

## Medical Student Education in Ophthalmology

### Educational Priorities

In the listings below, information is marked with one of the following:

- Single asterisk **\***: Essential ophthalmic knowledge and clinical eye care skills that is basic for all medical student education;
- Two asterisks **\*\***: Information that reflects a greater level of understanding; or
- Three asterisks **\*\*\***: Areas of cognitive and clinical skills that are more appropriate for students who seek further training in ophthalmology.
- #Denotes condition that requires immediate ophthalmologic care.

While important to ophthalmic care, the Task Force does not regard the cognitive or skill set designated **\*\*** or **\*\*\*** as essential to the basic curriculum of most medical students.

### 1. Fundamentals and Principles of Ophthalmology

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

- i) **Ocular Anatomy\*** The student should be able to define each of these structures and provide relevant information regarding function and structure.
- |                |                        |                    |
|----------------|------------------------|--------------------|
| a) Eyelids     | g) Cornea              | m) Vitreous cavity |
| b) Sclera      | h) Extraocular muscles | n) Retina          |
| c) Limbus      | i) Anterior chamber    | o) Macula          |
| d) Iris        | j) Lens                | p) Choroid         |
| e) Pupil       | k) Ciliary body        | q) Optic disc      |
| f) Conjunctiva | l) Posterior chamber   |                    |
- ii) **Visual Acuity\*** Students should understand the purpose of measurement of near visual acuity with and without correction, and test for near visual acuity of the right eye, left eye, and both eyes. Students should understand the concept of distance visual acuity testing with and without correction and with a pinhole, but are not expected to perform refraction.
- iii) **External Inspection\*** Students should understand the external ocular anatomy and evaluate the position of the lids and inspect the conjunctiva, sclera, cornea and iris with a penlight
- iv) **Pupillary Reaction Testing\*** Students should measure the pupillary size and assess the direct and consensual pupillary reaction.
- v) **Ocular Motility Testing\*** Student should understand the importance of assessing ocular motility in the six primary directions.

- vi) **Direct Ophthalmoscopy\*** Student should understand the use of a direct ophthalmoscope and the importance of testing the patient right eye with the ophthalmoscope held in the examiner right hand, and left eye with the examiner 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 understand 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 how evert the upper lid to examine for foreign bodies.
- 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;
- Measure near visual acuity;
- Test for direct, consensual and afferent pupillary reactions;
- Understand and master basic direct ophthalmoscopy;
- Understand normal funduscopic appearance of the optic disc, macula and major vessels;
- Understand the rationale and interpretation of test the red reflex;
- Understand the importance of the dilated fundus examination; and
- Understand important causes of reduced vision, abnormal fundus appearance and 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 (d) Visual acuity.  
 (b) The schematic eye (e) Clinical measurement of visual acuity (Snellen)  
 (c) Pupil size and its effect on visual resolution.

- i) **Refraction States** (as it affects direct ophthalmoscopy)\*  
 a) Emmetropia c) Hyperopia e) Presbyopia and accommodation  
 b) Myopia d) Astigmatism
- ii) **Spectacle Correction\*\*\***  
 a) Spherical lenses b) Bifocals, trifocals, multi-focal lenses
- iii) **Special Lens Material\*\*\***  
 a) Plastic c) Polycarbonate lens  
 b) Impact resistant high index glass
- iv) **Contact Lenses\*\*** Clinically important features of contact lens:  
 a) Optics c) Image size e) Flexible contact lens  
 b) Field of vision d) Hard contact lens f) Therapeutic contact lens
- v) **Intraocular Lens\*\*** Concept only
- vi) **Refractive Surgery\*\*\*** Concept only, with some knowledge of principles and indications.
- vii) **A Patient with Low Vision\*\*\*** Need for special rehabilitation with low vision optical devices.

