



## **Abnormal Vision**

Common neuro-ophthalmic presentations treated in the emergency department include double vision, blindness, and decreased vision. The lecturer will describe the integration of the history with the physical examination of the ocular system to locate the neuro-ophthalmic abnormality. Case studies will be used as examples of abnormal vision presentations.

- Describe the anatomy and physiology of the neuro-ophthalmology system.
- Discuss the etiology of visual disturbances based on the history and focused physical examination.

WE-143  
Wednesday, October 13, 1999  
12:30 PM - 1:25 PM  
Room # N204  
Las Vegas Convention Center

## **FACULTY**

Andy S Jagoda, MD, FACEP

Associate Professor, Associate  
Residency Director, Department of  
Emergency Medicine, Mount Sinai  
School of Medicine, New York, New  
York

## ABNORMAL VISION

Andy Jagoda, MD, FACEP  
Mount Sinai School of Medicine  
Department of Emergency Medicine  
New York, New York

---

---

---

---

---

---

---



## OVERVIEW

- Initial assessment
- Pupils
- Loss of vision
- Diplopia

---

---

---

---

---

---

---



A 30 YO FEMALE IS IN AN MVA HITTING  
HER HEAD ON THE DASH. THE NEXT DAY  
SHE DEVELOPED A SUDDEN ONSET  
SEVERE RIGHT FRONTAL HA.

IN THE ED SHE HAD AN OD PTOSIS AND OD  
MIOSIS. HER MOTOR / SENSORY EXAM  
WAS "WNL".

WHAT IS YOUR INITIAL IMPRESSION?

---

---

---

---

---

---

---



A 20 YO FEMALE PRESENTS TO THE ED COMPLAINING OF A FRONTAL HEADACHES THAT ARE BETTER WHEN SHE CLOSES HER EYES AND WORSE WHEN SHE MOVES HER EYES. SHE DENIES TRAUMA. SHE IS ON NO MEDICATIONS.

ON EXAM VISUAL ACUITY IS 20/20 OS AND 20/100 OD; PERL; FUNDI HAVE SHARP DISCS. IT IS NOTED THAT HER PUPILS DILATE WHEN A LIGHT IS SHINED IN THE OD (MARCUS GUNN PUPIL).

WHAT IS YOUR DIAGNOSIS.

---

---

---

---

---

---

---

---



A 40 YO FEMALE PRESENTS TO THE ED COMPLAINING OF SEVERE HEADACHES FOR WHICH SHE HAS BEEN DRINKING A PINT OF VODKA A DAY. SHE ALSO COMPLAINS OF FREQUENT 10-20 SEC EPISODES OF VISION LOSS.

PAST HISTORY IS POSITIVE FOR OBESITY AND ASTHMA. MEDS: PROVENTIL INHALER

EXAM: ALERT, OX3, COOPERATIVE. FUNDI WERE NOT VISUALIZED. OS VI NERVE PALSY WAS NOTED.

HEAD CT MINUS WAS NORMAL.

WHAT IS YOUR NEXT DIAGNOSTIC STEP?

---

---

---

---

---

---

---

---



A 60 YO MALE PRESENTS TO THE ED WITH A COMPLAINT OF "I AM SEEING DOUBLE".

PAST HISTORY IS POSITIVE FOR HTN, DM; HE IS ON ENALAPRIL AND INSULIN

ON EXAM, THE PATIENT HAS A COMPLETE OS III NERVE PALSY; THE PUPILLARY LIGHT RESPONSE IS NORMAL.

DOES THIS PATIENT NEED EMERGENCY NEUROIMAGING

---

---

---

---

---

---

---

---



### Ophthalmologic exam

- Define the complaint
- Determine if one or both eyes are involved
- Onset
  - Rapid = Vascular, inflammatory, demyelinating disease
  - Slow = Compressive lesion, degenerative disease
- Complete medical assessment

---

---

---

---

---

---

---

### ESSENTIAL STEPS IN THE OCULAR EXAM

- Inspection
  - Head position
  - Facial asymmetry
  - Evidence of trauma
  - Proptosis / Ptosis

---

---

---

---

---

---

---

### PTOSIS

- Lid is usually 1.5 mm below the upper limbus of the cornea
- Eyelid innervation
  - III Nerve (Pronounced ptosis)
  - Sympathetic (Mild ptosis)
- Etiologies
  - Neuropathic
  - Myopathic
- “Rule” with many exceptions:
  - Unilateral = Neurologic process

