Pertinent Pupillary Problems

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“My turn? ... Well, I’m originally from the shores of the upper Nile and ... saaaaaay ... did anyone ever tell you your pupils are round?”
Objectives

1. Describe parasympathetic and sympathetic pupillary pathway anatomy.
2. Identify a relative afferent pupillary defect
3. List the differential diagnosis of anisocoria.
Outline

I. Anatomy
II. Examination
III. Relative Afferent Pupillary Defect
IV. Anisocoria
This patient has?

1. Horner syndrome
2. 3rd nerve palsy
3. Right Relative Afferent Pupillary defect
4. Left Relative Afferent Pupillary Defect
Afferent Anatomy

- Retina
- Optic Nerve
- Chiasm

→ Midbrain (3rd nerve nucleus)
Parasympathetic Efferent Anatomy

3rd nerve → Ciliary Ganglion

→ Iris Sphincter & Ciliary Body
Consensual Light Response
Consensual Light Response

“Double Decussation”
Sympathetic Anatomy
Outline

I. Anatomy

II. Examination

III. Relative Afferent Pupillary Defect

IV. Anisocoria
Pupil Examination

Shape
Size
Reactivity
Fellow Travelers
Pupil Examination

Shape
Size
Reactivity
Fellow Travelers
Pupil Examination

Shape

Size

Reactivity

Fellow Travelers
Pupil Examination

Shape
Size
Reactivity
Fellow Travelers

trace, 1 - 4+
trace, mild, moderate, brisk
Pupil Examination

Shape
Size
Reactivity
Fellow Travelers
Pupil Examination

Shape
Size
Reactivity

Fellow Travelers 3rd nerve - eye lid, extraocular muscles & iris sphincter

Sympathetics - eyelid & iris dilator
Outline

I. Anatomy

II. Examination

III. Relative Afferent Pupillary Defect (RAPD)

IV. Anisocoria
Relative Afferent Pupillary Defect - RAPD (aka Marcus Gunn Pupil)

One pupil dilates and the other constricts when a light is swung from eye-to-eye.
Relative Afferent Pupillary Defect (Marcus Gunn Pupil)
Testing: Requirements

- dark room
- bright light
- fixation target
- patient

Tech

0.3 log
0.6 log
0.9 log
1.5 log
This patient has?

A. Small R-RAPD
B. Small L-RAPD
C. Normal Pupils
No RAPD means the optic nerves are fine?

A. True
B. False
**Nuance #1: RAPD - The “R” is for Relative**

**Implications:**

1. The presence of a RAPD doesn’t mean the contralateral side is normal.

2. No RAPD if damage is symmetric. Thus, the lack of an RAPD doesn’t mean the afferent system is normal.
Nuance #1: RAPD - The “R” is for Relative
Nuance #2: Only need 1 working pupil

Left RAPD
30-yo-WF s/p MVA/CHI, unresponsive
An ipsilateral RAPD may be seen in all of the following except?

A. Monocular occlusion
B. Amblyopia
C. Dense heme
D. cataract
Nuance #3: More Causes of RAPDs

- Amblyopia
- Monocular Occlusion
- Anisocoria
- Dense Blood
  8-ball hyphema
  vitreal heme
- Not Cataracts

The RAPD should be small!

Implication: if the RAPD is moderate, look for other causes.
RAPD - Summary

**Nuance #1:** The “R” is for relative.

**Implication:** Bilateral, symmetric optic nerve damage will not result in a RAPD.

**Nuance #2:** Only 1 working pupil is needed.

**Implication:** Watch the pupil that works!

**Nuance #3:** A small RAPD may be seen in amblyopia, monocular occlusion, and big anisocoria.

**Implication:** Look for other cause if the RAPD is more than small.
Outline

I. Anatomy
II. Examination
III. Relative Afferent Pupillary Defect
IV. Anisocoria
Anisocoria

- Normal light reaction
  - physiologic
  - Horner’s

- Abnormal light reaction
  - Adie’s tonic
  - 3rd nerve palsy
  - pharmacologic
  - sphincter damage
25-yo-WF notes larger right pupil day after wedding.

Exam otherwise normal.
Physiologic Anisocoria

- 11% > 0.3 mm
- light = dark (about)
- old photos

In light

In dark
55-yo-woman notes mild neck pain after minor car accident. She probably has?

1. Physiologic anisocoria
2. L RAPD
3. R Horner syndrome
Sympathetic Anatomy

hypothalamus → spinal cord → lung → carotid artery → cavernous sinus → iris dilator & Muller’s
Horner Syndrome

sympathetic chain disruption
- miosis, ptosis, anhydrosis
- anisocoria worse in dark
- dilation lag

In light

In dark
Horner’s Syndrome

Dilation lag
Horner Syndrome

- cocaine (apraclonidene) to confirm
- hydroxyamphetamine to localize

**preganglionic** -
- Wallenberg’s (PICA infarct)
- Pancoast Tumor (lung apex)

**postganglionic** - cluster HA, idiopathic
either pre or post - ICA dissection
Carotid Artery Dissection
Anisocoria

Normal light reaction
- physiologic
- Horner’s

Abnormal light reaction
- Adie’s tonic
- 3rd nerve palsy
- pharmacologic
- sphincter damage
Co-worker notes PT’s pupils to be different in size. Pt is asymptomatic.
This represents:

1. RAPD
2. Adie tonic pupil
3. 3rd nerve palsy
4. Pharmacologic
Adie’s Tonic Pupil

- postganglionic parasympathetic, no ptosis/ophthalmoplegia
- mydriatic pupil
- segmental iris contraction
- slow (tonic) redilation
- light - near dissociation

usually idiopathic
Before 0.1% pilocarpine

Adie – denervation supersensitivity

After 0.1% pilocarpine
54-yo-WM notes diplopia X 2 wks.
54-yo-WM notes diplopia X 2 wks.
Oculomotor Nerve Palsy

May be mild!

- Subtle ptosis, anisocoria, ophthalmoplegia
- pupil exam will dictate evaluation
- prompt miosis with 1% pilo
Pharmacologic Mydriasis

- Large dilated pupil
- no ptosis, ophthalmoplegia
- lack of history shouldn’t dissuade you!
- Poor reaction to 1% pilo

motion sickness patches (scopolamine), plants
Iris sphincter damage
Pertinent Pupillary Problems

Summary

• As usual, need to know some anatomy!
• RAPD crucial – need to swing the light.

Anisocoria

Normal light reaction
• physiologic
• Horner’s

Abnormal light reaction
• Adie’s tonic
• 3rd nerve palsy
• pharmacologic
• sphincter damage