**Competencies\*** Student should:

- Understand emmetropia, myopia, hyperopia, astigmatism, and presbyopia;\*\*
- Measure near central acuity;\*
- Understand optical principles of contact lens, intraocular lens, and refractive surgery; and\*\*
- Understand the need for low vision rehabilitation.\*\*\*

### 3. Pediatric Ophthalmology and Strabismus

- i) **Anatomy of the Extraocular Muscles and their Fascia**  
 a) Origin, course, insertion, innervation, and action of the extraocular muscles  
 b) Horizontal rectus muscles\* h) Arterial  
 c) Vertical rectus muscles\* i) Venous  
 d) Oblique muscles\* j) Fine structure of EOMs\*\*  
 e) Levator palpebrae superioris muscle\* k) Fiber types  
 f) Insertion relationships of the rectus muscles\* l) Anatomical implications  
 g) Blood supply of the Extraocular muscles\*\*\*

ii) **Amblyopia\*\***

- |                         |   |
|-------------------------|---|
| a) Strabismic amblyopia | c) Form deprivation and occlusion amblyopia |
| b) Refractive amblyopia |   |

iii) **Strabismus\*\***

- |  |   |
|--|---|
| a) Concomitant strabismus                        | i) Hypertropia: upward deviation- manifest*       |
| b) Incomitant strabismus                         | j) Hypophoria: downward deviation- not manifest** |
| c) Heterotropia                                  | k) Hypotropia: downward deviation- manifest*      |
| d) Esophoria: inward deviation- not manifest**   |   |
| e) Esotropia: inward deviation- manifest*        |   |
| f) Exophoria: outward deviation- not manifest**  |   |
| g) Exotropia: outward deviation- manifest*       |   |
| h) Hyperphoria: upward deviation- not manifest** |   |

iv) **Examination of the Eyes**

- |                                   |                       |
|-----------------------------------|-----------------------|
| a) Visual acuity and amblyopia*** | d) 2 to 4 years old** |
| b) Newborns                       | e) 4 to 5 and up**    |
| c) Infants to 2 years old**       |                       |

v) **Strabismus Testing**

- |                          |                      |
|--------------------------|----------------------|
| a) General Inspection*   | e) Red reflex        |
| b) Corneal light reflex* | f) Ophthalmoscopy    |
| c) Cover test**          | g) Pupillary testing |
| d) Other tests**         |                      |

vi) **Leukocoria\***

- |                    |               |
|--------------------|---------------|
| a) Retinoblastoma* | c) ROP**      |
| b) PHPV***         | d) Cataract** |

vii) **Management or Referral\*\***

- |              |               |               |
|--------------|---------------|---------------|
| a) Amblyopia | b) Strabismus | c) Leukocoria |
|--------------|---------------|---------------|

**Competencies\*** Student should:

- Perform visual acuity testing in each eye in preverbal children by fixation and recognizing fixation preference if present; \*\*\*
- Measure visual acuity in children 2-5 years with Allen cards with each eye; \*\*\*
- Recognize and characterize ocular misalignment (strabismus) by performing Hirschberg testing; \*
- Recognize leukocoria and importance; and\*
- Understanding referral for leukocoria, amblyopia, and strabismus in a child as an urgent issue. \*

## 4. Neuro-Ophthalmology

i) **Anatomy\*\***

- |                                      |                              |
|--------------------------------------|------------------------------|
| a) Bony anatomy                      | f) Trigeminal nerve*         |
| b) Vascular anatomy                  | g) Facial nerve*             |
| c) Afferent visual pathways          | h) Ocular autonomic pathways |
| d) Ocular motor pathways             | i) Sympathetic pathways      |
| e) Facial motor and sensory anatomy* | j) Parasympathetic pathways  |

ii) **Neuroimaging\*\***

- |             |   |
|-------------|---|
| a) Glossary | c) Basics of MRI                        |
| b) History  | d) Fundamental concepts in localization |

iii) **How to Examine the Patient\***

- |   |  |
|---|--|
| a) Visual acuity testing*                 | e) Limitation movement of one eye                    |
| b) Visual field testing (confrontation) * | f) Limitation of gaze (both eyes affected similarly) |
| c) Extraocular motility*                  | g) Nystagmus (spontaneous jerking movements)         |
| d) Strabismus                             | h) Direct ophthalmoscopy*                            |

