# EYE SHORT Notes and Important Points

From Jatoi

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# Micro Organisms

* Hordoleum → Staph aureus
* Ulcerative Blepharitis → Staph aureus
  Staph epidermitis
* Squamous Cell Papilloma → HPV
* Kaposi Sarcoma → HHV-8 (Human Herpes Virus 8)
* Acute Canaliculitis → Actinomyces israelii
* Acute Dacryocystitis → Pyogenic organisms:
  Staphylococcus
  Streptococcus
  Pneumococcus
* Acute Dacryoadenitis →
  Viruses → EBV, CMV, Mumps, Infectious mononucleosis
  Bacteria → Staphylococcus, Streptococcus, Gonococcus
  Fungi → Histoplasma, Blastomyces

## ★ Bacterial Conjunctivitis

### (1) Mucopurulent Conjunctivitis

- Staph aureus
- Streptococcus pneumonia
- Hemophilus influenza
- Other Less Common → Moraxella lacunata
  Proteus spp
  Klebsiella

### (2) Purulent (Gonococcal) Conjunctivitis

- Neisseria gonorrhea

### (3) Membranous Conjunctivitis

- Corynebacterium diphtheriae

## ★ Chlamydial Conjunctivitis

Chlamydia trachomatis

- Trachoma → Serotype A-C
- Adult Inclusion Conjunctivitis → Serotype D-K
- Neonatal Inclusion Conjunctivitis → Serotype D-K

# Neonatal Conjunctivitis
## (Opthalmia Neonatorum)

- Chlamydia trachomatis serotype D-K
  - Neonatal Inclusion Conjunctivitis
  - within 1-3 weeks

- Neisseria gonorrhea
  - Gonococcal Conjunctivitis
  - in first week

- Other bacteria: Staphylococcus, Streptococcus pneumonia, Hemophilus influenza
  - within a week

- HSV-2
  - within 1-2 weeks

- Chemical Irritation (due to prophylactic silver nitrate or antibiotic drops)
  - within few hours after use

# VIRAL CONJUNCTIVITIS

* Epidemic Keratoconjunctivitis (EKC)
  - Adenovirus serotype 8, 19 and 37

* Pharyngoconjunctival Fever (PCF)
  - Adenovirus serotype 3, 4, 7

* Picornavirus Conjunctivitis
  - Enterovirus 70 → A member of picornavirus group

* Herpes Simplex Virus Conjunctivitis
  - HSV

* Molluscum Contagiosum Conjunctivitis
  - DNA virus of poxvirus group

* Covid Conjunctivitis
  - SARS-COV-2 virus

# Bacterial Corneal Ulcer (Bacterial Keratitis)

- Staph aureus
- Streptococcus pneumonia
- Gonococcus
- Moraxella
- Pseudomonas aeruginosa
- Klabsiella
- Proteus

# Fungal Keratitis (Keratomycosis)

- Filamentous Fungi
  - Aspergillus
  - Fusarium
  - Cuvularia
- Yeasts
  - Canaida sp.

# Viral Keratitis

- Herpes Simplex
- Herpes Zoster Ophthalmicus → HHV-3
- Adeno virus
- Measles
- Mumps

* Congenital Cataract due to Intra uterine infections

TORCH

Toxoplasmosis
Others → Syphilis, Varicella
Rubella → most frequent cause
Cytomegalovirus
Herpes Simplex Virus

* Pre Septal Cellulitis

Staph aureus
streptococcus pyogenes

* Orbital Cellulitis

Streptococcus pneumonia
Staphylococcus aureus
streptococcus pyogenes
Hemophilus influenza

* Toxoplasmosis
  - Toxoplasma gondii (intracellular protozoan parasite)

  - Definitive host → Cat
  - Intermediate host → Human and Live stock

* Endophthalmitis
  - Bacteria
    - Gram positive 90%
    - Gram Negative 10%
  - Fungi

# Imp Points

* Chalazion → Obstruction of Meibomian gland orifice

* Hordoleum Internum → suppurative infection of Meibomian gland

* Posterior blepharitis → hypersecretion of meibomian gland

* Sebaceous Gland Carcinoma → discrete painless nodule (may resemble Chalazion)
  ↓
  arises from meibomian gland

* S-shaped ptosis → felt as bag of fom → Neurofibroma

* S-shaped curve of eyelid margin → Acute Dacryoadenitis

* Blepharophimosis Syndrome
  - Ptosis
  - Telecanthus
  - Epicanthus inversus
  - Blepharophimosis (small palpebral fissures)

* Pinkish red lesion which blanches with pressure and swells on crying → Capillary hemangioma

* Shiny firm indurated nodule with blood vessels on its surface → Nodular Basal cell Carcinoma

* Pouting punctum → Acute canaliculitis

* Red and velvety conjunctiva → Gonococcal Conjunctivitis

* Discrete subepithelial opacities (Corneal Infiltrates)
  ↳ Epidemic Keratoconjunctivitis

* Arlt's line, Herbert's pits → Trachoma

* Giant papillae
  Cobblestone appearance → Vernal Keratoconjunctivitis

* Trantas dots → Vernal Keratoconjunctivitis

* Stocker Line → Pterygium
  (Linear epithelial iron deposition)

