

Ptosis and Pupils

Jack CF Chong, MS, MD

How to Examine the Nervous System

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Ptosis

Ptosis

- Bilateral, longstanding, familial:
 - CPEO (chronic progressive external ophthalmoplegia)
- D/D: Acute, recent, unilateral

Palpebral fissure

- Palpebral fissure
 - 7–12 mm in the vertical midline
- Cornea
 - about 10.5 mm in vertical diameter
 - upper lid usually covers the top 0.5–1 mm
 - bottom lid touches the lower limbus

Blepharospasm or ptosis ?

- Blepharospasm
 - eye closure resulting from a contraction of the orbicularis oculi muscle
- Ptosis
 - partial or complete eye closure caused by paresis or paralysis of
 - levator palpebrae muscle or
 - superior tarsal muscle

Blepharospasm

- May be a result of some painful or irritating ocular disease
- May be voluntary to abolish the false image of diplopia
- May be a dystonia (involuntary movement because of organic disease), in this case always bilateral

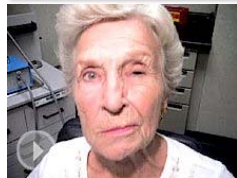
Blepharospasm or ptosis

■ Blepharospasm

- Eyebrow is pulled down below the superior orbital margin

■ Ptosis

- Eyebrow is on the margin or above
- If above, the forehead is wrinkled as the patient uses his frontalis to compensate for the drooping lid



Ptosis: CN3 palsy or Horner's?

■ CN3 palsy

- Big pupil on the side of the ptosis, with or without the appropriate EOM palsies
- Complete ptosis
- Ptosis does not change on upward gaze

■ Horner's syndrome

- Small pupil on the same side
- Incomplete ptosis
- Ptosis will diminish on upward gaze
- The lower lid is higher than the normal lower lid (covers more of the limbus at 6 o'clock, due to paresis of the inferior tarsal muscle)

Horner syndrome

- Refers to a constellation of signs produced when *sympathetic innervation* to the eye is interrupted
 1. Miosis
 2. Dilation lag
 3. Mild-to-moderate ptosis*
 4. Slight elevation of the lower lid (upside-down ptosis or reverse ptosis*)
 - * 3 & 4 are due to denervation of the sympathetically controlled Müller muscle
 5. Impaired flushing ipsilaterally
 6. Impaired sweating (anhidrosis) ipsilaterally



- lower eyelid ptosis occurs in Horner's syndrome and contributes to narrowing of the palpebral fissure, giving the impression of "apparent" enophthalmos



- Strength of the the levator palpebrae muscle: decreased eyelid elevation suggests myopathic conditions (eg. myasthenia) or third nerve palsy, while the degree of eyelid retraction is normal in Horner's syndrome (even when ptosis is present)

Bilateral ptosis following stroke

- Bilateral ptosis has been seen following **basilar artery** infarction and ischemia
- There are no other signs of either third nerve or sympathetic lesions
 - Pupils and eye movements were normal
 - Patients were alert

The Pupils

Pupils

- Prime physical signs
 - Pupil **size**
 - Pupil **equality** between right and left
 - Pupil **responses** to various stimuli
- Conscious vs. comatose

Pupil size (1)

- **2 to 5 mm** in diameter
- Depends on
 - Light
 - Near reaction
 - Sympathetic tone
 - Parasympathetic tone

Pupil size (2)

- Smaller pupils
 - Newborn and elderly (than youths)
- Bigger pupils
 - Schizophrenic patients and frightened people
 - Blueeyed people (than brown-eyed)
 - Myopic people
- Pupils in young people
 - Normally constrict and dilate in a repetitive rhythmic way (**hippus**); its absence is also normal