iv) **How to Interpret Findings**

- |                                   |   |
|-----------------------------------|---|
| a) Pupillary disorders            | k) Nystagmus**                            |
| b) Dilated pupil*                 | l) Optic nerve disease                    |
| c) Tonic pupil**                  | m) Optic disc elevation                   |
| d) Sfferent pupillary defect*     | (1) Congenital anomalous disc elevation** |
| e) Unilateral small pupil**       | (2) Papilledema*                          |
| f) Neuro- motility abnormalities  | (3) Papillitis**                          |
| g) Cranial nerve palsies*         | (4) Ischemic optic neuropathy**           |
| (1) III nerve                     | n) Amaurosis fugax**                      |
| (2) IV nerve                      | o) Optic atrophy**                        |
| (3) VI nerve                      | p) Visual field defect**                  |
| h) Other cranial nerve palsies**  | q) Glossary                               |
| (1) V cranial nerve               | r) Scotoma***                             |
| (2) VII cranial nerve             | s) Hemianopia*                            |
| i) Myasthenia gravis**            | t) Homonymous hemianopia*                 |
| j) Intranuclear ophthalmoplegia** | u) Bi-temporal hemianopia*                |

**Competencies\*** Student should:

- Measure visual acuity with near card;
- Perform confrontation visual field testing in four quadrants in each eye;
- Test pupillary function and be able to recognize afferent pupillary defect;
- Perform ductions and versions and recognize cranial nerve palsies III, IV, VI;
- Recognize and diagnose nystagmus; and
- Exam the optic disc with the direct ophthalmoscope and recognize optic nerve pallor and papilledema.

## 5. Retina and 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) **Anatomy of Retina and Vitreous\*\***

- 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 vessels on/adjacent to optic disc
- d) Examination of posterior retina and choroid

iv) **Normal Fundus Features 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 by Direct Ophthalmoscopy\***

- a) General\*
- b) Loss of normal red reflex
- c) Dark spots in red reflex
- d) Abnormal color of red reflex
- e) Sclerotic (chronic) retinopathy
- f) Diabetes mellitus
- g) Background diabetic retinopathy
- h) Proliferative diabetic retinopathy
- i) Systemic hypertension\*
- j) Vasospastic (accelerated) retinopathy
- k) Fundus features of important systemic diseases\*
- l) Atherosclerotic carotid occlusive disease\*
- m) Central retinal artery occlusion
- n) Central retinal vein occlusion
- o) Embolic cardiovascular disease
- p) AIDS\*\*
- q) Disseminated metastatic cancer\*\*\*
- r) Fundus features of important ocular diseases
- s) Retinoblastoma\*
- t) Retinal detachment\*\*
- u) Age-related macular degeneration\*

vi) **When to Refer a Patient to an Ophthalmologist**

- a) Whenever examination reveals abnormal features of red reflex or fundus\*\*
- b) Whenever patient reports visual loss or symptoms consistent with a vitreoretinal disorder\*\*

**Competencies\*** Student should:

- Understand anatomy and function of retina;\*
- Understand definition and function of the macula;\*
- Recognize normal retinal vasculature;\*
- Detect diabetic retinopathy;\*
- Background;
- Proliferative ;
- Understand definition and treatment of retinal detachment;\*\*\*
- Understand importance of retinoblastoma and recognize leukocoria;\*

- Understand importance of choroidal malignant melanoma (definition and prevalence);\*\*\*
- Understand importance of dilated fundus exam; and\*
- Recognize a change in red reflex.\*

## 6. Lens and Cataract

### i) **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

### iv) **Abnormal Lens Features by Direct Ophthalmoscopy**

- a) General\*
- b) Loss of normal red reflex
- c) Dark spots in red reflex
- d) Abnormal color of red reflex
- e) Marfan syndrome: Pspontaneous dislocation of lens
- f) Lens abnormalities found in ocular diseases\*\*
- g) Cataract (clouding or opacification of lens)
- h) Implanted artificial intraocular lens
- e) Lens abnormalities found in important systemic diseases\*\*

### v) **Treatment of Cataract**

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

### vi) **When to Refer a Patient to an Ophthalmologist\*\***

- a) Examination reveals abnormal red reflex or lens clouding or opacity
- b) Patient reports progressive visual loss or blurring

### **Competencies\*** Student should:

- Understand the anatomy of lens;\*\*
- Describe presbyopia (definition and symptoms);\*\*
- Diagnose cataract;\*
- Definition and symptoms;\*
- Red reflex;\*
- Slit lamp findings;\*\*\*
- Understand important of lens dislocation;\*\*\*
- Describe management of cataract;\*\*\*
- Surgery; and
- Intraocular lens.