* Bitot spots → Vit A deficiency

* Corneal stain with 2% Fluorescein → pathognomonic of corneal ulcer

* Greyish white ulcer with filamentous or feathery edges → Fungal keratitis

* Multifocal or Satellite lesions → Fungal Keratitis

* Yellow white infiltration with dense suppuration
  ↳ Candidal keratitis

* Dendritic ulcer (club shaped ends) → Acute epithelial keratitis (HSV 1, 2)
  Geographical (amoeboid) ulcer

* Disc shaped, localized grayish area of corneal edema → Disciform keratitis

* Wessely immune Ring → Disciform keratitis

* Hutchinson's Sign → Herpes Zoster

* Dendritic ulcer (ends NOT club shaped) → Herper Zoster Ophthalmicus

* Ring infiltrate (Ring Abscess) → Acanthamoeba keratitis

* Perineural infiltrates + Enlargement of corneal nerves
  ↳ Acanthamoeba keratitis

* Shaffer Sign → pathognomonic of retinal tear

* Cherry Red spot → CRAO

- Central Oil Droplet Cataract
  - characteristic of galactosemia

- Blue Dot Cataract
  - Trisomy 21 / Down's Syndrome

- Stellate or Rosette shaped opacity in anterior part of lens
  - Cataract due to trauma

- Sunflower Appearance Cataract
  - Wilson's disease

- Age Related (senile) Cataract
  - Posterior Subcapsular → Cupuliform
  - Cortical → Cuneiform
  - Nuclear

- Wedge shaped (Cuneiform) opacities / cortical spokes
  - Cortical Senile Cataract

- Snowflake Cataract
  - Diabetes

* Cortical Cataract → Hypermetropic Shift
  Angle closure Glaucoma

* Nuclear Cataract → Myopic Shift

* Immature or Mature Cataract → Phacomorphic Glaucoma

* Hypermature cataract → Phacolytic Glaucoma

* Morgagnian cataract → Nucleus sinks into bottom of lens

* Posterior Capsular opacification
  • Elschnig's pearls

* Aphakic eye is highly hypermetropic due to absence of lens

* Myopes are predisposed to POAG

* Hyperopia → POAG

* Myopia → Pigment Dispersion Syndrome
  ↳ Pigmentary Glaucoma

* High Myopia → Rhegmatogenous Retinal Detachment

* Aphakia and Pseudophakia → Rhegmatogenous RD

* High Myopia → Retinitis pigmentosa

* High Axial Myopia → Pseudo proptosis

* Index Hypermetropia → Cortical Cataract

* Amblyopia common in
  - High hypermetropia
  - Unilateral hypermetropia

* Cotton wool Spots
  - Diabetic Retinopathy
  - Hypertensive Retinopathy
  - Non ischemic CRVO
  - Ischemic CRVO
  - Papilledema

* Dot blot and Flame shaped hemorrhages
  - Diabetic Retinopathy
  - Hypertensive Retinopathy
  - Ischemic CRVO

* IRMA → Diabetic Retinopathy
* Salus Sign, Gunn sign, Bonnet sign → Hypertensive Retinopathy
* Copper wire and Silver wire appearance of arterioles → Hypertensive Retinopathy
* Elschnig spot, Siegrist Streak → Malignant HTN
* Tomato Splashed appearance of Fundus → Ischemic CRVO
* Enlarged foveolar avascular zone → Ischemic CRVO
* Diminished b wave → Ischemic CRVO, CRAO

* Amaurosis Fugax → CRAO
* Macular star → Neuroretinitis
  Papilledema
* Paton's lines → Papilledema
* Heterochromia → Horner Syndrome
* Foster Fuchs spot → Pathological myopia
* Tear Drop Sign on CT → Blow out Fracture

- First line Tx for POAG → Prostaglandins
  2nd DOC for POAG → $\alpha_2$ Agonists

MRI

## Indications

MRI is particularly suitable for examining soft tissue structures and nervous tissue, e.g.:

- Injury of cartilaginous structures and ligaments (e.g., ankle joint and cruciate ligament injury)
- Tumor evaluation (e.g., breast cancer)
- Evaluation of CNS disease (e.g., encephalitis, demyelination, acoustic neuroma)

The American College of Radiology offers ACR Appropriateness Criteria®, which are evidence-based guidelines intended to help healthcare providers in making clinical decisions regarding imaging for a wide variety of diagnostic and interventional topics. They can be found at https://acsearch.acr.org/list. [1]

MRI is indicated especially for the evaluation of soft and nervous tissue, while CT is preferable in the emergency setting and for the evaluation of bone structures!

CT

## Indications

As with any radiographic study, performing a CT scan should always be weighed against the risks associated with radiation exposure. CT scan has a very wide range of indications, including:

- Visualization of abdominal organs (e.g., in nonspecific acute abdomen)
- Visualization of bones and joints in multiple trauma
- Evaluation of brain parenchyma for diagnosis of acute cerebral hemorrhage
- CT angiography is performed for visualization of vascular changes (e.g., intracranial aneurysm, peripheral artery disease).

