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The Pupil

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Slide 2

The Pupil

- What is the pupil (anatomy)?
- What does the pupil do (physiology)?
- How to test for pupillary function?
- What are some common pupillary abnormalities?

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The Pupil

- The opening of the iris (aperture)
- Originally covered by vascular network (tunica vasculosa lentis)
- Regresses at about 6-8 months gestation (preemies)
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The Pupil
- Slightly nasal to the center of the cornea (light reflex is not perfectly centered)
- Relatively bigger size in childhood (decreases as we age)

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The Pupil
- 2 muscles within the iris
  - Pupillary sphincter-constriction (miosis)
  - Pupillary dilator-dilation (mydriasis)

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The Pupil
- Function is to moderate the amount of light entering the eye
- Resting pupil size is result of balance of sympathetic and parasympathetic nervous system
  - Sympathetic (“fight or flight”) - pupillary dilation
  - Parasympathetic (“rest and digest”) - pupillary constriction
- Pupil will respond to light and near stimulus
  - "near triad"
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The Pupil
- Sympathetic nervous system

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The Pupil
- Parasympathetic pathway

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The Pupil
- Pupillary testing
  - Direct response to light
  - Checking for rAPD (relative afferent pupillary defect)
  - Assessment of pupillary size (anisocoria)
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Direct Light Response
- Use of a dark room and bright light (indirect or muscle light turned all of the way up)
- Focus at distance (no near miosis)
- Hold for about 2-3 seconds then release
- Check several times
- Should also watch the other eye for constriction as well
- May show hippus, which are rhythmic contractions at the end of the constriction cycle

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Direct Light Response
- Absent direct light response
- Pharmacologic dilation
- Adie's tonic pupil
- Argyll-Robertson pupil (tertiary syphilis)
- Iris sphincter damage (trauma)
- Blindness from optic nerve or retinal disease

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Iris Sphincter Tears
Relative Afferent Pupillary Defect

- Because the pupils constrict in BOTH eyes when a light is shined in one eye, we can test how the eyes view the light compared to one another (relative)
- "Swinging flashlight test"
- Test for optic neuropathy or retinopathy (diffuse)
- Anterior segment disease does NOT cause an rAPD
- Rarely, a densely amblyopic eye may have a mild rAPD

Pupillary Size

- Ways to measure pupil
  - Need to be looking at a distance target (near miosis)
  - Oblique lighting if measuring in dark
  - Use of Rosenbaum (near) card
  - Pupilometer (refractive surgery)
Anisocoria
- Difference in pupillary size
- 20% of people will have some level of anisocoria (physiologic)
- Usually <0.5 mm or less
- Key is measuring difference in size in light and dark
- If greater difference in light, then the bigger pupil is abnormal
- If greater difference in the dark, then the smaller pupil is abnormal
- If equal in light/dark, physiologic

Horner Syndrome
- Oculosympathetic paresis
- Insult to the sympathetic pathway anywhere along the chain
- Miosis, ptosis, anhidrosis (sweating dysfunction)
- Anisocoria worse in dark
- Importance is determining etiology
  - Congenital vs. acquired (concern for neuroblastoma)
  - Noted from birth
  - Iris heterochromia
  - History of birth trauma
Pharmacologic testing

- Cocaine
  - Allows for confirmation of Horner but not localization
  - 10% solution; poor dilator
  - Hard to obtain (not surprising!)
- Hydramine (Paredrine)
  - Helps to localize Horner syndrome (3rd vs 1st/2nd)
  - Also hard to obtain
- Apraclonidine
  - Nice alternative in that it reverses the anisocoria
  - Extreme caution in children
  - Respiratory depression, sedation, lethargy
Persistent Pupillary Membrane
- Almost always visually insignificant

3rd Nerve Palsy
- Damage to the 3rd nerve can lead to motility problems, ptosis, pupillary problems, or all
- Classic is fixed, dilated, unresponsive pupil to light
- Concern again is etiology
- PCOM aneurysm needs to be ruled out
Fixed, Dilated Pupil

- Concern is for a 3rd nerve palsy/aneurysm
- Often medical workers or travelers (motion sickness patch); generally young
- Will have no ptosis, no motility issues
- Will recheck in 1-2 days to look for progression

Pharmacologic testing

- 1% Pilocarpine
- Will not constrict a pharmacologic pupil
- Will constrict 3rd nerve pupil

Adie's Tonic Pupil

- Segmental paralysis of the pupillary sphincter
- Vermiform movements of the pupil (worm-like)
- Usually starts as a dilated pupil and then will shrink over time
- Young women are the most common
Thank you very much for your attention!
Any questions?