Pupil equality

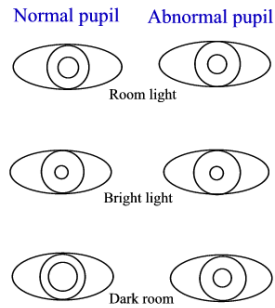
- **15 to 20%** of patients have anisocoria that cannot be explained, but the difference is usually not more than **1 mm**
- Normal inequality:
 - the difference in size remains constant in both bright and dim illumination
- Pathologic inequality:
 - the difference in size changes with the illumination

Anisocoria

- Anisocoria that changes with illumination
 - One should measure pupil sizes in **average** room light, **dimness**, and **bright** light
- Horner's syndrome
 - the small pupil of will not dilate in dim light as much as the pupil of the other normal eye
- CN3 palsy
 - the larger pupil will not constrict as much as the normal pupil in bright light

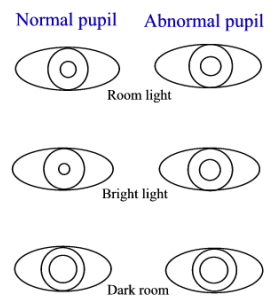
Horner's syndrome

- the small pupil of will not dilate in dim light as much as the pupil of the other normal eye



CN3 palsy

- The larger pupil will not constrict as much as the normal pupil in bright light
- All patients with a new-onset CN3 palsy with pupillary involvement should be presumed to have a cerebral artery aneurysm until proved otherwise => require an expeditious MRI angiogram or four-vessel angiography (emergently if a headache is also present)



Pupil equality

- The followings do not cause anisocoria
 - Unilateral or bilateral diminished or absent visual acuity or peripheral visual field defects
 - Differences in refractive errors between the two eyes

How to examine the Pupils

Light Reaction

- Sitting, moderate background illumination
- Flashlight held vertically, pointing up, below the eye, and just in front of the cheek
- Ask patient to look at the far, illuminate each eye in isolation
- Afferent: CN2
- Efferent: CN3

Direct / consensual light reaction

- **Direct**
 - Ipsilateral pupillary constriction in response to bright light exposure
- **Consensual**
 - Contralateral pupillary constriction in response to bright light exposure

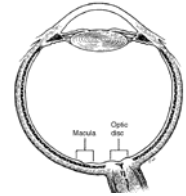


Abnormal light reaction

- Q: Lesion at?
 1. Right eye has a normal direct response and an abnormal consensual response
 2. Right eye has an abnormal direct response and a normal consensual response
 3. Right eye has neither a direct nor a consensual response

Near reaction

- Light reflex ok → near reflex ok (test can be skipped)
- Near reflex: ask patient to look at the far wall and then at the tip of your pencil or tip of his own finger (5 to 10 cm in front nose)
- Look for two things:
 - bilateral constriction of pupils
 - convergence eyes
- Sluggish direct light response but brisk near response → lesion at right afferent limb of light reflex



Abnormal pupils

- Marcus Gunn pupil
- Argyll-Robertson pupils
- Horner's syndrome
- Oculomotor nerve lesion (unilateral)
- Adie's syndrome
- Benign anisocoria
- The factitious big pupil
- Parinaud's syndrome
- Carotid artery occlusion (unilateral)
- Pontine miosis (bilateral)

Marcus Gunn Pupil



- Implies afferent pupil defect, e.g. **retrobulbar neuritis** of optic nerve
- **Swinging flashlight test** (e.g. right afferent defect):
 - Examine his pupil responses in dim illumination
 - Shine strong light into left eye → both pupils constrict
 - Shine into right eye → right pupil seems to constrict momentarily and then dilates widely, as does the left
 - Swing light back to left eye → both constrict
- Defected pupil:
 - normal consensual light reaction → constriction
 - reduced direct light reaction → relative dilatation

Argyll-Robertson pupils

- Result from
 - Tertiary syphilis of the nervous system
 - Diabetes
 - Late signs of bilateral tonic pupils
- Pupils (usually bilateral)
 - **small, irregular, and unequal**
 - light response (may be absent) much less evident than near response
 - do not dilate in the dark
 - respond poorly to mydriatics
 - can be made to constrict even more by miotics
- Visual acuity not impaired