# POAG Risk Factors

- Age
- Myopia
- Diabetes
- Contraceptive pill
- CRVO
- Retinitis pigmentosa

# Acute Primary Angle Closure Glaucoma

- Pain
- Perception of halos around eyes
- Decreased visual Acuity
- Raised IOP → may be as high as 70 mmHg
- Conjunctiva → Red and congested
- Limbus → marked ciliary congestion
- Cornea → Cloudy
- Aqueous Flare
- Pupil → mid dilated and fixed
- Iris → white atrophic patches
- Lens → Glaukomflecken (anterior subcapsular lens opacities)
- Optic Disc swelling
- Gonioscopy → narrow angle

# ✱ Neovascular Glaucoma

## Causes

- Ischemic CRVO → Most common cause
- Diabetic Retinopathy → Common cause
- Ocular ischemic Syndrome
- Eale's disease
- Chronic intraocular inflammation
- Intra ocular tumors

## Clinical Features

- Pain
- Neo-vessels on Pupillary margin
  Iris Anterior surface
  Anterior chamber Angle

- ↑ IOP
- Anterior Chamber → Flare cells
  Hyphema
  Ciliary congestion

- Gonioscopy → Abnormal vessels in angle

## ✯ Phacomorphic Glaucoma

- swollen cataractous lens cause pupillary block, iris bombe and angle block

## ✯ Phacolytic Glaucoma

- complication of hypermature cataract
  ↓
  soluble lens proteins leak from intact anterior capsule

## ✯ Phaco anaphylactic Glaucoma

- inflammatory reaction to lens protein
  - Cornea → keratic precipitates
  - Anterior chamber → Flare cells, hypopyon, Synechiae

## ✯ Ghost Cell Glaucoma

- occur in vitreous hemorrhage
- Ghost cells → Hb leak from red cells and become empty spherical khaki colored cells

# ✡ Congenital Glaucoma

- Lacrimation, photophobia, blepharospasm
- Corneal haze (corneal clouding) → Corneal edema
- Buphthalmos (enlarged eyeball like an ox eye)
- Enlargement of corneal diameter
- Breaks in Descemet's membrane
- Haab striae → healed breaks in Descemet membrane
- Deep Anterior Chamber
- Axial myopia → due to enlargemet of eye
- Glaucomatous cupping
- Reduced visual acuity
- Corneal edema

# ✱ Anterior Uveitis

- Deep ocular pain → worse at night
- Reduced visual acuity
- Circum corneal congestion
- Cornea → keratic precipitates
- Anterior Chamber → Aqueous Flare
  Aqueous cells
  Fibrinous exudates
  Hypopyon
- Iris → muddy in appearance
- Pupil → miosis
  sluggish reactions to light
  irregular pupil shape
- Posterior synechiae
- Poor red reflex
- Fundus → Normal

# ✱ Chronic Anterior Uveitis

- Flare and cells
- Mutton Fat KPs → due to greasy appearance
- Posterior synechiae, occlusio pupillae, Ring Synechiae
- Iris Nodules → Koeppe and Busacca nodules
  ↓ along pupillary border
  ↓ within Stroma of iris

* Granulomatous →
- Mutton Fat KPs present
- Iris nodules usually present
- Posterior Synechiae → Thick and broad based
- Fundus → Nodular Lesions
- Pain → Minimal
- Onset → Insidious

* Non Granulomatous
- Mutton Fat KPs → Small
- Iris nodules usually Absent
- Posterior Synechiae → Thin and tenuous
- Fundus → Diffuse Involvement
- Pain → Marked

## ✱ Intermediate Uveitis (Pars Planitis)

- Insidious onset of blurred vision
- Vitreous cells
- Snow balls
- Snowbanking
- Peripheral vasculitis/periphlebitis with venous sheathing
- Neovascularization
- Optic Disc Edema/swelling

## ✱ Posterior Uveitis (Choroiditis)

- Reduced vision
- Floaters → black spots moving in front of eye
- Metamorphopsia
- Photopsia
- Positive scotoma

- Headlight in fog sign → Toxoplasmosis
- Pizza pie appearance → CMV
- Cotton ball colonies → candida

# Uveitis

* Most common cause of Retinochoroiditis (Posterior uveitis)
  - Toxoplasmosis

# ASSOCIATIONS

* Anterior Uveitis
  - Idiopathic
  - HLA-B27
  - Seronegative Spondyloarthropathies
    - Ankylosing Spondylitis
    - Reiters Syndrome
    - Inflammatory bowel disease

* Intermediate Uveitis
  - Idiopathic
  - Systemic Diseases
    - Sarcoidosis
    - Syphilis
    - TB
    - Multiple sclerosis
    - Cat scratch disease
    - Lyme disease
    - Toxoplasmosis
    - Toxocariasis

* Posterior Uveitis
  - Toxoplasmosis
  - TB
  - Sarcoidus
  - Infections
    - Bacterial
    - Fungal
    - Viral
    - Parasitic

* Radial Spoke-like Trans illumination Defects
  in iris
  - Pigment Dispersion Syndrome
    ↳ may lead to pigmentary Glaucoma

* Pigment Dispersion Syndrome
  - may lead to pigmentary Glaucoma
  - Radial spoke-like trans illumination defects
    in iris
  - Cornea → Krukenberg spindle (pigment deposition
    in vertical spindle shape)

* Differential Diagnosis of Leukocoria (whitish pupillary Reflex)

