

AOS Task Force on Curriculum in Ophthalmology for Medical Students

Introduction – Curriculum in Ophthalmology for Medical Students

Vision impairment is one of the most feared disabilities. Although roughly half of all blindness is preventable, the number of Americans who suffer vision loss continues to increase. As the baby boomer generation ages, the number of Americans at risk for age-related eye disease is increasing. These conditions, age-related macular degeneration, glaucoma, cataract, and diabetic retinopathy, affect more Americans than ever. Based upon the 2000 census, more than 119 million people in the United States are over 40 and at risk to develop age-related eye disease. Because most age-related vision loss can be prevented, it is important that all physicians are aware of the presenting signs and symptoms as well as the major physical findings of the most common conditions leading to vision loss.

The American Ophthalmological Society has developed a basic curriculum for medical students, which outlines the features important to understanding these conditions, with the intent of reducing vision loss in Americans.

Blindness and visual impairment represent a significant burden, not only to those afflicted with loss of sight, but to our national economy. It is estimated that blindness and visual impairment cost the federal government more than \$4 billion annually. The visually impaired total more than 3.4 million Americans. Blacks are blinded more frequently than Whites and Hispanics. Hispanics, the fastest growing segment of the population, have higher rates of visual impairment than other races. The prevalence of blindness increases rapidly in later years, particularly after age 75.

Age-related Eye Diseases:

1. Cataract, clouding of the eye's naturally clear lens, appears with advancing age. It can also occur at any age as a result of injury, exposure to toxic substances or radiation, or secondary to disease such as diabetes. Cataract affects nearly 20.5 million Americans age 40 or older. By age 80 more than half of all Americans have cataract. Cataract surgery can successfully help most patients with cataract.

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2. Age-related macular degeneration affects over 1.6 million Americans age 50 or older. Although there is no generally accepted treatment for most macular degeneration, laser treatment for the wet form and certain doses of zinc, vitamins A and C, and beta carotene can help control the advance of late macular degeneration in certain patients.
3. Glaucoma affects more than 2.2 million Americans age 40 and older. Glaucoma is more common in Blacks and Hispanics, and with increasing age. The exact cause of glaucoma is unknown, although there is a genetic predisposition. It causes a gradual degeneration of the retinal neurons resulting in an insidious painless loss of peripheral vision. Most cases of glaucoma can be controlled and vision loss prevented. However, vision loss due to glaucoma cannot be restored.
4. Diabetic Retinopathy is a complication of both Type I and Type II diabetes. Type II diabetes is on the increase in the U.S., with obesity as a predisposing factor. Presently diabetes affects over 5.3 million Americans age 18 and older. Although Whites suffer with diabetic retinopathy more commonly prior to age 40, in later decades Hispanics are more affected by the disease. Vision loss from diabetes can be prevented with early detection of retinopathy and appropriate retinal treatment. Control of blood sugar is an important feature of the management.

Vision loss is a devastating occurrence at any age, but occurs more commonly in people over 40. The common causes of visual loss can often be prevented with early detection and appropriate management. All physicians should have a basic understanding of the patho-physiology of vision loss in the common conditions and be prepared to suggest an appropriate ophthalmologic evaluation.

Curriculum in Ophthalmology for Medical Students

1) Fundamentals and Principles of Ophthalmology

A medical student should be able to recognize the significant external and internal ocular structures of the normal eye and to perform a basic eye examination.

A medical student should know the following:

- i) The essentials of ocular anatomy.
- ii) To measure and record visual acuity.
- iii) To assess pupillary reflexes.
- iv) To evaluate ocular motility.
- v) To use the direct ophthalmoscope for assessment of red reflex, the optic nerve and posterior fundus examination.
- vi) To dilate the pupils as an adjunct to ophthalmoscopy.
- vii) To perform and evaluate visual fields by confrontation.

i) Ocular Anatomy

- a) Eyelids
- b) Sclera
- c) Limbus
- d) Iris
- e) Pupil
- f) Conjunctiva
- g) Cornea
- h) Extraocular muscles
- i) Anterior chamber
- j) Lens
- k) Ciliary body
- l) Posterior chamber
- m) Vitreous cavity
- n) Retina
- o) Macula
- p) Choroid
- q) Optic disc

The student should be able to define each of these structures and provide relevant information regarding function and structure.

ii) Visual Acuity

Student should understand the purpose of measurement of visual acuity, and be able to test for near visual acuity of the right eye, left eye, and both eyes.