Horner's syndrome

- AKA **oculomotor palsy** (unilateral)
 - lesion of the sympathetic fibers can be in the brain stem, cervical cord, apex of the lung, carotid sheath, or orbit
- Pupil
 - small and round
 - good response to light and near
 - **anisocoria** more prominent in the dark (affected pupil dilates later and less)
- Additional signs
 - **ptosis** (incomplete)
 - apparent **enophthalmos**
 - warm, dry, **nonsweating**, ipsilateral face
- Painful Horner's syndrome
 - **carotid artery dissection**
 - **cluster headaches** (normal carotid artery)

Oculomotor nerve lesion (unilateral)

- **Structural** oculomotor nerve lesion
 - Ipsilateral mid-dilated pupil
 - pupil not respond to light or near
 - difference in pupil size is greater in the light (in contrast with Horner's syndrome)
 - mydriatics and miotics are both effective
- **Diabetic** oculomotor nerve palsies
 - usually have normal pupils
 - can be painful



Adie's syndrome

- **Adie's syndrome**, or **tonic pupil** or "the big, slow pupil"
 - enlarged pupil may be unilateral or asymmetrically bilateral
 - does not react to light or eventually constricts after being exposed to very bright light for 15–20 min
 - eventually constricts for near after a similarly long effort
 - redilatation is just as protracted
 - difference in the pupil sizes is best seen in the light
 - pupils respond to mydriatics and miotics and demonstrate **denervation supersensitivity** (pupil will constrict from 2.5% solution of Mechoyl or 0.125% pilocarpine)
 - accommodation is slow and may be the presenting complaint
- **Holmes-Adie syndrome**
 - Adie's synd + absent / diminished deep tendon reflexes
 - cause is unknown

Benign anisocoria

- Usually a young adult
- Chronic → less important
- Examine old photographs
- Response to light and near in both eyes is normal
- Difference in pupil size is no greater in dimness or light
- Mydriatics and miotics have a normal response, and there is no diagnosis

The factitious big pupil

- Causes
 - Eyedrops containing impurities with atropine-like properties
 - Ointments with atropine-like properties inadvertently introduced into eye
 - Occasionally a deliberate atropine abuser
- S/S
 - The biggest pupil you have ever seen
 - No response to light or near
 - Difference greatest in bright light
 - **Neither mydriatics nor miotics change the pupil** (Pilocarpine will not constrict an atropinized pupil; it will, however, constrict an Adie's pupil)
- Reexamine the eye daily for 3 consecutive days

Parinaud's syndrome

- **Parinaud's syndrome**, also known as **dorsal midbrain syndrome**
 - Paralysis of upgaze
 - **Accommodative paresis**
 - Pupils **mid-dilated** with **light-near dissociation**
 - **Convergence-Retraction nystagmus**
 - Eyelid retraction (**Collier's sign**)
 - Conjugate down gaze: "**setting-sun sign**"

Carotid artery occlusion (unilateral)

- An enlarged pupil ipsilateral to the occlusion has been reported in **atheroma** and **Takayasu's disease**
- The pupil reacts poorly to light (direct and indirect) and near
- The explanation is probably **ischemic atrophy of the iris**, rather than nerve disease

Pontine miosis (bilateral)

- The classic sign of pontine infarction or hemorrhage is small (1 to 1.5 mm) pupils
- They will constrict to light if a bright enough stimulus is used and if examined through a magnifying glass

Accommodation & convergence

- For near vision
 - the eyes converge (ie, turn toward the midline),
 - the pupils constrict, and
 - the lenses thicken
- Convergence: simultaneous contractions of the two medial recti
- Failing accommodation is most commonly related to aging, as the lens becomes less resilient