---

---

---

---

---

---

---

### ESSENTIAL STEPS IN THE OCULAR EXAM

- Inspection
- Acuity (use pinhole test if decreased)
- Pupil size and reactivity
  - Darkened room with patient looking in the distance to avoid accommodative miosis
  - Swinging flashlight test
- Finger counting field test
- Ophthalmoscopic exam

---

---

---

---

---

---

---

### THE FUNDUS

- Papilledema
  - Raised intracranial pressure (no effect on the pupil)
  - Hypertension (Bilateral)
  - Anterior ischemic neuropathy (Unilateral: Loss of vision)
  - Central vein thrombosis (Unilateral: Vision intact)
  - Retrobulbar neuritis (Unilateral: Loss of vision)
- Optic atrophy: disc is pale, margins are sharp

---

---

---

---

---

---

---

### PAPILLEDEMA: EARLY FINDINGS

- Disc is pink
- Margin is blurred
- Impossible to focus down the cup onto the cribrosa
- Vessels are lost as they are enveloped in edema
- Veins are distended; Venous pulsations lost
  - Lost when pressure > 200 mm hg
- Hemorrhage and exudates appear

---

---

---

---

---

---

---

### THE PUPILLARY LIGHT REFLEX

- Mediated entirely through the parasympathetics
  - Retina / Optic tract / Midbrain / EW Nucleus / III CN / Ciliary ganglion / Sphincter pupillae
- Sympathetics
  - Hypothalamus / Upper thoracic spinal cord / Sympathetic chain / Superior cervical ganglion / Ascend along / V CN / Nasociliary branch / Pupillodilator muscle
- Pupils are dilated and poorly reactive in

---

---

---

---

---

---

---

### THE PUPIL

- Constriction: Parasympathetic response
  - Response to light, accommodation, convergence
  - Control by the Edinger-Wesphal Nucleus
  - Blind eye will constrict when good eye exposed to light
- Dilatation: Sympathetic response
- Physiologic anisocoria
  - <1.5mm difference

---

---

---

---

---

---

---

### PUPIL DILATATION

- Tectal lesions disrupting the light reflex
- Compression of the third nerve
- Damage to the ciliary ganglion
- Ingestions of sympathomimetics
- Instillation of atropine

---

---

---

---

---

---

---

### PUPIL DILATATION

- Common causes of III nerve palsy
  - Microvascular disease
  - Aneurysm
- Ischemia to III nerve often spares the parasympathics
  - Dual blood supply
- Complete III with intact pupil
  - Most commonly due to microvascular lesion (DM, HTN)

---

---

---

---

---

---

---

### THE ISOLATED DILATED, LIGHT-FIXED PUPIL (ADIE'S PUPIL)

- Idiopathic dysautonomic state
- Typical patients:
  - Healthy young woman
  - Unilateral dilated pupil
  - Loss of deep tendon reflexes
- Pupil appears fixed and unresponsive
  - “Tonic” pupil slowly constricts to light
  - Old Adie's pupils tend not to dilate to light
  - Must distinguish from aneurysm
  - No III CN involvement

---

---

---

---

---

---

---

### Atropinized pupils

- Postsynaptic sphincter blockade
- Not reversed by 4-6% pilocarpine (cholinergic activator of the iris sphincter)
- Reliable test unless underlying sphincter pathology (ruled out by slit light exam)

---

---

---

---

---

---

---

### PUPIL CONSTRICTION

- Disruption of the sympathetics
  - Horner's
  - Carotid artery dissection
  - Pontine hemorrhage
- Toxins
  - Narcotics
  - Cholinergics

---

---

---

---

---

---

---

### VISUAL FIELDS

- Technique
- Chart fields as seen by patient
- Four main types of visual field defects
  - Monocular
  - Bitemporal hemianopia
  - Homonymous hemianopia
  - Total blindness

---

---

---

---

---

---

---

### MONOCULAR VISION LOSS

- Lesion anterior to chiasm
- Opacities of the ocular media
  - Cataracts
  - Vitreous hemorrhage
- Macular disease
  - Retinal detachment
  - Retinal artery occlusion
  - Thrombosis of the central retinal vein
- Optic nerve disease
  - Retrobulbar neuritis