Student should understand the concept of distance visual acuity testing, but not required to perform the test including refraction.

iii) External Inspection

Student should understand the ocular anatomy such that through external inspection an evaluation of the position of the lids, external inspection of the conjunctiva and sclera as well as the cornea and iris can be evaluated.

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- iv) **Pupillary Reaction Testing**
Inspection of the pupils, including size and direct and consensual pupillary reaction should be understood and the testing mastered.
- v) **Ocular Motility Testing**
Student should understand the need to test ocular motility in six directions, right, left, right and up, right and down, left and up, left and down.
- vi) **Ophthalmoscopy**
Student should understand the use of a direct ophthalmoscope and the importance of testing the patient's right eye with the ophthalmoscope held in the examiner's right hand, and left eye with the examiner's left hand. The student should understand the basic function of an ophthalmoscope including the need to adjust the focus.
- vii) **Pupillary Dilatation**
Student should understand the need to pharmacologically dilate the pupils in order to facilitate the examination of the fundus. Student should understand the difference between retinal arterioles and retinal venules, the normal appearance of the optic nerve head and macula. Student should also understand that the normal retinal background is a uniform red-orange color due to pigmentation of the retinal pigment epithelium.
- viii) **Intraocular Pressure Measurement**
Student should understand the concept, but not actually measure pressure.
- ix) **Anterior Chamber Depth Assessment**
Student should understand the concept.
- x) **Confrontation Field Testing**
Student should understand the principle and the technique for determination of confrontation of visual field.
- xi) **Upper Lid Eversion**
Student should understand that it may be necessary to search for foreign bodies by eversion of the upper lid.
- xii) **Fluorescein Staining of the Cornea**
Student should understand fluorescein staining for an epithelial defect of the cornea.
- xiii) **Indications for Referral**
Student should understand potential causes for reduced visual acuity, abnormal fundus appearance, and potentially other abnormal findings that would result in referral of the patient to an ophthalmologist for evaluation.

Competencies:

- Student should understand basic ocular anatomy
- Student should be able to measure near visual acuity.
- Student should be able to test for direct and consensual pupillary reactions.
- Student should understand and master basic direct ophthalmoscopy.
- Student should understand normal fundusoscopic appearance of the optic disc, macula and major vessels.
- Student should be able to understand the reason for and test for red reflex.
- Student should understand the importance of a dilated fundus examination.

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- Student should understand potential causes for reduced vision, abnormal fundus appearance and other abnormal findings that would result in referral of a patient to an ophthalmologist for evaluation.

2) Refraction and Contact Lens

Student should understand the following:

- (a) The human eye is an optical system.
- (b) The schematic eye.
- (c) Pupil size and its effect on visual resolution.
- (d) Visual acuity.
- (e) Clinical measurement of visual acuity –

- Snellen fraction

ii) Refraction States of the Eye

- a) Emmetropia
- b) Myopia
- c) Hyperopia
- d) Astigmatism
- e) Presbyopia and accommodation

iii) Spectacle Correction

- a) Spherical lenses
- b) Bifocals, trifocals, multi-focal lenses

iv) Special Lens Material

- a) Plastic
- b) Impact resistant high index glass
- c) Polycarbonate lens

v) Contact Lenses

Clinically important features of contact lens –

- Optics
- Field of vision
- Image size
- Hard contact lens
- Flexible contact lens
- Therapeutic contact lens

vi) Intraocular Lens

Concept only

vii) Refractive Surgery

Concept only, with some knowledge of principles and indications.

viii) A Patient with Low Vision

Need for special rehabilitation with low vision optical devices.

Competencies:

- Student should understand emmetropia, myopia, hyperopia, astigmatism, and presbyopia.
- Student should be able to measure near central acuity.
- Student should understand optical principles of contact lens, intraocular lens, and refractive surgery.