- Congenital cataract
- Retinoblastoma
- Retrolental fibroplasia
- Anterior persisent hyperplastic primary vitreous (APHPV)
- Coat's disease
- Endophthalmitis
- Toxocarial granuloma

# ENDOPHTHALMITIS

- Inflammation of intra ocular structures of eye
- Exogenous Source of Infection
  - Trauma
  - Perforating Corneal ulcer
  - Intra ocular surgery e.g cataract, glaucoma
  - After intravitreal injection
- Endogenous Infection

* Signs
  - Swollen eyelids
  - Conjunctiva → congestion and chemosis
  - Cornea → hazy
  - Anterior chamber → Fibrinous exudate, Hypopyon
  - Loss of Red Reflex
  - Vitreous exudation
  - ↑ IOP → early stage
    ↓ IOP → later due to ciliary process destruction

# DIABETIC RETINOPATHY

Capillary leakage

- Retinal edema
  - Exudates
  - Retinal hemorrhages

capillary occlusion

- cotton wool spots
- IRMA (Intraretinal Microvascular Abnormalities)

- Neovascularization

Visual Loss Due To

- Macular edema, exudation or hemorrhage
- Macular ischemia
- Neovascularization leading to
  - Vitreous hemorrhage
  - Tractional Retinal detachment
  - Neovascular glaucoma

# Diabetic Retinopathy

## Background Diabetic Retinopathy

- Micro aneurysms → earliest detectable
- Retinal edema
- Retinal hemorrhages
  - Flame shaped
  - Dot blot
  - Dark blot
- Hard exudates

- IRMA do not bleed
- Neovascularization bleed and cause vitreous hemorrhage

## Pre-proliferative Diabetic Retinopathy

- Cotton wool spots (Soft exudates)
- Generalized dilatation and tortuosity of veins
- IRMA

## Proliferative Diabetic Retinopathy

- Retinal Neovascularization → hallmark of proliferative stage
  - NVD (New vessels on disc)
  - NVE (New vessels elsewhere)
- Neovascularization of iris
- Pre-retinal hemorrhage → in Retrohyaloid space
- Vitreous hemorrhage
- Tractional Retinal detachment

## Diabetic Maculopathy

- Focal Macular edema
- Diffuse (cystoid) macular edema
- Clinically Significant Macular edema

# Advanced Diabetic Eye Disease

- Persistent vitreous hemorrhage
- Tractional Retinal detachment
- Neovascular glaucoma

# Hypertensive Retinopathy

* Grade 1
  - Generalized arteriolar narrowing
  - Broadening of arteriolar light reflex
  - Concealment of vein by arteriole

* Grade 2
  - Focal arteriolar constriction (narrowing)
  - AV crossing (AV Nicking)
    - Salus sign
    - Gunn sign
    - Bonnetls sign

* Grade 3
  - Retinal edema
  - Hard exudates
  - Cotton wool spots and hemorrhages, Dot blot - Flame shaped
  - Arteriole → Copper wire color

* Grade 4
  - Optic Disc Edema
  - Arterioles → Silver wire color

# Malignant Hypertension

- Bilateral Disc edema (papilledema)
- Fibrinoid Necrosis of Choroidal Arteriales
  - Elschnig's spot → yellow RPE
  - Siegrist's streaks → RPE hyperplasia over choroidal infarcts
  - Exudative Retinal detachment

# Toxemia of pregnancy

## Stage of Angiospasm

Severe arteriolar spasm → M/C Fundoscopic finding

- Retinal Vessels → Corkscrew
- Narrowing of nasal arterioles → Initially
  Generalized narrowing → Later

## Stage of Hypoxic Retinopathy

- Cotton wool spot
- Superficial retinal hemorrhages
- Retinal edema
- Hard exudates
- Optic disc swelling
- Exudative Retinal detachment

# Non-Ischemic CRVO
## (Venous Stasis Retinopathy)

- sudden onset of unilateral painless loss of vision
- Afferent pupillary defect → Absent or mild
  - ↑ IOP
- Fundus Examination
  - Spontaneous Venous pulsation → Absent
  - Retinal Veins → dilated, engorged, tortuous
  - Dot blot and flame shaped hemorrhages in all four quadrants
  - cotton wool spots
  - Optic disc and macular edema → mild
- FFA → Capillary perfusion
- OCT → Severe macular edema
- ERG → Normal

# ISCHEMIC CRVO

- sudden monocular painless loss of vision
- Visual Acuity → Reduced to counting fingers or hand movements

- RAPD is marked
- ↑ IOP

## FUNDUS EXAMINATION

- Retinal Veins → very tortuous and enlarged
- Retinal hemorrhages → Extensive deep blot and flame shaped in all 4 quadrants

Tomato Splashed Appearance

- Macular hemorrhages
- Macula → severely edematous
- Disc edema and hyperemia
- Cotton wool spots
- Break through vitreous hemorrhage

## FFA

- extensive area of capillary non perfusion

## ERG

- Reduced Amplitude of b-wave

continued..