---

---

---

---

---

---

---



### RETINAL ARTERY OCCLUSION

- Produces horizontal defects: "Shutter coming down" : Painless
  - Amaurosis fugax: Harbinger of stroke
  - Permanent damage if loss persists > 2 hours
- Diffuse or focal attenuations of the retinal arterioles and "Box Carring"
- Pale retina due to edema in the nerve fiber layer
  - Requires 12 - 24 hours to develop
  - Macula (No nerve fibers) Choroidal circulation is intact thus "cherry red spot"

---

---

---

---

---

---

---

### CENTRAL RETINAL VEIN OCCLUSION

- Decrease in vision is marked and rapid
- Fundoscopic: Blood not edema, not exudate
- Etiologies: Glaucoma, hypercoagulable conditions, DM

---

---

---

---

---

---

---

### RETINAL DETACHMENT

- Separation of the two retinal layers
  - Pigment epithelium
  - Anterior (Inner) neurosensory
- Visual loss from total to mild decrease
- Flashes due to traction on the retina by the vitreous humor
- Curtain that comes across from any direction

---

---

---

---

---

---

---

### ISCHEMIC OPTIC NEUROPATHY

- Causes:
  - Atherosclerosis of posterior ciliary arteries
  - Temporal arteritis
    - » Search for associated signs and symptoms
- Sudden painless loss of vision
- Positive swinging flashlight test
- Swollen optic nerve head
- Treatment

---

---

---

---

---

---

---

### OPTIC NEURITIS

- Inflammation of the optic nerve
  - Papillitis (Indistinguishable from papilledema)
  - Retrobulbar
- Blurred vision
  - Central scotoma
- Pain with eye movement
- Marcus Gunn Pupil
- Severe loss of color vision (Retained in retinal disease)
- 20-50% of cases caused by multiple

---

---

---

---

---

---

---

### BITEMPORAL HEMIANOPIA

- Compression of the decussating fibers from the nasal half of each eye
- Pituitary adenoma most common cause
  - Meningiomas
  - Craniopharyngiomas
  - Aneurysms
  - Dilated third ventricle

---

---

---

---

---

---

---

### HOMONYMOUS HEMIANOPIA

- Lesion behind the chiasm, visual acuity unaffected
- Images falling on the retina are inverted
  - Temporal lobe carries images from above eye level
  - Parietal lobe carries images from below eye level
- Lesions in the temporal lobe produce an homonymous hemianopia worse in the upper part of the fields
- Parietal lesions have the opposite effect

---

---

---

---

---

---

---

---

### BILATERAL BLINDNESS

- Bilateral ischemia of the occipital lobes
  - Degenerative artery disease
  - Spasm (Basilar migraine)
  - Profound hypoxia
- Macula (Central vision) located in posterior end of calcarine cortex; blood supply from both MCA and posterior circulation
  - Central vision spared in posterior circulation infarct
  - Occipital trauma produces bilateral central field defects

---

---

---

---

---

---

---

---

### FUNCTIONAL VISUAL LOSS

- Opticokinetic testing
  - Opticokinetic nystagmus proves some degree of vision
- Signature
  - Legible and intact in blindness
- Finger to finger testing
  - Intact in blindness

---

---

---

---

---

---

---

---

### APPROACH TO DIPLOPIA

- Monocular vs binocular
- Elicit position or activities that make it better / worse
- Accompanying complaints (pain, weakness, fatigue)
- Past medical history
- Look for ptosis / proptosis
- Assess pupil
- Assess range of motion

---

---

---

---

---

---

---

### APPROACH TO DIPLOPIA

- Monocular causes are very rare
  - Mechanical deformation of the corneal surface
  - Lens subluxation
  - Occipital lobe lesions
- Binocular
  - Muscle (Thyroid, myopathies)
  - NMJ (myasthenia, botulism)
  - Cranial nerve

---

---

---

---

---

---

---



### III NERVE

- Emerges from brainstem next to PCA
- Runs in the lateral wall of the cavernous sinus
- May be compressed:
  - Herniation
  - Aneurysm
    - » PCA
    - » ICA in the cavernous sinus (IV, V and VI involvement)

---

---

---

---

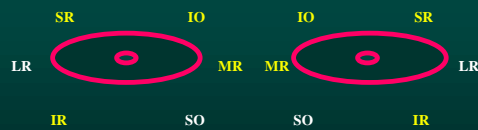
---

---

---

### III CRANIAL NERVE

- Parasympathetics
- Levator palpebrae
- Inferior obliques, medial, inferior, and superior rectus muscles