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- Student should understand the need for low vision rehabilitation.

3) Pediatric Ophthalmology and Strabismus

- I. Anatomy of the Extraocular Muscles and their Fascia
 1. Origin, course, insertion, innervation, and action of the extraocular muscles
 - a. Horizontal rectus muscles
 - b. Vertical rectus muscles
 - c. Oblique muscles
 - d. Levator palpebrae superioris muscle
 - e. Insertion relationships of the rectus muscles
 2. Blood supply of the Extraocular muscles
 - a. Arterial
 - b. Venous
 3. Fine structure of the extraocular muscles
 - a. Fiber types
 5. Anatomical implications
- II. Amblyopia
 1. Strabismic amblyopia
 2. Refractive amblyopia
 3. Form deprivation and occlusion amblyopia
- III. Strabismus
 1. Concomitant strabismus
 2. Incomitant strabismus
 3. Heterotropia
 - a. Esophoria: inward deviation not manifest
 - b. Exotropia: inward deviation manifest
 - c. Exophoria: outward deviation not manifest
 - d. Exotropia : outward deviation
 - e. Hyperphoria: upward deviation not manifest
 - f. Hypertropia: upward deviation
 - g. Hypophoria: downward deviation not manifest
 - h. Hypotropia: downward deviation
- IV. Examination of the eyes
 1. Visual acuity and amblyopia
 - a. Newborns
 - b. Infants to 2 years old
 - c. 2 to 4 years old
 - d. 4 to 5 and up
- V. Strabismus Testing
 1. General Inspection

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2. Corneal light reflex
3. Cover test
4. Other tests
 - a. Red reflex
 - b. Ophthalmoscopy
 - c. Pupillary testing

VI. Leukocoria

1. Retinoblastoma
2. PHPV
3. ROP
4. Cataract

VII. Management or referral

1. Amblyopia
2. Strabismus
3. Leukocoria

Competencies:

1. Visual acuity testing in each eye in preverbal children by fixation and recognizing fixation preference if present.
 - a. Visual acuity testing 2-5 years with Allen cards with each eye.
2. Strabismus
 - a. Performing Hirschberg testing
3. Recognizing leukocoria
4. Understanding a referral for leukocoria as an emergent issue, and amblyopia and Strabismus as an urgent issue

4) Neuro-Ophthalmology:

- I. Anatomy
 1. Bony Anatomy
 2. Vascular Anatomy
 3. Afferent Visual Pathways
 4. Ocular Motor Pathways
 5. Facial Motor and Sensory Anatomy
 - a. Trigeminal Nerve
 - b. Facial Nerve
 6. Ocular Autonomic Pathways
 - a. Sympathetic Pathways
 - b. Parasympathetic Pathways
- II. Neuroimaging
 1. Glossary
 2. History
 3. Basics of MRI
 4. Fundamental Concepts in Localization

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- III. How to examine the patient
 - 1. Visual acuity testing
 - 2. Visual field testing
 - 3. Pupillary reactions
 - a. strabismus
 - b. limitation movement of one eye
 - c. limitation of gaze (both eyes affected similarly)
 - d. nystagmus (spontaneous jerking eye movements)
 - 4. Ophthalmoscopy

- IV. How to interpret findings
 - 1. Pupillary disorders
 - a. dilated pupil
 - b. tonic pupil
 - c. unilateral small pupil
 - 2. Neuro- motility abnormalities
 - a. cranial nerve palsies
 - (1) III nerve
 - (2) IV nerve
 - (3) VI nerve
 - b. other cranial nerve palsies
 - (1) V cranial nerve
 - (2) VII cranial nerve
 - c. Myasthenia Gravis
 - d. Intranuclear ophthalmoplegia
 - e. Nystagmus
 - 3. Optic nerve disease
 - a. Optic disc elevation
 - (1) Congenital anomalous disc elevation
 - (2) Papilledema
 - (3) Papillitis
 - (4) Ischemic optic neuropathy
 - b. Amaurosis Fugax
 - c. Optic atrophy
 - d. Visual field defect
 - 4. Glossary
 - a. Scotoma
 - b. Hemianopia
 - c. Homonymous hemianopia
 - d. Bi-temporal hemianopia

