

**International Council of Ophthalmology Task Force
On Medical Student Education in Ophthalmology**

**International Curriculum Guidelines on Medical
Student Education in Ophthalmology**

Introduction

Draft, September 16, 2003

In response to a request from the Vice President of the International Council of Ophthalmology to continue the work initiated by the Task Force on Medical Student Education under the leadership of Professors Tano and Lang, the committee respectfully submits the following proposal for the education of international medical students in ophthalmology. The following principles have guided the committee in the preparation of this document.

1. The reduction of time allotted for ophthalmic education in medical school threatens to diminish the clinical skills of graduating physicians throughout the world and to adversely affect eye care.
2. An ophthalmic cognitive and clinical skill set should be defined for international medical educators.
3. Basic ophthalmic knowledge and clinical skills should be recognized internationally and included as a part of the general medical student curriculum.
4. Recommendations of the Task Force should reflect the consensus of a broad based international ophthalmic educational community.
5. The Task Force should define minimum standards for medical student education that are not intended to supplant more extensive existing curricula
6. Teaching materials, including clinical photographs, selected readings from existing textbooks and publications should be made available through the ICO website for international medical students who do not have ready access to printed material.

To this end the Task Force queried members of the Ophthalmic Societies of the International Council of Ophthalmology in January and April 2003. The consensus was that all medical students demonstrate competency in these clinical skills:

1. Measurement of distance visual acuity with and without correction or pinhole and near visual acuity
2. Confrontation visual fields

3. Assessment of extraocular motility and ocular position
4. Measurement and interpretation of pupillary size and reaction
5. Penlight examination of the anterior segment including upper lid eversion
6. Direct ophthalmoscopy
7. Removal of superficial corneal or conjunctival foreign body

With these skills the graduating medical student should make the following diagnoses and initiate appropriate diagnostic or treatment plan for the following conditions:

1. Cataract
2. Conjunctivitis
3. Corneal ulcer/abscess
4. Macular degeneration
5. Diabetic retinopathy
6. Glaucoma
7. Uncorrected refractive error
8. Ocular trauma
9. Papilledema
10. Hemianopic and bitemporal visual field defects

The ICO Task Force medical student curriculum is based on the Basic and Clinical Science Course of the American Academy of Ophthalmology and the recommendations of the American Ophthalmological Society for medical student education in the United States.

Educational Priorities

Essential ophthalmic knowledge and clinical eye care skills are marked with a single asterisk *. The Task Force regards this as basic information for all international medical student education. Information that reflects a greater level of understanding is marked with two asterisks**. Although not basic, many medical schools may already include this material in their curricula. Areas of cognitive and clinical skills that are more appropriate for students who seek further training in ophthalmology are marked with three asterisks***. While important to ophthalmic care, the Task Force does not regard the cognitive or skill set designated ** or *** within the basic curriculum of most international medical students. This material could form the basis for an ophthalmology elective in medical school.

Hours in Curriculum

The ICO Task Force strongly recommends that all medical schools include ophthalmology as a part of the essential or core curriculum, rather than as an elective exclusively. The increasing age of the world's population; high prevalence of common problems, such as eye injury and red eye; and importance of vision in the information age support the expansion of ophthalmic education. **To achieve this goal, the exact allotment of curriculum hours will depend on existing specific medical school**

infrastructure and general curriculum. The ICO Task Force strongly recommends that sufficient time in the classroom and clinical setting be dedicated to meeting the learning objectives that are labeled with a single asterisk * for all medical students.

The ICO Task Force strongly believes that ophthalmic education should take place not only in the classroom, but in the clinic and operating room. Each student should be provided an opportunity to observe a simple ophthalmic procedure, such as treatment of chalazion, removal of corneal foreign body, and cataract operation. The ICO Task Force estimates that the total educational commitment will require approximately 20-25 hours.

Specific Teaching Methods

Three teaching methods have been described to achieve ophthalmic educational goals: traditional didactic lecture and clinical demonstration, illustrative case method study, and evidence-based medicine teaching in which ophthalmic education is paired with neuroscience, neurology, endocrinology and geriatric medicine. **The ICO Task Force strongly recommends that international medical schools employ all methods to achieve these broad educational goals.** The Task Force judges these teaching techniques to be complimentary and not competitive in nature. As new information is rapidly acquired through randomized clinical trials, the Task Force believes that the importance of evidence-based medicine will continue to grow.