## OCT

- Macular edema
- Intra/ subretinal fluid
- Epiretinal membrane (ERM)
- Retinal Atrophy

## OCT Angiography

- Enlarged Foveolar Avascular Zone (FAZ)
- ↑ para foveal Capillary non perfusion
- ↓ Parafoveal vascular density

# Pathognomonic Features of Ischemic CRVO (Differentiating it from Non ischemic)

- RAPD
- Visual field defects
- ERG → Reduced b wave
- Rubeosis irdis → Neovasculanization of iris
- Neovascular glaucome

# CRAO

- suaden, severe, painless loss of vision
- Amaurosis fugax → painless temporary loss of vision
- Visual Acuity → profound loss of visin ranging from counting fingers to perception of light
- RAPD → profound
  — sometimes total (Amaurotic pupil)

- Fundus Examination
  - pale, whitish appearance of Retina
  - Cherry red spot - The orange Reflex
  - marked narrowing of Retinal arteries
    Mild narrowing of Retinal veins
  - Cattle Tracking
  - Retinal Emboli → visible in 20-40%
  - Optic Atrophy → After few weeks
- OCT → Embolic plaque at optic nerve head
- FFA → Delay in arterial filling
  ↳ masking of choroidal fluorescence due to retinal edema
- ERG → diminshed b wave

# Rhegmatogenous Retinal Detachment

- Flashes (photopsia)
- Floaters → moving black spots
- Sudden painless loss of vision
- Field Defects → perceived as dark curtain in front of eye
- Visual Acuity → Reduced
- RAPD present
- ↓ IOP (5mm Hg lower than normal)
- Tobacco dust (Shaffer's Sign) → pigment cells in anterior vitreous

Shaffer Sign → pathognomonic of Retinal tear

- Demarcation line (high water or tide marks) occur after 3 months
- Intra Retinal cyst may occur after 1 year

# Retinitis Pigmentosa

- hereditary progressive degenerative disorders of retina
  - Autosomal dominant → best prognosis
  - Autosomal Recessive
  - X Linked → worst prognosis
- Atrophy of RPE and photoreceptors (predominantly rods)
- Photoreceptor Dystrophy start at equatorial Region
- Night blindness → early symptom
- Visual Field Constriction → gradually result into a small tunnel vision
  - classic Ring Scotoma
- Defective vision during day
- Blindness → Advanced Stage → involvement of macula
- Appearance of bone corpuscles / bone spicules on RPE due to pigment deposition
- Contrast sensitivity affected earlier than visual acuity
- Thread like Retinal blood vessels
- Optic Disc has waxy appearance
- Maculopathy may be either:
  - Atrophic patch
  - Cellophane maculopathy
  - Cystoid macular edema

# Retinoblastoma

- Congenital malignant tumor arising from retinoblasts of sensory retina
- Presents within 3 years of life
- Gene → Chromosome 13q14
- Heritable Retinoblastoma → RB gene mutation in all cells of body

- Non Heritable → RB gene mutation only in eye cells

- Exophytic Growth → common
  ↳ grows towards subretinal space and detach retina
  - Gives appearance of exudative retinal detachment with subretinal, multilobulated white mass
- Endophytic Growth → tumor protrudes from retina into vitreous cavity, retina is not detached
  - Pale pink or white mass with newly formed blood vessels on its surface

- Spread through optic nerve
- Most common metastasis → Bones

# Stages of Retinoblastoma

## Quiescent Stage

- lasts for 6 months to 1 year
- Leukocoria (white pupillary Reflex) → Most Common
- Convergent Squint → 2nd most common
- Decreased Vision
- Calcium Deposition
  - on surface Tumor → white pearly
  - within the tumor → Chalky white

## Inflammatory / Glaucomatous Stage

- Pseudo hypopyon → intra ocular inflammation
- Painful Red eye due to secondary Glaucoma

## Extra ocular Extension Stage

- Extends outside eyeball → Marked proptosis

## Metastasis Stage

- Direct Extension → along optic nerve to brain
- Lymphatic Spread → to pre auricular lymph nodes
- Bloodstream → to liver and other organs

# Causes of Neovascular Glaucoma

- Ischemic CRVO → Most common cause
- Diabetic Retinopathy → common cause

## ✯ Optic Neuritis → inflammation of optic nerve

- Acute or subacute mono ocular visual los
- Discomfort or pain in or around eye
- Phosphenes → sensation of tiny white or colored flashes or sparkles produced by pressure on eyeball
- Reduced visual acuity
- Impaired color vision
- RAPD
- Central or centrocecal scotoma

## ★ Fully Developed Papilledema

- Normal visual acuity
- Normal pupil reactions
- Disc → hyperemic, elevated with blurred margins
- Venous pulsation → Absent when IOP > 20-25mmHg
- Splinter and flame shaped hemorrhages
- Cotton wool spots and exudates
- Incomplete macular star
- Paton's lines
- Earliest Sign → loss of Spontaneous venous pulsation
  blurring nasal disc margin
- M/c Visual Field Defect → Enlargement of blind spot

## ★ Chronic Papilledema

- Visual acuity reduced
- Hemorrhage, exudates, edema resolves
- Disc → Champagne cork appearance
- Blind spot enlarge
  Visual field constit