---

---

---

---

---

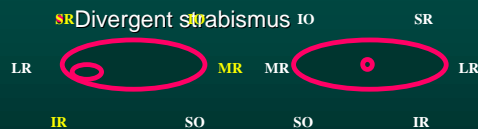
---

---

---

### III CRANIAL NERVE PARALYSIS

- Ptosis
- Dilated pupil
- Paralyzed eye is deviated out and down; SO AND LR control eye




---

---

---

---

---

---

---

---

### III CRANIAL NERVE LESIONS

- Progressive lesions after passage through the dura usually causes a ptosis and pupil dilatation first
- Lesions in the nucleus cause motor deficits first
- Intact pupil suggests a peripheral ischemic lesion




---

---

---

---

---

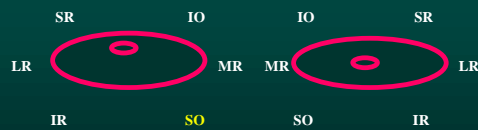
---

---

---

### IV CRANIAL NERVE

- Superior oblique
- Causes eye to turn in and down
- When paralyzed, eye can not turn down when it is rotated in




---

---

---

---

---

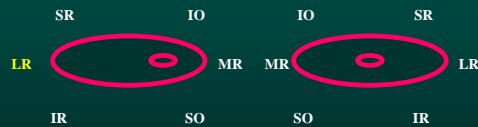
---

---

---

### VI CRANIAL NERVE

- Lateral rectus
- Long course; goes through the CS, not within the wall
- Paralysis impairs abduction
- Convergent strabismus; esotropia




---

---

---

---

---

---

---

---

### CONJUGATE GAZE

- Controlled by supranuclear connections
- Medial longitudinal fasciculus is responsible for coordinating the oculomotor nerves; lesions result in impairment LR and MR moving in sync, ie, contralateral eye does not pass the midline
  - Multiple sclerosis
- Convergence remains intact




---

---

---

---

---

---

---

---

### PEARLS

- Pinhole test corrects refractive errors
- Swinging flashlight test assesses optic nerve function
- CN II, III, IV, and VI are critical to assess in patients with head / face pain
- In a complete III nerve palsy with intact pupil, aneurysm is unlikely
- Perform a systematic exam

---

---

---

---

---

---

---

## **SELECTED READINGS: ABNORMAL VISION**

**LaVene D, Halpern, J. Jagoda A. Loss of Vision. Emerg Med Clin No Am 1995; 13:539-560.**

Review of the causes of loss of vision. Begins with a detailed discussion of the neurologic exam and ends with a discussion of specific diagnoses. Excellent diagrams help to illustrate main points.

**Richardson L, Joyce D. Diplopia in the emergency department. Emerg Med Clin No Am 1997; 15:649-659.**

An indepth discussion of the clinical neuroanatomy of vision. Discusses cranial nerve function and a practical approach of the patient complaining of double vision.

**Parsons M. Color Atlas of Clinical Neurology. Mosby Year Book 1993. 320 pages.**

This is a wonderful atlas and excellent reference book for the emergency department. The text accompanying the pictures and diagrams is clear and easy to read. This book makes some of the difficult concepts in neurology easy to understand. The section on Neuro-ophthalmology is great.

**Goodwin J. Neuro-ophthalmologic emergencies. In: Weiner W (editor). Emergent and Urgent Neurology. Lippincott 1992; pages 423-461.**

This chapter focuses on the diagnosis and management of specific neuro-ophthalmologic emergencies. The section on pupils is particularly strong.

**Walsh T. (Editor) Neuro-ophthalmology. Lea and Febiger 1992. 642 pages.**

This is a well written reference book that well illustrated both with black and white and color phototgraphs. It is more in depth than generally needed in an emergency department but is a excellent resource.

**Mumenthaler M. Neurologic Differential Diagnosis. Thieme Medical Publishers, New York 1992. 178 pages.**

This concise text provides a comprehensive deferential diagnosis of neurologic complaints. The section on "Visual disturbances" is clearly written and easy to follow.

**Spoor T. Atlas of Optic Nerve Disorders. Raven Press 1992. 178 pages.**

This atlas has outstanding color photographs and a valuable resource when questions arise regarding findings on fundoscopic exam. A case based format is used followed by focused commentary.

**Weisberg L., Strub R. Garcia C., Decision making in adult Neurology. Mosby Year Book 1993. 319 pages.**

This book provides excellent algorithms on the approach to the main neurologic signs and symptoms. The sections on vision complaints are particularly good.