## 7. Eyelid, Lacrimal and Orbit

### i) Eyelid\*

- a) Examination and Technique
- b) Assess the position of the upper eyelid by measuring the distance between the lid margin and the corneal light reflex
- c) Visual inspection of eyelids and periocular area
- d) Anatomy\*\*
- e) Anterior and posterior lamellae\*\*\*
- f) Lid margin\*\*
- g) Orbital septum relationship to eyelid/orbit\*\*
- h) Eyebrow\*\*
- i) Levator aponeurosis\*\*
- j) Blood supply (internal and external carotid circulation)\*\*\*
- k) Sensory supply PV1 and V2\*
- l) Motor supply PCN III, CN VII, and sympathetics\*
- m) Eyelid diseases
- n) Malpositions
 

(1) Blepharoptosis**	(3) Dermatochalasis**	(5) Entropion*
(2) Ectropion*	(4) Retraction*	(6) Lagophthalmos*
- o) Inflammations
 

(1) Chalazion*	(2) Blepharitis*	(3) Meibomitis**
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- p) Infections
 

(1) Hordeolum*	(2) Preseptal cellulitis**
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- q) Tumors
- r) Benign
 

(1) Cysts***	(3) Papillomas**
(2) Nevi**	(4) Xanthelasma*
- s) Malignant\*\*
 

(1) Basal cell carcinoma**	(2) Squamous cell carcinoma**
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- t) Eyelid trauma\*\*

### ii) Lacrimal

- a) Examination technique
- b) Visual inspection of medial canthal area\*
- c) Anatomy
- d) Upper lacrimal system (puncta, canaliculi and lac sac)\*
- e) Lower lacrimal system (bony and mucosal nasolacrimal duct)\*\*\*
- f) Lacrimal diseases
- g) Congenital nasolacrimal duct obstruction\*\*
- h) Acquired nasolacrimal duct obstruction\*\*
- i) Dacryocystitis\*\*
- j) Lacrimal trauma\*\*

### iii) Orbit

- a) Examination technique

- b) Use visual techniques to identify axial and non-axial proptosis\*
- c) Be familiar with exophthalmometer\*\*\*
- d) Anatomy
- e) Seven bones comprise 4 walls (floor, medial and lateral walls and roof)\*\*\*
- f) Orbital septum relationship to orbit\*\*
- g) Contents of orbit Pextraocular muscles, lacrimal system, ophthalmic artery, nerves (CN II, IV, V, VI, sympathetics, and parasympathetics)\*
- h) Relationship of orbit to surrounding structures Psinuses, cranial cavity\*
- i) Orbital diseases
- j) Orbital cellulitis\*
- k) Graves ophthalmolopathy\*
- l) Orbital inflammatory disease\*\*
- m) Orbital tumors (vascular, nerve sheath, metastatic and lacrimal tumors)\*\*\*
- n) Orbital trauma\*\*

**Competencies** Student should:

- Understand basic structure and function of eyelids, and common malpositions, and acquired disorders;\*
- Understand tear production and drainage; and\*\*
- Understand orbital structure and common abnormalities.\*\*

## 8. Refractive Surgery

- 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
- 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\*\*\***
- Infection
  - Loss of best-corrected visual acuity
  - Overcorrection, undercorrection, regression
  - Visual aberrations such as glare and halos
- vi) **Success in refractive surgery depends on\*\*\***
- Careful preoperative evaluation
  - Exclusion of systemic diseases and eye disorders that may be contraindicated
  - A thorough explanation of treatment options and risks and benefits of each procedure

### Competencies Student should:

- Understand refractive errors and their relations to eye length, corneal curvature, and lens status;\*
- Describe refractive surgical theory and practice; and\*\*\*
- Understand risks and benefits of commonly discussed and performed refractive procedures.\*\*\*

