

# Approach to the Blown Pupil

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# Disclosures

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# Disclosures

- Grant Support
  - Supported by an educational grant from McGraw Hill Education that is not relevant to this presentation

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- This lecture will discuss an off label use of Pilocarpine

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PICK YOUR POISON

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## A 3-Year-Old With Sudden-Onset Anisocoria After Playing Outside

**CASE**  
 A previously healthy 3-year-old girl presents to the pediatric emergency department with her parents for "unequal pupils." The girl was in her usual state until 2 hours before arrival, when her parents noted that she had an abnormally large right pupil. At that time, they were eating dinner and there was no change in behavior to suggest pain or vision loss. Before this, she had spent most of her day playing outside, and there was no known trauma or other injuries. She had no changes in her level of consciousness and had no ataxia, abnormal speech, or abnormal movements. She has had no recent illnesses. The family reports that she has all the usual symptoms of a blown pupil.

associated with any other symptoms. Her parents brought the girl to the emergency department today because her symptoms have persisted for several hours; the prior episodes did not last this long. She is currently behaving normally and denies any headache but does endorse mild blurred vision in the right eye. Her parents deny family history of intracranial tumors, aneurysms, aneurysms, or aneurysms.

On examination, she is awake, friendly, and playing with her toys. Her vital signs are normal: blood pressure is 87/51 mm Hg, temperature is 98.6°F, heart rate is 113 beats per minute, respiratory rate is 20 breaths per minute, and oxygen saturation is 98% on room air. Physical examination shows an

7 mm in dim light and constricted to 3 mm in bright light. The left pupil constricts from 7 mm in dim light to 3.5 mm in bright light. There is no relative afferent pupillary defect by swinging flashlight test. Unaided retinal examination is notable for sharp the lateral optic disc. The remainder of the neurologic examination is normal including 5/5 strength in all 4 extremities, symmetric and normal sensation to light touch in the face and all extremities, normal gait, normal speech, and no ophthalmoplegia or ptosis. The remainder of her physical examination is unremarkable. Given the examination findings and remaining history, a dilute pilocarpine challenge is performed, which is notable for resistance to constriction.

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# Outline

- Why this topic?
- When it is easy
- When it is challenging
- First step, Cause, Management

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### Why This Topic?

- What does a blown pupil represent?

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- What does a blown pupil represent?
  - Something that happens right before death

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- What does a blown pupil represent?
  - Something that happens right before death
  - A concussion

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### Why This Topic?

- What does a blown pupil represent?
  - Something that happens right before death
  - A concussion
  - An aneurysm

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### Why This Topic?

- What does a blown pupil represent?
  - Something that happens right before death
  - A concussion
  - An aneurysm
  - Nothing good

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### Why This Topic?

- What does a blown pupil represent?

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### Why This Topic?

- What does a blown pupil represent?  
– Short answer: it depends....

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### Case 1

- 21yo s/p assault to head, GCS 5, moaning, right pupil is blown

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### The Blown Pupil

- First Step?

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### The Blown Pupil

- First Step?
- Cause?

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### The Blown Pupil

- First Step?
- Cause?
- Management?

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### Case 2

- 54yo F with severe headache, hypertension, moaning in pain

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The Blown Pupil

- First Step?

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The Blown Pupil

- First Step?
- Cause?

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The Blown Pupil

- First Step?
- Cause?
- Management?

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Case 3

- A 3 year old girl comes in to your office after her parents noticed that her pupil was "blown".

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The Blown Pupil

- First Step?

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The Blown Pupil

- First Step?
- Cause?

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### The Blown Pupil

- First Step?
- Cause?
- Management

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### Approach to the Blown Pupil

- Causes:
  - Bleed (mass effect)
  - Aneurysm
  - Stroke
  - Tumor
  - Herniation
  - CN III Palsy
  - Iritis
  - Pharmacologic
  - Tonic (Adie's Pupil)
  - Benign Episodic Mydriasis

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### Approach to the Blown Pupil

- Causes:
  - Life threatening and benign causes

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### Approach to the Blown Pupil

- Causes:
  - Life threatening and benign causes
  - How do we differentiate between them?

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### Approach to the Blown Pupil

- First Step:
  - History, Physical Exam and Vital Signs

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### Approach to the Blown Pupil

- First Step:
  - History, Physical Exam and Vital Signs
    - History: recent symptoms? trauma? gradual onset?