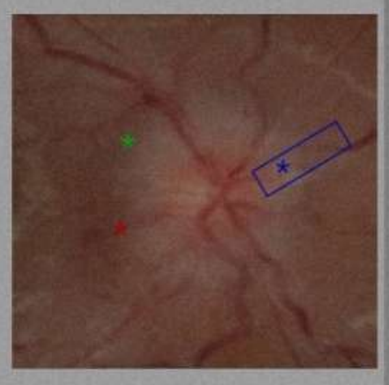
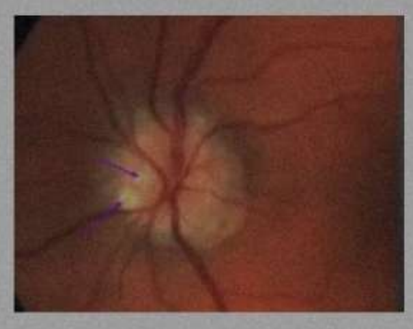
## ↳ Atrophic papilledema

- Visual acuity → severely impaired
- Disc → greyish white with blur margins

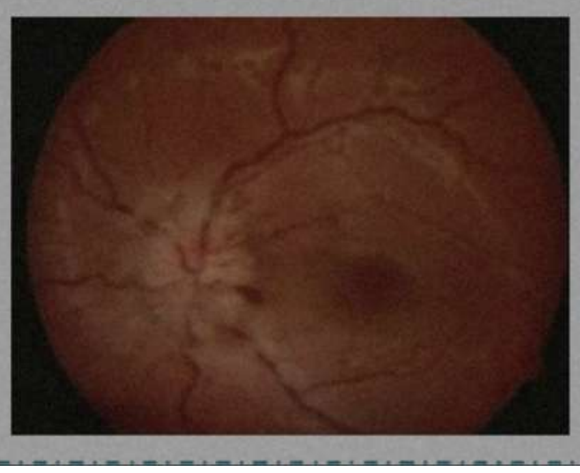
* Macular Star → Optic Neuritis
  ↳ Papilledema

* Paton's lines → Papilledema

• Champagne cork appearance of disc → Papilledema

| Optic disc edema | Congenital disc elevation |
| --- | --- |
| 1- Hue of fluids (*)<br>2- Splinter hemorrhage indicating ischemia (*)<br>3-Blood vessels can't be traced; some parts appearing and other disappearing (*)  | 1- Optic disc margins blurred and the cup is absent<br>2- No edema, hemorrhage<br>3- May be associated with hyperopia<br>4- Drusens (*)  |

- **Papilledema**
  - Bilateral swelling of the optic discs secondary to increased intracranial pressure.
  - **Fundoscopy:**
    - Hyperemia of the disc
    - Tortuosity of the veins and capillaries
    - Blurring and elevation of disc margins
    - Peripapillary flame shaped haemorrhages
  - **Look for spontaneous venous pulsation**. If present = pseudopapilledema
  - **Cause:**
    - Intracranial mass
    - Severe systemic hypertension
    - Idiopathic intracranial hypertension (pseudotumor cerebri)



Bilateral optic neuritis can cause similar findings but with NO elevation of ICP!

# Afferent Visual System Tests

439 only

## Afferent Visual System Tests

- **During exam:**
  - Visual field test.
  - A and B scans (ultrasound of the eyeball) : when you have a patient with cataract and you can't see the fundus (optic nerve)
  - Optical Coherence Tomography (OCT) it can show the anatomy of retina in ten layers (it can be used in macular edema to show the exact location of the abnormality
  - Electroretinography (ERG) like ECG it measures the function of photoreceptor
  - Visual Evoked Potential (VEP) test the conductivity of the optic nerve
  - *the doctor said you don't have to know these tests

- **Neuroimaging:**
  - CT scan
  - MRI scan

- **Blood test:**
  - Vasculitis (ESR, CBC, ANA, VDRL) because the optic nerve can be affected by SLE, sarcoidosis ,TB, syphilis, behçet disease.
  - LFT (SGOT[1], SGPT[2], Alkaline phosphatase).
  - Urine analysis
  - Creatinine, BUN
  - Electrolytes

- **Ultrasound:**
  - Carotid doppler , orbital color doppler

- **Genetic evaluation.**
  -

- [1] Serum glutamic oxaloacetic transaminase
- [2] Serum glutamic pyruvic transaminase

## Extraocular muscles function

| Muscle | Primary | Secondary | Tertiary |
|---|---|---|---|
| Medial rectus | Adduction | | |
| Lateral rectus | Abduction | | |
| Inferior rectus | Depression | Excyclotorsion | Adduction |
| Superior rectus | Elevation | Incyclotorsion | Adduction |
| Inferior oblique | Excyclotorsion | Elevation | Abduction |
| Superior oblique | Incyclotorsion | Depression | Abduction |

| EOM | Primary action | Innervation | Nucleus |
|---|---|---|---|
| Superior rectus | Elevation (maximal on lateral gaze) | Third cranial nerve, oculomotor | Midbrain |
| Inferior rectus | Depression (maximal on lateral gaze) | Third cranial nerve, oculomotor | |
| Medial rectus | Adduction | Third cranial nerve, oculomotor | |
| Inferior oblique | Excyclotorsion | Third cranial nerve, oculomotor | |
| Superior oblique | Incyclotorsion | Fourth cranial nerve, trochlear | |
| Lateral rectus | Abduction | Sixth cranial nerve, abducens | Pons |