## 9. Ocular Manifestations of Systemic Disease

- i) **Diabetes\***
- Anterior segment
  - Corneal wound healing\*\*\*
  - Cataract\*
  - Posterior segment
  - Background retinopathy-hard exudates, hemorrhages, microaneurysms\*
  - Preproliferative retinopathy-soft exudates, intraretinal microvascular abnormality\*\*\*
  - Proliferative retinopathy: Neovascularization of the disc, neovascularization elsewhere\*
  - Diabetic retinopathy\*
  - Vitreous hemorrhage\*
  - Ischemic optic neuropathy\*\*\*
- ii) **Sickle cell anemia**
- Anterior segment
  - Posterior segment
  - Anterior segment ischemia\*\*\*
  - Importance of recognizing traumatic hyphema\*\*
  - Salmon patch\*\*\*
  - Black sunburst\*\*\*
  - Sea fan\*\*\*
- iii) **Hypertension**
- Posterior segment
  - Arteriolar narrowing\*  
(1) copper wire (2) silver wire
  - Hemorrhages (flame-shaped)\*
  - Exudates (cotton wool spots, macular star) \*
  - Disc edema (malignant hypertension)\*
  - Neuro-ophthalmic manifestations
  - Cranial nerve palsy\*\*
  - Intracranial hemorrhage\*\*
- iv) **Cerebrovascular diseases**

- a) Transitory Ischemia Attack (TIA)\*
  - b) Visual changes\*
  - c) Fundus findings\*\*
  - d) Infarction
  - e) History\*
  - f) Visual field findings\*
    - (1) Homonymous hemianopia
    - (2) Homonymous quadrantanopia
- v) **Thyroid (Graves) disease**
- a) Clinical (Werner classification) \*
  - b) Treatment for thyroid orbitopathy\*\*
    - (1) Non-surgical\*\*
      - Corticosteroids    Radiation
    - (2) Surgical\*\*\*
      - Eyelids    Orbital decompression
- vi) **Sarcoidosis/inflammatory conditions\*\***
- a) Clinical
  - b) Nodules
    - (1) Eyelid    (2) Conjunctival
  - c) Uveitis
    - (1) Non-granulomatous (associated diseases-JRA, Reiter, Behcet)\*\*\*
    - (2) Granulomatous (associated diseases-sarcoid, TB, fungal)\*\*\*
  - d) Diagnostic tests
  - e) Imaging, gallium scan\*\*
  - f) ACE level\*\*
- vii) **Malignancy**
- a) Primary
    - b) Intraocular\*\*
      - (1) Retinoblastoma\*\*
      - (2) Uveal malignant melanoma\*\*
      - (3) Lymphoma\*\*\*
    - c) Eyelid
      - 1) Basal cell carcinoma\*\*
      - (2) Sebaceous carcinoma\*\*
      - (3) Melanoma\*\*\*
  - d) Orbit
    - (1) Lymphoma\*\*\*
    - (2) Lacrimal gland tumors\*\*\*
    - (3) Other
  - e) Secondary
  - f) Extension from sinus carcinoma\*\*\*
  - g) Metastasis\*\*\*
    - (1) Adults-carcinoma
    - (2) Children-leukemia
- viii) **AIDS**
- a) Anterior segment
  - b) Bacterial infections of the lids and adnexa\*
  - c) Kaposi sarcoma (conjunctiva or eyelid)\*
  - d) Conjunctival tumors
  - e) Posterior segment
  - f) CMV retinitis\*
- ix) **Syphilis**
- a) Anterior segment
  - b) Interstitial keratitis\*\*\*
  - c) Anterior uveitis\*\*
  - d) Posterior segment
  - e) Neuroretinitis\*\*
  - f) Papillitis\*\*\*
  - g) Posterior uveitis\*\*\*
- x) **Other systemic infections**
- a) Viral (e.g. herpes zoster ophthalmicus "shingles")\*
  - b) Fungal (e.g. candida endophthalmitis)\*\*\*
  - c) Bacterial (e.g. Tb uveitis)\*\*\*
  - d) Toxoplasmosis
  - e) Onchocerciasis

**Competencies** Student should:

- Recognize retinal exudates and hemorrhages on dilated fundus exam;\*
- Detect hyphema on slit lamp exam;\*\*\*
- Recognize retinal arteriolar narrowing (copper wire/silver wire) on dilated fundus exam;\*
- Detect disc edema on fundus exam with direct ophthalmoscopy;\*
- Perform neurologic assessment of all cranial nerves;\*
- Perform confrontational visual fields with recognition of hemianopias;\*
- Recognize limited ocular motility;\*
- Recognize proptosis;\*
- Recognize photophobia as symptom of uveitis; and\*
- Assess for malignant neoplasms of eyelids (carcinoma, melanoma).\*\*\*