Competencies:

- 1. Measure visual acuity with near card
- 2. Perform confrontation visual field testing in four quadrants in each eye
- 3. Test pupillary function and be able to recognize afferent pupillary defect

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4. Perform ductions and versions and recognize cranial nerve palsies 3, 4, 6
5. Recognize and diagnose nystagmus
6. Exam the optic disc with the direct ophthalmoscope and recognize optic nerve pallor and papilledema

5) RETINA VITREOUS

I. SYMPTOMS SUGGESTIVE OF VITREORETINAL DISORDERS

- a. Flashes
- b. Floaters
- c. Central blur and/or distortion and/or minification
- d. Abrupt or progressive dimming of vision in one eye
- e. Abrupt or progressive loss of peripheral visual field in one eye

II. PRACTICAL ANATOMY OF VITREOUS AND RETINA

- a. Clarity of vitreous
- b. Transparency of retina and normal retinal blood vessel walls
- c. Location of rods and cones in retina relative to vitreous and choroid
- d. Nature of retinal pigment epithelium
- e. Nature of choroid

III. EXAMINATION OF THE EYE BY DIRECT OPHTHALMOSCOPY

- a. Evaluation of *red reflex*
- b. Examination of optic disc
- c. Examination of retinal blood vessels on and adjacent to optic disc
- d. Examination of posterior retina and choroid

IV. NORMAL FUNDUS FEATURES REVEALED BY DIRECT OPHTHALMOSCOPY

- a. Appearance of normal *red reflex*
- b. Appearance of normal optic disc
- c. Appearance of normal retinal arteries and veins
- d. Appearance of normal posterior retina and choroid

V. ABNORMAL FUNDUS FEATURES REVEALED BY DIRECT OPHTHALMOSCOPY

1. General
 - a. Loss of normal *red reflex*
 - b. Dark spots in *red reflex*
 - c. Abnormal color of *red reflex*
2. Fundus features of important systemic diseases
 - a. Diabetes mellitus
 - Background diabetic retinopathy
 - Proliferative diabetic retinopathy
3. Systemic hypertension
 - Vasospastic (accelerated) retinopathy
 - Sclerotic (chronic) retinopathy
- c. Atherosclerotic carotid occlusive disease

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- Central retinal artery occlusion
 - Central retinal vein occlusion
 - 4. Embolic cardiovascular disease
 - AIDS
 - Disseminated metastatic cancer
 - 5. Fundus features of important ocular diseases
 - Retinoblastoma
 - Retinal detachment
 - Age-related macular degeneration
- VI. WHEN TO REFER PATIENT TO AN OPHTHALMOLOGIST (assuming that patient is not already under regular care by an ophthalmologist for the identified findings, symptoms, or diagnosis)
1. Whenever examination reveals abnormal features of *red reflex* or fundus
 2. Whenever patient reports pertinent visual loss or symptoms consistent with a vitreoretinal disorder

Competencies:

1. Anatomy and function of retina
2. Macula definition and function
3. Normal retinal vasculature
4. Detection of diabetic retinopathy
 - background
 - proliferative
5. Retinal detachment – definition and treatment
6. Retinoblastoma - leukocoria
7. Malignant melanoma – definition and prevalence
8. Importance of dilated fundus exam
9. Change in red reflex.