Accommodation & convergence

- Complete peripheral CN3 palsy: parasympathetic nerve fibers subserving accommodation, as well as those subserving the pupillary near response, will be interrupted
- The diabetic, out of control or of recent onset, can have a sudden improvement in near vision if symptom reversed
- Anticholinergic drugs commonly produce a complaint of blurred vision from diminished accommodation if taken in large enough doses

Near reaction

- Near reaction
 - If the pupils react to light, they will react to near
 - If the pupils do not react to light, it is important to know whether the near response is also abnormal
- Convergence
 - If there is a defect in adduction, it is important to know whether or not convergence is present
 - Verify patient's efforts to converge by the attendant miosis

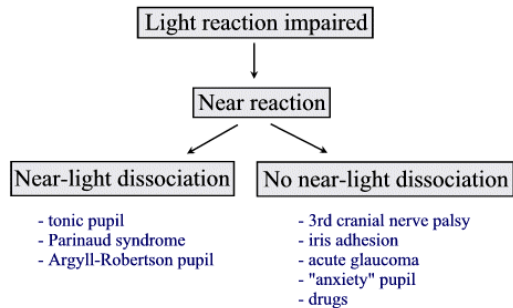
Near reaction

- **Convergence paresis**
 - Sudden onset of diplopia, with eyes divergent
 - Full monocular eye movements
 - E.g. periaqueduct syndrome
- **Convergence excess**
 - Patient staring at the tip of his nose
 - Looks like unilateral or bilateral lateral rectus palsy
 - Often a hysterical disease - when you ask the patient to look laterally, which he says he cannot do, his pupils constrict, proving that he is overconverging
 - Can be organic following head injury and can be part of the periaqueduct syndrome

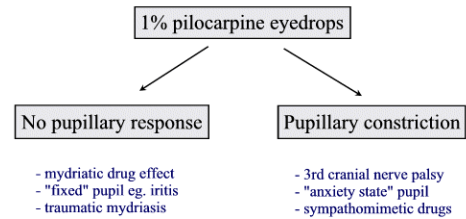
Near reaction

- **Toxin of Clostridium botulinum**
 - large, nonreacting pupils
 - paralysis of accommodation
 - Ptosis
 - extraocular muscle palsies
 - patient awake, with progressing respiratory distress
 - may have vomited but usually constipated
- **Diphtheria**
 - paralysis of accommodation
 - affects bulbar originating nerves and cardiac rhythm

D/D (1)



D/D (2)



Myasthenia gravis

- Ocular complaints often diagnosed late
- Weakness of one muscle or one eye or any combination of muscles
- The essence of the disease is excessive fatigability, that is, the patient cannot *sustain* upward gaze or *sustain* the upper lids in a fixed open position
- Of all the possible combinations of myasthenic muscle weakness (eg, ocular, pharyngeal, or limb), *bilateral fluctuating undulating ptosis* is probably the most common

Myasthenia gravis

- Look at the patient's eyes and keep looking
 - she may blink 3 times with blinks of the same duration and the same interval between blinks, but she does not open as wide after each blink
 - in the 4th blink, she keeps her eyes closed for 10–20 s
 - when she finally opens her eyes after the long blink, her ptosis is less pronounced and you can see more of her eyes
 - she then has 3 or 4 of her usual blinks with her ptosis increasing and then has another long blink

Myasthenia gravis

- When the eye opening muscles are weak and the eye closing muscles are also weak, the diagnosis is almost always either MG or one of the CPEOs
- Consider MG when a young woman or an old man says,
 - *"My eyelids are drooping"* or
 - *"I see double when I'm watching the late news on TV"*

CPEO

- *Chronic Progressive External Ophthalmoplegia*
- Progressive, very chronic
- Restricted range of EOM and ptosis
- Usually do not cause diplopia
- May have ptosis only (patient may unaware)
- Most family members look the same
- CPEO is actually a number of diseases
- May be associated with oculopharyngeal dystrophy, myotonic dystrophy, thyroid ocular myopathy