## 10. Intraocular Tumors

**i) Retinoblastoma\*\*\***

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>a) Knudson two-hit hypothesis           <ol style="list-style-type: none"> <li>1. Genetics</li> <li>2. 13q14 deletion</li> <li>3. Heritable vs sporadic</li> </ol> </li> <li>b) Clinical           <ol style="list-style-type: none"> <li>1. Leukokoria</li> <li>2. Strabismus</li> </ol> </li> </ul> | <ul style="list-style-type: none"> <li>c) Treatment           <ol style="list-style-type: none"> <li>1. Non-surgical</li> <li>2. Surgical (enucleation)</li> </ol> </li> <li>d) Differential diagnosis           <ol style="list-style-type: none"> <li>1. ROP</li> <li>2. Coats disease</li> <li>3. PHPV</li> </ol> </li> </ul> |
|--|--|

**ii) Uveal Melanoma\*\*\***

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>a) Most common 1° intraocular malignancy</li> <li>b) Variants           <ol style="list-style-type: none"> <li>1. Iris</li> <li>2. Ciliary body</li> <li>3. Choroidal</li> </ol> </li> <li>c) Clinical           <ol style="list-style-type: none"> <li>1. Asymptomatic vs symptomatic</li> <li>2. Pigmented vs amelanotic</li> </ol> </li> <li>d) Prognosis           <ol style="list-style-type: none"> <li>1. Size</li> <li>2. Cell type</li> </ol> </li> </ul> | <ul style="list-style-type: none"> <li>e) Treatment           <ol style="list-style-type: none"> <li>1. Non-surgical</li> <li>2. Surgical (enucleation)</li> </ol> </li> <li>f) Differential diagnosis           <ol style="list-style-type: none"> <li>1. Nevus</li> <li>2. Metastasis to eye</li> <li>3. Retinal detachment</li> </ol> </li> </ul> |
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**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.** Student should

- Assess for red reflex with flashlight/penlight\*
- Assess for strabismus with Hirshberg test. \*
- Obtain history to determine for risk factors for retinoblastoma\*
- Detect retinal detachment/intraocular tumor on fundus exam of adult\*\*\*

## 11. Cornea and External Disease

### i) Anatomy

- |                            |                             |
|----------------------------|-----------------------------|
| a) Lids*                   | k) Sub-mandibular           |
| b) Glands of Zeis and Moll | l) Cornea*                  |
| c) Lashes                  | m) Tear film layer          |
| d) Meibomian glands        | n) Epithelium               |
| e) Lacrimal gland          | o) Stroma                   |
| f) Conjunctiva*            | p) Endothelium              |
| g) Bulbar                  | q) Lacrimal system*         |
| h) Palpaebal               | r) Punctum: upper and lower |
| i) Regional lymph nodes**  | s) Lacrimal sac             |
| j) Pre-auricular           |                             |

### ii) The red eye\*

- |                                  |   |
|----------------------------------|---|
| a) Acute angle closure glaucoma* | m) Thyroid eye disease*                       |
| b) Iritis or iridocyclitis*      | n) Dacryocystitis*                            |
| c) Herpes simplex keratitis*     | o) Hordeolum*                                 |
| d) Conjunctivitis*               | p) Chalazion*                                 |
| e) Bacterial                     | q) Subconjunctival hemorrhage versus hyphema* |
| f) Viral                         | r) Pterygium*                                 |
| g) Allergic                      | s) Keratoconjunctivitis sicca*                |
| h) Toxic                         | t) Corneal abrasions and foreign body*        |
| i) Episcleritis**                | u) Secondary to abnormal lid function**       |
| j) Scleritis**                   | v) Bell palsy                                 |
| k) Adnexal disease*              | w) Thyroid ophthalmopathy                     |
| l) Blepharitis*                  |   |

### iii) Symptoms associated with a red eye\*

- |                   |              |
|-------------------|--------------|
| a) Blurred vision | d) Discharge |
| b) Photophobia    | e) Itching   |
| c) Colored Haloes |              |