6) LENS & CATARACT

- I. PRACTICAL ANATOMY OF LENS
 - a. Intraocular location of lens behind plane of iris
 - b. Optical clarity of normal lens
 - c. Suspension of normal lens in retroiridic position by zonule
- II. SYMPTOMS ATTRIBUTABLE TO CATARACT
 - a. Slowly progressive blurring of vision
 - b. Progressive painless loss of vision
- III. EXAMINATION OF THE LENS BY DIRECT OPHTHALMOSCOPY
 - a. Evaluation of *red reflex*

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IV. ABNORMAL LENS FEATURES REVEALED BY DIRECT OPHTHALMOSCOPY

1. General
 - a. Loss of normal *red reflex*
 - b. Dark spots in *red reflex*
 - c. Abnormal color of *red reflex*
2. Lens abnormalities found in important systemic diseases
 - a. Marfan's syndrome – spontaneous dislocation of lens
3. Lens abnormalities found in important ocular diseases
 - a. Cataract (clouding or opacification of lens)
 - b. Implanted artificial intraocular lens

V. TREATMENT OF CATARACT

- a. Surgical removal of lens (cataract extraction)
- b. Implantation of artificial lens in eye

VI. WHEN TO REFER PATIENT TO AN OPHTHALMOLOGIST (assuming that patient is not already under regular care by an ophthalmologist for the identified findings, symptoms, or diagnosis)

- a. Whenever examination reveals abnormal *red reflex* or lens clouding or opacity
- b. Whenever a patient reports progressive visual loss or blurring

Competencies:

1. Anatomy of lens
2. Presbyopia – definition and symptoms
3. Cataract
 - definition and symptoms
 - definition red reflex
 - definition slit lap
4. Lens dislocation
5. Management of cataract
 - surgery
 - Intraocular lens

7) Eyelid, Lacrimal and Orbit

I. Eyelid

- A. Examination and Technique
 - a. Assess the position of the upper eyelid by measuring the distance between the lid margin and the corneal light reflex
 - b. Visual inspection of eyelids and periocular area
- B. Anatomy
 - a. Anterior and posterior lamellae
 - b. Lid margin
 - c. Orbital septum relationship to eyelid/orbit

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- d. Eyebrow
 - e. Levator aponeurosis
 - f. Blood supply – internal and external carotid circulation
 - g. Sensory supply – V and VI
 - h. Motor supply – CN III, CN VII, and sympathetics
 - C. Eyelid Diseases
 - 1. Malpositions
 - a. Blepharoptosis
 - b. Dermatochalasis
 - c. Entropion
 - d. Ectropion
 - e. Retraction
 - f. Lagophthalmos
 - 2. Inflammations
 - a. Chalazion
 - b. Blepharitis
 - c. Meibomitis
 - 3. Infections
 - a. Hordeolum
 - b. Preseptal cellulites
 - 4. Tumors
 - a. Benign
 - 1. Cysts
 - 2. Nevi
 - 3. Papillomas
 - 4. Xanthelasma
 - b. Malignant
 - 1. Basal cell carcinoma
 - 2. Squamous cell carcinoma
 - 5. Eyelid trauma
- ## II. Lacrimal
- A. Examination Technique
 - 1. Visual inspection of medial canthal area
 - B. Anatomy
 - 1. Upper lacrimal system – puncta, canaliculi and lac sac
 - 2. Lower lacrimal system – bony and mucosal nasolacrimal duct
 - C. Lacrimal Diseases
 - 1. Congenital nasolacrimal duct obstruction
 - 2. Acquired nasolacrimal duct obstruction
 - 3. Dacryocystitis
 - 4. Lacrimal Trauma

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III. Orbit

- A. Examination technique
 - 1. Use visual techniques to identify both axial and non-axial proptosis
 - 2. Be familiar with exophthalmometer
- B. Anatomy
 - 1. Seven bones used to make up 4 walls – floor, medial and lateral walls and roof
 - 2. Orbital septum relationship to orbit
 - 3. Contents of orbit – extraocular muscles, lacrimal system, ophthalmic artery, nerves (CN I, II, IV, V, VI, sympathetics, and parasympathetics)
 - 4. Relationship of orbit to surrounding structures – sinuses, cranial cavity
- C. Orbital Diseases
 - 1. Orbital cellulites
 - 2. Graves' ophthalmopathy
 - 3. Orbital inflammatory disease
 - 4. Orbital tumors – vascular, nerve sheath, metastatic and lacrimal tumors
 - 5. Orbital trauma

Competencies:

- 1. Understand basic structure and function of eyelids, and common malpositions, and acquired disorders.
- 2. Understand tear production and drainage.
- 3. Understand orbital structure and common abnormalities.