Educational Priorities

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Information that reflects a greater level of understanding is marked with two asterisks**.

Areas of cognitive and clinical skills that are more appropriate for students who seek further training in ophthalmology are marked with three asterisks***.

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 international 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.

A medical student should know the following:

- i) 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.*
- 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***
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 not is 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'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 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 fundusoscopic 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.
 - 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.
- (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 (as it affects direct ophthalmoscopy)*

- 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**
 - Measure near central acuity*
 - Understand optical principles of contact lens, intraocular lens, and refractive surgery**
 - 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
 4. 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. Esotropia: inward deviation - manifest*
 - c. Exophoria: outward deviation - not manifest**
 - d. Exotropia : outward deviation*- manifest
 - e. Hyperphoria: upward deviation - not manifest**

- f. Hypertropia: upward deviation*- manifest*
- g. Hypophoria: downward deviation - not manifest**
- h. Hypotropia: downward deviation* -manifest

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*
 - 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

- 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*
 - Understanding referral for leukocoria, amblyopia, and strabismus in a child 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*
 - d. Trigeminal Nerve*
 - e. 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
- III. How to examine the patient*
 1. Visual acuity testing*
 2. Visual field testing – confrontation*
 3. Extraocular motility*
 - a. strabismus
 - b. limitation movement of one eye
 - c. limitation of gaze (both eyes affected similarly)
 - d. nystagmus (spontaneous jerking eye movements)
 4. Direct Ophthalmoscopy*
- IV. How to interpret findings
 1. Pupillary disorders
 - a. dilated pupil*
 - b. tonic pupil**
 - c. afferent pupillary defect*
 - d. 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:

- 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
 - 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. 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 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*

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
 - b. Systemic hypertension*
 - Vasospastic (accelerated) retinopathy
 - Sclerotic (chronic) retinopathy
 - c. Atherosclerotic carotid occlusive disease*
 - Central retinal artery occlusion
 - Central retinal vein occlusion
 - Embolic cardiovascular disease
 - d. AIDS**
 - e. Disseminated metastatic cancer***
3. Fundus features of important ocular diseases
 - Retinoblastoma*
 - Retinal detachment**
 - Age-related macular degeneration*

VI. WHEN TO REFER PATIENT TO AN OPHTHALMOLOGIST

1. Whenever examination reveals abnormal features of *red reflex* or fundus**
2. 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*
- Recognize a change in red reflex*

6) LENS & 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

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 **

- 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
 - 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**
 - d. Eyebrow**
 - e. Levator aponeurosis**
 - f. Blood supply – internal and external carotid circulation***
 - g. Sensory supply – V₁ and V₂*
 - 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 cellulitis**
 - 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**

III. Orbit

- A. Examination technique
 - 1. Use visual techniques to identify axial and non-axial proptosis*
 - 2. Be familiar with exophthalmometer***
- B. Anatomy
 - 1. Seven bones comprise 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 II, IV, V, VI, sympathetics, and parasympathetics)*
 - 4. Relationship of orbit to surrounding structures – sinuses, cranial cavity*
- C. Orbital Diseases
 - 1. Orbital cellulitis*
 - 2. Graves' ophthalmopathy*
 - 3. Orbital inflammatory disease**
 - 4. Orbital tumors – vascular, nerve sheath, metastatic and lacrimal tumors***
 - 5. Orbital trauma**

Competencies:

- **Student should**
 - Understand basic structure and function of eyelids, and common malpositions, and acquired disorders.*
 - Understand tear production and drainage.**
 - 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:***
- 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:

- **Student should**
 - Understand refractive errors and their relations to eye length, corneal curvature, and lens status.*
 - Describe refractive surgical theory and practice.***
 - 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. background retinopathy-hard exudates, hemorrhages, microaneurysms*
 - b. preproliferative retinopathy-soft exudates, intraretinal microvascular abnormality***
 - c. proliferative retinopathy – neovascularization of the disc, neovascularization elsewhere*
 - 2. vitreous hemorrhage*
 - 3. ischemic optic neuropathy***
- II. Sickle cell anemia
 - A. Anterior segment
 - 1. importance of recognizing traumatic 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. exudates (cotton wool spots, macular star)*
 - 4. disc edema (malignant hypertension)*
 - B. Neuro-ophthalmic manifestations
 - 1. Cranial 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. homonymous hemianopia