- All Recti muscles arise from Annulus of Zinn and inserted on sclera

Medial

Lateral

Inf R

SR

IO

SO

Adduction

Abduction

Depression

Elevation

Excyclo

Incyclo

Excyclo

Elevation

Depression

Add

Add

Inc

Abd

Abd

All 3rd

SO4

LR6

★ 3rd Nerve palsy

- eye is out and down
- ptosis
- diplopia
- pupil → dilated and poor response to light

◦ Diabetes and HTN cause pupil sparing 3rd nerve palsy

★ 4th nerve palsy

- Diplopia in down gaze (at near distance or reading)
- Head tilt
- Hypertropia

★ 6th nerve palsy

◦ Diplopia

◦ Esotropia in primary gaze

- Peribulbar anesthesia given in peripheral orbital space
- In orbital cellulitis, pus collects in subperiosteal space
- In cataract surgery, anesthetic agent given in Subtenon's space

# *Thyroid Eye Disease / Graves ophthalmopathy

- enlargement of extra ocular muscles → 4→3 times (inferior and medial Rectus most commonly affected)
- proptosis (exophthalmos)
- papilledema
- Restrictive myopathy
- Diplopia
- Optic neuropathy
- Retrobulbar discomfort
- Periorbital swelling
- Conjunctiva → hyperemia and chemosis
- Cornea → epithelial erosion, superior limbic keratoconjunctivitis
- Keratoconjunctivitis sicca
- Retraction of upper eyelid → Dalrymple's sign

↳ characteristic findings

- Kocher Sign → staring and frightened appearance of eyes
- Von Graefe Sign → Lid Lag
- Stellwag's Sign → infrequent blinking
- Mobius Sign → weakness of convergence

Grading → NO SPECS

* Vossius Ring → pigment deposition on lens due to mechanical compression of iris against anterior surface of lens

* 8 ball hyphema → Total hyphema with bright red blood

4 Black ball hyphema → Total hyphema with dark red-black blood

# Hypermetropia
## (Far Sightedness)

- close object are more blur
- Total Hypermetropia = Latent + Manifest

Manifest → Facultative + Absolute

- Latent → +1 D → corrected by normal physiological tone of ciliary body
- Facultative → corrected by effort of accomodation

### Clinical Features
- Asthenopia
- Defective Vision
- Convergent Squint

### Signs
- Reduced visual Acuity
- Eyeball size normal or small
- Fundus → pseudopapilledema when hypermetropia exceed 5 Diopter
- A-Scan → short Axial length

Tx → Convex lens

Surgical → PRK, Lasik, Conductive keratoplasty

- Index Hypermetropia
  - ↓ in Refractive index of lens
  - Cataract

- Index Myopia
  - ↑ in Refractive index of lens
  - Nuclear Sclerosis

* Posterior Displacement of lens → Hypermetropia

* Anterior Displacement of lens → Myopia

* Simple Myopia → Seldom exceed 6 Diopters

* Pathological Myopia → Reach 15-20 Diopters in early adulthood

- Simple Myopia → Fundus is normal
- Pathological Myopia → Degenerative myopic changes in fundus

# Pathological (Degenerative) Myopia

- Changes in Optic Disc
  - Myopic crescent
  - Peripapillary Atrophy
  - Super Traction crescent
- Breaks in Bruch's membrane (Lacquer cracks)
- Choroidal Neovascularization
- Foster Fuchs spot → Dark pigmented lesion in macula due to hemorrhage and Pigmentation
- Diffuse / patchy chorioretinal atrophy
- Posterior staphyloma → Abnormal protrusion of uveal tissue through weak point in eyeball. Protrusion is generally black in color
- Degenerative holes in peripheral retina
- ↑ incidence of retinal detachment
- Degenerative changes in vitreous

Symptoms:
- Blurred vision for distance
- Divergent Squint (exodeviation)

# Regular Astigmatism

* With-the-rule Astigmatism
  - vertical meridian is more curved

* Against-the-rule Astigmatism
  - horizontal meridian is more curved

* Oblique Astigmatism
  - The two principal meridians are at right angle to one another (e.g 45° and 135°)

# Irregular Astigmatism

- irregular change of refractive power in different meridians due to irregularities in corneal curvature
- No geometrical figure of focus formed on retina

## Causes

- Keratoconus
- Corneal injury
- Scarring
- Previous eye surgery
-

* Refractory power of Cornea
  - Anterior Convex Surface = +48 D
  - Posterior Concave Surface = −5 D
  - Average power of cornea = +43 D

* Refractory power of lens = 18 − 20 D

* Normal Refractive power of eye = +59 D

Lesions In

* Optic Nerve → Complete blindness of same eye
* Optic Chiasm → Bitemporal hemianopia
* Left optic tract → Left homonymous hemianopia