### iv) Steps to differentiate the red eye and how to interpret findings

- Measure central acuity (understand importance of reduced visual acuity)\*
- Determine location of redness\*
- Subconjunctival hemorrhage
- Conjunctival hyperemia (epibulbar, palpaebal or both)
- Ciliary flush associated with corneal inflammation, iritis, acute glaucoma#
- Assess discharge and characterize\*
- Profuse or scant
- Purulent, mucopurulent, or serous
- Assess for corneal opacity associated with edema, inflammation, ulcer\*#
- Examine for corneal epithelial defect with fluorescein\*
- Estimate anterior chamber depth associated with acute angle closure glaucoma\*#

- l) Examine pupils importance with iritis, acute angle closure glaucoma\*#
- m) Measure intraocular pressure if elevation suspected\*\*\*
- n) Detect presence of
- o) Proptosis associated with orbital mass\*#
- p) Lid malfunction\*
- q) Limitation of eye movement\*
- r) Pre-auricular lymph-node enlargement\*

### Competencies Student should:

- Measure central acuity with near card;
- Assess corneal clarity with penlight;
- Assess anterior chamber depth and narrowness of angle;
- Assess pupil size, shape, regularity, and reactivity;
- Determine if redness is associated with subconjunctival hemorrhage, ciliary flush, or conjunctival hyperemia;
- Assess conjunctival discharge;
- Determine if proptosis is present;
- Assess ocular motility; and
- Understand findings that are associated serious ocular conditions that require immediate ophthalmologic care.

## 12. Glaucoma

### I. Anatomy

- a) Aqueous humor\*\*
- b) Production: Ciliary body
- c) Circulation: From posterior chamber through pupil into anterior chamber
- d) Outflow Pathway: Trabecular meshwork in anterior chamber angle
- e) Optic Nerve\*
- f) "Glaucoma" as a chronic progressive optic neuropathy usually associated with increased intraocular pressure
- g) Injury to axons from retinal ganglion cells at lamina cribosa
- h) Signs of optic nerve injury
  1. Increased size of central cup
  2. Asymmetric cupping
- i) Palpaebal
- j) Organization of axons and associated visual field defects\*\*\*

### II. How to examine the patient

- a) Central visual acuity measurement\*
- b) Visual field testing\*
- c) Confrontation testing in 4 quadrants OU
- d) Central color testing Pred top bottle
- e) Pupillary reaction\*
- f) Penlight examination\*
- g) Relative afferent pupillary defect as sign of unilateral optic nerve injury
- h) Anterior chamber depth estimation
  1. Normal
  2. Narrow
- i) Intraocular pressure\*\*\*
- j) Applanation tonometry
- k) Normal value range
- l) Direct ophthalmoscopy\*

### III. How to interpret history

- a) Primary open angle glaucoma\*
- b) Risk factors
  1. African and Caribbean African ancestry\*
  2. Age greater than 75 years\*
  3. Primary family member with glaucoma\*
- c) Genetic influence\*\*\*. GIC1a (myocillin gene) juvenile open angle glaucoma
- d) Symptoms\*. Lack of symptoms until late in disease
- e) Normal tension glaucoma\*\*\*
- f) Optic nerve injury and visual field loss similar to primary open angle glaucoma
- g) Not associated with elevated intraocular pressure
- h) Primary Angle Closure Glaucoma\*
- i) Risk Factors
  1. Anatomically narrow anterior chamber angle
  2. Hyperopia
  3. Dilating drops in eyes with narrow angles
  4. Anti-cholinergic medications
- j) Symptoms\*
  1. Ocular pain (may be severe)
  2. Ocular redness\*
  3. Blurred vision and colored haloes; nausea
- k) Signs\*
  1. Dilated fixed pupil
  2. Narrow anterior chamber angle
  3. Pupillary block
  4. Corneal edema

### IV. Pharmacological treatment for open angle glaucoma\*\*

- 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
- b) Peripheral iridectomy
- c) Primary open angle glaucoma\*\*\*
- d) Argon laser trabeculoplasty
- e) Filtering surgery

### Competencies Student should:

- Measure visual acuity with near card;\*
- Perform confrontation visual field testing in four quadrants in each eye;\*
- Assess pupillary reaction for relative afferent pupillary defect;\*
- Estimate anterior chamber depth with penlight to determine angle width;\*
- Diagnose primary acute angle closure glaucoma by history and penlight examination;\*
- Recognize signs of optic nerve injury Pincreased cupping and asymmetric cupping; and\*

- Obtain history to determine risk factors for primary open angle glaucoma.\*

## References

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