- b. homonymous 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
 - 2. uveitis
 - a. non-granulomatous***
(associated diseases-JRA, Reiter, Behcet)
 - b. granulomatous***
(associated diseases-sarcoid, Tb, fungal)
- B. Diagnostic tests
 - 1. Imaging, gallium scan**
 - 2. ACE level**

VII. Malignancy

- A. Primary
 - 1. intraocular**
 - a. retinoblastoma**
 - b. uveal malignant 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

VIII. AIDS

- A. Anterior segment
 - 1. bacterial infections of the lids and adnexa*
 - 2. Kaposi sarcoma*
(conjunctiva or eyelid)
 - 3. Conjunctival tumors
- B. Posterior segment
 - 1. CMV retinitis*

IX. Syphilis

- A. Anterior segment
 - 1. interstitial keratitis***
 - 2. anterior uveitis**
- B. Posterior segment
 - 1. neuroretinitis**
 - 2. papillitis***
 - 3. 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*
 - Assess 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
 - 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:

- **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*
 - 1. Glands of Zeis and Moll
 - 2. Lashes
 - 3. Meibomian glands
 - 4. Lacrimal gland
 - B. Conjunctiva*
 - 1. Bulbar
 - 2. Palpaebreal
 - C. Regional lymph nodes**
 - 1. Pre-auricular
 - 2. Sub-mandibular
 - D. Cornea*
 - 1. Tear film layer
 - 2. Epithelium
 - 3. Stroma
 - 4. Endothelium
 - 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. Toxic
 - E. Episcleritis**
 - F. Scleritis**
 - G. Adnexal disease*
 - 1. Blepharitis*
 - 2. Thyroid eye disease*
 - 3. Dacryocystitis*
 - 4. Hordeolum*
 - 5. Chalazion*
 - H. Subconjunctival hemorrhage versus hyphema*
 - 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. Discharge
 - E. Itching

- IV. Steps to differentiate the red eye and how to interpret findings
 - A. Measure central acuity* (understand importance of reduced visual acuity)
 - B. Determine location of redness*
 - 1. Subconjunctival hemorrhage
 - 2. Conjunctival hyperemia (epibulbar, palpaebal or both)
 - 3. Ciliary flush associated with corneal inflammation, iritis, acute glaucoma#
 - C. Assess discharge and characterize*
 - 1. Profuse or scant
 - 2. Purulent, mucopurulent, or serous
 - D. Assess for corneal opacity associated with edema, inflammation, ulcer*#
 - E. Examine for corneal epithelial defect with fluorescein*
 - F. Estimate anterior chamber depth associated with acute angle closure glaucoma*#
 - G. Examine pupils importance with iritis, acute angle closure glaucoma*#
 - H. Measure intraocular pressure if elevation suspected***
 - I. Detect presence of
 - 1. Proptosis associated with orbital mass*#
 - 2. Lid malfunction*
 - 3. Limitation of eye movement*
 - 4. Pre-auricular lymph-node enlargement*

#Denotes condition that requires immediate ophthalmologic care

(From Basic Ophthalmology for Medical Students and Primary Care Residents, edited by Bradford CA, 7th Edition, 1999, Chapter 4, 58-76)

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
- Understand findings that are associated serious ocular conditions that require immediate ophthalmologic care

12) Glaucoma

I. Anatomy

A. Aqueous humor**

1. Production
 - a. Ciliary body
2. Circulation
 - a. From posterior chamber through pupil into anterior chamber
3. Outflow Pathway
 - a. Trabecular meshwork in anterior chamber angle

B. Optic Nerve*

1. “Glaucoma” as a chronic progressive optic neuropathy usually associated with increased intraocular pressure
 - a. Injury to axons from retinal ganglion cells at lamina cribrosa
 - b. Signs of optic nerve injury
 - (1) Increased size of central cup
 - (2) Asymmetric cupping

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. GIC1a (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. Ocular pain (may be severe)
 - b. Ocular redness*
 - c. Blurred vision and colored haloes; nausea
 3. Signs*
 - a. Dilated fixed pupil
 - b. Narrow anterior chamber angle
 - c. Pupillary block
 - d. 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
 1. Peripheral iridectomy
 - B. Primary open angle glaucoma***
 1. Argon laser trabeculoplasty
 2. 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 – increased cupping and asymmetric cupping*
- Obtain history to determine risk factors for primary open angle glaucoma*

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