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### Approach to the Blown Pupil

- First Step:
  - History, Physical Exam and Vital Signs
    - History: recent symptoms? trauma? gradual onset?
    - Physical Exam: awake/alert? Other findings?

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### Approach to the Blown Pupil

- First Step:
  - History, Physical Exam and Vital Signs
    - History: recent symptoms? trauma? gradual onset?
    - Physical Exam: awake/alert? Other findings?
    - Vital Signs: Hypertensive?

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### Approach to the (Benign) Blown Pupil

- Physical Exam:
  - Which pupil is abnormal?
    - Blown pupil?
  - Slit lamp
  - Dilute Pilocarpine Challenge

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### Which Pupil is Abnormal?

- Visual Acuity
- EOM
- Presence/Absence of Ptosis
- Dark Room

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### Which Pupil is Abnormal?

- Large pupil is abnormal?

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### Which Pupil is Abnormal?

- Large pupil is abnormal?
  - Oculomotor nerve problem

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### The Oculomotor Nerve

- Superior Rectus
- Inferior Rectus
- Inferior Oblique
- Medial Rectus
- Levator Palpebrae
- Parasympathetics to sphincter and ciliary muscles

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### Location of Pupillomotor fibres

In the part of oculomotor nerve which lies between brainstem and cavernous sinus, the pupillomotor parasympathetic fibres are located superficially and superomedially

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### Which Pupil is Abnormal?

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### CN III Compression

- CN III compression results in ptosis, limited supraduction, adduction, and infraduction of the eye
- While it is theoretically possible, it is (almost) impossible

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### Aneurysm? Other Compression?

**Oculomotor nerve paresis starting as isolated internal ophthalmoplegia**

Helmut Wilhelm, Reiner Klier, Brigitte Tóth & BÄRbel Wilhelm

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### Aneurysm? Other Compression?

- 5 cases of isolated dilated pupils from CN III palsy
- **All but one had headache and/or seizure**
- The one without a headache had an indolent tumor found years later

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Aneurysm? Other Compression?

Eye

Altmetric 1 Citations: 22 More detail >>

Clinical Study

Ocular manifestations of head injury: a clinical study

A R Kulkarni, S P Aggarwal, R R Kulkarni, M D Deshpande, P B Walimbe & A S Labhsetwar

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Aneurysm? Other Compression?

- 200 trauma patients with any pupil abnormality
- 87.5% had associated neurologic deficits
- 198/200 had GCS <13

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Literature Takeaways

- Blown pupil = not bad
- Blown pupil + symptoms = bad

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Literature Takeaways

- Blown pupil = not bad
- Blown pupil + symptoms = bad

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Causes of Benign Blown Pupil

- Iritis
- Tonic Pupil
- Benign episodic mydriasis
- Pharmacologic

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Causes of Benign Blown Pupil

- Iritis:
  - PAINFUL
  - Slit lamp findings (cell + flare, iris border irregularities)

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### Causes of Benign Blown Pupil

- Tonic Pupil
  - Occurs from parasympathetic denervation
  - Usually idiopathic but can be viral/bacterial

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### Causes of Benign Blown Pupil

- Benign episodic mydriasis
  - Cause unknown, but is benign

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### Causes of Benign Blown Pupil

- Pharmacologic Cause

Mydriasis	
Environmental	Drugs (Red Cap)
<i>Datura</i> species	Cyclopentolate
<i>Mandragora</i> species	Tropicamide
<i>Brugmansia</i> species	Ipratropium
<i>Belladonna</i> species	Scopolamine
	Atropine
	Homatropine
	Epinephrine
	Cocaine
	Phenylephrine

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### Causes of Benign Blown Pupil