8) Refractive Surgery

The goal of refractive surgery is elimination or reduction of one's dependence on eyeglasses and contact lenses.

- I. Types of refractive errors:
 - a. Myopia – long eye or steep cornea
 - b. Hyperopia – short eye or flat cornea
 - c. Astigmatism – uneven curvature of cornea
 - d. Presbyopia – inability to focus at near due to aging
- II. Types of surgical techniques to correct refractive errors:
 - a. Incisional – weaken cornea structurally to induce changes in its curvature
 - b. Lamellar – change shape of the cornea with addition or removal of tissue
 - c. Thermal – shrink corneal collagen to induce corneal steepening
 - d. Intraocular – implantation of intraocular lens or removal of crystalline lens

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- III. Recent advances involve the use of FDA approved excimer laser to perform:
 - a. Photorefractive keratectomy (PRK)
 - b. Laser in situ keratomileusis (LASIK)

- IV. Effectiveness of refractive surgery:
 - a. Continues to improve
 - b. Newer techniques such as LASIK are more predictable than older techniques such as RK
 - c. Uncorrected visual acuity of 20/40 or better is achieved in 95% of eyes after myopic LASIK in most large series
 - d. Range of treatable refractive errors is expanding

- V. Risks associated with refractive surgery include:
 - a. Infection
 - b. Loss of best-corrected visual acuity
 - c. Overcorrection, undercorrection, regression
 - d. Visual aberrations such as glare and halos

- VI. Success in refractive surgery depends on:
 - a. Careful preoperative evaluation
 - b. Exclusion of systemic diseases and eye disorders that may be contraindicated
 - c. A thorough explanation of treatment options and risks and benefits of each procedure

Competencies:

1. Understand refractive errors and their relations to eye length, corneal curvature, and lens status.
2. Basic knowledge of refractive surgical theory and practice.
3. Understand risks and benefits of commonly discussed and performed refractive procedures.

9) Ocular Manifestations of Systemic Disease

- I. Diabetes
 - A. Anterior segment
 - 1. corneal wound healing
 - 2. cataract
 - B. Posterior segment
 - 1. diabetic retinopathy
 - a. BDR-hard exudates, hemorrhages, microaneurysms
 - b. preproliferative-soft exudates, IRMA
 - c. proliferative - NVE, NVD
 - 2. vitreous hemorrhage
 - 3. ischemic optic neuropathy

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- II. Sickle cell anemia
 - A. Anterior segment
 - 1. hyphema
 - 2. anterior segment ischemia
 - B. Posterior segment
 - 1. salmon patch
 - 2. black sunburst
 - 3. sea fan

- III. Hypertension
 - A. Posterior segment
 - 1. arteriolar narrowing
 - a. copper wire
 - b. silver wire
 - 2. hemorrhages (flame-shaped)
 - 3. disc edema (malignant hypertension)
 - B. Neuro-ophthalmic manifestations
 - 1. VI nerve palsy
 - 2. intracranial hemorrhage

- IV. Cerebrovascular diseases
 - A. Transitory Ischemia Attack (TIA)
 - 1. visual changes
 - 2. fundus findings
 - B. Infarction
 - 1. history
 - 2. visual field findings
 - a. homonomous hemianopia
 - b. homonomous quadrantanopia

- V. Thyroid (Graves) disease
 - A. Clinical (Werner classification)
 - B. Treatment for thyroid orbitopathy
 - 1. non-surgical
 - a. corticosteroids
 - b. radiation
 - 2. surgical
 - a. eyelid
 - b. orbital decompression

- VI. Sarcoidosis/inflammatory conditions
 - A. Clinical
 - 1. nodules
 - a. eyelid
 - b. conjunctival

