus, and to treat certain types of malaria infections.
Plaquinel Vision Changes

- Decreased vision
- Color vision change
- Bull’s Eye Maculopathy
- Visual field loss
- Decreased contrast sensitivity

Testing in office includes:

- Visual Acuity
- Central visual field analysis with 10-2 or macular threshold VF
- Color vision testing including blue/yellow
- Dilated evaluation of macula
- OCT
- Multifocal ERG (very sensitive!) when needed
Plaquenil

- If patient is on 200 mg/day and there are no vision problems, can be seen yearly
- If on 400 mg/day, see patient every 6 months if no problems, more frequently if issues arise
- Communication with the prescribing physician is the key

**Posterior subcapsular cataract associated with steroid use**

- It has been suggested that 10-15 mg of daily prednisone for one year may be enough to cause a cataract

[Image from http://opt.pacificu.edu/ce/catalog/13890-AS/SteroidsAnc.html]
When to have eye exams

- Annual exam for healthy individuals
- Every 6 months to monitor controlled eye diseases:
  - Hypertension
  - Diabetes
  - Macular Degeneration

True/False

1. Presbyopia affects distance vision.
2. Dry eye is more common in females.
3. The amsler grid is tool for monitoring cataract progression.
4. Flashing lights in vision can indicate a retinal detachment.
5. Glaucoma is a painful eye disease.
Kailua, Oahu Sunrise

Thank you!