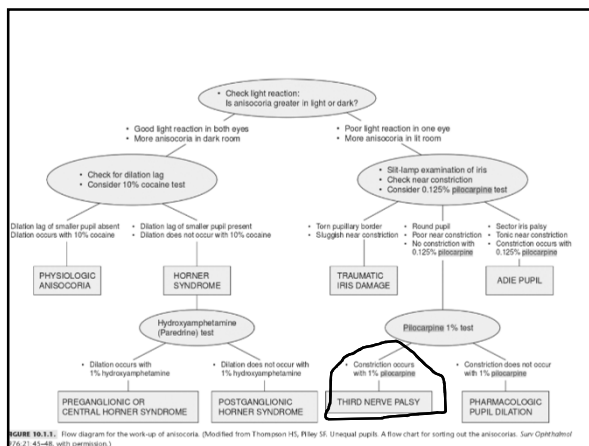
- Pharmacologic Cause

Mydriasis	
Environmental	Drugs (Red Cap)
<i>Datura</i> species	Cyclopentolate
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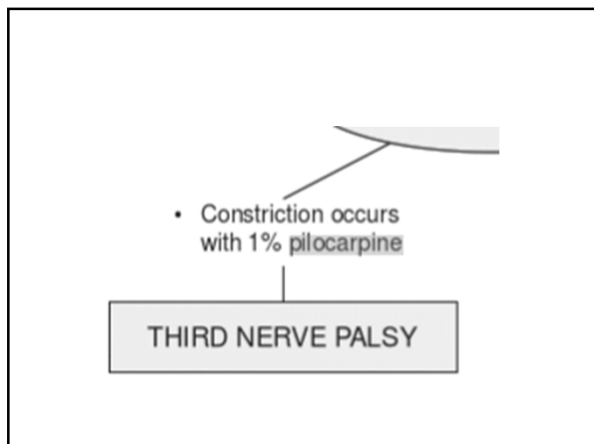
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### What does Will's Say?

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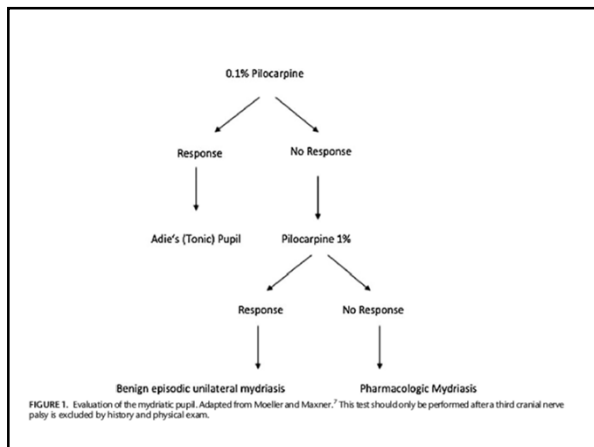


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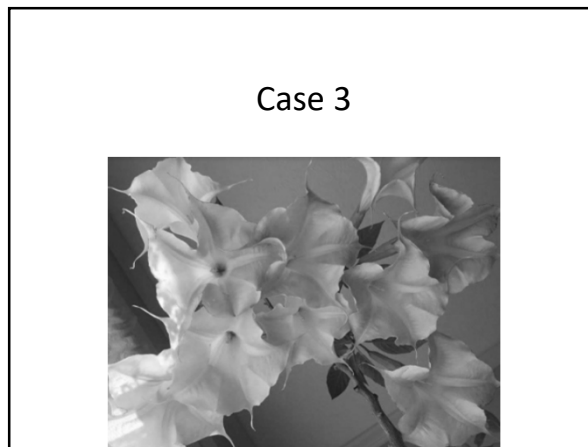
### What does Wills Say?

- Don't do a pilocarpine challenge on a patient with a CN III palsy...

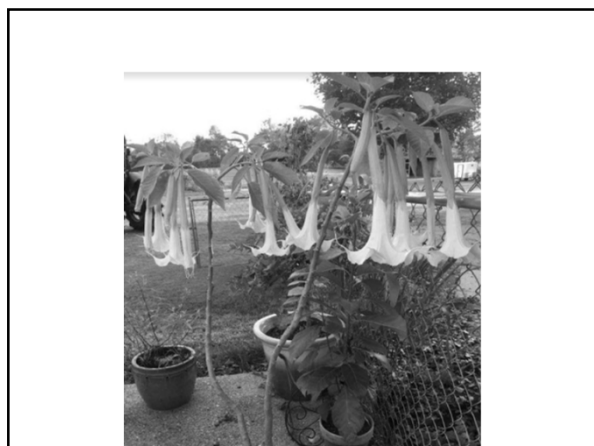
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### Case 3

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TABLE 1. Topical Exposures Causing Pupillary Changes

Miosis		Mydriasis	
Environmental	Drugs (Green Cap)	Environmental	Drugs (Red Cap)
<i>Microphyllus</i> species	Pilocarpine	<i>Datura</i> species	Cyclopentolate
<i>Quadrifolia</i> species	Carbachol	<i>Mandragora</i> species	Tropicamide
	Physostigmine	<i>Brugmansia</i> species	Atropine
	Demecarium	<i>Belladonna</i> species	Scopolamine
			Atropine
			Homatropine
			Epinephrine
			Cocaine
			Phenylephrine

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