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- 2. uveitis
 - a. non-granulomatous
(associated diseases-JRA, Reiter, Behcet)
 - b. granulomatous
(associated diseases-sarcoid, Tb, fungal)
- B. Diagnostic tests
 - 1. imaging
 - 2. ACE level
- VII. Malignancy
 - A. Primary
 - 1. intraocular
 - a. retinoblastoma
 - b. uveal melanoma
 - c. lymphoma
 - 2. eyelid
 - a. basal cell carcinoma
 - b. sebaceous carcinoma
 - c. melanoma
 - 3. orbit
 - a. lymphoma
 - b. lacrimal gland tumors
 - c. other
 - B. Secondary
 - 1. extension from sinus carcinoma
 - 2. metastasis
 - a. adults-carcinoma
 - b. children-leukemia
- V. AIDS
 - A. Anterior segment
 - 1. bacterial infection
 - 2. Kaposi sarcoma
(conjunctiva or eyelid)
 - B. Posterior segment
 - 1. CMV retinitis
- VI. Syphilis
 - A. Anterior segment
 - 1. interstitial keratitis
 - 2. anterior uveitis
 - B. Posterior segment
 - 1. neuroretinitis
 - 2. papillitis
 - 3. posterior uveitis

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- VII. Other systemic infections
 - A. Viral (e.g. herpes zoster ophthalmicus “shingles”)
 - B. Fungal (e.g. candida endophthalmitis)
 - C. Bacterial (e.g. Tb uveitis)

Competencies:

1. Recognize exudates and hemorrhages on dilated fundus exam
2. Detect hyphema on slit lamp exam
3. Recognize retinal arteriolar narrowing (copper wire/silver wire) on dilated fundus exam
4. Detect disc edema on fundus exam
5. Neurologic assessment of cranial nerves
6. Confrontational visual fields with recognition of hemianopias
7. Recognition of limited ocular motility
8. Recognition of proptosis
9. Recognition of photophobia as symptom of uveitis
10. Assessment for malignant neoplasms of eyelids (carcinoma, melanoma)

10) Intraocular Tumors

- I. Retinoblastoma
 - A. Knudson’s two-hit hypothesis
 - B. Genetics
 - 1. 13q14 deletion
 - 2. heritable vs sporadic
 - C. Clinical
 - 1. leukokoria
 - 2. strabismus
 - D. Treatment
 - 1. non-surgical
 - 2. surgical (enucleation)
 - E. Differential diagnosis
 - 1. ROP
 - 2. Coats’ disease
 - 3. PHPV
- II. Uveal Melanoma
 - A. Most common primary Intraocular malignancy
 - B. Variants
 - 1. iris
 - 2. ciliary body
 - 3. choroidal

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- C. Clinical
 - 1. asymptomatic vs symptomatic
 - 2. pigmented vs amelanotic
 - 3. prognosis
 - a. size
 - b. cell type
- D. Treatment
 - 1. non-surgical
 - 2. surgical (enucleation)
- E. Differential diagnosis
 - 1. nevus
 - 2. metastasis to eye
 - 3. retinal detachment

III. Other Intraocular Tumors

- A. Lymphoma-primary large cell lymphoma vs manifestations of systemic lymphoma
- B. Metastasis-carcinomas in adults vs leukemia in children

Competencies:

1. Assess for red reflex with flashlight/penlight
2. Assess for strabismus with Hirshberg test.
3. Obtain history to determine for risk factors for retinoblastoma
4. Ability to detect retinal detachment/Intraocular tumor on fundus exam of adult

11) Cornea and External Disease

- I. Anatomy
 - A. Lids
 - 1. Glands of Zeis and Moll
 - 2. Lashes
 - 3. Meibomian glands
 - 4. Lacrimal gland
 - B. Conjunctiva
 - 1. Bulbar
 - 2. Palpaebal
 - C. Regional lymph nodes
 - 1. Pre-auricular
 - 2. Sub-mandibular
 - D. Cornea
 - 1. Tear film layer
 - 2. Epithelium
 - 3. Stroma
 - 4. Endothelium

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- E. Lacrimal system
 - 1. Punctum – upper and lower
 - 2. Lacrimal sac