Right optic tract → Right homonymous hemianopia

Pri  Elevators = IO + SR
Depressors = IR + SO

## Diagnosis

- **Horizontal** paralytic strabismus
  - Exotropia → medial rectus **weakness** → oculomotor nerve palsy
  - Esotropia → lateral rectus **weakness** → abducens nerve palsy
- **Vertical** paralytic strabismus: perform a 3-step Park-Bielchowsky test

| Steps | Inference | Underlying principle |
|---|---|---|
| **Step 1**: Determine which eye is hypertropic in primary gaze. | • Hypertropic right eye → weakness of right eye depressors or left eye elevators<br>• Hypertropic left eye → weakness of right eye elevators or left eye depressors | • Elevators: inferior oblique, superior rectus<br>• Depressors: inferior rectus, superior oblique |
| **Step 2**: Determine whether hypertropia increases on the right or left gaze. | • Vertical strabismus increases on looking right → weakness of right superior rectus, right inferior rectus, left superior obliquus, or left inferior obliquus<br>• Vertical strabismus increases on looking left → weakness of right superior obliquus, right inferior obliquus, left superior rectus, or left inferior rectus | • Superior and inferior rectus muscles have their greatest vertical action when the eye is abducted.<br>• Superior and inferior oblique muscles have their greatest vertical action when the eye is adducted. |
| **Step 3**: Determine whether hypertropia increases on right or left head tilt. | • Vertical strabismus increases on tilting the head towards the right shoulder → weakness of a right eye intorter or a left eye extorter<br>• Vertical strabismus increases on lilting the head towards the left shoulder → weakness of a left eye intorter or right eye extorter | • Intorters: superior oblique, superior rectus<br>• Extorters: inferior rectus, inferior oblique |

Primary Gaze

- Elevators = IO + SR
- Depressors = IR + SO

Hypertropia ↑ on Right or Left Gaze

↓

Ipsi SR + IR

Cont IO + IO

↙

Ipsilateral SR + IR

Contralateral SO + IO

# Systemic Drugs with ocular Side Effects

* Corticosteroids
  - Posterior Subcapsular Cataract
  - Open Angle Glaucoma
  - Central Serous Chorioretinopathy

* Cyclosporin
  - bilateral Vision loss

* Ethambutal
  - Toxic optic neuropathy

* Ritampicin
  - orange, light pink, or red tears

* Antimalarial Medications: Chloroquine and Hydroxy chloroquine
  - Retino toxic
  - moderate to severe visual loss with bull eye macular lesion characterized by foveolar island of pigment surrounded by a depigmented zone RPE atrophy.
  - Retinal arterioles may become attenuated
  - Pigment clumps can form in peripheral retina

* Digoxin
  - Decrease visual acuity
  - Xanthopsia → yellow colored vision
  - Chromatopsia → abnormal coloration of objects
  - Photopsia → sparkles of light in vision
  - Photophobia
  - Blind spots near center of vision

* Amiodarone
  - Deposits in cornea in the form of whorled pattern and produce vortex keratopathy
  - optic neuropathy

* Beta Blockers
  - Dry eyes
  - Glaucoma progression
  - Decreased IOP

* OCP
  - papilledema
  - optic neuropathy
  - brain infarction

* Anti Cholinergic (Dicyclomine, Hyoscamine)
  - Dry eye and Dry mouth
  - Pupillary dilation
  - Decreased accomodation
  - Acute angle closure glaucoma → in patients with shallow anterior chamber

* $\alpha_1$ Blockers (Tamsulosin)
  - Intra operative floppy iris Syndrome

* Sildenafil, Verdenafil, Tadalafil
  - pupillary dilatation
  - Redness and Dryness
  - Blurred vision
  - Temporary bluish coloration of vision
  - Ischemic optic neuropathy
  - Central serous retinopathy
  - Conjunctival hemorrhage

* Tamoxifen
  - Decreased vision due to intraretinal crystalline deposits
  - Macular edema
  - Localised Retinal pigmentary changes

* Vitamin A
  - increased intracranial pressure
  - papilledema

* Bisphosphonates
  - orbital inflammation
  - uveitis
  - scleritis

* Interferon A
  - Retinopathy → cotton wool spots and retinal hemorrhages near optic nerves
  - CRAO
  - CRVO
  - Branch Retinal artery occlusion
  - Cystoid macular edema
  - Optic disc edema
  - irreversible visual loss

* Fluoroquinolones
  - Retinal Detachment

* Anti Psychotic
  - Progressive retinal toxicity characterized by salt and pepper pigmentary disturbance
  - Diffuse loss of RPE and choriocapillaris

* Anti Histamines
  - Mydriasis
  - Dry eyes
  - Decreased accomodation and blurred vision
  - Risk of angle closure glaucoma

* Deferoxamine → Chelating Agent
  - Retinal Toxicity → Damage to RPE and bull's eye maculopathy
  - Retrobulbar optic neuritis
  - Cataract formation

## Preseptal cellulitis vs. orbital cellulitis

| | Preseptal cellulitis | Orbital cellulitis |
|---|---|---|
| **Location** | • Confined to soft tissues **anterior** to orbital septum | • Involves soft tissues **posterior** to the orbital septum |
| **Etiology** | • Most common: direct inoculation, e.g., scratch, bite | • Most common: **bacterial sinusitis** |
| **Distinguishing clinical features** | • Fever can be present<br>• No red flags for orbital cellulitis | • Systemic signs of infection (e.g., fever, malaise) often present<br>• Red flags of orbital cellulitis present |
| **Diagnostics** | • Clinical diagnosis | • Clinical diagnosis confirmed on CT orbits and sinuses with contrast |
| **Treatment** | • Empiric oral antibiotics | • Empiric IV antibiotics |
| **Complications** | • Rare | • Visual loss<br>• Orbital compartment syndrome<br>• Systemic or CNS infections (e.g., brain abscess)<br>• **Cavernous sinus thrombosis** |