- II. The red eye
 - A. Acute angle closure glaucoma
 - B. Iritis or iridocyclitis
 - C. Herpes simplex keratitis
 - D. Conjunctivitis
 - 1. Bacterial
 - 2. Viral
 - 3. Allergic
 - 4. Irritative
 - E. Episcleritis
 - F. Scleritis
 - G. Adnexal disease
 - 1. Blepharitis
 - 2. Thyroid eye disease
 - 3. Dacryocystitis
 - 4. Hordeolum
 - 5. Chalazion
 - H. Subconjunctival hemorrhage
 - I. Pterygium
 - J. Keratoconjunctivitis sicca
 - K. Corneal abrasions and foreign body
 - L. Secondary to abnormal lid function
 - 1. Bell's palsy
 - 2. Thyroid ophthalmopathy

- III. Symptoms associated with a red eye
 - A. Blurred vision
 - B. Photophobia
 - C. Colored Haloes
 - D. Exudation (mattering)
 - E. Itching

- IV. Steps to differentiate the red eye and how to interpret findings
 - A. Measure central acuity* *reduced acuity
 - B. Determine location of redness
 - 1. Subconjunctival hemorrhage
 - 2. Conjunctival hyperemia
 - 3. Ciliary flush* * corneal inflammation, iritis, acute glaucoma
 - C. Assess discharge and characterize as
 - 1. Profuse or scant
 - 2. Purulent, mucopurulent, or serous

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- C. Organization of axons and associated visual field defects

- II. How to examine the patient
 - A. Central visual acuity measurement
 - B. Visual field testing
 - 1. Confrontation testing in 4 quadrants in each eye
 - 2. Central color testing – red top bottle
 - C. Pupillary reaction
 - 1. Relative afferent pupillary defect as sign of unilateral optic nerve injury
 - D. Penlight examination
 - 1. Anterior chamber depth estimation
 - a. Normal
 - b. Narrow
 - E. Intraocular pressure
 - 1. Applanation tonometry
 - 2. Normal value range
 - F. Direct ophthalmoscopy

- III. How to interpret history
 - A. Primary open angle glaucoma
 - 1. Risk factors
 - a. African and Caribbean African ancestry
 - b. Age greater than 75 years
 - c. Primary family member with glaucoma
 - 2. Genetic influence
 - a. GLC1a (myocillin gene) juvenile open angle glaucoma
 - 3. Symptoms
 - b. Lack of symptoms until late in disease
 - B. Normal tension glaucoma
 - 1. Optic nerve injury and visual field loss similar to primary open angle glaucoma
 - 2. Not associated with elevated intraocular pressure
 - C. Primary Angle Closure Glaucoma
 - 1. Risk Factors
 - a. Anatomically narrow anterior chamber angle
 - b. Hyperopia
 - c. Dilating drops in eyes with narrow angles
 - d. Anti-cholinergic medications
 - 2. Symptoms
 - a. Severe ocular pain
 - b. Ocular redness
 - c. Blurred vision and colored haloes
 - 3. Signs
 - a. Dilated fixed pupil
 - b. Narrow anterior chamber angle
 - c. Pupillary block

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d. Corneal edema

IV. Pharmacological treatment

- A. Medications that increase aqueous humor outflow
 - 1. Parasympathomimetics
 - 2. Prostaglandin analogues
- B. Medications that decrease aqueous production
 - 1. Beta blockers
 - 2. Carbonic anhydrase inhibitors
 - 3. Alpha₂-agonists

V. Surgical treatment

- A. Primary acute angle closure glaucoma
 - 1. Peripheral iridectomy
- B. Primary open angle glaucoma
 - 1. Argon laser trabeculoplasty
 - 2. Filtering surgery

Competencies:

- 1. Measure visual acuity with near card
- 2. Perform confrontation visual field testing in four quadrants in each eye
- 3. Assess pupillary reaction for relative afferent pupillary defect
- 4. Estimate anterior chamber depth with penlight to determine angle width
- 5. Diagnose primary acute angle closure glaucoma by history and penlight examination
- 6. Recognize signs of optic nerve injury – increased cupping and asymmetric cupping
- 7. Obtain history to determine risk factors for primary open angle glaucoma

References:

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- 3. Vision Problems in the U.S.: Prevalence of Adult Vision Impairment and Age-Related Eye Disease in America. NEI/NIH Prevent Blindness America (2002)